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FACULTY OF ECONOMICS AND MANAGEMENT**



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FOOD SAFETY – FOOD SECURITY

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FOREWORD

Food Safety and Food Security were the central topics of the 27th conference Agrarian Perspectives held at the Faculty of Economics and Management of the Czech University of Life Sciences Prague from 19th to 20th September 2018.

"Why Food Safety?", one may ask. In the past, food has never been safer than today, thus is it worth dealing with the question? The opening plenary panel discussion, the opening event of the conference, revealed the hot topics in this field. It is my great pleasure that the following experts accepted our invitation to join the discussion:

Jana Hajšlová, the Head of ISO 17025 accredited laboratory at the Department of Food Analysis and Nutrition, the University of Chemistry and Technology, Prague,

Miroslav Koberna, the Director for Programming and Strategy, the Federation of Food and Drink Industries of the Czech Republic,

Ladislav Miko, the Head of the Representation of the European Commission in Slovakia,

Stanislav Němec, the Honorary chairman of the Association of Private Farming of the Czech Republic, and

Margit Slimáková, the Czech specialist in nutrition and health prevention.

Facilitated by Milena Vicenová, the Czech veterinary doctor, editor, official and politician, the panel discussion was aimed at the conceptions and interpretations of food safety or balancing the requirements on the current lifestyle and food safety. We can also ask reversely, whether the current food is safe too enough or not. On one hand, we can have the food of perfect safety and durability. On the other hand, how about its nutrition value and taste?

In the Food Security, the topics such as the national food security in the context of international trade, but also the problems of food wasting, sustainable land use, landscape water management, etc. have been discussed.

Except the above-mentioned topics, the 27th conference Agrarian Perspectives dealt with food trade, rural development, economics and management in agribusiness and other related issues. The conference intended to provoke discussion on the key topics and provided a platform for discussing theoretical issues, sharing experience, identifying practical problems and exploring the solutions for clarification with the assistance of the scientific communities. Let me wish you a pleasant reading of the conference proceeding and success in your effort to find the answers to your questions.



Milan Houška
Vice-dean for Science and Research
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HOW LOCAL IS LOCAL: CASE STUDY OF PRAGUE FARMERS' MARKET

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Annotation: Farmers' markets offering locally grown produce are meant by vendors as key to build self-reliant food economies, support local farmers, reduce energy use, and provide high quality fresh fruits and vegetables. By purchasing fresh, organic, local products at farmers' markets, consumers satisfy not only their current concerns for nutrition and health but as well the well-being of the society and support the local community. The objective of this paper is to determine how local the products are at farmers markets through a case study of Prague (Czech Republic). The study was conducted on a sample of 125 farmers markets' products. Based on the analysis of 127 products from the farmers' markets in Prague, it can be said that the distance from the destination of their origin is from 1 km to 838 km. The most local products sold at the farmers' markets are vegetable and bakery products. Beyond that the least local products are wine, beer, meat and sausages. According to the regional labelling rules, regional food can be considered as such that is produced in the region and coming mainly from local resources. In the field of beer, wine, meat and sausage, the distance these products was identified as the greatest and therefore there is a high possibility of increasing the competitive advantage based on the production of food that will meet this requirement.

Key words: Farmers' Market, Local Product, Regional Product, Regional Food Labels

JEL classification: Q13, M31

1. Introduction

Recently, the farmers' markets becoming much popular, which can be seen particularly in the industrialized countries (Gallardo et al., 2015). This way of purchasing food directly from the producers has many positive impacts in the form of economic and social factors (Varner and Otto 2007; Pascucci 2011) which is key in rebuilding local and regional food systems (Gillespie et al., 2008). Farmers' markets offering locally grown produce are meant by vendors as key to build self-reliant food economies, support local farmers, reduce energy use, and provide high quality fresh fruits and vegetables (Racine et al., 2013; Martinez, 2010; Feenstra, 2002). Customers perceive farmers' markets as a way to get quality food products (Besik and Nagurney, 2017). Basic products sold at a farmers' markets include agricultural produce such as fruit, vegetables, flowers, bakery products, eggs or other dairy products (Govindasamy et al., 2002). The additional value is the direct face-to-face purchase from producers/farmers or indirect by market vendors (Spiller, 2012; Carson, 2016). Farmers' markets have spread because they are able to meet the needs of consumers who care about social values and local or regional support (Chalupová et al, 2016; Pokorná et al., 2015; Vokáčová and Margarisová, 2017).

By purchasing fresh, organic, local products at farmers' markets, consumers satisfy not only their current concerns for nutrition and health but aswell the well-being of the society and support the local community (Pokorná et al., 2015). When perceiving food, consumers are more focused on complex aspects (Terblanche, 2018). The food quality is not only seen by objective characteristics of the product such as price (Marian et al., 2014; Gosadi et al., 2016), but also by aspects related to higher personal needs (Pilař et al., 2016) such as food safety (Scarpa and Thiene 2011), environmental impact (Beckford at al., 2011) or supporting local communities (Gumirakiza et al., 2016). Not taking costs (it is meant not only price, but also time, costs of travel, convenience and other

expenses) into account, customers at farmers' markets have high standards regarding the quality of fresh food (Onianwa et al., 2005; Gumirakiza and Curtis, 2013; Pilar et al., 2016; Mack and Tong, 2015; Besik and Nagurney, 2017; Mejía and García-Díaz, 2018) and the consideration of social (Kirwan, 2006; Baker et al, 2009; Spilkova et al., 2013), ethical (Johnston et al, 2012) and environmental aspects of its production (Leiper and Clarke-Sather, 2017).

Small family farmers are facing the current food market production which is considered as mass and is aimed at profit maximization (Migliore et al, 2015; Kirvan, 2004). Their aim is to produce high-quality production, and to fight for sustainable development and environmental stability (Migliore et al. 2015; Caracciolo and Lombardi 2012). The development of alternative food networks (such as. Farmers' markets) promoting sustainable use of local resources can serve as a large support for local food producers (Migliore et al. 2015; Lanfranchi and Giannetto 2014; D'Amico et al. 2014; Cranfield et al. 2012). In addition, the farmers' market gives the possibility of displaying the region and its local production (McNeill and Hale, 2016; Çela et al., 2007; Plummer et al., 2005) and maintaining the regional identity (Boyne et al., 2003; Thomas, 2004). Although the food market is gradually becoming more globalized, customers started to prefer such chains that represent the shortest route from the farmer to the final consumer (Pokorna et al., 2015; Renting et al., 2003) and prefer the production that is local and from producers in the nearest region (Rojík, 2015). Local food can be defined as connection of food producers and their consumers in the same geographic region (Šánová et al., 2016). But the specifics and especially the distance when the production can be considered as local is not unified (Šánová et al., 2016; Feenstra, 2002). The distance differs according to the size of the country. As it is stated by previous researches, the wider range of the local food is considered as such grown/produces within 160 km, but there are other studies considering further distance which is even 400 miles (Choices, 2010; Roosevelt, 2006). The Great Britain settled the distance for local production as 30 miles (19 km) (Pearson et al., 2011). In the Czech Republic, the local food is such produces within 50-60 km from the place of consumption (Guthová, 2005). The aim of the paper is to point out the great disparity in terms of how local individual products are at farmers markets and to find international partners for further research in all EU capitals. This aim gave rise to a research question: What is the average distance between the original location of a product and a farmers market, where the product is sold?

The study was conducted on a sample of 125 farmers markets' products. The products at the farmers market were selected randomly, with a maximum of 3 products selected from one vendor. Products sold by a total of 68 vendors were included in the study (approximately 1.8 products per vendor). The ratio of different product categories included in the study was the following: 23.5% fruit, 24.2% vegetables, 15.2% meat products, 12.1% dairy products, 9.1% bakery products, 9.1% beverages and alcohol, 6.8% seedlings, flowers and herbs. The distance between the product's original location and the point of sale (Prague's farmers market) was measured using the Google Maps Internet application. This application was used for measuring the shortest distance as the crow flies and when driving. Based on the results, the average distance between the product and the farmers market was calculated, and also the median of such distance. Subsequently, average and median values were calculated for the individual product categories.

2. Results and Discussion

Based on the previous studies, farmers markets' products are perceived as local products. The studies have also shown that people attend farmers markets to support local producers. Research has shown that there is a great disparity in distance from the original location of products sold at the farmers market. The average distance for the 127 products in question was 77.84 km (median = 65.94). Not considering the shortest and longest distance, the average value was 72.42 km (median = 61.47). What can be considered as most local products are bakery products with an average distance

of 9.7 km. On the contrary, the products sold at the greatest distance are beverages and alcohol with an average distance of 251 km due to foreign wine products. The average distance for the other product categories in question was the following: fruit – 57 km, vegetables – 31 km, meat and smoked meat – 93 km, dairy products – 69 km, herbs + flowers and seedlings – 42.9 km. The question remains how to address the disparity between the customers' perception and the actual origin of food. Vendors who sell actually local products could use their local nature in marketing; the customers would thus get a clear message and the producer would have a competitive edge.

Table 1. The average distance of product categories in the farmers' markets from the place of production

Commodity	Average distance by the road	Min	Max	Median	%55
Herbs + flowers, plants	38,6 km	9,7 km	55 km	42,9	66.67
Bakery	39,05 km	3,8 km	143 km	9,7	75.00
Meat and sausages	117,13 km	5,4 km	154 km	93	30.00
Vegetable	27,29 km	3,8 km	46,3 km	31	100.00
Fruit	82,43 km	6,7 km	297 km	57	48.39
Dairy products	83,63 km	6,4 km	173 km	69	31.25
Wine and beer	287,43 km	1 km	838 km	251	14.29

Source: own research, 2018

Note: %55 – The percentage of products produced within the 55 km from the market

If we compare the results with other studies, where for example New England assumed local production within 80-160 km (50-100 miles), Great Britain settled 19 km (30 miles) and for the US Department of Agriculture the local production means the maximal distance of 640 km (400 miles), it is possible to consider the farmers' markets as the place where the local products are sold. In the case of capital city Prague the average distance is 77.84 km (48 miles), but in this area it is necessary to consider the size of the whole country where New England has an area of 186 458 km², the USA have 9 631 214 km² and the Czech Republic only 78 866 km². If we derive the locality of the products on the basis of the area and the distance in comparison with New England, the distance for the Czech Republic will be between 16.9 and 67.7 km ($(78\ 866/186\ 458) * 80$ (160)), the Great Britain 7.1 and in comparison with USA 5.2 km ($(9631214/78866) * 640$). Based on this comparison, it would not be possible to generalize farmers' markets as a place for local food. Based on the methodology for granting regional food labels, as a local (regional) products the food produced within 50-60 km of the place of consumption can be assumed. Here we can state that from a location closer to 55 km is 100% of vegetable, 75% of bakery products and 66% of herbs, flowers and plants. On the contrary, the least local is wine and beer, where it is only 14%, meat and sausages 30% and dairy products 31.25%.

3. Conclusion

Based on the analysis of 127 products from the farmers' markets in Prague, it can be said that the distance from the destination of their origin is from 1 km to 838 km. The most local products sold

at the farmers' markets are vegetable and bakery products. Beyond that the least local products are wine, beer, meat and sausages. According to the regional labelling rules, regional food can be considered as such that is produced in the region and coming mainly from local resources. In the field of beer, wine, meat and sausage, the distance of these products was identified as the greatest and therefore there is a high possibility of increasing the competitive advantage based on the production of food that will meet this requirement. Based on the results and the comparison with other countries such as the USA and the Great Britain the intention of the further research work is to broaden the field at the main cities of the European Union.

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USER-CENTERED DESIGN OF VČELSTVA ONLINE WEB APPLICATION

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Annotation: The paper deals with the design of Vcelstva online (BeeTech) web application User Interface (UI) and User Experience (UX) according to the principles of User-centered Design (UCD). The main objective of the study is to identify the needs of the users of the Vcelstva online web application and then, according to appropriate methods, to design a new interface that would significantly improve the UX. A partial objective is to validate the UX results of an existing application with the results of the newly designed UI prototype. The result should be a new design of Vcelstva online web application, which aim is to expand smart farming in the Czech Republic in the field of beekeeping and thus support the breeding and protection of bees in the landscape of the Czech Republic. The object of the research is the Vcelstva online web application (vcelstva.czu.cz). Qualitative research methods are applied. Specifically, the selected methods of User Experience and Usability. For the creation of a new web application, the User-centered design framework principles are used.

Key words: Včelstva online, Beekeeping, User-centered design, User Experience, UX, Usability, A/B testing

JEL classification: L86 Information and Internet Services / Computer Software, O32 Management of Technological Innovation and R&D, Q10 General

1. Introduction

If we want to describe the concept User-centered design (UCD) briefly, we need to start with the term Human-centered design (HCD), which has its roots in fields such ergonomics and computer science (Giacomin, 2014) and it is standardized by ISO 9241-210:2010 - Ergonomics of Human system interaction — Part 210: Human-centered design for interactive systems. New important ISO document about “Usability: Definitions and concepts” is still under development (ISO/FDIS 9241-11, 2018). Human-centered design is an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, usability knowledge, and techniques. This approach enhances effectiveness and efficiency, improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance. It is a multi-disciplinary activity. (ISO 9241-210:2010).

User Centered Design is more focused and concise version of Human-centered design with deeper aim and analysis of intended target audience. It is concentrated on not only human characteristics and perception in general but also on specific traits and features of target users. This is the stage when details about concrete target user of design object start playing their role.

UCD approach is a contemporary design approach which actively involves users at every stage of the design process for the development of more effective, efficient and safe products (Kahraman, 2010). The term User-centered design was firstly used in the area of Human-computer interaction (HCI) in the 1980s (Norman and Draper, 1986). In the field of UCD, HCD or even covering HCI seems to have difficult cooperation between designers, engineers and scientists in the community, but the study of Bartneck and Rauterberg (2007) reports no significant differences in the perception of this term and the use of specific methods. The first applications of User-centered design approach in this area referred the needs and interests of users and focused on the usability of computer design.

Those applications proposed easily understandable and usable actions and systems in computer design. This attempt places the users at the center of the design process. The designer who acts as the facilitator and mediator in the design process facilitates the task for the user and enables the use of the product with a minimum effort to learn how to use it (Norman, 2013).

User-centered design process includes analysis of needs, limitations, preferences and expectations of users, creating design solutions, and evaluations of users about the final version of the design after their use (Preece et al., 2002).

Both described terms are also part of the Human-Computer Interaction (HCI) which combines several different disciplines, each of which focuses on a different aspect of creating user interfaces. These disciplines include information science, psychology, sociology, anthropology, design, linguistics, ergonomics, and all other disciplines that focus on the subject (Carrol, 2003; Dix et al., 2003). So, the term User-centered design (UCD) is defined as a design and management Framework of processes that develops solutions to problems by involving the concrete user perspective in all steps of the problem-solving process in which usability goals, user characteristics, environment, tasks and workflow of a product, service or process are given extensive attention at each stage of the design process. The main goal of the User-Centered design is to make products which have very high usability. This includes how convenient the product is in terms of its usage, manageability, effectiveness and how well the product is mapped to the user requirements.

In our paper we focused mainly on the last phase of User-Centered Design process, which is defined by ISO 9241-210:2010 as *Product Evaluation: Product designers do usability testing to get users' feedback of the product. Product evaluation is a crucial step in product development which gives critical feedback of the product.* So, we focused on the product evaluation by usability and UX (User Experience) testing. But in order to identify the results as relevant, it is necessary to briefly describe the whole process of developing the prototype of Vcelstva online web application and the methods used.

2. Materials and Methods

At the very beginning of the process, user research methods were used. User research is the beginning of each UX process, helping to interpret user information, behavior, goals, motivations, and needs. What a UX designer can see as an intuitive solution can be perceived by a target audience as a completely non-intuitive experience, so user research is absolutely essential to the success of the application. For successful user performance, the UX empowerment of the designer is very important, as the key to success is understanding the specific behavior of users, the ability to feel empowered. Merholz and Skinner (2016) to emphasize the importance of empathy in UX research says: *Don't confuse process for outcome – knowing UX practices like personas, flows, and wireframes is important, but not sufficient to delivering great experiences. More important is a UX mindset – a commitment to seeing the world from the perspective of your users and doing everything you can to make sure what you're doing makes sense to them.* Thus, user research helps determine exactly how users feel when using the application while meeting goals and whether the product is working properly. Jeff Gothelf (2013) describes major changes in the application development process, pointing out that continuous improvements and product iterations are widely used today. In this paper we focus namely on Personas, Wireframe Prototyping, Blind test and A/B testing methods which are described briefly in next chapter regarding to our concrete application of these methods.

Several other tests, which are normally used to test such projects (Benda et al., 2017; Šimek et al., 2015), were used, eg 5 second test, 30 second test, User eye-fixation and focus in order to Jahanian

et al. (2018), Think Aloud test, etc., but their comprehensive description is beyond the scope of this paper.

3. Results and Discussion

To apply user research methods, we had to understand who our users are, so to meet the first point of the process and therefore to identify who are the primary users of the product, why they will use the product, what are their requirements and under what environment they will use it. For this purpose, we used the method called Personas.

Persona in User-centered design and marketing is a fictional character created to represent a user type that might use a site, brand, or product in a similar way (Lidwell and Holden, 2010). Humphrey (2017) describes a persona as a representation of the goals and behavior of a hypothesized group of users. In most cases, personas are synthesized from data collected from interviews with users. The purpose of personas is to create reliable and realistic representations of your key audience segments for reference. These representations should be based on qualitative and some quantitative user research and web analytics, personas are only as good as the research behind them.

For the purposes of our study we defined two personas. The first one represents beekeepers who could use the application. Within this person was also defined the assumption that not all beekeepers use modern technology and not necessarily have a high level or skill in the use of web pages. The second persona, we defined, represented a wide audience, so users which are interested in the field of beekeeping or its products, but are not beekeepers.

Based on the defined Personas we performed Pen and paper interview with real users which represents both created Personas the most and asked them about their needs and requirements. On the basis of these interviews and taking into account Krug's (2006) Three-step rule, to provide key features of application up to three steps at a time, we were able to determine basic user scenarios. These scenarios were also defined by project operator and user behavior of original Vcelstva online project were taken into account. Scenarios in diagrams were created for all major identified sections. The most important factor was the conversion of new users, clear information and interaction with the map. For logged-in users, it seeks primarily to register honey bee colonies and sales outlets.

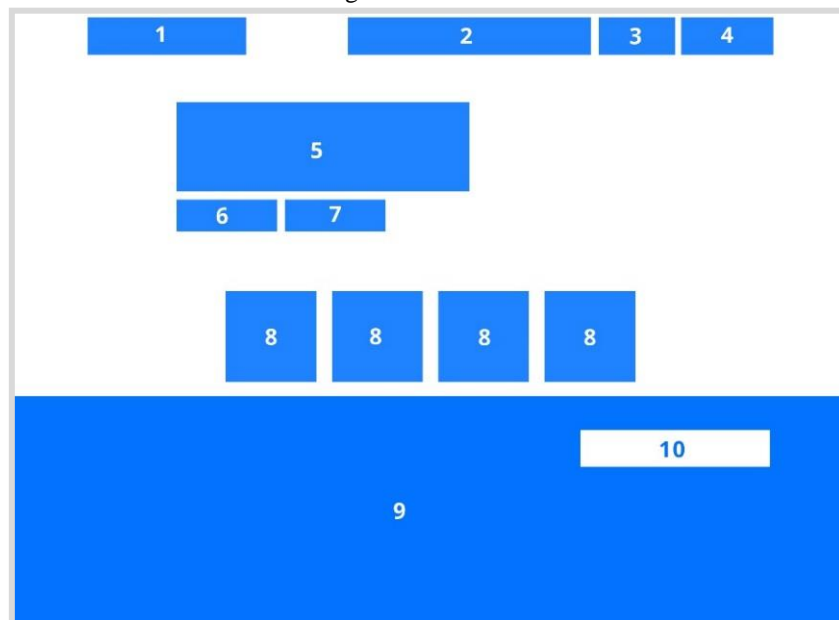
In order to the application to have high-quality user content, it is first and foremost a need for the user to create it. The primary type of content that is required is the honey sales station, as this content adds to the platform also for users who are not interested in functionality after registration and want to look for honey dealers first. Equally important is the addition of bee habitats. Therefore, a group of these elements must be presented to the user immediately from the start. It is also desirable for a user to interact with a map in which they can also edit their existing objects and search for objects of other beekeepers. The last important aspect is providing access to advanced functions, this section does not have to be specially structured but, above all, must have sufficiently distinct elements. The diagrams thus created are the basic building blocks for wireframes, as they describe the functionality of each wireframe.

The next step in the project was the creation of wireframes. As stated by Wolfram (2015), wireframes allow the first visual representation of the application's user interface based on the background information obtained from previous research phases. As a basis for creating the first version of the prototype using wireframes, we used the knowledge and feedback from test users, created personas, and critical application scenarios. The purpose of this prototype was a possibility to test, before the design of a visual part, whether the implementation of knowledge from the initialization analysis has actually produced measurable and significant improvements in these directions and can continue the next stage of development.

To test the created prototype, a special procedure was chosen to use the new user base. Therefore, users who did not take part in the initial testing and were never previously in contact with the application themselves were selected to test. This unbiased look helped to objectively measure and evaluate user experience improvements for new users who do not know the application. Thanks to the resources of the FEM, it was possible to use a specialized Laboratory for examining the human behavior (HUBRU). In addition to the complete viewing of users' responses, this lab also allows eye tracking, eye tracking, which is a very effective tool for detecting potential drawbacks and verifying whether a user uses the application according to the proposed plan with pixel precision.

The so-called Blind test was performed before testing the prototype. The purpose of the Blind test was to verify the accuracy of the structure of the elements without affecting the content and the visual (Nunnally and Farkas, 2016). The test was based on the subjective expectations of users of the location of individual elements. The Wireframe consists of monochrome blocks that are individually numbered. In addition, commands are given to the users according to scenarios, which are also numbered, followed by the step number of the scenario assigned to the element number that the user selected in the given step. The figure below contains the blind screen wireframe visualization that was created by masking the contents of the actual wireframe.

Figure 1. Blind Test



Source: authors

Users were given commands by a microphone according to a pre-prepared scenario. Each user first had 15 seconds to view the entire template, and after this time, each step went to the steps of each task. User responses were immediately written to pre-arranged sheets marked with boxes for the element number that the user selected at that step. For each user, their own evaluation sheet was conducted. The advantage of this test is the simplicity and overall ease of execution, providing very useful data on user thinking.

Subsequently, we also tested the interactive prototype with users. This test method allows several types of outputs to be analyzed during one test run. First of all, we explored how the user is using the application and how it reacts to individual elements by sensing face and Eye Tracking. The camera can capture frustration, confusion or satisfaction with the application's responses, the eye sensor can then provide a great deal of information from eye movement to the intensity of tracking individual locations using the heat map. This has made it possible to find out how the user is moving

in the application, where his view is first and where the application directs his view. One type of output of such testing is, for example, heat maps capturing the intensity of attention of individual elements.

Figure 2. Eye Tracking Heatmap of Včelstva online prototype



Source: authors

Thanks to this, it is possible to recognize not only the order in which the user discovers elements but also how the individual elements attract the user's attention. Figure 2 shows the part of the screen, which in this case overlaps with the already completed heat map created after 30 seconds of user interaction with the application, this time was sufficient to generate the data without unnecessarily confusing the number of these zones.

Based on all of the above steps, the final version of the functional prototype of the Včelstva Online (BeeTech) web application was created. This final version was tested by a third independent user group, a group that did not come into contact with the project earlier. For the final comparison of the original and the new version of the web application we used the A/B testing method.

A/B testing method is a controlled experiment with two variants, A and B. It is a form of statistical hypothesis testing or "two-sample hypothesis testing" as used in the field of statistics. A/B testing is a way to compare two versions of a single variable typically by testing a subject's response to variable A against variable B, and determining which of the two variables is more effective (Kohavi and Longbotham, 2017). The comparison of the original project with the new prototype created on the basis of the above described procedure is clearly won the new solution. A total of 32 user testers, chosen by above mentioned Persona strategy, participated in A/B testing. Concrete result is that the tested prototype is performing better, and the difference is 95.0% likely to be statistically significant (Z-Score is 2.22), this means that we can be confident that the new solution is actually better by this testing method, and not performing better due to random chance.

4. Conclusion

The main reason for this study was to increase the number of Vcelstva online (BeeTech) web application users and their satisfaction with this application, because in order to application to have high-quality user content, it is first and foremost a need for the user to create it. Based on the final A/B testing performed by users who did not previously come into contact with the Vcelstva online web application nor the tested prototype, the use of all of the above described methods within the chosen User-centered design framework and procedures led to an overall improvement of Vcelstva online. Within the UCD framework, the intended users of this application were part of all

the steps of developing a new prototype, which proved to be a really good procedure with positive results. In addition, the workload and difficulty of this project is not significantly higher than that of the conventionally developed software. Other important and comparable data on the potential improvement of Vcelstva online web application will be available from regular web site traffic. Both directly from users and also the analytical data measured directly on the site and compared to the original solution.

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CONSUMER'S PERCEPTIONS OF FOOD QUALITY AND LABELLING IN THE CZECH REPUBLIC

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Annotation: The aim of this paper is to analyse knowledge of food quality labels as well as satisfaction with food quality and trust in the origin of food in a selected population of the Czech Republic. The paper is based on primary research carried out in the form of data collection through a questionnaire implemented jointly by the Department of Trade and Finance at the Czech University of Life Sciences Prague and the State Agricultural Intervention Fund of the Czech Republic. There were 857 ($n = 857$) respondents in the survey – housewives between 25 and 55 years.

From the total number of respondents, 75.1% knew at least one food quality label and only 5.0% were not aware of any labelling. Most respondents named the labels “Klasa”, “Český výrobek” (“Czech Product”), “Regionální potravina” (“Regional Food”) and “Bio” (“Organic”). This part of the survey showed a dependence between knowledge of at least one quality label and level of education. From the total number of respondents who knew at least one food quality label, 74.4% said they had confidence in Czech food. 22.5% do not differentiate between Czech and imported food and only 3.1% prefer foreign food. From the total number of respondents, 74.6% are satisfied with the quality of Czech food while 25.4% find it unsatisfactory. In terms of trust and satisfaction with food quality in the Czech Republic, we observed no statistical dependence on the variables of age, education and size of the municipality where the respondents live.

Key words: food, consumer, quality, label, market, women

JEL classification: F18, Q13, Q18

1. Introduction

The ever-growing demand for high quality safe food requires certain measures that will make it easier for consumers to understand the market offer. One of the available responses to this situation is labelling food quality. Labelling and quality of information are among the main attributes people consider when choosing food (Fernqvist and Ekelund, 2014). Food quality labelling and food quality as such are the topic of numerous discussions and research by authors all over the world (Velčovská and Chiappa, 2015; Navrátilová et al., 2017).

The Czech food market has experienced significant changes in the last few decades. As noted by Turčínková and Stávková (2009), the strongest development from the consumers' perspective was the growing demand for high added value products and increased consumer interest in perceived quality, longer shelf life and products with special characteristics. Caswell and Mojduška (1996) add that consumers choose those food products that will bring them the benefits they expect. And this growing consumer demand for food transparency is the reason why consumers today, more than ever before, want to know where their food comes from (Czech or imported) and expect to receive clear, accurate and useful information about the food they buy (Pollard, 2018).

One of the most important attributes in describing consumers is typically gender, because the purchase behaviour of men and women exhibits considerable differences (Turčínková et al., 2012). Despite the gender equality in modern societies, the traditional family model still survives and it's predominantly women who care for a household. For this reason, women's awareness and women's choices in purchasing are a very important factor for the health of the entire population as our understanding of the importance of food for human health keeps evolving (Verbeke, 2006).

The aim of this paper is to analyse knowledge of food labels as well as satisfaction with food quality and trust in the origin of food in a selected population of the Czech Republic. In the Introduction, a theoretical background of the examined issue is provided. The Materials and Methods section of this paper describes how the primary research was conducted as well as the samples of respondents. Results and Discussion section presents the results obtained and discussion and comparison of the final results of own research with similar studies in the context of the issue are conducted.

2. Materials and Methods

The theoretical background of this paper was based on an analysis of secondary sources gained from scholarly papers, specialised literature, and official web portals. Primary data was obtained through a survey.

The data was obtained by quantitative research using a questionnaire survey among the following group of respondents: housewives (i.e. working women with families) from the age of 25 to 55 (n = 857); the target group was selected intentionally. Research data was gathered in the autumn of 2015.

Primary data was gathered through a questionnaire survey launched by a co-operating team comprised of the Department of Trade and Finance, the Czech University of Life Sciences Prague, and the State Agricultural Intervention Fund of the Czech Republic.

Basic sociodemographic factors of the respondent reference group are summarised in the following table:

Table 1. Sociodemographic factors of the respondents in % and total

Gender	Females	100.00	857
Age	25 – 35 Years	39.1	335
	36 – 45 Years	34.1	292
	46 – 55 Years	26.8	230
Highest education level obtained	Elementary	0.8	7
	Secondary with no graduation exam	11.6	99
	Secondary with graduation exam	43.1	369
	University	44.5	382
Permanent residence	Prague	11.9	102
	Central Bohemian region	12.4	106
	Ústí nad Labem region	9.7	83
	South Bohemian region	5.7	49
	Hradec Králové region	4.9	42
	Pardubice region	4.8	41
	Vysočina region	4.7	40
	Plzeň region	5.1	44
	Moravian-Silesian region	11.3	98
	Karlovy Vary region	2.9	25
	Liberec region	4.6	39
	South Moravian region	10.5	90
	Zlín region	6.0	51
	Olomouc region	5.5	47
Population of place of residence	up to 1,000 inhabitants	17.6	151
	1,001 – 10,000 inhabitants	16.8	144
	10,001 – 100,000 inhabitants	39.3	337
	Over 10,001 inhabitants	26.3	225

Source: Authors' research, 2015

To evaluate the various results of the survey, methods of descriptive statistics (absolute and relative frequency, testing of independency between set qualitative characteristics, and power dependency measures), Pearson's chi-square test and Cramer's V were applied. If the p-value calculated

by the means of the χ^2 test was lower than the selected level of significance $\alpha = 0.05$, null hypothesis about independency was rejected.

The table provides an overview of the set hypotheses for the purposes of data analysis:

Table 2. Set hypotheses summary

Hypothesis No.	Hypothesis
H0 ₁	General knowledge of food quality labels is not dependent on respondents' age
H0 ₂	General knowledge of food quality labels is not dependent on respondents' education
H0 ₃	General knowledge of food quality labels is not dependent on the size of the municipality where respondents live
H0 ₄	Trust in Czech or imported food is not dependent on respondents' age
H0 ₅	Trust in Czech or imported food is not dependent on respondents' education
H0 ₆	Trust in Czech or imported food is not dependent on the size of the municipality where respondents live
H0 ₇	Overall satisfaction with the quality of Czech food is not dependent on respondents' age
H0 ₈	Overall satisfaction with the quality of Czech food is not dependent on respondents' education
H0 ₉	Overall satisfaction with the quality of Czech food is not dependent on the size of the municipality where respondents live

Source: Authors' research, 2015

3. Results and Discussion

The age, level of the highest education and population of place of residence obtained of the respondents are the attributes of the utmost significance in the research of food quality and labelling. This section provides an overview of tests of these variables in relation to selected questions.

Table 3. General awareness of quality food product marks by age

Age category	Yes, I am very well aware	Yes, I am generally aware	I have heard about; however I am not aware	No, I am neither aware, nor I have heard about	Total
15 – 25 years	65	195	66	9	335
26 – 35 years	63	154	54	21	292
36 – 45 years	53	114	50	13	230
Total	181	463	170	43	857

Source: Authors' research, 2015

The calculated chi-square value of 10.2 in Table 3 is lower than the critical value of the distribution by 6 degrees of freedom at level 0.95. Therefore, null hypothesis cannot be rejected. The awareness of one quality food product mark, minimally, is not dependent on the respondents' age.

Table 4. General awareness of quality food product marks by education

Highest education level obtained	Yes, I am very well aware	Yes, I am generally aware	I have heard about; however I am not aware	No, I am neither aware, nor I have heard about	Total
Elementary + Secondary with no graduation exam	18	46	28	14	106
Secondary with graduation exam	58	216	75	20	369
University	105	201	67	9	382
Total	181	463	170	43	857

Source: Authors' research, 2015

It should be stated that the number of respondents with elementary education was substantially low to implement correct contingency table calculations as the statistics would demonstrate false dependence. Therefore, the category of elementary education was merged with the one of secondary education with no graduation exam. Table 4 demonstrates the data preceding the merge; nevertheless, both the value of statistics and critical value, reflect the results after the merge of the first two categories into a common category of the respondents with secondary education with no graduation exam.

The calculated chi-square value of 40.1 in Table 4 is higher than the critical value of the distribution by 6 degrees of freedom at level 0.95. Null hypothesis can therefore be rejected. The awareness of one quality food product mark, minimally, is dependent on the respondents' education. Not surprisingly, higher awareness corresponds to the rising of higher education of the respondents. The authors (Navrátilová et al., 2017) have obtained the same result in a previous survey which was aimed at the general population.

Table 5. General awareness of quality food product marks by place of residence

Population of place of residence	Yes, I am very well aware	Yes, I am generally aware	I have heard about; however I am not aware	No, I am neither aware, nor I have heard about	Total
up to 1,000 inhabitants	31	82	30	8	151
1,001 – 10,000 inhabitants	29	81	23	11	144
10,001 – 100,000 inhabitants	72	182	68	15	337
Over 10,001 inhabitants	49	118	49	9	225
Total	181	463	170	43	857

Source: Authors' research, 2015

The calculated chi-square value of 4.59 in Table 5 is lower than the critical value of the distribution by 9 degrees of freedom at level 0.95. Therefore, null hypothesis cannot be rejected. The awareness of one quality food product mark, minimally, is not dependent on the respondents' place of residence.

In terms of specific labels, the respondents most often remembered “Klasa”, “Český výrobek” (“Czech Product”), “Regionální potravina” (“Regional Food”) and “Bio” (“Organic”). The findings are in compliance with Velčovská and Sadílek (2014) who defined the ‘Klasa’ mark as the most known mark in the Czech market.

Table 6. Aggregate statistic values for trust in the origin of food and overall satisfaction with the quality of Czech food

Category	Values	Trust in the origin of food	Overall satisfaction with the quality of Czech food
Age	Critical value	9.49	12.59
	χ^2	4.93	7.21
	Cramer's <i>V</i>	0.07	0.07
Highest education level obtained	Critical value	9.49	12.59
	χ^2	0.43	5.08
	Cramer's <i>V</i>	0.02	0.05
Population of place of residence	Critical value	12.59	16.92
	χ^2	6.43	6.45
	Cramer's <i>V</i>	0.08	0.05

Source: Authors' research, 2015

Our further research focused on trust in Czech and imported food and overall satisfaction with Czech food. Table 6 shows the aggregate values of statistic dependence between trust in the origin of a food and overall satisfaction with food quality on the one hand and the variables of age, education and size of municipality on the other. None of these variables exhibited any statistical dependence. The respondents answered two closed questions. From the total number of respondents who know at least one food quality label, 74.4% said they had confidence in Czech food; 22.5% do not differentiate between Czech and imported food and only 3.1% prefer foreign food. This shows that Czech consumers are interested in the country of origin of their food and prefer local food (Turčínková, 2011). This result agrees with the research done by Grunert (2002) who shows how important local products are on the food market. The growing interest in local food in the last 15 years is confirmed also by Feldmann and Hamm (2015).

Bredahl (2004) notes that the perception of quality by consumers is often based on individual value assessments. From the total number of respondents, 74.6% are satisfied with the quality of Czech food (answers "very satisfied" and "generally satisfied") while 25.4% find it unsatisfactory (answers "generally unsatisfied" and "very unsatisfied").

Table 7. Total results of tested hypotheses in food labelling, trust in food and satisfaction with food quality among Czech housewives

Hypothesis	Results
H0 ₁	cannot be rejected
H0 ₂	rejected
H0 ₃	cannot be rejected
H0 ₄	cannot be rejected
H0 ₅	cannot be rejected
H0 ₆	cannot be rejected
H0 ₇	cannot be rejected
H0 ₈	cannot be rejected
H0 ₉	cannot be rejected

Source: Authors' research, 2015

Table 7 shows the aggregate results for tested hypotheses (H0₁ – H0₉) defined in Table 2. As mentioned, general awareness of at least one food quality label correlates with respondents' education. No other dependence was proven for the examined variables. Despite that, the research still provides valuable insights into the role of local products, quality and trust on the Czech food market.

4. Conclusion

This paper aims to present the current results of primary research in the field of consumer's perceptions of food quality and labelling in the Czech Republic, which is a very important factor when individuals are deciding on food product purchases in the current competitive food market.

From the total number of respondents, 75.1% knew at least one food quality label and only about 5.0% were not aware of any labelling. Most respondents named the labels "Klasa", "Český výrobek" ("Czech Product"), "Regionální potravina" ("Regional Food") and "Bio" ("Organic"). This part of the survey showed a dependence between knowledge of at least one quality label and level of education.

From the total number of respondents who knew at least one food quality label, 74.4% said they had confidence in Czech food. 22.5% do not differentiate between Czech and imported food and only 3.1% prefer foreign food. From the total number of respondents, 74.6% are satisfied with the quality of Czech food while 25.4% find it unsatisfactory. In terms of trust and satisfaction with food quality in the Czech Republic, we observed no statistical dependence on the variables of age, education and size of the municipality where the respondents live.

The positive theoretical contribution of the paper lies in highlighting the issues of food labelling, satisfaction with food quality and trust in the origin of food. Its practical contribution is the presentation of results of primary research in this field focusing on a group of women – housewives.

As a follow-up to a previous article published by the same authors last year, this paper focuses more in-depth on a specific group of Czech consumers and their experience with food labelling and quality. The main limitation of this research is its validity, as it was carried out only in the Czech Republic. Possible direction for further research is the focus on quality and labelling of food abroad.

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RUSSIAN FARM ECONOMIC RESILIENCE IN THE CONTEXT OF STRUCTURAL ADJUSTMENTS: THE CASE OF THE NORTHWEST REGION AND THE 2008 ECONOMIC CRISIS

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Annotation: Farms across the globe are frequently subjected to many external shocks – from natural and climatic to economic, societal or political. Farm resilience to such shocks is thus of crucial importance for food security. Improving resilience of farms in transition countries may be of a particular importance as these farms still suffer from high technical inefficiencies and structural weaknesses. This study addresses the issue of organizational resilience in Russian agricultural enterprises, and focuses on the differences between various legal forms – cooperatives, limited liability companies, and joint stock companies. Using financial statement data from farms in northwestern Russia from 2001 to 2012, descriptive analysis and a fixed-effect growth model, we investigate farm resilience in the form of post-2008 crisis sales growth robustness and recovery. The empirical results show a significant negative effect of the economic crisis on farm production and farm survival rate, both of which suggest low farm resilience. The recovery from the economic crisis was mainly driven by farm restructuring, in which the formation of limited liability companies played a significant role. Profitability (performance) was also found to significantly increase farm resilience; not necessarily farm robustness, but farms' speed of recover from the negative consequences of the economic shock.

Key words: Farm resilience, economic crisis, sales growth, legal form, cooperatives, fixed effect model, Russia.

JEL classification: Q12, Q14.

1. Introduction

Empirical analyses of economic resilience are in their early stages. Although current literature features studies of economic resilience on the macroeconomic (Briguglio et al., 2009; Halegatte, 2014) and microeconomic levels (Rose, 2009; Rose and Krausmann, 2013), most inquiries concern resilience to natural and man-made disasters. At the same time, the amount of studies of organizational resilience toward economic disruptions is miniscule. This is surprising given that economic crises directly affect the economic side of organizations – the basis upon which the other aspects of organizational activity rest.

In the present study we focus on agricultural enterprises, whose core function is to provide food security or, in other words, sustain delivery of agricultural produce. We particularly focus on the ability of Russian farms to maintain and recover agricultural production in times of crisis. Russia's agriculture has experienced ongoing structural adjustments, discernible in the continuous emergence of farms with more concentrated ownership structure (limited liability companies) and a decline in the number of cooperatives (producer, consumer, and collective farms).

In this context, the main aim of our inquiry is to understand whether differences in farm post-crisis recovery gain their explanation from differences in farm legal forms.

Legal forms frame farm corporate structure, liability, as well as conditions for managerial discretion, and hence the organizational flexibility and performance that influences the level of generated internal funds (cash flow or profitability), as well as access to external finance (bank credit). Legal form is, therefore, assumed to be reflected in the organizations' resilience. In the context of transition countries, farm legal forms also capture the degree and progress of farm transformation, and thus the availability of effective (versus ineffective) excess resources and managerial capacities that will further impact farm resilience.

Among the three main legal forms of agricultural enterprises in Russia – cooperatives, limited liability (partnerships) companies (LLCs) and joint stock companies (JSCs), cooperatives are the least transformed agricultural businesses, exhibiting an inflexible decision-making structure (albeit with an extensive scope for managerial discretion), 'old-style' managerial practices and 'historic' (ineffective) excess resources. Their decreasing number could be indicative of their weaker performance and lesser available (including human) resources. We hypothesize that all these factors reflect a lower resilience.

The most direct form of transformation, popular mainly in the earlier years of transition but stagnating in numbers in more recent years, was a legal form change to a joint stock company (JSCs), in which (most) members of former collective farms (or cooperatives) became shareholders (Brooks et al., 1996). The companies thus retained large sizes but allowed larger numbers of shareholders to gain greater impact in the decision-making process (mainly in major decisions). While JSCs were considered not effectively different from cooperatives in the first decade of transition (Brooks et al., 1996), gradual capital concentration through share purchases could have resulted in management changes since larger shareholders may exercise greater pressure on farm performance. In addition, this legal form allows successful JSCs to grow not only through debt financing but also equity financing by issuing shares and going public. JSCs are thus assumed to benefit not only from 'new' management and economies of size and scope, but also from better access to resources. We hypothesize that JSCs are more resilient than agricultural cooperatives.

Finally, LLCs were formed by contributing members' shares to the charter capital of the enterprise (Brooks et al., 1996: 2). Unlike shareholders of JSCs, LLC members have formal voting rights on routine managerial decisions. While in the initial phase of transition, LLCs were of a comparable size with JSCs (ibid.), in more recent years, LLCs have emerged by regrouping the shares of original (mainly) cooperative farm members. They are hence enterprises that are reorganized into smaller units in which the reorganization followed the aim to retain more productive capacities and to cancel unrepayable debts of the predecessor company. These financially healthier companies have a better standing on the financial (debt) markets. Also, their smaller membership base may allow them to respond to external market disruptions and other economic shocks more effectively than the other two previously discussed legal forms. We assume these companies to be the most resilient farm type.

We will test our hypotheses by looking at the legal form differences in resilience in the context of the agricultural enterprise production responses to the economic crisis of 2008/09. The economic crisis of 2008/09 represents a unique natural experiment that exposed farms to a severe external shock.

2. Materials and empirical strategy

a. Data

In our micro-analysis, we analyze data from agricultural enterprises of Northwest Russia from 2001 to 2012.¹ The data originate from financial statements collected by the Statistical Office. The available time series include the year of the global financial crisis, which affected Russia's economy and its agricultural sector. Therefore, 2008 will be considered the year of the shock to the agricultural sector against which farm resilience will be assessed. In addition to financial statement variables, the dataset includes information about agricultural enterprise legal form, region, and an indication of whether the farm is integrated into a holding structure. We excluded all enterprises that are business group (agroholding) members and thus focused on independent farms. Also, the data is marked by significant dynamics in the farm structure, and particularly the entry/exit of farms. Ignoring the structural dynamics could significantly influence econometric results. Therefore, our econometric analysis is performed on observations that exist in the database over the entire period of 2001 to 2012 (balanced panel); these results are thus specific for surviving farms. Nevertheless, legal form-specific exit/entry statistics will be provided and descriptive resilience analysis performed on the entire sample.

b. Empirical model

We base our analysis on a simple firm growth model and analyze resilience indirectly in that we estimate the immediate (static) and longer-term (dynamic) impact of the economic crisis on firm growth, defined as an annual change in sales. We investigate the differences in farm resilience between the three main legal forms by estimating two farm sales growth model specifications separately for each legal form type. This allows parameter variability between the legal forms. The first, basic, farm growth model is specified as follows:

$$\Delta s_{it} = \beta_0 + \beta x_{it-1} + \delta t + \alpha_i + \varepsilon_{it}, \quad (1)$$

where Δs_{it} denotes a natural logarithm of the annual change in total sales² (s_{it}/s_{it-1}) of farm i in time t , x is a vector of four variables – total sales, total assets, sales to costs ratio as a proxy for profitability, and indebtedness (short- and long-term debts to total assets ratio) all in natural logarithm form in time $t-1$, t denotes a vector of dummy variables for individual crisis and post-crisis years (2008, 2009, 2010, 2011, and 2012, respectively) that will allow to estimate the short-term drop in sales due to the crisis (compared to average sales growth of previous years) and the parameters of recovery. Parameter δ will thus provide us with an indirect indication of farm resilience. Because of panel data, the model further includes latent, farm-level fixed effects α_i , that could be correlated with variables in vector x . Finally, ε_{it} captures an identically and independently distributed (i.i.d.) error term (Blundell and MaCurdy, 1999).

To eliminate the observable and unobservable time-invariant farm heterogeneity that could be correlated with x , we estimate a fixed-effect model specification that is obtained by transforming equation (1) by differencing each observation from group mean. After this transformation, vector x contains observable variables that change across t but not i . This variable thus remains farm heterogeneity unrelated. The resulting model specification is as follows:

¹ In total 11,280 observations are available, however, not all observations are considered for the analysis due to the shortness of the enterprise presence in the official statistics. Also, observations with annual change in sales equal to or greater than four were excluded from the analysis to reduce the effect of potential outliers.

² The sales values are adjusted to real values for 2002-2012 using agricultural production price indexes for Northwestern Russia of Russian Statistical Yearbook for the corresponding years.

$$\Delta s_{it} - \overline{\Delta s}_i = \gamma_0 + \gamma (x_{it-1} - \bar{x}_i) + \pi t + (\varepsilon_{it} - \bar{\varepsilon}_i). \quad (2)$$

This specification assumes that the effects of total sales and assets, profitability and indebtedness, as well as of the economic crisis are identical for all observations in the group for which the mode is estimated. To allow for variation in resilience (responses to economic crisis) due to farm differences in profitability and indebtedness, we adjust the model in equation (2) by including interaction terms of all time dummy variables with logarithms of the sale to costs ratio and debts to assets ratio, both in t-1. This specification will be referred to as an extended model. We estimate all models using statistical software Stata 14.1.

3. Results

Farm structure in northwestern Russia has been marked by a wide spectrum of legal forms and dramatic changes – these dynamics are depicted in Table 1. In 2001, agricultural enterprises of this region were to a large extent represented by mainly producer cooperatives (42% of agricultural enterprises), while 18% were made up of LLCs and 33% were JSCs. With just a 7% share, state farms played a marginal role that further decreased over the following years. In 2012, the dominant legal form became LLC (44% of all enterprises). However, when looking at the changes in more detail, we can observe that many LLCs drop from the national statistics and many new companies emerge with this legal form. Still, it is actually the LLC form that shows the highest rate of exit. This may indicate that agricultural enterprises with the LLC form may be attractive for restructured farms as well as for take-overs (mergers and acquisition).

These farm types significantly differ in their sizes, capital structure as well as performance. Table 2 presents median values of selected variables for the balanced panel, i.e. surviving farms and a balanced panel that includes all the above indicated structural changes. In the value of sales, the median size of LLCs is twice the median size of cooperatives; however, median JSCs – mainly closed JSCs – are significantly larger. When considering the surviving agricultural enterprises only (balanced panel), the median values of annual sales growth before the economic crises are very similar for all legal forms at around 3% to 4%. However, as a result of the economic crises, the growth rate declined the most for LLCs, which, together with closed JSCs, are the only two groups of agricultural enterprises displaying median value profits (sales to costs ratio above one). These two types of companies also show the highest indebtedness among legal forms. The level of indebtedness interestingly increased in all groups of farms from before to after the crisis period, which would suggest that agricultural companies partially coped with the consequences of the economic crises by acquiring external finance.

Table 1: Number of agricultural enterprises of different legal forms in years 2001, 2007 and 2012 (unbalanced panel, complete database)

	2001 all	2007 of those in 2001	2007/2001*	2012 of those in 2001	2012/2007*	2007 all	2012 of those in 2007	2012/2007*	2012 all
Coops	530	346	0.65	213	0.62	458	257	0.56	287
LLCs	224	115	0.51	78	0.68	365	188	0.52	438
Closed JSCs	274	168	0.61	123	0.73	199	134	0.67	148
Open JSCs	146	119	0.82	89	0.75	143	103	0.72	104
State farms	86	36	0.42	12	0.33	53	17	0.32	20
Total	1,260	784	0.62	515	0.66	1,218	699	0.57	997

Note: * indicates survival rate.

Table 2: Median values of selected variables for farms of different legal forms before and after the economic crises for balanced panel and unbalanced data panel

Unbalanced panel	Coops	LLCs	Closed JSCs	Open JSCs	State Farms
<i>Before 2008</i>					
Sales _t / Sales _{t-1}	1.003	1.036	1.004	1.026	0.990
Sales (thousand RUB)	2374	2842	14059	6315	3617
Assets _t / Assets _{t-1}	1.003	1.068	1.063	1.030	0.997
Sales _t /Costs _t	0.922	1.015	1.049	0.971	0.883
Debts _t /Assets _t	0.135	0.275	0.204	0.139	0.213
<i>After 2007</i>					
Sales _t / Sales _{t-1}	0.976	1.022	0.989	0.982	0.952
Sales (thousand RUB)	2947	3774	26703	8780	3105
Assets _t / Assets _{t-1}	1.003	1.057	1.065	1.043	0.994
Sales _t /Costs _t	0.945	1.002	1.038	1.000	0.933
Debts _t /Assets _t	0.129	0.274	0.225	0.144	0.211
Balanced panel	Coops	LLCs	Closed JSCs	Open JSCs	State Farms
<i>Before 2008</i>					
Sales _t / Sales _{t-1}	1.032	1.034	1.037	1.037	1.030
Sales (thousand RUB)	3686	6914	30658	8336	17418
Assets _t / Assets _{t-1}	1.027	1.040	1.104	1.031	1.037
Sales _t /Costs _t	0.992	1.043	1.088	0.973	0.976
Debts _t /Assets _t	0.095	0.145	0.183	0.088	0.137
<i>After 2007</i>					
Sales _t / Sales _{t-1}	0.983	0.972	1.003	0.983	0.967
Sales (thousand RUB)	3705	7664	33370	8011	15996
Assets _t / Assets _{t-1}	1.003	1.029	1.075	1.043	1.032
Sales _t /Costs _t	0.969	1.006	1.037	1.000	0.983
Debts _t /Assets _t	0.107	0.191	0.204	0.124	0.154

Comparing the median values of the selected variables between surviving agricultural enterprises in the balanced panel and all agricultural enterprises in the unbalanced panel shows important differences. Farms that operated over the entire period from 2001 to 2012 had a significantly higher growth rate in the pre-crisis years compared to the full sample that includes a significant share of farms that exited the sector. All farm types except LLCs in the unbalanced panel show a reduction in post-crisis production. This higher sales growth of LLCs implies that newly established LLCs are more likely resilient to the economic crisis. The dynamics in farm structure in the post-crisis period characterized by a high rate of LLC entry and a decline of other legal forms may thus be an indication of LLCs' greater adaptability. This may be attributed to the concentrated ownership (lower agency costs), governance mechanisms and faster decision making process. The way these enterprises are being formed and what form of original enterprises' restructuring accompanies this formation remains unknown and may be politically critical.

In the following, we investigate the resilience of farms in the balanced panel using fixed-effects sales growth models as specified previously. We are mainly interested in the legal form-specific changes in the growth rate due to economic crisis of 2008/09 captured in the parameters on time dummies from 2008 to 2012. Table 3 lists estimates of the basic and extended fixed-effects growth models.

The parameter estimates in Table 3 suggest differences in growth behavior and strategy between the legal forms of Coops, LLCs and JSCs. The parameters on the first variable, $\ln(sales)_{t-1}$, indicates

that the (relative) sales growth rate decreases with the size of the (absolute) increase of sales. This effect is largest in the case of JSCs and smallest for Coops that represent the largest and smallest companies in the sample, respectively. Keeping all other variables constant, an increase in the value of assets, on the other hand, results in an increase of sales growth rate, particularly in LLCs and JSCs. Positive returns (profitability) motivates an increase in production only in the group of LLCs. In the case of cooperatives and JSCs, the profitability effect on growth is not statistically significant. Farm indebtedness is found to have a positive effect on farm growth in the group of cooperatives only (in the basic model, at a 10% significance level among LLCs). This indicates that farms in these groups that were able to mobilize external funds grew faster than credit constrained farms that depended more on internally generated funds for growth. JSCs adjusted their growth rate irrespective of the level of external funding.

The parameter estimates with respect to the crisis and post-crisis time dummies indicate that the level of sales growth statistically significantly dropped as a result of the macro-economic conditions of these years when compared to the sales growth rate of 2001 to 2007 in enterprises of all legal forms. Their responses show significant temporal and size variations; however, these do not seem to exhibit systematic patterns. Surprisingly, there is also no clear indication of production recovery some time after the economic crisis. On the contrary, there is evidence of another year shock in 2011 in case of LLCs and in 2012 that is affecting cooperatives and JSCs. This may relate to production structure differences between legal forms, as large JSCs may have a greater share of crop production that could have been affected by the drought of 2012.

The farms' production response to economic crises and especially the recovery from the economic disruption is found by the extended model to vary significantly with the level of profitability. Higher profitability (higher farm performance) speeds up the farm recovery from the economic crisis. This relates to the statistically significant parameter on the interaction term between sale to costs ratio and dummy variables for the years 2011 and 2012 for all three analyzed legal forms. The effect of external funding on farm resilience remains ambiguous as statistically significant effects of the interaction term between time dummies and indebtedness rate are found in some cases positive and in some negative.

Table 3: Estimates of the fixed-effects growth models for farms in northwest Russia, balanced panel of 2001-2012

Dependent variable:	Basic model				Extended model			
	Pooled model	Coop model	LLC model	JSC model	Pooled model	Coop model	LLC model	JSC model
$\ln(sales_t/sales_{t-1})$	-0.223** (-14.04)	-0.210** (-10.81)	-0.248** (-5.00)	-0.283** (-10.46)	-0.240** (-15.24)	-0.226** (-11.72)	-0.251** (-4.98)	-0.289** (-10.55)
$\ln(assets)_{t-1}$	0.131** (7.83)	0.110** (4.75)	0.177** (3.29)	0.215** (7.41)	0.121** (6.99)	0.0861** (3.61)	0.178** (3.27)	0.183** (6.13)
$\ln(sales/cost)_{t-1}$	0.245** (7.26)	-0.0027 (-0.06)	0.792** (8.78)	0.0703 (1.10)	0.0686 (1.40)	-0.113+ (-1.89)	0.550** (3.40)	-0.0505 (-0.56)
$\ln(debt/assets)_{t-1}$	0.0260** (2.72)	0.0250* (2.28)	0.0705+ (1.83)	-0.0002 (-0.01)	0.0272* (2.29)	0.0232+ (1.70)	0.0616 (1.29)	-0.0089 (-0.43)
td_{2008}	-0.101** (-4.98)	-0.085** (-3.67)	-0.200* (-2.25)	-0.117** (-3.36)	-0.177** (-3.69)	-0.176** (-2.88)	-0.136 (-0.80)	-0.211** (-2.61)
td_{2009}	-0.185** (-8.75)	-0.167** (-6.95)	-0.176+ (-1.85)	-0.222** (-5.94)	-0.178** (-3.79)	-0.194** (-3.30)	-0.177 (-0.96)	-0.277** (-3.39)
td_{2010}	-0.194** (-8.95)	-0.169** (-6.86)	-0.140 (-1.48)	-0.402** (-10.41)	-0.0945* (-2.02)	-0.0823 (-1.43)	-0.365+ (-1.80)	-0.0491 (-0.61)
td_{2011}	-0.144** (-6.44)	-0.109** (-4.30)	-0.422** (-4.38)	-0.222** (-5.40)	-0.228** (-4.69)	-0.155** (-2.66)	-0.699** (-3.42)	-0.144+ (-1.73)
td_{2012}	-0.315**	-0.288**	-0.161	-0.438**	-0.250**	-0.0508	-0.106	-0.568**

	(-13.78)	(-11.28)	(-1.62)	(-10.22)	(-5.38)	(-0.87)	(-0.63)	(-6.92)
$\ln(\text{sales}/\text{cost})_{t-1}$ *								
<i>td_2008</i>					-0.0950 (-1.13)	-0.0236 (-0.25)	-0.0471 (-0.15)	0.0131 (0.08)
$\ln(\text{sales}/\text{cost})_{t-1}$ *								
<i>td_2009</i>					-0.0660 (-0.86)	-0.141 (-1.36)	-0.109 (-0.38)	0.0406 (0.32)
$\ln(\text{sales}/\text{cost})_{t-1}$ *								
<i>td_2010</i>					-0.0895 (-0.99)	-0.103 (-0.95)	-0.773* (-2.04)	0.162 (0.99)
$\ln(\text{sales}/\text{cost})_{t-1}$ *								
<i>td_2011</i>					0.281** (3.03)	0.248* (2.10)	0.610* (2.12)	0.301+ (1.70)
$\ln(\text{sales}/\text{cost})_{t-1}$ *								
<i>td_2012</i>					0.705** (9.52)	0.998** (8.71)	0.373+ (1.90)	0.773** (4.61)
$\ln(\text{debt}/\text{assets})_{t-1}$								
* <i>td_2008</i>					-0.0345+ (-1.80)	-0.0376+ (-1.67)	0.0284 (0.40)	-0.0509 (-1.45)
$\ln(\text{debt}/\text{assets})_{t-1}$								
* <i>td_2009</i>					-0.001 (-0.03)	-0.0123 (-0.59)	-0.0075 (-0.10)	-0.0364 (-1.06)
$\ln(\text{debt}/\text{assets})_{t-1}$								
* <i>td_2010</i>					0.0503** (2.82)	0.0395* (1.98)	-0.0842 (-0.94)	0.166** (4.95)
$\ln(\text{debt}/\text{assets})_{t-1}$								
* <i>td_2011</i>					-0.0429* (-2.22)	-0.0295 (-1.41)	-0.141 (-1.51)	0.0314 (0.86)
$\ln(\text{debt}/\text{assets})_{t-1}$								
* <i>td_2012</i>					0.0187 (1.02)	0.0677** (3.24)	0.0247 (0.35)	-0.0698+ (-1.94)
_cons	0.725** (4.54)	0.743** (3.33)	0.471 (1.17)	0.417 (1.41)	0.984** (5.95)	1.109** (4.80)	0.484 (1.20)	0.799* (2.50)
R^2 (within)	0.086	0.096	0.222	0.116	0.120	0.142	0.267	0.153
N	4321	2367	389	1752	4321	2367	389	1752

Note: *t* statistics appear in parentheses; + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

4. Conclusions

This study delivers an empirical analysis of the economic resilience of agricultural enterprises in the northwestern region of Russia. This investigation considers the context of farm structural changes and places specific emphasis on the differences between legal forms whose representation has markedly changed in the process of transition. Farm resilience is measured as the ability to maintain agricultural production during the economic crisis of 2008/09 and the rapidity of the production recovery over the years that follow. We conducted a descriptive analysis of farm structure dynamics and estimated a fixed effect growth model with legal-form variability in the effect of the economic crisis and post-crisis time dummies using data from farm financial statements for the period of 2001-2012.

The empirical results suggest that the economic crisis had a significant negative effect on the volume of agricultural production; this effect was, however, not monotonous over all farm types. Concretely, we found the economic resilience of farms to significantly differ between legal forms, but only when farm exits and entries were considered. State farms and cooperatives displayed the lowest sales growth rate in the post-crisis period. In addition, they are legal forms with the highest rate of farm exits. On the other hand, LLCs are the only legal form that showed positive median post-crisis sales growth. Among farms that operated (survived) over the entire analyzed period of time, the economic crises also had a significant negative production impact; however, the differences between legal forms were not found to be systematic. The higher resilience of LLCs found in the case of the entire sample is thus mainly a result of farm restructuring as high share of these companies were newly registered. The structural changes introducing greater representation of LLCs may be attributed to LLCs' greater adaptability related to concentrated ownership (lower agency costs), governance mechanisms and faster decision making process. The way these enterprises are being formed and what form of restructuring accompanies this formation remains unknown and may be politically questionable.

The resilience analysis by means of growth model suggested the importance of profitability (performance) for farm resilience, mainly the farm's ability to recover from the negative

consequences of the economic shock. The effect of access to external finance was found to be ambiguous.

This study points out that farm economic resilience should be analyzed in conjunction with economic performance as well as structural changes. It was the consideration of the broader structural and performance contexts that allowed us to conclude that LLC is the most resilient legal form. A closer analysis into the decision-making mechanisms and corporate governance of the different legal forms would still significantly contribute to a better understanding of the obtained results. In future research, we will improve our econometric resilience analysis by considering exit/entry in the model specification and also by considering the effect of farm integration into holding structures. Despite some of the study's limitations, we can overall conclude that structural changes in Russian agriculture characterized by an ongoing transformation of producer cooperatives into other corporate and legal forms, mainly LLCs, improve sectorial resilience and contribute to Russia's food security.

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CONSUMER PREFERENCES IN BUYING FOOD ONLINE

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Annotation: Trading, just like any other human activity, keeps changing and evolving. In this context, what mainly changes are methods and techniques used to transport goods from producers through wholesale and retail all the way to end consumers. Nowadays, the internet is used by more and more people and for many companies represents an important distribution channel, to target on groups of customers. Currently the internet is increasingly used in food sale as a distribution channel. The subject of the paper is to evaluate consumer preferences when purchasing food online. This paper, follow up customers experiences, preferences and last but not least willingness try to use “e-grocery” among customers of all ages in various regions of the Czech Republic. Data acquired in the framework of quantitative research and questionnaire survey has been selected as a methodological tool for this paper. Respondents were persons from different age groups and from various regions of the Czech Republic. The questionnaire concerning online shopping of food preferences has been answered by 669 respondents, 44 % of men and 56 % women. For the evaluation of the questionnaire survey statistical methods were used to examine the dependence between the variables (Fischer, Pearson test). Research shows that over 24 % of the respondents have experience buying food online and over 5 % buy food online on regular basis. Furthermore, it has not been proven that the frequency of food shopping affects the place of purchase. There has been evidence of dependence between age and experience of purchasing food online, where younger persons have more experiences. The research was realized through questionnaires survey at the turn of 2017 and 2018. The contribution of this paper is to present current preferences of customers in innovative approaches in food buying as a guide for food vendors.

Key words: e-grocery, retail, trade, food sale, consumer, preferences

JEL classification: F10, Q13

1. Introduction

In 2017, Czech e-commerce continued in its significant growth. Total turnover in sales exceeded CZK 115 billion, which is an 18% increase over the previous year. This means that online selling reached a share of 10.5% in all of Czech retail. These figures are based on data of the Association for Electronic Commerce (APEK) and the shopping advisory service Heureka.cz (Hospodářské noviny, 2017). According to APEK, 2017 saw a continuation of the general trend of growing interest in purchasing everyday goods such as groceries and chemist products online. APEK expects to see a similar trend in 2018, particularly due to the continued fusion of traditional and internet stores which are gradually merging together (APEK, 2018).

Internet shoppers can be divided into several groups based on their purchase behaviour. Harris et al. (2017) define four groups of customers: Variety seekers, who are exceptionally likely to shop online. Balanced buyers who tend to shop online. Then there are convenience shoppers who will use whichever option is currently easiest. Finally there are store-oriented shoppers who have the lowest tendency to shop online. And when they do overcome their objections and shop online, they prefer to pick up the goods in a brick-and-mortar store.

Consumers who have switched from traditional shopping in physical stores to purchasing groceries online typically use a combination of both channels; the benefits they see in buying online are not a sufficient motivation to stop visiting traditional stores. So even if they transition

to a new distribution channel (e-shop), consumers continue to use the original channel as well (Harris, Dall 'Olmo Riley and Riley, 2017). In the survey executed by Nagyová, Berčík and Horská (2016) showed that 80% of surveyed had no negative experience with technologies in retail.

Sociodemographic characteristics have a significant impact on whether consumers adopt and start using the online channel when purchasing food. These characteristics can be divided into two levels. The first is the personal level (age, gender, education, income); these characteristics influence whether the consumer decides to use this shopping channel at all. The second level are the characteristics of households (composition, economic activity of its members etc.) which impact the final consumer decision when buying food. When comparing the influence of household characteristics and the influence of age, it can be concluded that the impact of age is declining. Even though age is a significant factor determining how well consumers are able to use modern technology, when it comes to the impact on consumer behaviour it is weaker than the characteristics of households: whether there are any children, whether both parents are in full-time employment and as a related characteristic what is their education (Droogenbroeck and Hove, 2017). Kervenoael, Elms and Hallsworth (2014) includes among the characteristics that influence the choice of the online channel also the lifestyle of consumers in the current phase of their lives, which corresponds to the household-level characteristics identified by Droogenbroeck and Hove (2017). Verhoef (2001) in his research concludes that for online vendors, the most interesting market segment are older consumers for whom shopping in traditional stores may be challenging. The limiting factor, however, is precisely their age and with it the willingness and ability to use new technologies. Another group is successful people who are often very busy, which again corresponds to the claim of Droogenbroeck and Hove (2017) who consider the employment of household members to be one of the sociodemographic characteristics influencing the choice of the online channel. The understanding that age and time pressure are significant factors influencing the choice of retail channels allows companies to devise a more accurate marketing strategy and target specific consumer segments with greater precision.

Looking at the consumers' perception of online sales of food, Anesbury (2015) claims that customers appreciate seeing their favourite brands on the landing pages of e-shops, meaning it's in the interest of retailers to carefully consider the positioning of the most popular products. Anesbury also mentions that customers who shop online spend more time choosing their goods than customers in brick-and-mortar shops where their buying is often habitual and they are trying to make their purchases as quickly as possible. Buying from home gives them enough time and the convenience to be able to select more carefully. The time spent on shopping online was also studied by Kervenoael, Elms and Hallsworth (2014) who confirms that people spend more time shopping online than in a traditional physical store. Huyghe et al. (2017) conclude from their research that consumers purchase less unhealthy food (sweets etc.) when shopping online. Their explanation is that in online shopping the goods are represented only as symbols that are less "real", reducing the customers' desire to immediately satisfy their needs.

Purchasing behaviour may be also influenced by quality labels applied to food. Based on a survey of consumers' awareness of quality labels, it was determined that 60% of respondents are aware of food quality labels, 30% have heard about them and only 10% of respondents are not aware that any food quality labels exist. In terms of awareness of food quality brands, research has identified a correspondence between general brand awareness and sociodemographic characteristics such as the respondents' age and gender (Navrátilová et al., 2017). When purchasing food online, quality brands may compensate for the lack of "realness" and the possibility of physically assessing the groceries while shopping. This means the labels should guarantee quality when buying online.

Purchasing food on the internet however also has its pitfalls; most common issues include the optimisation of distribution to the consumers' homes. Belavina, Girotra and Kabra (2016) compare two business models used in the distribution of food from online shops. In the first model, customers pay for the delivery of each separate order; in the second model, however, the customer pays through a subscription and the individual deliveries are free of charge (included in the subscription). These two models were examined from the perspective of customers who are not fully decided in their choice between the online and offline channels and the perspective of online food retailers who deliver food through their own distribution network. The research shows that subscription services motivate customers to make smaller but more frequent purchases which reduces food waste. The specific benefits of the subscription model are higher sales for the retailer, lower food costs for the consumer and a higher utility of the food for the consumer. The disadvantage, however, lies in higher transport costs and environmental footprint due to the emissions produced in transport (Belavina, Girotra and Kabra, 2016). Another issue concerning shipping and logistics was analysed by Seidel, Marei and Blanquart (2016): whether a retailer should use their own distribution network to deliver the purchases or whether it's better to rely on external carriers. Because of the specific requirements of the delivery of fresh perishable food, the preferable but more expensive option is to use the retailer's own distribution network that takes into account all the requirements and can deliver goods to customers within hours (Seidel, Marei and Blanquart, 2016). Zissis, Aktas and Bourlakis (2016) mentioned If all retailers collaborate on the last mile logistics for home deliveries; we are able to reduce the total transport distance which is required by retailer's fleets of trucks and the operational costs about the distribution centres in order to satisfy the demand.

2. Materials and Methods

Data for the research was collected from January to March 2018. The questionnaire was available on the vyplnto.cz portal. 669 respondents completed the survey. From this total figure, 169 have no experience with purchasing food on the internet. These respondents were excluded from further processing. The collected data on 500 respondents was then entered into a contingency table and statistically analysed using the chi-squared independence test. Tahal (2017) gives the following hypothesis for the chi-squared test: there is no statistically significant difference between the expected and actual frequency and the variables are therefore independent. According to Israel (2008), the prerequisite for the test is that 80% of theoretical frequencies are greater than 5 and at the same time there is no frequency equal to zero; if there is a demonstrated correlation between the analysed characteristics, the strength of their dependence can be expressed with the contingency coefficient C. Cohen (1977) offers the following interpretation of the strength of correlation: more than 0.1 is low dependence, over 0.3 moderate dependence and more than 0.5 is strong dependence. Everitt (1992) notes that in cases when the chi-squared independence test cannot be used in a 2x2 table, it is possible to perform Fisher's exact test. All tests were based on a significance level of $\alpha = 0.05$. Adjusted residuals allow to assess the significance in each.

The following table presents a summary overview of hypotheses tested in the data analysis.

Table 1. Overview of hypotheses

Hyp. #	Hypothesis (H ₀)	p-value	Score	strength of correlation
1	Frequency of shopping does not affect the choice of sales channel	P=0.25	H ₀ is not rejected	X
2	Age has no impact on experience with purchasing food on the internet	P=0.001	H ₀ is rejected	Cramer's V=0.232
3	Place of residence has no impact on experience with purchasing food on the internet	P=0.03	H ₀ is rejected	Cramer's V=0.118
4	The intent to purchase food on the internet is not dependent on age	P=0.019	H ₀ is rejected	Cramer's V=0.157

Source: own research, 2018

3. Results and Discussion

For hypothesis no. 1, with regard to the conditions for employing the chi-squared test and the fact that the prerequisites were not met despite the merging of all cells (see Table 2), we had to carry out Fisher's test for a four cell table. H₀ was defined as follows: the frequency of shopping does not affect the choice of sales channel. The resulting p-value of Fisher's test is P= 0.25 and H₀ was therefore not rejected. This means that the frequency of shopping does not affect the choice of sales channel.

Table 2. Frequency of shopping x Type of shop

Purchase_frequency * Type Crosstabulation					
				Total	
		Brick and mortar store	Internet		
Purchase_frequency	1-5 times per week	Count	272	9	281
		Expected Count	270.1	10.9	281
	Several times per month	Count	99	6	105
		Expected Count	100.9	4.1	105
Total		Count	371	15	386
		Expected Count	371	15	386

Source: own research, 2018

Hypothesis no. 2 was analysed using Pearson's χ^2 test. The prerequisites for the test were met by merging the answers "Yes" and "Yes, I shop regularly". One cell has a theoretical frequency of less than 5. This is 8.3% from the total figure. The prerequisites of the test are therefore met. H₀ was defined as follows: age has no impact on experience with purchasing food on the internet. The results of the test are $\chi^2=20.88$; P=0.001 (see Table 3); $P < \alpha$ and therefore H₀ is rejected. Based on this analysis, we can conclude that age does have an impact on experience with purchasing food on the internet. As the next step, we evaluated the strength of correlation; Cramer's V=0.232, meaning this is a weak dependence. By adjusted residuals were detected that age groups up to 19, between 26-35 years and 36-49 years, are statistically significant at a significance level of 0.05. The group of respondents aged 50-64 is statistically significant at a significance level of 0.01.

Table 3. Pearson's χ^2 test of age x experience with purchasing food online

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	20.880 ^a	5	0.001
Likelihood Ratio	22.769	5	0
Linear-by-Linear Association	0.702	1	0.402
N of Valid Cases	388		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 3.23.

Source: own research, 2018

For hypothesis no. 3, H₀ was defined as follows: Place of residence has no impact on experience with purchasing food on the internet. Data was evaluated for groups of regions defined on the basis of net disposable income of households. The first group included Prague and the Central Bohemian region. The second group consisted of the following regions: South Moravia, Plzeň, Hradec Králové, Vysočina, Liberec, Pardubice, South Bohemia, Karlovy Vary, Zlín. The third group comprised the regions of Ústí nad Labem, Olomouc and the Moravian-Silesian Region. The frequency distribution is summarised in Table 4. The prerequisites for calculating the chi-squared test were met. Significant P-value P=0.03. $P < \alpha$, H₀ is rejected. Therefore, the place of residence does have an influence on experience with purchasing on the internet. We also tested the strength of correlation using Cramer's V with a result of 0.118, meaning weak dependence. By method of adjusted residuals, respondents who have experience with purchasing of food on internet in group 3 is less than in other regions ($\alpha = 0.05$). Frequent experience with online shopping has respondents from Prague and the Central Bohemian Region ($\alpha = 0.05$). Only a few respondents from the second group of regions have a lot of experience with shopping online ($\alpha = 0.05$). Most respondents who have no Internet shopping experience are in proportion from Group 3 ($\alpha = 0.05$)

Table 4. Experience with purchasing food online x place of residence

Purchasing_experience * Region Crosstabulation						
			Region			Total
			1	2	3	
Purchasing_experience	Yes	Count	46	41	7	94
		Expected Count	45.4	35.9	12.6	94
	Yes often	Count	15	4	1	20
		Expected Count	9.7	7.6	2.7	20
	no	Count	126	103	44	273
		Expected Count	131.9	104.4	36.7	273
Total		Count	187	148	52	387
		Expected Count	187	148	52	387

Source: own research, 2018

Table 5. Pearson's χ^2 test: experience with purchasing food online x place of residence

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.717 ^a	4	0.03
Likelihood Ratio	11.37	4	0.023
Linear-by-Linear Association	2.675	1	0.102
N of Valid Cases	387		
a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 2.69.			

Source: own research, 2018

The data analysis for the verification of hypothesis no. 4 again employed Pearson's χ^2 test. The prerequisites for the testing were met by merging the answers "I agree" and "I mostly agree". The age group of 65 and above was excluded from the test due to low numbers (only 7 respondents) – see table; none of the theoretical frequencies is lower than 5. H₀ was defined as follows: The intent to purchase food on the internet is not dependent on age. The result of the test is a rejection of the null hypothesis, see Table 6. The result values of the test are $\chi^2=19.788$ and $P=0.019$; $P < \alpha$. The test shows that the intention to try purchasing food online in the future is dependent on age. The strength of the correlation as expressed by Cramer's V is 0.157 – weak dependence. The strength of the correlation as expressed by Cramer's V is 0.157

– weak dependence. From Analysis of adjusted residues large proportion of respondents under the age of 19 do not decide whether they are interested in buying online ($\alpha=0.05$). A significant group of respondents between 20-25 years certainly does not plan to buy food on the Internet ($\alpha=0.05$). Relatively the majority of respondents, who definitely do not plan to buy online, is between 50 and 64 years of age ($\alpha=0.01$). Due to age of respondents, the last fact is quite understandable.

Table 6. Pearson's χ^2 test: intent to try purchasing food online x age

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	19.788	9	0.019
Likelihood Ratio	18.583	9	0.029
Linear-by-Linear Association	14.493	1	0
N of Valid Cases	266		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.59.			

Source: own research, 2018

In their research, Droogenbroeck and Hove (2017) note that the influence of the age of consumers on their use of e-shops selling groceries is on the decline. While this research cannot unambiguously disprove this claim, our analysis shows that age has a weak dependence on the purchasing of food online. Verhof (2016) says that the ideal target group for purchasing food online are older customers for whom shopping in a traditional physical store may be complicated for various health reasons; this survey however suggests that the tendency to buy food online actually decreases with age.

4. Conclusion

When it comes to purchasing food, just like many other types of goods, customers increasingly often turn to the internet, which was also the focus of this paper. Consumer behaviour when shopping online varies depending on factors identified in the questionnaire survey presented in this paper. These factors and their impact on consumers' purchasing behaviour have their specifics when it comes to food. This research shows that 24% of surveyed respondents have experience with purchasing groceries online and 5% of respondents buy groceries online regularly. From the dependences analysed in this article, we can conclude that: We have not proven any dependence between the frequency of purchase and choice of distribution channel (brick-and-mortar store, the internet). We have proven dependence between experience with buying food online, the willingness to try buying food online and age. Younger respondents have more experience with the online channel and are more willing to try it. Another proven dependence was the impact of the place of residence on experience with shopping online: generally, people living in regions with higher net disposable income have more experience with this distribution channel. The recommendations derived from this survey are the following: It is recommended to clearly define consumer segments who will be purchasing food online and try to adapt the service to their needs as much as possible. Making this method of food purchasing more accessible and popular could particularly benefit older customers for whom physical shopping may be difficult.

Further research in this area will focus on an analysis of the most frequently purchased grocery goods and an optimisation of food distribution through the online channel in order to maximise coverage of the Czech Republic with this type of service.

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FOOD SECURITY IN CRISIS SITUATIONS: FOCUS ON BEEF, PORK AND POULTRY MEAT

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Annotation: Food security lies in effort to provide to population such resources of agricultural raw materials with transformation to food, that consumption habits are maintained. The aim of the paper is to assess the height of domestic production to preserve current consumption structure of beef, pork and poultry in the Czech Republic (CR) and not to overcome production possibilities in crisis if imports, exports or both are limited or impossible.

The development is simulated by optimization model AGRO-2014 that links agriculture, food industry, trade and food consumption. Five scenarios were calculated. In case of a crisis where imports are eliminated, and exports kept at the current level (scenario 1), the level of domestic resources would be exceeded. The need for areas for growing not only feed crops exceeds the land in the CR by 66%. Therefore, scenario 2 – crisis when import and export are impossible – was considered. Even in this case, the Czech area would not be sufficient. In scenario 3, imports are limited to 20% of current levels and the country does not export. Then the land area would be sufficient. It would require less sucker cows, but significantly more pigs and poultry.

Scenario 4 (where imports are possible from 50% while export is on 50% level) needs slightly more cattle but pork could be partly imported. The increase in land claims would exceed available by 20%. Optimal use of land would occur in scenario 5 with imports on 50% level and exports reduced to 18%.

It is problematic to increase the export of agricultural commodities while reducing imports. In the case of pork, it would be necessary to increase the number of pigs to cover domestic consumption and exports to the extent that it would be impossible to provide enough grain feed due to lack of available land.

Key words: beef meat, crisis situation, food security, pork meat, poultry meat

JEL classification: Q18, C67, C54, Q02

1. Introduction

The principle of food security lies in effort to provide to domestic consumers such resources of agricultural raw materials, with the consequent transformation to food, that it would be maintained the consumer's standard consumption habits. According to Grega (2004) the food security “exists in case when all people have in every moment physical and economic access to sufficient amount of safe food with corresponding nutrition values, that corresponds to their diet needs and food preferences leading to active and healthy life”.

Food consumption in the Czech Republic (CR) has undergone significant changes in the structure of food, especially meat, since 1989. The development can be characterized by long-term high consumption of pig meat (PM) (a standard consumption habit of the Czech population), a significant decrease in beef consumption (BM) and its substitution by a double increased consumption of poultry meat (DM). “Average value of year meat consumption in the Czech Republic does not change much – it fluctuates around 80 kg per capita and is close to the EU level, where it reaches 92 kg,” (Foret and Paděra, 2007).

Significant change happened especially in the structure of consumption of BM, PM and DM. While average consumption of PM per capita decreased between 1989 and 2015 only mildly

(from approx. 50 kg to approx. 43 kg), consumption of BM decreased dramatically in the same period (from 30 kg to 8 kg). On the other hand, the consumption of DM increased significantly (from 13 kg up to 26 kg). This is related to change in lifestyle of the consumers towards healthy food and to change of price of meat production and income situation of the inhabitants.

Health education also plays a part in the decreasing consumption of meat, which convinces consumers about the negative consequences of eating meat and civilization diseases (obesity, high blood pressure) that are associated with excessive consumption of these products. “While meat consumption tends to increase with economic development, it is increasingly contested in affluent societies due to the environmental and human health implications of too high meat consumption,” (Tilman and Clark, 2014).

Changes in consumption are linked with the change in the availability of agricultural raw material resources. Whereas in 1995 the domestic production of BM was 322 thous. t of live weight (l. w.), in 2015 it was only 175 thous. t. In the case of PM, production in the same period decreased from 650 thous. t of l. w. to about 310 thous. t. The PM showed an increase from 180 thous. t in 1995 to about 255 thous. t in 2015. This change reflects economic situation of the different types of production. The most advantageous is the production of DM whose annual turnover is between 8-10 cycles of broiler fattening. PM production is more expensive and represents 2.5 turns per year to achieve carcass weight in pig fattening. The most expensive is the production of beef, where the final weight is more than a two-year cycle.

Impact of EU membership on the development of the Czech agriculture was considerable (see e. g. Pechrová 2014). The situation of self-sufficiency in the CR significantly changed after EU accession, especially in pork and poultry. “The self-sufficiency for pork meat decreased to 57% and to 73% in the case of poultry,” (Slaboch and Kotyza, 2016). The degree of self-sufficiency in BM increased from about 100% (i. e. all domestic consumption covered by domestic production) to 140% in 2015 and allows exports and almost zero imports.

Ensuring sufficient food for the people of Western Europe was a main reason for creating an integrated agriculture in Europe. (Vošta, 2010). Nevertheless, “Access to safe and nutritious food is, however, not guaranteed for all of Europe’s consumers” (Rutten et al., 2018). As pointed out by Borch and Kjærnes (2016) despite that it is often taken for granted that people in Western countries are ‘food secure’ in terms of having enough food for an active, healthy life, the prevalence of food insecurity varies between countries and groups of inhabitants (most at risk are low-income groups and other social groups associated with poverty, such as single mothers and ethnic minorities).

“In recent years, due to the decrease in competitiveness of Czech producers, national self-sufficiency has decreased in poultry and pig meat and to satisfy the domestic consumption in CR it needs to be supplemented by imports from abroad” (MoA, 2016). Hence, availability of PM is the most significant problem. In relation to the strategy of the ministry on the direction of the agricultural sector, the main long-term objective is to certain extend replace imports (especially of PM) by domestic production. Strategy’s main priority is “Ensuring the strategic level of production in the main agricultural commodities of the moderate zone, especially those for which there is potential for competitive production in the CR,” (MoA, 2016).

The aim of the paper is to assess how high must be the domestic production to preserve current structure of consumption of BM, PM and DM and not to overcome the production possibilities of the Czech economy, in the context of the strategic considerations, or in crisis if imports, exports or both are limited or impossible.

2. Materials and Methods

The data were obtained from the internal database of the Institute of Agricultural Economics and Information (IAEI) “Baseline”, that consists of data of Czech Statistical Office (about production and price levels of agricultural row materials, food production and consumption), data from own cost surveys of IAEI and further information related to the data about healthy nutrition needs of inhabitants. The main objective is to secure production and standard consumption of basic meat commodities. The default state of the indicators is shown in the table 1.

Table 1. Initial value of the indicators

Variable name	Description	Thous. pieces
SKOT1	cattle with market milk production represented by the state of dairy cows	373
SKOT2	cattle without market production of milk represented by the state of cows without market production of milk (CWMPM)	180
PRAS	total state of pigs represented by the sum of all animals in all categories	1 618
DRUB	total state of poultry represented by the sum of all animals in all categories	21 464
ZP	total available agricultural land - arable land and permanent grassland	3 500

Source: own elaboration, 2018

To address strategic considerations and assumptions about food safety and food self-sufficiency in the CR, 5 scenarios of future development were formulated and calculated. A critical factor in model simulations was the fulfilment of domestic agricultural production in crop (CP) and livestock production (LP) by domestic raw material sources (food production and provision of voluminous and compound feeds) on available agricultural land of the CR (3,5 mil. ha according to LPIS). Scenarios are displayed in table 2.

Table 2. Description of the simulated scenarios

Scenario	Import level	Export level	Scenario description
SC1	0%	100%	complete elimination of imports and the maintenance of existing exports
SC2	0%	0%	complete elimination of both imports and exports
SC3	20%	0%	reducing imports to 20% and complete elimination of exports
SC4	50%	50%	reducing imports and exports to 50%
SC5	50%	18%	reducing imports to 50% and exports to 18%

Source: own elaboration, 2018

Simulations are done in mathematical balance-optimization model AGRO-2014 (version 2018). Detail description of previous versions of the model can be found in Foltýn and Zedníčková (2001). Model simulates the relations of agricultural sectors (ZEM), food industry (POTR), trade (OBCH) and food consumption (SPOT). Model is based on Leontieff's method of I/O (input-output) table in a scope of approx. 1200x1200 lines and columns. In contains production and economic indicators of sectors ZEM (37 commodities of CP and LP), sector POTR (approx. 130 commodities of NACE 10 and 11), sectors OBCH and SPOT (approx. 50 commodities in relation to the sales of food in shops and their consumption by inhabitants. Mathematical description of the model AGRO-2014 is described by equation (1).

$$X_i + IMP_i + SELF_i = \sum_{j=1}^n A_{i,j} X_j + EXP_i + NEP_i \quad \text{for } i = 1, \dots, n \quad (1)$$

where X_i for $i = 1, 2, \dots, n$ ($n \cong 1200$) are variables of the model AGRO-2014 with a square matrix $A = A_{i,j}$ of the $n \times n$ matrix. $A_{i,j}$ represents the amount of a commodity i which is consumed for the production of commodity j . IMP states for import, SELF for self-sufficiency, EXP for export, and NEP for non-food production (e.g. technical and other use of the commodity). The SELF and IMP items reduce the need of production, EXP and feeds increase it. Model optimize the scope of production of CP that is divided on direct consumption of food commodities of crop origin and feed basement, voluminous feed and feed mixes. Solution of the model in MS Excel is done by the iterative procedure. Optimal solution is reached by Makro programme that ensures cycles of orders. One can enter inputs and calculate outputs or vice versa.

Let us denote:

$X_{i,0}$ an initial state of the solution X_i for all $i = 1, \dots, n$ of the model and

$X_{i,k}$ of the k^{th} approximation of the solution X_i for $k = 1, \dots, n$.

Then, for the k^{th} iteration the relations (2) hold.

$$X_{i,k+1} = \sum_{j=1}^n A_{i,j} X_{j,k} + EXP_i + NEP_i - IMP_i - SELF_i \quad \text{for } i = 1, \dots, n \quad (2)$$

The calculation takes place so long while $X_{i,k+1} \neq X_{i,k}$ holds. If the equality occurs, i.e. (3) then the procedure ends and $X_{i,k}$ is the solution of the model.

$$X_{i,k+1} = X_{i,k} \quad \text{for all } i = 1, \dots, n \text{ and for some } k \in Z \quad (3)$$

3. Results and Discussion

Five scenarios of development were formulated and calculated. The results are displayed in table 3. Scenario 1, that assumes total elimination of imports while maintaining exports is almost unrealistic. If the country had to produce everything from its own resources (feed, etc.), the need of resources would increase unrealistically. In case of BM (instead of 373 thous. pc. of dairy cows 456 thous. pc. would be needed and CWMPM would have to increase from 180 thous. pc. on 192 thous. pc.). In the case of PM, the states would have to increase by 99% as same as in case of DM. Agricultural land would be exceeded by 68%. It is obvious that holding export when import is cancelled is unrealistic.

Crisis scenario 2, when import and export are impossible, also did not provide food safety, because the demand for agricultural land would have to be increased by 7%, states of pigs by 72% and of poultry by 56%. Hence, at least some import must be allowed.

Scenario 3 allows imports in all food production branches in height of 20%, but country does not export at all. This scenario is theoretically possible, because for preservation of consumption of inhabitants the land would be sufficient. Less CWMPM would be need (even by 20%), because majority of BM is for export, that is not taken into account in this scenario. There would be increase of state of pigs (by 52%) and poultry (by 42%). This is also linked to the increase in the demand for voluminous and compound feed. We expect decrease of voluminous feed and its substitution by compound feed.

Scenario 4 maintains the import and export level on 50% of the original scope. A large scope of export can be expected in case of commodities that feed pigs because their stocks have declined in comparison with scenario 3. It is still needed to increase the state of pigs by 35%. States of poultry would have to increase by 42%. The need of land in this scenario will again overcome the real scope

(this time even by 22%). Hence, it is not possible to halve the import and simultaneously keep the export on 50% level. The export must decrease more than import (especially in case of cereals).

This balance situation was reached in scenario 5, where import decrease on 50% and export on 18 % of the current level in a way to preserve the limitation in the form of available agricultural land in the CR. In this case, needed land would be almost equal to available land (the difference is only 2%). States of dairy cows and CWMPM would significantly decrease, on the other hand, the states of pigs and poultry would have to be increased (by 26%, 29%, respectively), but the least of all the scenarios.

Table 3. Results of the simulations of 5 scenarios

Variable (thous. pc.)	Initial values	SC1		SC2		SC3		SC4		SC5	
		abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
SKOT1	373	456	122	321	86	298	80	331	89	288	77
SKOT2	180	192	107	106	59	101	56	136	76	109	61
PRAS	1 618	3 221	199	2 782	172	2 455	152	2 183	135	2 043	126
DRUB	21 464	42 429	198	33 537	156	30 528	142	30 461	142	27 615	129
ZP (thous. ha)	3 500	5 890	168	3 742	107	3 522	101	4 266	122	3 579	102

Source: own calculation, 2018

Above stated simulations show that idea that it would be possible to increase the export of agricultural commodities and reduce import is problematic. In the case of pork, where the CR is not self-sufficient, it would be necessary to increase the number of pigs to cover domestic consumption and exports to the extent that it would be impossible to provide enough grain feed from own resources (lack of available land). Full self-sufficiency in PM is unreal, because the production is expensive and unprofitable. More realistic scenario is to decrease imports on reasonable level. Scenario 5 indicates partial increase of states of pigs that can be reached also by the increase of intensity of current production, that is in the CR relatively low so-far (number of bred piglets per sow is low compared to EU countries, despite that is getting better).

The optimization of consumption of food supply for the population in case of emergencies situations is elaborated e.g. by Štiková et al. (2012) for the case of CR. Regarding the food safety in EU in general, Moragues-Faus, Sonnino and Marsden (2017) identified (linking empirical data with theoretical discussions on vulnerability and governance) five food system governance deficiencies that impinge upon food security in Europe: “a failure to deal with cross-scale dynamics; the inability to address issues related to persistent inequalities in food rights and entitlements; increasing geopolitical and sectorial interdependencies; power imbalances and low institutional capacities; and conflicting values and interpretations of “food security” (Moragues-Faus, Sonnino and Marsden, 2017). These dimensions shall be according to them addressed to build a more democratic, sustainable and secure European food system.

4. Conclusion

Because meat consumption in the CR has undergone significant changes that were not accompanied by analogous developments in production and the level of self-sufficiency in pork and poultry meat decreased, and this situation is considered to be unsafe (especially high dependence on PM imports), there is a strategic idea of minimization or elimination of imports and their substitution by domestic production while maintaining exports. The aim of the paper was to assess how the high height must be the domestic production to preserve current consumption structure of consumption of beef, pork and poultry in the CR and not to overcome the production possibilities of the Czech economy, in the context of the strategic considerations, or in crisis if imports, exports or both are limited or impossible.

The development in the agrarian sector was simulated by mathematical optimization model AGRO-2014 that links agriculture, food industry, trade and food. It is based on the Leontieff's input-output method, and includes the production and economy of sector ZEM (37 crop and livestock commodities), POTR (about 130 commodities CZ-NACE 10 and 11), sectors OBCH and SPOT (about 50 food commodities sold in retail and consumed by population).

Five scenarios of development were formulated and calculated. Scenario 1 envisaged a crisis where imports are eliminated, and exports kept at the current level, but the level of domestic resources would be exceeded. Scenario 2 – crisis when import and export are impossible – was also unsafe. In scenario 3, a less extreme crisis was foreseen – imports were limited to 20% of current levels and export was 0. Then the land area would be sufficient. Scenario 4 presents a situation where imports and exports were on 50% level. Then slightly more cattle would be needed than in the previous scenario, but less pigs as the pork could be partly imported. However, the increase in land claims would be unrealistic and would exceed available resources by 20%. Optimal use of land would occur in scenario 5 with imports on 50% level and exports reduced to 18%.

Based on the simulations we can conclude that the idea that it would be possible to increase the export of agricultural commodities and while reduce reducing imports is problematic. In the case of pork, where the CR is not self-sufficient, it would be necessary to increase the number of pigs to cover domestic consumption and exports to the extent that it would be impossible to provide enough grain feed from own resources (due to lack of available land).

The model will be adjusted in future research in order to enable modelling the import and export limitations not only of the whole agricultural sector at once, but also of each commodity separately.

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ANALYSIS OF SELECTED FACTORS AFFECTING OFFICIAL LAND PRICES IN CZECH AGRICULTURE (2009 – 2018)

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Annotation: The aim of this paper is to prove or reject the impact of selected factors on official land price in agriculture, which can be considered as a possible mark of agricultural land quality. The research is based on data of the Land Survey Office in Prague, the Czech Statistical Office, Farm Accountancy Data Network, official prices of agricultural land based on public notice of the Ministry of Finance of the Czech Republic, information of the Czech Chamber of Commerce and the Research Institute for Soil and Water conservation. There were used methods of comparison, correlation and index analyses to process the data. The selected factors which could have some impact on the soil quality are; 1) Grown crops on fields (there were selected perennial fodder crops and maize for grain). 2) The extent of rented land. 3) Investments to land. The regions with the highest decrease of the official price of agricultural land (2009-2018) are: Zlínský, Moravskoslezský, Jihomoravský, Olomoucký, and Středočeský region. The official land price slightly increased or didn't change in these regions: Vysočina, Královohradecký, Ústecký, Jihočeský. The correlation analysis found that the official prices are influenced by the extent of grown maize for grain. There weren't founded correlation between the official price and the other factors. The analysis of documents of the Czech Chamber of Commerce have found that significant decrease of the official prices (more than 10 %) are based from 60.6 % on negative anthropogenic factors (erosion processes caused by intensive agricultural production (40.15 % of cases), the influence of other agricultural processes (17.42 %), and floods (3.03 %)). Forty percent of cases when price decreased in cadastre is related with the more detailed research of soil quality. The positive impact of anthropogenic factors has been prove for 11 % of selected factors. The rest (89 %) is related with the more detailed paedological research.

Key words: Soil quality, erosion, official land price, corn, land lease, estimated *soil-ecological units* (ESEU) update.

JEL classification: Q15, Q24

1. Introduction

The aim of this paper is to, based on the statistical methods, prove or reject the impact of selected factors on the official land price in agriculture (OLP) which can be considered as a possible mark of agricultural land quality. The sub-objective is to determine what the impact of annual update of estimated soil-ecological units (ESEU) is (research in period 2008 – 2017).

British economist Malthus (1798)³ addressed his research to the efficiency of production factors in agriculture. His research was focused on population development and possible sources of livelihood. According to Malthus the geometrical increase of population is related with these limits: decrease of the non-renewable resources, exhausted soil, lack of raw materials and fuels, decreasing yields, and incapability of nature to absorb the pollution. Yields didn't decrease, but the rest represents nowadays problems. There is still not enough attention paid to the soil quality. Although the rich soil is needed for sustainability in agriculture. Paleari (2017) revealed increasing soil degradation in the EU since 2000 and this trend will probably continue.

³ Czech edition: MALTHUS, T. (2002)

There still doesn't exist EU law for soil protection, in spite of the fact that ambitious political strategies to prevent the soil quality were adopted by the EU. The aims concerning the soil protection are spread in many areas of EU policy.

Agricultural land in the EU is facing to many threats, as a wind and water erosion, decreasing content of organic matter, local and diffusion contamination, solidification, decreasing of biodiversity, salinization, floods and landslides (Jones et al., 2012). Mikanová et al. (2010) pointed out that the soil quality is related with agricultural production. The most significant are agro-technical interventions as a fertilizing, technology of plants growing, crop rotation, soil investments, etc. Turpin et al. (2017) concluded that soil problems are related with the pressure to the natural resources. This pressure includes agricultural and industrial activities, urbanization, and climate change. It is not possible to assess the direct impact of existing policies and the pressure on agricultural land in the EU will continue.

Soil erosion become a part of the EU environmental agenda during the past decade due to the impact on the drinking water quality, ecosystem services, mud floods, eutrophication, biodiversity and carbon stock shrinkage (Boardman and Poesen, 2006). The assessment of soil shrinkage can help to determine: a) quantify the impacts of soil loss at such a large scale, b) assess the main effects of climate, vegetation and land use changes on soil erosion rates, and c) prioritise effective remediation programmes (Lu et al., 2003).

The annual shrinkage of agricultural land is estimated at 9 millions of tons per year in the Czech Republic. The average value of soil loss is 2.7 tons/ha in EU 27, when the values exceeding 1 ton/ha are considered as harmful and threatening the main soil characteristics. (Dostál et al., 2002). According to the qualified estimations there are 112 million of hectares threatened by water erosion, and 42 million by wind erosion. There is estimated that 16 % of total area of old EU countries (before the EU extension in 2004) is affected by some form of degradation. It represents 520 000 km². The extent of soil degradation is estimated at 35 % of area for new EU countries (Soil Atlas of Europe, 2005).

2. Materials and Methods

The average basic official land price in cadastre is based on estimated *soil-ecological units* (agro-economical soil qualification). The change of ESEU is based on the field research of qualitative agronomical characteristics and quantitative ones (changes in the extent of areas with specific ESEU). The aim of this more precise specification is to update the former field research, improve the incorrectly classified areas; evaluate the erosion, fertilization, and changes of area about more than 10 %.

Data are based on:

- 1) Primary data from the Czech Office for Surveying, Mapping and Cadastre (COSMC). The information about the extent of built-up areas in regions (averages for years 2008 - 2017).
- 2) Public notice of the determination of list with cadastral areas including average basic prices of agricultural land from the Ministry of Finance and the Ministry of Agriculture of the Czech Republic (as amended 2009 – 2018).
- 3) Data of the Czech Statistical Office (CSO) - selected crops on sowing areas (perennial crops and maize for grain), average for the period 2008 - 2017. Perennial crops protect soil against the erosion. They are recommended to be grown in areas with the high risk of erosion. On the contrary the maize for grain is a wide row crop and it is recommended for areas with low risk of erosion.

4) Farm Accountancy Data Network (FADN): a) Soil investments based on depreciation of soil improvements as a: soil irrigation, draining, fix irrigation systems, etc.; b) The extent of rented land. There is used the average for years (2008 – 2017).

5) The Data of the Czech Chamber of Commerce (CCC) for 2009 - 2018 (cadastral OLP comments for the CR).

The regional official land price in the Czech Republic (regional OLP) is calculated as weighted arithmetic mean of OLP. The weight is set up according to the extent of cadastral area. The chain index of the OLP is based on the regional OLP before and after ESEU update – see table 1.

The correlation analysis is employed to determine the tightness of dependence between the variables (Pearson correlation coefficient r). The endogenous variable (y) is region I_{OLP} in years 2009 - 2018, the exogenous variables ($x_1 - x_4$) are: Perennial crops; percent of the crops area (x_1), maize for grain; percent of the crops area (x_2), percent of rented land (x_3), depreciations of soil improvements; CZK/ha (x_4). If the significant correlation between the variables is proved, the relationship will be represented by the regression function. The “p-value” in Gretl software is used for comparison with stated level of significance ($\alpha = 0.05$).

The alternative quantification of reasons for ESEU update is based on analysis of public notice comments from the Czech Chamber of Commerce of the Czech Republic. The attachment of these explanations contains specific pronouncement about the individual OLP changes (if the change is higher than 10 %) from employees of the Research Institute for Soil and Water Conservation (RISWC). The frequency of published reasons for OLP changes is used to determine a) anthropogenic impact on OLP changes, b) impact of ESEU update on OLP change (for individual years and regions).

3. Results and Discussion

Areas under Crops Survey (CSO, 2016) shows the long-term tendency of decreasing crops area in the Czech Republic and also very small diversity of crops. The share of the five most spread crops (wheat, spring barley, rape-seed, and maize for grain, and maize for silage) was 70.55 % for total crop area in 2016. This number represents increase about 5.64 % in comparison with year 2002 (64.91 % of total crop area). The maize for grain can be a threat for soil quality, even it represents only 3 % of crop area in the CR. Perennial crops, according to the agro-technical measures, are recommended for the areas with the high risk of erosion. Their share decreased from 9.63 % to 5.98 % over the period 2002 – 2016. The FADN analysis (2015) found that the small entrepreneurs (up to the 50 ha) invest to the soil. It is not obvious if these investments are soil irrigation, or draining. The most of irrigation systems is from sixties and they are supposed to be fully depreciated. But farmers spent money for their maintenance (TGM WRI, 2015). The extent of rented land is about 75 – 80 % in the CR (FADN 2015). The rent contracts were usually concluded for one year. This fact and the extent of rented land are the main obstacles for higher investments to the soil.

The analysis of OLP changes shows that the highest decrease of the OLP has been recorded in the Zlínský region and on the contrary there was recorded increase in the Liberecký region (as amended 2009 – 2018).

Table 1. Underlying data for the correlation and regression analysis

Region	Chain price index	Perennial Crops	Maize	Rented Land *)	Investments*
	(%)	(% Crops area)			(CZK/ha)
	y	x ₁	x ₂	x ₃	x ₄
Zlínský	99.8217	10.00	7.67	89.34	0.00
Moravskoslezský	99.8877	7.29	3.23	82.72	1.23
Jihomoravský	99.9038	5.08	13.70	86.82	1.01
Olomoucký	99.9447	6.15	4.05	90.60	0.13
Středočeský	99.9647	6.02	2.83	87.91	6.32
Karlovarský	99.9678	6.98	0.08	69.74	18.52
Vysočina	100.0000	10.11	0.86	90.40	0.92
Královéhradecký	100.0001	8.65	3.22	84.72	0.78
Plzeňský	100.0001	7.95	0.95	87.12	27.48
Ústecký	100.0002	5.33	2.49	75.75	0.91
Jihočeský	100.0002	7.71	1.19	87.73	18.14
Pardubický	100.0006	10.30	4.45	86.12	1.76
Liberecký	100.0008	9.79	0.98	89.45	4.13

Source: Authors based on: Public notice of CMA 2009 - 2018, concerning the OLP changes in years 2008, COSMC (2008-2016), CSO (2008-2016), FADN (2008-2015)

Note: *) 2008-2015; data (y, x₁ - x₃): average for 2008 - 2016

The correlation matrix was used to determine relationships between the variables x_1 to x_5 (table 1) a y. The significance level was stated at 5 %. The values of correlation coefficients rejecting the null hypothesis are marked by red color (SW Gretl).

The correlation has been proved only for variables y and x_2 (average annual change of the OLP and share of maize on crop areas). The value of the correlation coefficient is $r = -0.56$. This value indicates medium correlation. The higher share of crops area causes the higher decrease of the OLP. The regression analysis revealed that: Maize for grain (x_2) is relevant in terms of land price decrease (y). The relationship can be expressed as: $y = 100.0143 - 0.0112x_2$ (p-value of regression coefficient b is 0.042). Correlation between the variables is weak ($R^2 = 0.26$). According to these results can be expected that there are other factors with significant impact on OLP decrease.

According to CCC document analysis (Comments of OLP changes, 2009 – 2018, online) there were found that decrease of OLP (about more than 10%) is caused by negative anthropogenic factors (60.6 %). Between these factors belong: erosion processes caused by intensive agricultural production which change specification of soil granularity, slope, and the depth of soil profile, etc. (40 % of cases). The influence of agricultural production (not complying of agro-technical procedures, infrastructure construction) is related with more than 17 % of cases. The more detailed update of ESEU system is the reason for approx. 40 % of observed reasons for OLP decrease. The significant positive impact of anthropogenic factors on the soil quality have been proved in 11 % of cases. The rest (89 %) is related with the ESEU system update.

Table 2. Reasons for OLP changes (more than 10 %) in selected regions of the CR

Region		Erosion, other agricultural processes	Impac of floods	Bonity system update
	Frequency	(% of cases)	(%)	(%)
Jihomoravský	22	86.36	4.55	9.09
Zlín	16	87.50	-	12.50
Olomoucký	15	60.00	20.00	20.00
Ústecký	13	15.38	-	84.62
Středočeský	13	15.38	-	84.62
Jihočeský	12	-	-	100.00
Vysočina	8	62.50	-	37.50

Source: Authors based on: CCC comments 2009 - 2018, online

The analysis of the comments of the OLP changes about more than 10 % (2008 – 2017) found the highest frequency for Jihomoravský region (22 negative changes), Zlínský region (16 negative changes), Olomoucký region (15 negative changes), and Vysočina (8 negative changes). The highest impact on the decreasing soil quality is related with erosion processes caused by agricultural production (Jihomoravský region: 87 %, Zlínský region: 88 %, Vysočina 63 %, Olomoucký region: 60 % of negative changes).

These results correspond with findings of Vopravil (2013), and generally also with Žižala et al. (2016), and MoA (2015). There is estimated the risk of water erosion for 13 % of European land. The highest risk has been determined for the Mediterranean (Soil Atlas, 2005). There is approximately 50 % of agricultural land in the Czech Republic threatened by the water erosion (approx. 16.5 % of total area in the CR). The problems of water erosion have been reported for the USA and the Middle East (Shoshany et al., 2013), Canada (Uddin et al. 2016), and other areas.

The impact of floods have been reported for Olomoucký region (20 % of negative changes of OLP). Other regions with OLP decrease are: Ústecký, Středočeský, and Jihočeský. OLP in these regions were decreased according to the ESEU system update (from 100 to 85 of observed cases).

The soil quality assessment has a long tradition in the Czech Republic (since 17th century). The unique detailed assessment of agricultural land has been done in sixties by Němeček et al. (1967): Assessment of agronomic characteristics of agricultural land, including climate and relief. This fact provided some advantage to the Czech Republic. According to Comino et al. (2018) from Spain there is no consensus which factors should be included to the soil quality assessment. But on the other hand there is a consensus that biological factors should be included. They are robust and they tend to show a short-term response after disturbances, their measurement is usually expensive and time consuming. The research results demonstrate the applicability of infrared spectroscopy as a fast and efficient technique for estimating biological soil quality, as well as for discriminating between soils with differing biological quality. Spain-Denmark team (Aksoy et al., 2017) evaluated the biodiversity potential for whole Europe by combining several soil characteristics (pH, soil texture and soil organic matter) and environmental factors (potential evapotranspiration, average temperature, soil biomass productivity and land use type).

4. Conclusion

Factors affecting the soil quality are generally known (MoA, 2015). Except the impact of erosion crops growing (maize for grain) their impact has not be proved by authors. Commodity homogeneity decreasing should became a priority in the Czech Republic. The area of maize for grain is slightly decreasing (-0.5 p.p per year, CSO, 20014-2016). The attention should be paid also to the wheat and rapeseed. Both these crops need lot of mineral fertilizers. The research revealed that the soil

devaluation in affected areas (Moravia, partly Vysočina) is related with water erosion and anthropogenic factors (60 – 80 %). This paper (in contrary to other studies) brings information about the positive impact of human activity to the soil quality (11 % of observed cases, when the OLP in the Czech Republic increased). It is necessary to assess the changes of soil fertility individually. The negative changes of soil fertility may be prevented by applying of good agricultural standards. The high percentage of arable land doesn't have to be risky, intensive farming doesn't have to be a problem. Farmers will have to also deal with factors which cannot be affected (e.g. lack of rains during the season).

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DETERMINANTS INFLUENCING CONSUMER BEHAVIOUR IN BEER MARKET, USING THE THEORY OF CONSUMPTION VALUES

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Annotation: The article uses the theory of consumption values to identify the factors affecting decision-making about drinking or not drinking beer on the Czech market of young consumers. According to CVVM (Vinopal, 2009) the share of youngest man, aged 18 -30 years who drink beer declines continuously from 92% in 2004 to 84% in 2009, and at the same time shows this age group lower consumption of beer than is the average in those who drink beer. The question is, what kind of motives can lead to such behavior. A project was developed that sought explanations using the "Theory of Market Choice Behavior". The research, that was carried out on a set of a total of 265 respondents, led to the identification of factors of consumer values, that express the perceived motives influencing the decision about drinking and not drinking beer.

Key words: beer, consumer behavior, theory of consumption value,

JEL classification: M 31

1. Introduction

The long term per capita beer consumption in the Czech Republic is one of the highest in the world, in 2014 the consumption per capita was 142.6 liters. Beer consumption in the Czech Republic has a long tradition and beer is the most consumed alcoholic beverage. According to CVVM (Vinopal, 2009), there has been a decline in the proportion of those who drink beer from 92% in 2004 to 84% in 2009 among youngest men aged 18-30, and this age group shows lower beer consumption than average consumption for those who drink beer.

To understand the trends of this development, it is important to understand the determinants that influence customers market decisions. In the available literary sources about Czech beer consumer behavior taste preferences, price, advertising, brand, beer habit and beer production region are considered to be the main factors for beer selection, the importance of these factors being different for women and men (Vinopal, 2014). Economic factors as demand determinants studied Castiglione et al. (2011) who considered the price, income and habits as the main factors influencing demand for beer. Janda et al. (2010) stated the main factors influencing the level of beer consumption the price of substitute products and consumer incomes. Grosová et al. (2017) dealt with the economic factors influencing the level of beer consumption on and off-trade, the prices of beer on and off, the price of the substitute product - mineral water and custom were identified most important. Foret and Procházka (2006) investigated consumer behavior in the food market in terms of the importance of marketing mix tools and found quality (49%), price (25%) and brand (20%) as the key factors in beer selection. Stávková et al. (2008) dealt with the influence of tradition and habit, the urgency of need, experience, the recommendations of friends and expert, product characteristics, quality, prices, brands, discounts, advertising, curiosity, trends and product design. (Sudzina, 2017a) studied scales for attitude towards beer and scales for beer brand loyalty (Sudzina, 2017b).

Classical models explaining purchasing and consumption behavior centered on product attributes as the main product or brand selection criteria. In this context, the consumer chooses the product that provides a set of attributes best suited to personal preferences and customer needs

According to Sheth, Newman, Gross (1991a), consumer choice in the market is influenced by a set of consumer values rather than a set of product attributes. The authors identified five sets of consumer values, functional, social, emotional, epistemic and situational values.

Functional values are traditionally considered a key factor in consumer choice and are a set of functional, functional or functional attributes. It can be measured on a set of attributes according to which the consumer realizes his choice of product or brand

The social value gains a product through the fact that its use is associated positively or negatively with one or more specofoc social groups. Often these are products whose use and consumption are shared and can be monitored by other consumers

The emotional value arises from the combination of specific feelings or the emergence of a certain emotional state in relation to the consumption of the product. In recent years, emotions have been seen as a key factor influencing consumer choice.

The epistemic value arises in connection with the potential of the product to provoke curiosity, a sense of novelty, or the satisfaction of the desire to acquire new knowledge.

The conditional value of is acquired as a result of the specific situation or set of circumstances with a particular situation or a set of specific conditions. Consumer judgment influences the situation environment

The five consumer value groups identified in this theory make differential contributions in specific consumer situations. It depends on the particular product, product category, brand, which will more or less influence the choice of the consumer.

The aim of this article is the identification of factors of consumption values that express the perceived motives influencing the decision about drinking and not drinking beer.

2. Materials and Methods

The set of questions proposed by (Sheth et al, 1991b) was adapted for use in the Czech language, for the decision making to drink or not to drink beer. The questions were presented to two groups of UCT Prague students. The first group consisted of 8 students who drink beer at least once a week, the second group consisted of 5 students who do not consume beer. Another 26 respondents aged 20-31, were asked through individual focused interviews. A total of 103 statements were processed into the questionnaire format and supplemented by questions examining the consumption or non-consumption of beer and demographic characteristics. Questions asked and statements for functional, social, emotional, epistemic and conditional values are presented in the Tables 2 to 6. Data were collected in May and June 2016 using an on-line and a personal questionnaire. Respondents were 265 bachelor, master, and doctoral students and their friends mostly from Prague and Přerov. Of them 85 stated, that they do not drink beer or drink it only occasionally (max. 2 times in the month).

Data were processed in the IBM SPSS 19.0 statistical software, Principal Component Analysis (PCA) as part of factor analysis was used. Kaiser-Meyer-Olkin Test was used to measure how well suited are data for factor analysis. The number of factors and their factor loadings were determined by the main component method and Varimax rotation metod.

3. Results and Discussion

Principal Component Analysis results are shown in the tables that were created for each set of consumption values, see Table 1, 2,3, 4,5. Only factors with an Eigenvalue value greater than 1 were included in the model. In the tables, factor scores less than 0.1 are not included. Factors derived represent underlying value dimensions. In the study, consumption values are determined as totally by 28 factors. Functional consumption values are determined by 8 factors, social values by 6 factors, emotional values by 6 factors, epistemic 1 and conditional values by 7 factors. Kaiser-Mayer Olkin (KMO) test values for all consumption groups values was between 0.632 (functional CV) and 0.818 (epistemic CV). Hair et al. (2006) suggest accepting a value of 0.5 or more. Values between 0.5 and 0.7 are mediocre, and values between 0.7 and 0.8 are good. Small values (less than 0.05) of the significance level indicate that a factor analysis may be useful with data. Bartlett's test below 0.05 expresses, that there is strong relationship between variables. In our study Bartlett's test was 0.000, that means there is strong relationship between variables.

Table 1. Principal Component Analysis: Conditional value statements and derived factors

Certain conditions motivate people to behave differently than their regular behaviour or habit. Do you believe that the following conditions might cause you to change your behaviour to beer drinking YES/NO	Factor component							
	1	2	3	4	5	6	7	
After a fatty meal	.736		.148			.124		
Hot weather	.703	.182		.256		.238	.102	
On tour. after hard physical exercise	.650	.183	.368			-.139		
Events in the brewery or pub	.529	.214	.146	.223	.400	.179	-.186	
A great selection of unknown beers	.402	.174	.233	.154	.376	.321	-.274	
Taking medicine		.810	.187		.228	.150		
When I need to clear my head	.321	.794					.134	
When I'm ill		.789		.238				
When driving car	.141	.487	.189		.483	-.124	.216	
High price	.102	.105	.803	.184		.103		
Not enough money		.288	.738		.169	.130		
When the price is low	.307	-.145	.610	.111	.203	.236	.121	
Advertisement	.253		.523		-.381	.124	-.140	
When no one else drinks it		.147		.780	-.196	.154		
A taunted pub	.277		.142	.660	.345	-.190		
Nice restaurant	.558		.179	.635				
Friends recommendation	.387	.241	.171	.434	.192	.286	-.394	
There are not clean pipes in the pub	.124	.220			.793			
No alternative	.255		.190			.727		
In a pub when everyone else drinks		.122	.197	.412	-.355	.641	.191	
The decision to live healthier		.332	.179		.406	.513		
Only under pressure or threats		.174	.146			.139	.831	
Partner recommendation	.365	.387	.398		.218	.334	-.401	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.							.768	
Bartlett's Test of Sphericity Sig.							.000	

Table 2. Principal Component Analysis: Epistemic value statements and derived factors

People sometimes drink beer for personal and emotional reasons. Please indicate whether you personally experience any of the following feelings associated with your decision to drink beer YES/NO	Factor component					
	1	2	3	4	5	6
I feel good	.862		.185	.111		
I relax with beer	.810		.138	-.114		.106
I feel joyful	.787		.189	.279	.172	
Drinking beer is a ritual for me	.722	.112	-.162		.193	.173
I like taste	.613	-.122	.253	.329		.351
I'm well tuned	.555	.127	.537	.214	-.116	.214
I feel relaxed after beer	.529	.189	.287	.232	.195	.313
Feeling patriotism. I'm Czech	.466	.221	-.245			.403
I feel tired	.177	.832				
I'm afraid. I'm going to get fat after the beer	.127	.615	-.165		.221	.304
I'm afraid of getting drunk	-.342	.577	-.198	.231	.395	
I'm afraid of losing self-control	-.176	-.502	.167	-.423	-.210	.387
I'm afraid I'll have health problems	.166	-.490	.241	-.355	-.350	
I feel resistance to beer	.253	-.221	.724	-.253		
I do not feel well in the pub	.235		.716		-.167	
The feeling that drinking beer is "below the level"		-.471	.519	-.323		-.141
Feeling of belonging	.204		.135	.690	.161	.256
People respect me more if I don't drink beer		.166	-.251	.644	.151	
I feel like I am like everyone else	.174		-.158	.514	.502	.230
I feel the sense of personal victory that I can resist	.109	.479	-.245	.486		
Feeling to be "cool"	.216		-.260	.117	.728	
It lets you escape from reality	.101	.365			.705	
I'm afraid I will fit in	-.190		.520	-.234	-.524	
I want to support Czech beer producers	.172				.154	.802
I feel happy when I have a beer after a good meal	.416			.320		.610
Kaiser-Meyer-Olkin Measure of Sampling Adequacy						0.786
Bartlett's Test of Sphericity						Sig. .000

Table 3. Principal Component Analysis: Social value statements and derived factors

Not everybody drinks beer. Which of the following groups of people do you believe are most and least likely to drink beer? MOST LIKELY/LEAST LIKELY	Factor Component					
	1	2	3	4	5	6
Students	.845					
Elderly men	.713		.205		.108	.138
Young men	.712	.262		.229	-.119	
Inhabitants of small villages	.674	.208	-.119		-.175	
Blue collar workers	.641	.307		.314		-.114
Sport fans	.572	.551	.171		.108	
Pub regulars		.818		-.227		
Villagers	.421	.745				
My friends	.319	.599	.174	.293		
Drivers			.838			-.109
Elderly women	.213		.702	-.194	.168	
Pregnant women	-.257	.162	.627	.346		
Pensioners	.329	.184	.400		.295	.262
Teenagers	.247			.752		
Young women	.175		-.105	.693	.188	
Supporters of a healthy lifestyle	-.195	-.253	.298	.568		-.179
Wine users		-.413		.475	.255	-.112
Intellectuals		.193		.164	.805	
High earners			.315	.142	.671	
Recreational athletes	.226	.102	.209	.274	.103	-.739
Pseudointellecutuals	.105		-.227	.147	.543	.578
Low earners	.336	.309	.403		-.236	.524
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.					0.714	
Bartlett's Test of Sphericity Sig.					.000	

Table 4. Principal Component Analysis: Epistemic value statements and derived factors

Some people drink beer or drink the other beer because they are curious about it. or simply bored with whatever else they are doing. Do you (did you) drink beer (other beer) for any of the following reasons? YES/NO	Factor component
	1
I like to explore new things	.809
I'm curious about it. I want to try it	.791
I like change	.791
I want to try it	.790
Beer I have not tried before	.782
A new type of beer on the market	.747
I'm bored what drink I usually drink	.521
Kaiser-Meyer-Olkin Measure of Sampling Adequacy. .818	
Bartlett's Test of Sphericity Sig. 0.000	

Table 5. Principal Component Analysis Functional value statements and derived factors

Please indicate whether you agree or disagree that the following benefits or problems are associated with beer drinking YES/NO	Factor Component							
	1	2	3	4	5	6	7	8
Helps you keep your healthy drinking habits	-.034	.166	.383	-.593	.362	.032	.269	.208
It has low acidity	-.008	-.015	-.034	-.061	.815	.031	-.088	-.062
Refreshes	.341	.160	-.129	.172	.463	-.161	.319	.401
One burps after drinking	.507	.106	.266	-.029	-.002	.007	.340	.099
It is a source of vitamins	.147	.677	.112	.165	.270	.180	-.052	-.018
I get great ideas	.008	.011	.143	.073	-.141	-.040	-.012	.859
One goes to the bathroom more often after drinking beer	.173	.052	-.217	-.105	.186	.388	-.089	.461
It's expensive drink	-.090	.174	.031	.743	.086	.165	.215	.241
It removes communication barriers	-.763	-.089	-.085	-.228	-.074	.021	.157	.032
Supports cravings to smoke	.161	-.126	.356	.648	.061	.025	.071	-.046
Causes diseases of the digestive system	-.009	.113	.598	.217	-.129	.507	-.362	.065
One sleeps well after beer drinking	.074	.136	.166	.141	.058	.124	.783	-.033
Beer increases bust size	-.059	.036	.716	.150	.041	-.063	.153	.335
Beer causes obesity	.676	-.061	.027	-.152	-.188	.216	.260	.053
Beer is a natural drink	.088	.622	-.003	-.037	-.182	.214	.370	.017
Beer makes me silly	.161	-.434	.215	.201	.040	.613	.144	-.036
Beer is an iont drink	.143	.158	.686	-.021	-.007	-.020	.132	-.188
It causes bad breath	.179	.207	-.083	.037	-.047	.746	.131	-.008
It causes hangover	.789	.206	-.112	-.009	.104	.234	-.023	.038
Beer is healthy	.139	.774	.169	-.111	.092	-.135	.085	.082
Quenches thirst	-.029	.406	.127	.172	.615	-.066	.358	-.061
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.							.632	
Bartlett's Test of Sphericity							Sig. .000	

4. Conclusion

Recent developments of beer consumption in the Czech Republic requires still investigation. Beer purchasing and consumption determinants are of constant interest. The theory of consumer value provides an interesting framework for identifying what motivates or hinders beer consumption. As far as we know, this theory has not yet been used in available publications for the beer market in the Czech Republic.

The result of this article is a set of 98 statements, which represent the scales for the identification of functional, Social, emotional, epistemic and situational values.

PCA as a part of factor analysis on data from 265 respondents led to the identification of 28 factors that represent underlying dimensions of five consumption value groups. Future upcoming data processing stage will find those consumer values that distinguish a group of beer consumers from non-beer consumers using discriminatory analysis. It is a question of which factors representing

consumer values will be the most or the least distinguishing between consumers and non-consumers. Given that the respondents were young people under the age of 30, the information gained will help understand why this group consumes beer to a lesser extent. The results of the study are limited by the fact that the respondents sample is representative of the population 18-30 only by age and gender, not by education. The representation by beer users and non user is not completely proportional. We had only 86 beer non users in the sample of 265 respondents.

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RESPONSIBLE APPROACH TO BUYING FOOD AND WASTING FOOD

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Annotation: Food trade is a key determinant of the sustainable development of modern society in the global world. In connection with the ever-growing population and the increasing demands for sufficient food, urgent tasks are emerging for food production and trade. One is cost-effective and resource-efficient. An integral part of this task it is to deal with the increasing amount of food waste. The largest share of food waste, according to the European Commission, accounts for 42% of households in Europe. Every year, Europeans throw into the containers 89 million tons of unused food every year. A large share of this has a current trend in food purchases over the last decade. The impulsive purchase supported by vendors with a number of marketing communication promotion tools has a large share of the buyout decision and total purchases at the point of sale. The aim of the article is to propose options and ways to reduce the waste of household food, based on the experience gained from Czech households through surveys in 2014, 2015 and 2018 on the waste of food in households in the Czech Republic.

Key words: Food Security, Wasting Food, Food, Household, Responsible Approach, Sustainable Development

JEL classification: D1, M14, M31, Q01

1. Introduction

Food safety is a fundamental principle of European food policy that guarantees consumer health protection (e-AGRI, 2017). It is enough food that contains the necessary nutrients and is health-friendly. It is required that food be available and be of high quality.

In the current globalized world, this is not the case - on the one hand, for many people there is a lack or unavailability of food, on the other hand there is excess and waste with them (Butler, 2012, Evans, 2011, Farr-Wharton, et al. , Frewer, Gremmen, 2007). Food waste is becoming a serious problem of our civilization. This problem has not only an economic but also an ecological impact. This is related to the rapid development of the economy at the expense of nature. Many experts have already pointed out in the 80 years of the 20th century, when the development took a major extremes, as stated Jirasek (2006). Reports of problems raised have led scientists, experts and technicians to find more efficient technologies - to make more use of fuels and raw materials, and thus to "waste" in the production, consumption and recycling of used materials. The world has become aware of the critical state of nature and its importance for life (Šálková and Regnerová, 2016).

The Green Report (2017) states: The market price of food that is thrown out every year in the world corresponds to Switzerland's GDP, ie over \$ 685 billion. It is more than 14 trillion crowns (14,042.5 billion) transferred to the Czech crown at the CNB exchange rate of CZK 20.5 per USD. Wasting food also means wasting water used for food production. Apart from water, it is also wasted with other sources such as energy, land, human labor, fuel, etc. For example, to produce one liter of milk, 900 liters of water is needed and 15,500 liters of water is consumed in the production of one kilogram of beef. Waste of food and water is also an ethical problem. According to the Food and Agriculture Organization (FAO), 11% of humanity suffered from malnutrition in 2014 and, according to new reports, food is not available in Venezuela and many African countries are facing famine.

2. Materials and Methods

The starting point for article processing is the description and analysis of expert texts and external statistical data on the categories of decision making in the purchase and waste of food. The Food Wastage (Wasting Food) category is not comprehensively and readily compiled and published in the scientific literature. In literature and in the media, the terms Food Waste and Food Loss are often replaced.

In the methodological approach, the issue of scientific knowledge has been interconnected from the available professional literature with the acquired knowledge from internal investigations and external data. As Hendl (2012) points out in scientific research and cognition, work processes are based on knowledge organized according to paradigmatic criteria and are systemically organized primarily in written form. Firstly, the theoretical framework of the solved theme was defined, which was realized through analysis of secondary sources and synthesis of knowledge. As a basic method for processing the theoretical part of the article, the study of documents, ie scientific articles and professional books, was used. For the sake of clarity, the charts and tables have been created. A common text editor for MS Office Word was used during processing. It was used quantitative research **descriptive** design seeking to describe the current status of a variable. There were taken into account the relationship between designing the structure, collecting data and interpreting the results. These differences in the methodological approach were respected in seeking answers to a question that defines the stated goal of the present article: a proposal on how to reduce wasting food in households based on the experience gained from Czech households through a food waste pilot survey.

In addition to data from professional literature they are using the results of the internal pilot survey conducted at the Department of Business and Finance Life Sciences in Prague. The first survey was carried out in November 2014 in 121 households and mapped out the importance of household food waste in urban and rural settlements. In the second follow-up survey, in March 2015, 64 households were approached and they recorded a specific form of food waste for a month. In March and April 2018 a questionnaire survey was conducted focusing on waste of purchased food in households in the Czech Republic. The questionnaire was distributed online via the Internet through the Google Forms platform. The questionnaire survey was attended by 353 respondents. The questionnaire was designed for adults of all ages.

The knowledge and advancement of each individual-customer-consumer that he uses in everyday life in everyday decision-making, for example, when buying food, is based on knowledge organized according to the subjective importance. These differences in the methodological approach were respected in seeking answers to a question that defines the stated goal of the present article: a proposal on how to reduce wasting food in households based on the experience gained from Czech households through a food waste pilot survey.

3. Results and Discussion

A prerequisite for limiting and solving the problem of waste is the knowledge of basic categories - concepts of food waste and the acquisition of responsible access to food shopping. Current food supply in the Czech Republic exceeds demand. This greatly affects consumer behavior not only when purchasing food but also purchasing food services. This leads to food waste and food waste growth.

Defining food wastage is a debatable topic, often defined on the basis of whether it is professional, including international organizations, governments, or other institutions that can use their own definitions. A study by the Swedish Institute for Food and Biotechnology (SIK) on behalf of the Food and Agriculture Organization of the United Nations (FAO) distinguishes the terms Food Loss and Food Waste (Gustavsson et al., 2011) and defines:

Food Loss is defined by the United Nations (FAO) as a reduction in the weight of edible parts of food for human consumption (excluding inedible parts and seeds) throughout the supply chain. This loss definition includes parts originally intended for human consumption that were eventually used for another purpose, such as fuel or animal feed. Unpredictable food losses (ineligible) include shells, peels, stems, cheese crusts, egg shells, coffee remnants, teas and meat and fish (bone) residues, as reported by the Dutch Nutrition Center, Consumer food waste, 2014.

Food Waste is defined as the waste-loss of food that has been destined for human use, but it gets out of the food chain. This occurs especially in the retail trade, but also in catering (Rohn et al., 2014), and final consumption. This means that food is thrown away (Gustavsson, van Otterdijk and Meybeck, 2011), even though this waste is then used for non-food purposes (e.g. as a source of bioenergy, etc.). In this sense, it is wasting food or Food Wastage.

Interesting and beneficial is the Estimates of European food waste levels of the Authorized Collegium developed for the Clients European Commission (FP7), Coordination and Support Action (CSA); Projectleader FUSIONS coordinator: Toine Timmermans, Wageningen UR - Food, Biobased Research, The Netherlands, Project leader for this Deliverable: Åsa Stenmarck, IVL Swedish Environmental Research Institute (Sweden). This study also included estimates of food waste in the EU-28 in 2012 per individual sectors:

Table 1. Estimates of food waste in EU-28 in 2012 from this quantification study

Sector	Food waste (million tonnes) with 95% CI* ⁴	Food waste (kg per person) with 95% CI*
Primary production	9.1 ± 1.5	18 ± 3
Processing	16.9 ± 12.7	33 ± 25
Wholesale and retail	4.6 ± 1.2	9 ± 2
Food service	10.5 ± 1.5	21 ± 3
Households	46.5 ± 4.4	92 ± 9
Total food waste	87.6 ± 13.7	173 ± 27

Source: Estimates of European food waste levels

This study (see T1) shows that the largest amount of food waste (wasting food) in the EU-28 is consumed in households (53%), followed by processors including primary production (30%) then food service (restaurants 12%) and least in the waste involved in wholesale and retail trade (5%) (Stenmarck, Å. et al., 2016).

The 2012 data in the cited study is 11% higher for wasting households and 9% lower for primary processors than for the European Commission in 2014. According to the European Commission, 42% of European household food waste, representing a reduction of 11% compared to 2012. The manufacturer accounts for 39%, 14% for the hospitality sector and 5% for the retailer. From the 2012 and 2014 figures, it is clear that households are the biggest contributor to food waste.

The costs associated with food waste for EU-28 in 2012 are estimated at around 143 billion euros. Two-thirds of the cost is associated with food waste from households (around 98 billion euros). This is due to this sector a) having more edible food waste than any other sector and b) the costs associated with a tonne of food are accumulated along the supply chain e.g. processing, packaging, retailing costs (Stenmarck, Å. et al., 2016).

⁴ *Confidence interval

The European Commission further estimates that only 90 million tonnes of food is spent annually in the EU (87.6 in T1), which is about 173 kg per person. A large proportion of these foods are still suitable for human consumption. According to the European Commission, a growing number of analyzes casts doubt on the long-term sustainability of current trends in food production and consumption. The food system also has a great impact on the environment through greenhouse gas emissions, water and soil use and the use of chemical fertilizers and pesticides. European Commission aims to reduce food waste by 2020 by 50% (eAGRI, 2014).

According to UN data, the Czech Republic "produces" 729,000 tonnes of food waste per year. This number per capita means that every citizen of the Czech Republic produces 69 kg of food waste per year (173 kg of burnt dish for one European). This means that the average daily amount of food waste per inhabitant of the Czech Republic is 189 g. Every citizen-consumer in the Czech Republic produces daily 189 g of food waste and at an average life span of 77 years it is 5313 kg (about 5.3 tonnes). These figures, in contrast to the fact that almost every seventh person is hungry on the planet, and almost a third of all foods (Garbage can help Czechs in 2014) are striking.

Where and why is there so much food waste in households? The general trend of constant economic growth leads to the creation of overproducts. This is reflected in the food supply in the internal trade in the subsystem retail where consumers shop for home.

In the last decade, impulse and interactivity have become an actual phenomenon of marketing communication in sales outlets (Krofiánová, 2009). This is very strongly influenced by the current trend in food purchases. Impulsive buying has a large share of the total purchase, which is supported by a variety of vendor's promotional marketing communication tools at the point of sale. The final consumer for the household does not only buy the food he needs but he buys under the influence of current impulse actions. These are price reductions, time limited offers, "you save" when buying two or more pieces, double the presentation of goods-food on the shopping area, in shelves, supported by a number of trailers, convenient prices, tastings, etc. For the purchase at the point of sale up to 72% of customers, according to Brychta, (2009). Impressive purchases like this can be seen when buying in an e-shop where the shop area is represented by a computer desktop, advertising and offering the breadth and depth of a range of food at a bargain price. The customer does not only order what he needs but also purchases food that he cannot even consume.

Expert lectures by external staff on social responsibility and food waste have prompted great interest and feedback from our students. As the largest percentage of food waste falls on households, a survey was carried out in 121 households in urban and rural settlements on household wastage in collaboration with 3rd year PEF students in November 2014. This survey focused on the question of what makes food waste, what role media and advertising have in the family, at school, at work to reduce waste, sales points, and others at the discretion of the interviewees.

The results obtained from this survey were more general in nature and can be summarized into several levels concerning waste in households:

1. The economic and social position of the household
2. Family, school, community-based education
3. The buying behavior and consumer choices
4. Share of trade, hospitality and advertising for food waste in households
5. Minimal media information on food waste
6. Suggestions from students to reduce food waste

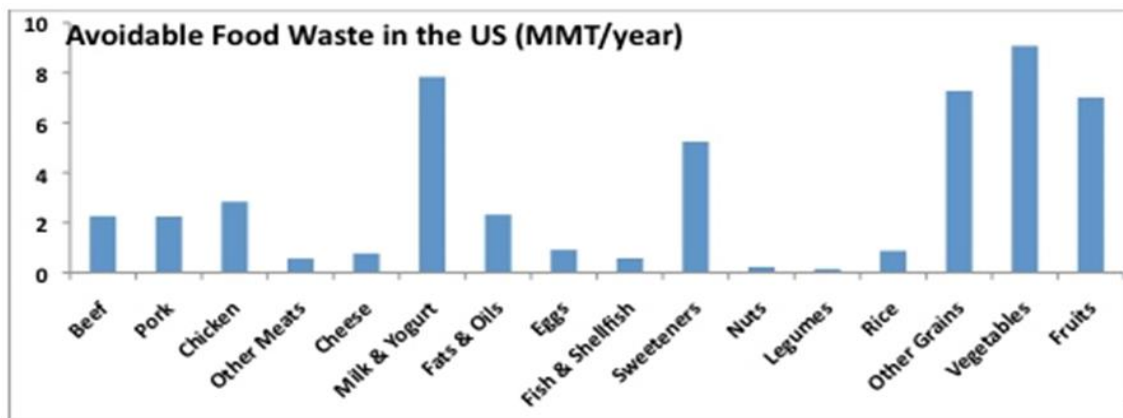
The second survey and survey of households' food wastage behavior was implemented in March 2015. The first part is demographic and it maps the district of the household, the total household net

income, the number of members and the data on individual household members. In the second part, the usual place of purchase of food, the frequency of purchase and also the frequency of cooking hot meals, which has a direct impact on food waste, was found. It was followed by a part of mapping opinions on food waste, information on degraded foods (reason, storage period, method of disposal), and proposals to prevent food waste in households. The survey was the diary, in which households for one month recorded realized purchases (purchase price and composition). Two-thirds of the population surveyed declare that they are trying not to waste food. In spite of this, food wastage occurs, more often in settlements with more people. This is confirmed by Secondi et al. (2015). The tendency to produce more food waste is generally people living in cities.

As reported by Porpino et al. (2015) identified several major causes of food waste in households: excessive purchase, excessive food preparation, avoiding the consumption of unused food unsuitable storage. This fact was confirmed at the first and second surveys. The survey also included the opinion of households on possible suggestions on how to avoid food waste. In a decisive number, households are more likely to check the shelf life of the purchased products, make more thoughtful purchases - avoid as much impulse purchases as possible, otherwise use unused food. It also takes into account the preparation and cooking of smaller portions of dishes and the sale of packages with fewer pieces. A great deal of food waste is projected to buy a large amount of food (large packaging) that its members are unable to consume.

The products that are most wasting in Czech households include: bread, fruit, vegetables and dairy products (yoghurt, milk, cheeses, etc.). Other places include sausages and cooked meals or served food. This is in line with a number of researches in other places, for example, as can be seen in the following graph:

Graph 1. Distribution of food waste by commodities in the USA (tons / year)

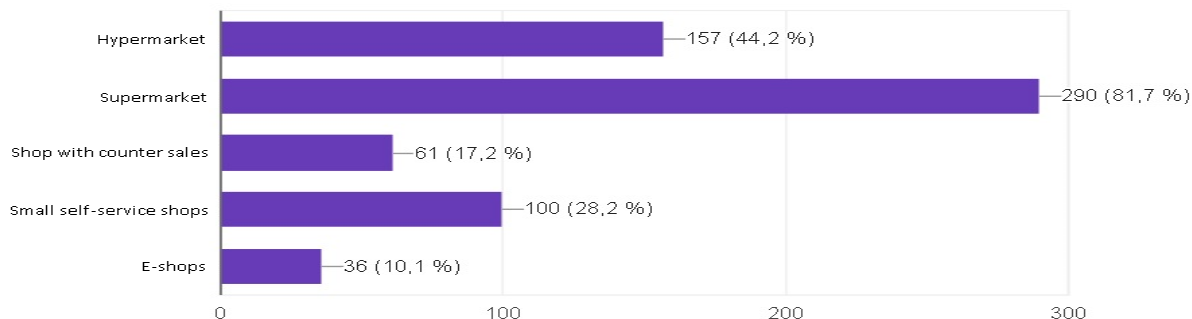


Source: *The Anatomy of Food Waste*.

The third household waste survey was conducted in March and April 2018 in the form of an electronic questionnaire. The questionnaire survey was attended by 353 respondents of all ages - adults. Regarding the demographic structure of the questionnaire, respondents from all regions and Prague responded. Of the 70% corresponded to women and 30% men. Most respondents were 21-35 years old (80%). In terms of economic status, most respondents were at the same time working (60%), the least unemployed (less than 1%). The questionnaire survey revealed a fact that confirms today's trend in the number of household members in economically advanced countries. 15% of the respondents had single-person households (singles). These respondents live mainly in the cities. Two-member households were 37%, three- and four-person households were equal to 20%. This also confirms the trend that families with two or three children are growing. An interesting result of the survey is that the income of the whole household ranged most in the range

above CZK 51,000 (30%), the income of 36,000-50,000 CZK (27%) was found in second place. The total household income was also followed by spending on food per household member. The most common answer (50%) was that this amount ranges from 2,000 to 4,000 CZK. Other questions in the questionnaire concerned the place of food purchases, the impact of advertising and food waste in the monitored households.

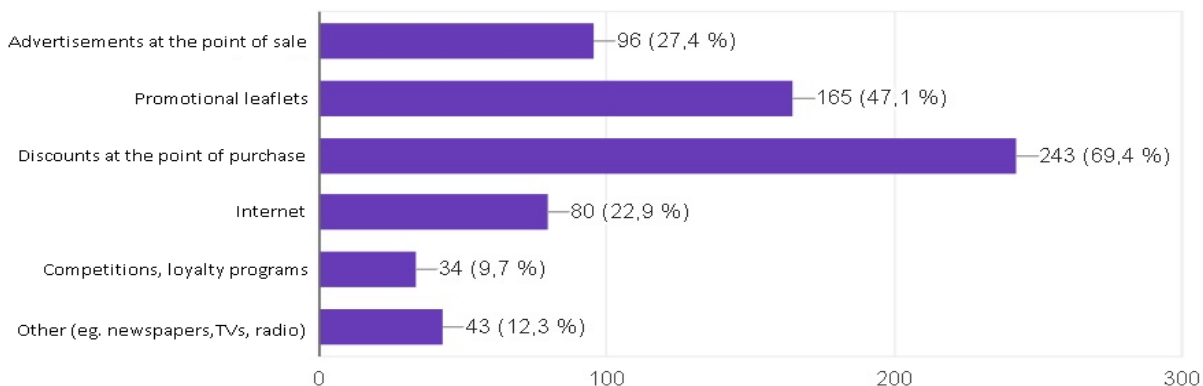
Graph 2. Share of the types of retail sales for food purchases



Source: Own research

As shown in Graph 2, most respondents buy food in supermarkets. Sales of food over the Internet occupies 10.1% last place, but this proportion will increase annually, especially in urban agglomerations.

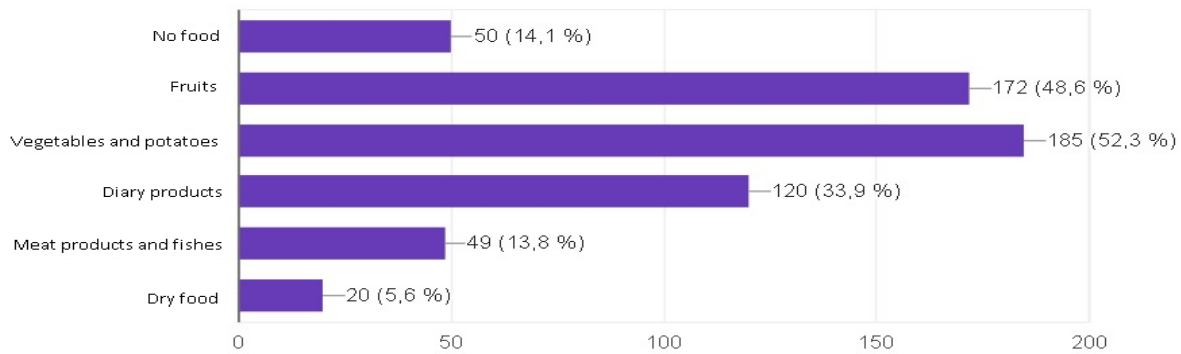
Graph 3. Share what methods of promotion influence decisions when buying food



Source: Own research

As part of the research, the question was asked: Which means of promotion affect respondents when buying food? As Graph 3 shows, the biggest impact on decision making when purchasing food has discounts for goods in the store, and for all age groups. Marking the discount table or obviously reducing the price of the seller will most affect the customer. According to our research, almost 70% of respondents from both towns and villages are subject to these influences. Another significant way of promoting food sales is leaflets. Leaflets as a means of promotion together with discounts in stores give priority to respondents over the age of 50.

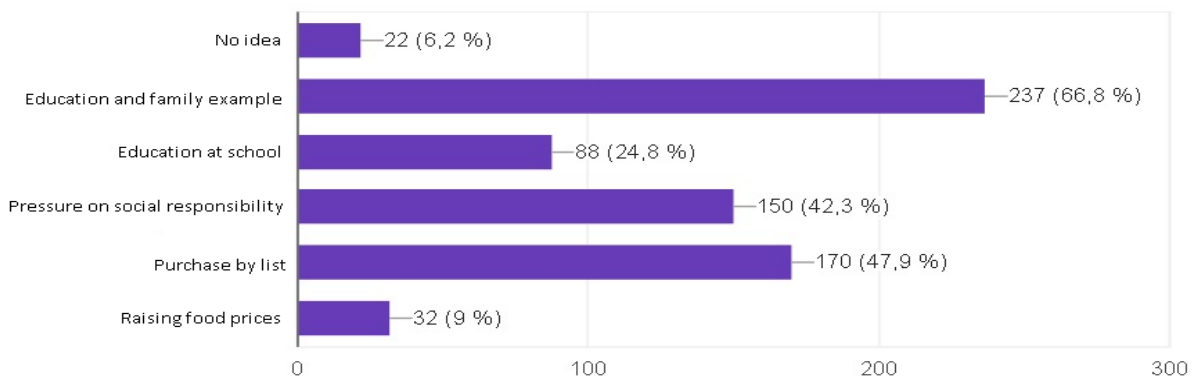
Graph 4. Share of the type of food waste to household waste



Source: Own research

The graph above illustrates the respondents' answers to the question of which food items are most wasting their households. Respondents could choose from more options. The pleasing finding was that 14% of the monitored households did not dispose of any food. These are, in particular, multi-person households located in the village. In the countryside, it is easier to use unprocessed food as a pet feed. 50% of respondents in cities try to freeze, dry or otherwise process unused food, 30% of respondents throw away food and 20% of respondents throw food completely. In a group that absolutely waste food, the respondent is over 35, living in cities in a single-person household with a monthly income of more than 30,000 CZK. As for the kind of food that is wasteful, it is vegetables, fruits and dairy products.

Graph 5: Means to reduce the amount of food ending up as waste



Source: Own research

In surveys visibly appeared a question of motivation to reduce waste, "saving money". Nevertheless, in the literature, we come across this question as suggested by the Lithuanian authors Tokareva and Eglite (2014): „Pilot research results shows that people are less concerned about reducing food wastage when it comes to environmental problems, but are the most motivated if they see a real opportunity to save money. So to motivate people waste less people need to be shown how their food wasting habit affect them economically“.

4. Conclusion

The aim of the article - based on the experience gained - was to draw up a proposal for options and ways to reduce the waste of food in households. The basic options for eliminating food waste that have emerged from surveys can be summed up into several conclusions:

- Talk about wasting food in the family, at school, at the workplace
- Shop rationally - plan purchases, write a list
- Restrict the purchase of large quantities of food with a short shelf-life

- Do not purchase a large number of pieces in one package ("action" menus)
- Do not buy just under the influence of advertising
- Learn to store food properly
- Food that is not eating at a restaurant can be packed

A great benefit that needs to be emphasized in the end is the positive attitude of students. All students enrolled in the survey see home-grown food waste as a negative phenomenon and a global problem that cannot be left indifferent. There is not much need to change this situation. Relatively easy and inexpensive steps on the part of household consumers, food business operators, traders and governments can lead to a significant reduction of waste. This was also the focus of the UN campaign "Think. Eat. Save. Reduce your food trail ", which aims to present facts and offer possible solutions, for example by spreading good practices. Families, supermarkets, hotel chains, schools, sports clubs, cities and municipalities, and eventually the country's top leaders are gradually being involved in the campaign. Measurable results are not yet clear. But it can be seen and heard in the mass media that the desire to convert thoughts into several levels.

Students who participated in the survey had information on issues in available literature. Collaboration on research has attracted students very much and led them to reflect on the issue. A positive result of the survey was the immediate effort to reduce the amount of food waste in the monitored households. This should also be the first and very important outcome of pilot research. The pilot survey will be followed by further food waste surveys to collect enough data to statistically process the results of the survey to make a more meaningful comparison of food waste problems in the Czech Republic compared to other developed countries.

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ENVIRONMENTAL ASPECTS OF MOBILITY

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Annotation: The phenomenon of the 20th century was a car and crude oil, no other individual branch of human activity has so far affected our lives. The paper sets out some options for addressing environment improving image of transport. Ecological management objectives setting the target greenhouse gases production by transport are compared with transport performance modes per person. The data in this paper shows that the most important decrease of transport emissions has occurred especially in road transport as road transport nowadays contributes to total transport more than ninety percent. The ways to reduce the environmental burden of transport are: using logistics and telematics, restrictions on congestion, increasing the efficiency of the transport of goods, stabilization of the traffic flow. Acceptance of image of plethora of technologies was observed. It was shown that the highest promotional efficiency has polarity and programming of acculturation because altruism of innovators is disseminated in communication channels similarly as experience of lost customer.

Key words: environmental management, greenhouse gases, emissions, noise, telematics

JEL classification: Q54

1. Introduction

Complexity of transport is usually expressed either by metaphors as objective data. For example transport network would pass over equator more than 740 times. That is approximately 30 million km, including six million km of flight corridors, sea corridors excluded. More precisely, 88 % are roads, 5.5 % railroads, 4.4 % tubes a 2.1 % are continental water ways.

Table 1. Czech energy consumption in transport (TJ)

	2011	2012	2013	2014	2015	2016
Black coal	6.9	19.6	22.2	17.6	16.4	15.9
Coke	22.6	35.9	21.1	17.9	16.8	15.1
Brown coal	120.0	107.0	98.3	94.2	94.3	109.7
Gasoline for planes	0.0	0.0	0.0	0.0	0.0	0.0
Kerosene	15,703.8	12,177.4	7,458.5	9,072.4	8,956.2	8,536.8
Gasoline for cars	243.2	199.5	187.1	177.3	180.4	180.2
Diesel	35,163.6	38,652.6	38,713.2	38,851.1	39,423.8	39,390.8
Heating oils	8.1	0.8	0.9	0.8	0.7	0.6
Natural gas	1,229.7	1,132.3	1,138.0	1,121.0	1,112.7	1,230.3
Other gaseous derivate	194.1	86.9	83.7	78.4	81.1	76.6
Electricity	6,450.7	6,776.4	6,651.7	6,352.0	6,858.9	6,804.5
Other energy	2,416.1	2,072.2	2,096.7	1,891.9	1,915.2	1,542.5
Total	61,558.8	61,260.6	56,471.4	57,674.6	58,656.5	57,903.0

Note: energy consumption of companies over 20 employees Source: Czech statistical office, 2018

Density of transport network is more than 22 km per 100 km² of land (Transport Research Centre, 2018). One inhabitant of Earth makes about 200 trips a year, Average trip is 33 km long but, citizen of USA travels 18 thousands km per year oppose to inhabitant of developing country, whose length of travels is hundred times lower. Surprisingly, transport energy consumption has decreased

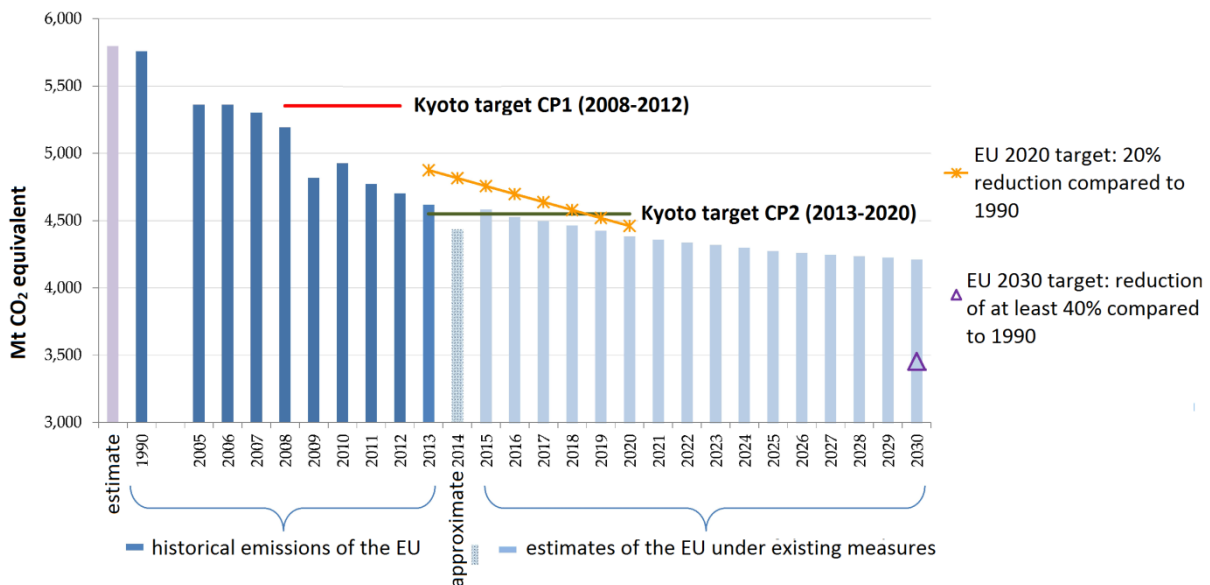
due to performance of new technologies improving traffic fluency between 2011 and 2016 (Table 1) Czech statistical office, 2018).

But, not all measures taken are improving fluency of traffic, decreasing energy consumption and emissions. Some obstacles can cause approval for road adaptation according to ecology respecting procedure (EIA) where requests of local actors or environmentalists may block investments improving transport infrastructure. Therefore, both campaigning and regulation were analysed in this article to increase impact of innovations and investments into transport facilities and infrastructure (Directive 2009/28/EC, 2018).

Methodology improving acceptance of regulating measures and campaigns improving environment in this article was inspired by methodologies for acceptance of brands at consumption market (Macdonald, 2012) or partners at market of organisations (Windler, 2017). Measures protecting environment are very strict. It is shown that EU is damaging transport companies for operational misconduct, subsidising development of new transport technologies or punishing its implementation errors, including employment and sector losses. Such sectoral reduction can be seen in biofuel sector recently. Czech environmental regulation of transport follows European one in following touchpoints: fuels, exhaust emissions, air quality, noise and vibration (Directive 2009/28/EC, 2018).

Naturally, legislation is delayed behind environment damaging events and new scientific findings. Therefore, EU has converted reactive into proactive approach by acceptance of Kyoto targets into its Europa 2020 strategy (Figure 1).

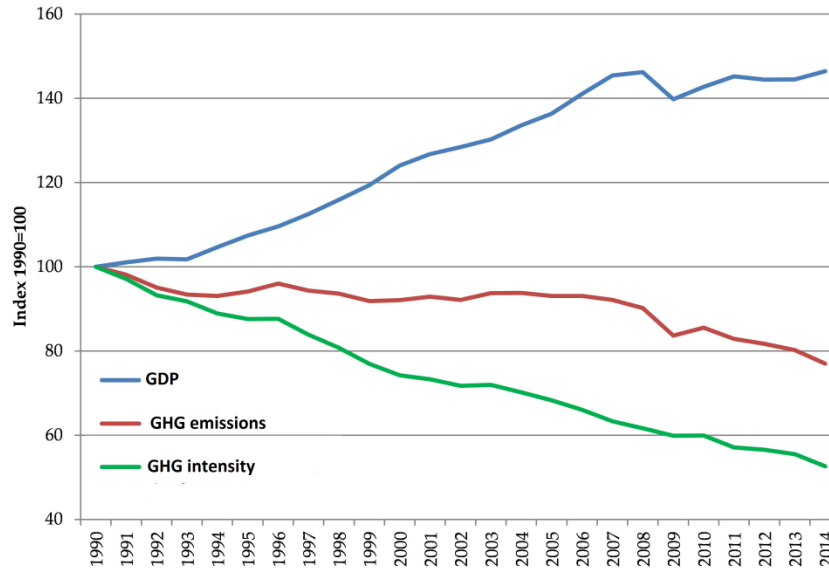
Figure 1. Kyoto GHG targets in Europa 2020 strategy



Source: Report from the Commission to the European Parliament and the Council, 2018

Data from EU member states predict 27 % decline of CO₂ equivalent emissions until 2030 oppose to 1990 year. But, 40 % decline of CO₂ equivalent emissions until 2030 should be reached. Therefore, additional measures declining GDP growth must be taken.

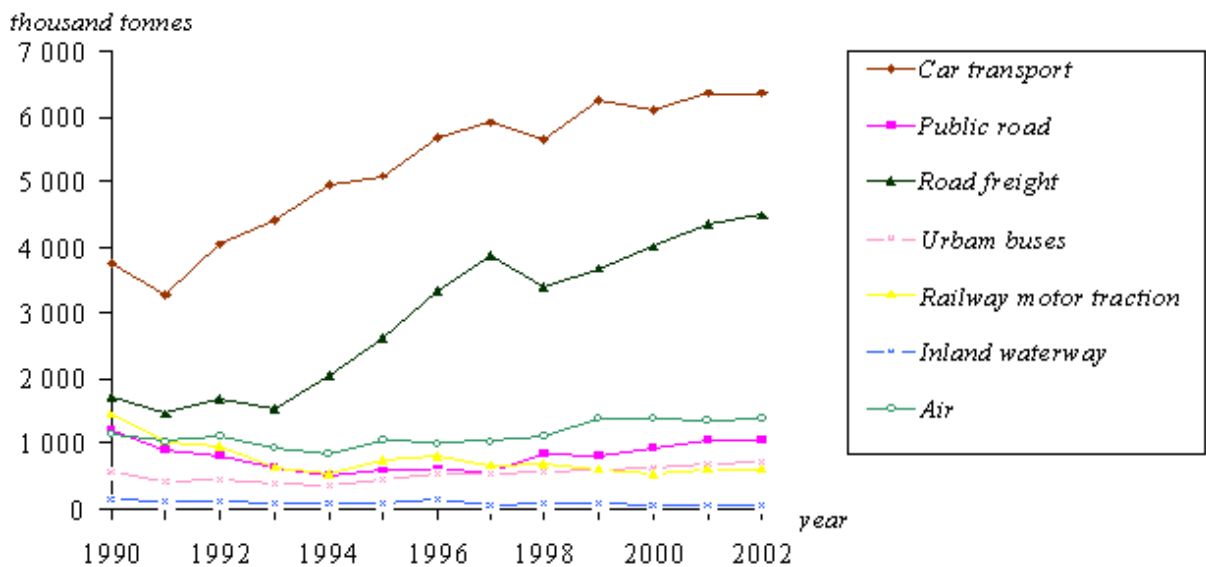
Figure 2. Monetary GDP relation to GHG and its intensity indexes (1990 = 100)



Source: Report from the Commission to the European Parliament and the Council, 2018

Improvement both climate and energy objectives were gained from increased share of price of carbon, renewable energies and improved energy efficiency up to 2006 year. Further emission savings are needed to convert GDP stagnation into growth. CO, NO_x, NO₂, VOC, SO₂ and Pb belong to emissions with declining impact oppose to CO₂ and N₂O (Figure 3).

Figure 3. CO₂ Production by transport [thousands of tons]



Source: Transport Research Centre, 2018

Transport pollution is not corresponding with decreased transport energy consumption (Table 1). Air and road transport have doubled energy consumption (Table 2) but, emissions should decline due to new norms and technologies (Figure 3). Dieselgate scandal explains why this forecast was not fully reached.

Table 2. Shares of specific transport energy consumption [%]

Specific transports	2010	2011	2012	2013	2014	2015	2016
Road total	90.6	90.9	90.6	90.3	90.8	90	90.1
Private cars	47.1	46.2	45.6	45	48.7	45.2	45.1
Road public	7.3	7.8	6.9	6.8	11.2	11.9	12
Road cargo	31.2	31.8	33.2	33.2	30.9	32.9	33
Railroad	4.1	4.4	4.3	4.3	1.8	2	2
Air	4.7	4.3	4.7	5.1	7.3	8	7.8
Water	0.5	0.4	0.4	0.3	0.1	0.1	0.1

Source: Czech statistical office, 2018

Additional 17000 t of solid emissions are produced by road transport in shape of particles from exhaust gasses, tires abrasion, brake linings and so on. All together it causes acid rains, air pollution, noise, vibrations, accidents, loss of land, destruction of settlements, loss of energy and barrier effect.

Therefore, the objective of this article is to merge efforts of all parties involved to remove negative and improve positive effects of transport. Parties involved are regulators, competitors and individuals. Efforts should implement campaigns into policies. Campaigns are not yet approved and implemented but generally rejected policies like GDPR, investments to safe of laggards, and so on. Policies are already approved regulations, for example non-systemic parties in governments, privatisations, renationalisation, cohesion, programming, and so on. Cases are unique events of both campaigns and policies with its consequences in court procedures (Khan et al. 2011, Machek et al., 2014).

2. Materials and Methods

Eeeles and Sims (1998), Machek, O. and Hnilica, J. (2015) define a business process as consisting of a number of elements; activities, transitions, states and decisions. But, if scenario method is applied on policies and campaigns the memory recall is less objective as measures taken at touchpoints. Doherty and Doherty (2018) are extending implications of this framing of experience for design, particularly in the case of systems to support self-knowledge, wellbeing, behaviour change, reflection, and decision making. In between former and later process states Kim et al., (in press) and Khan et al. (2011) use Construal level theory (CLT) to measure impact of sources at transition touchpoints to prevent collapse of the process.

Therefore, process states, sources and collapses at transition in between them are monitored for regulators and campaigners (Table 3). Scenario participants take their decisions from missing sources or thread of collapse. Data are derived from figures and tables above.

3. Results and Discussion

Efficiency of promotional messages about volume of transported goods, telematics, transport flow blockade, energy and emissions savings for policies, campaigns and cases were recorded for roles of lobby, judges in columns to find opportunity for spontaneously added alternatives by acculturated actors in last row of Table (3). Spontaneous transport alternatives were searched in interval of 18 thousands km per inhabitant per year in USA and 180 km per inhabitant per year in developing countries. GDP impact of average age of vehicles or traffic density due to lacking infrastructure on such variables as traffic flow organisation, cases like “dieselgate” and projects like low cost car for developing countries was derived by scenario participants.

Table 3. Impact of process indices on scenario acceptance by role takers

Roles /Process	Policies (operationalising democracy)	Campaigns improving profit while cancelling development)
States (levels)	Cohesion, unlimited delaying court procedures and number of expert statements. Judicature of “nothingness” blocking self-correction of procedural failure. GDPR	Privatisation. Double speed Europe. Renationalisation of policies. BrExit. Cash reserves to banks. Non-systemic parties in government. Divided non-euro zones.
Difference	Decrease of energy consumption TJ of transport (Table 1)	GDP stagnation due to emission control from 2006 (Figure 2),
Transition touchpoints (Lobby)	Europa 2020 strategy according to Kyoto protocol (Figure 1)	Investments into logistics and telematics is decreasing congestion and increasing efficiency of transport of goods and traffic flow
Difference	Kyoto CP1 vs. CP2 (Figure 1) + Actualization by Paris treaty	Decrease of emissions by 50 % while GDP increases by 50 % 1991 - 2014 (Figure 2)
Source (subsidies)	Subsidies, taxes, fines for overcompensation of biofuels	Saved energy consumption and emissions. Telematics improving traffic flow.
Difference	Lacking limits of emissions behind year 2020	Subsidies for imported technologies – Solar energies
Punishment of alternatives	Cancelled subsidies and set excise duty, and decreased targets for biofuels.	Removal of high percentage biofuels from petrol stations
Difference	Decrease of bio component in fuels. Fines for overcompensation.	Lost investments in EU biofuel sector cause double public and air transport of persons.

Source: Own processing

Differences between levels of (Table 3) show risk of collapse of mobility process improvement due to conflict between policies and campaigns. There is a little chance to change policies as EU budget roughly has not changed from 1 November 1993 and campaigns trying to change it a little bit last from one to 15 years. The most significant change in EU budget for these 25 years was decrease of budget for common agricultural policy from 50 % to 40 %. But, many changes were restrictive or declaring right to charge up to 10 times higher price, for example for green energies. Oppose to that certification campaigns and references to US standards were rejected. Therefore, public and air transport of persons doubled due to lost investments, support of imported solar, GPS, Google, Facebook, and other mobility improving technologies. The conclusion of table 3 is that individual citizens are empowered to solve problem of mobility themselves (Sosa López, Montero, 2018) while governmental focuses on mobility of disadvantaged groups (Wong, et.al., 2018) and companies are managed by bans. But, global companies may run campaigns directly to public (Winslott Hiselius, Smidfelt Rosqvist, 2016) without any EU or national restrictions. Simultaneously, this policy has no offer for local mobility alternatives schemes, for example of biofuels supporting local employment. Former policies shouldn't close down sooner than next policies will prove process sourcing for local economy according to Table 3.

4. Conclusion

The objective of this article was to set out touchpoints of mobility solutions while preventing loss of investments. It was show that inefficient communication of both regulators and lobbying investors transfers problems of mobility to public real-time experience tracking (RET) case by case (Doherty and Doherty, 2018). Parliament, Commission and Council favours imported over European investments due to lobbied guidelines for tendering procedures. Therefore, focus on operations, not on subsidises or penalties for investments into new alternatives will speed up innovativeness of EU. Lacking memory oppose to real-time experience tracking has focused on RET touchpoints, which

may replace friends of administrators by marketing automation according to transparent indices of abilities of participants. Science can benefit from this scenario “helicopter view”, which is checked by interest of role takers, whose main argument is not fulfilment of tender claims but performance of new construction. It is understood that new construction is environmental friendly transport in this case. But, such institutional, also ecological management can complement construction by reversal polarity of acculturation. Potential for polarity of acculturation management is well shown by Elon Musk and Gartner’s hype of innovations.

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THE MARKET FOR NATIVE PROTEIN CROPS AS A FACTOR IN IMPROVING FOOD SECURITY IN POLAND

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Annotation: An important problem, extensively discussed in the European Union countries including Poland, concerns self-sufficiency in terms of plant origin protein. Currently the demand for this raw material is met in approx. 75% by American imports of soybean meal. Dependence on such imports may constitute a threat to food security both for Poland and many other EU countries. For this reason presently actions are being taken in Poland and some other EU countries in order to reconstitute and develop the market of native protein crops. The aim of this paper is to indicate economic conditions for the development of production, infrastructure for this market and the marketing system, as well as potential utilisation of protein crops in Poland and in other selected EU countries. The study covers the period of 2006-2016.

Key words: food security, plant protein market, legumes, soy

JEL classification: Q13, Q18

1. Introduction

In recent years food security has become a particularly vital problem raising heated debates in the EU countries, including also Poland. It is understood as the economic and physical availability of food on the domestic market, irrespective of the fact whether it is produced domestically or imported (Mikuła, 2012; Slaboch and Kotyza, 2017). At present in Poland, similarly as in most EU countries, the demand in this respect is satisfied in approx. 75% by the protein raw material from imported American soybean meal (Watson, et al., 2017; Dzwonkowski, 2016). This raw material is the basis for feed production for pigs and poultry. It is a situation indicating excessive dependence of the country on the import of food raw materials, which in the case of natural disasters, crop failure or financial crisis even in other parts of the world may constitute a serious threat for the food security of Poland as well as many other EU countries (Rutkowski, Jankowski, 2011). For this reason in some EU countries actions are already being undertaken to reconstitute and develop the market of native protein crops (European Parliament, 2018). Studies conducted in Poland concern both genetic, agritechnical and economic problems and the potential utilisation of protein crops for animal feeds. The aim of this paper is to indicate economic conditions for the development of production, infrastructure of the market and the marketing system, as well as potential utilisation of protein crops for feed purposes in Poland and in other selected EU countries. It was decided to assume an additional research task aiming at the identification of market limitations in the supply of this raw material for the feed industry. It was also proposed to indicate the directions for potential actions aiming at the development of the market for native protein crops, and thus improve food security of the Polish economy.

2. Materials and Methods

The source material constituting the foundation for this study comprised statistical data of the Main Statistical Office of the Republic of Poland (GUS) and Food and Agriculture Organization of the United Nations (FAO). The analysis covers the years 2006-2016. Empirical studies were conducted on farms and feed mills throughout Poland. The applied method consisted in direct interviews using a standardised questionnaire. In order to identify advantages and disadvantages of the investigated market the SWOT analysis was applied. Moreover, measures of descriptive

statistics were used in calculations. The results were illustrated using graphic data presentation methods.

2. Results and Discussion

The deficit of domestic production of protein crops faced by Europe is a consequence of international agreements (the General Agreement on Tariffs and Trade GATT and the Blair House Agreement). They made it possible for the EU to protect their cereal production, but in exchange they admitted duty-free imports of oil crop seed material and protein crops to the EU (European Parliament, 2011). As a result, the production of protein crops proved to be highly unprofitable and as such it dropped drastically. Also enterprises specialising in oilseed crops and protein crops are presently focusing on the imports of protein crops and show very limited interest in domestic production.

As a consequence the EU countries in 2015 purchased 13.7 million ton genetically modified soybean meal from the US and Canada. The level was maintained also in other years. At that time the total demand for plant origin feed protein amounted to 18.5 million ton, which shows a deficit of native plant origin protein for feed purposes of 74.1%.

The primary sources of native plant origin protein are provided by legumes grown in Europe. According to the FAO data, the total area cropped to native legumes in the European Union in 2000 was 1.73 million ha, while in 2016 it was as much as 2.13 million ha (tab. 1).

Table 1. Production of legumes in EU-28 in the years 2010-2016

2010	2011	2012	2013	2014	2015	2016
cropped area (million ha)						
1738422	1578931	1437209	1329667	1608377	2102626	21344962
harvested crops (million tonnes)						
4357504	3588032	3155196	3190056	3762770	4886649	4960661

Source: the authors' study based on FAO data

Despite the fact that the total production of legumes in the EU in the analysed period increased from 4.3 million ton in 2010 to 4.9 million ton in 2016, it still fails to meet the current demand. The largest producers of legumes in the UE-28 include France, Great Britain and Spain, with the new member countries contributing approx. 15-20% EU production (Dzwonkowski, 2015).

Thus the ratio of the volume of imports for soybean meal as a protein raw material to the total demand for this raw material for feed purposes indicates that in the case of a long-term disturbance of soybean import results in a serious threat to food security of Poland and many other EU countries (Gołębiewska, Stefańczyk, 2017; Meyers, 2016). For this reason solutions to that potential problem are being searched for. However, this process is complex and depends on many factors, first of all the structure and volume of animal production, the structure of agricultural production on farms, as well as the ownership structure in the feed industry and legal and political conditions in individual countries.

For many years now production of protein raw materials in Poland has failed to satisfy the needs, with the shortages being covered in 75% also by imports (Śmiglak-Krajewska, 2014; Kapusta, 2017). Soybean meal vastly predominates in the structure of imported plant origin protein raw materials. The primary market where it is purchased comprises South American countries, including Argentina, Brazil and Paraguay. Imports of soybean meal to Poland ranged from 1927 thousand ton in 2010 to 2080 thousand ton in 2015.

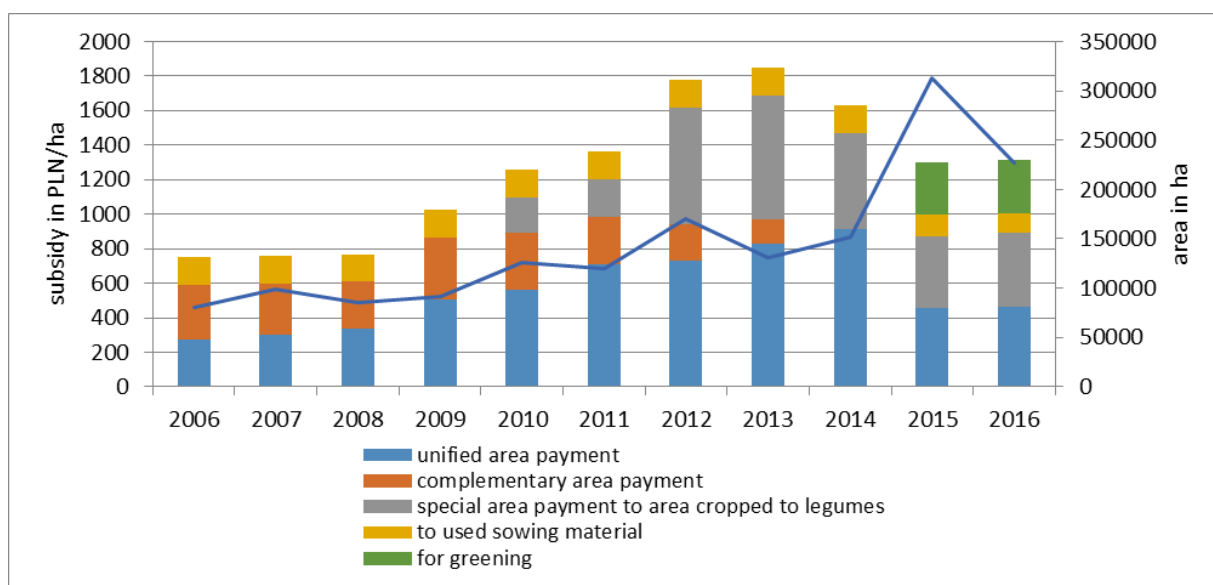
Native protein crop materials comprise rapeseed meal and legumes, supplemented with very small amounts of native soy. Production of legumes declined completely in Poland after 1990

due to the newly established opportunities to import soybean meal. As a consequence this led to the marginalisation of the domestic market for legumes (Jerzak, et al., 2012). The SWOT analysis showed weaknesses of this market. In terms of the supply these include considerable fragmentation of plantations, the scattered regional distribution and a very small production scale. Due to the absence of integrated trade in this raw material, contracts for small volumes of the raw material are not very attractive for feed mills. For this reason the demand for this native raw material is limited (Jerzak, 2014).

In this situation the Polish government in 2011 introduced subsidies to agricultural utilised land cropped to legumes. Thanks to these measures a considerable increase was observed for the area cropped to native legumes (Fig.1) (Czerwińska-Kayzer, 2015).

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Figure 1. The effect of subsidies on the increase in area cropped to native legumes in Poland in the years 2006-2016



Source: the Data Base of the Long-term Programme of the Ministry of Agriculture and Rural Development.

However, further studies showed that as little as approx. 2% potential production of this protein-rich material is traded. Its limited amount is used on the farms. Studies also showed that the agricultural producers as suppliers in view of a lack of commercial interest in native protein material liquidate their plantations before harvest (Florek, 2017).

In the search for the underlying causes a questionnaire survey was conducted on the feed market among agricultural enterprises and industrial plants. It showed that in Poland in the years 2010-2016 the number of suppliers ranged from 105 to 118 plants. In this group in terms of their numbers small feed mills predominated. They account for over 65% all entities in that branch of the economy. However, in market terms four large entities in the investigated period generated over 50% total revenue from feed sales in Poland. In turn, medium-sized feed mills had an approx. 35% share in total revenue from feed sales, while a large number of small mills generated as little as 12%. The financial standing of these entities was good. The synthetic measure to assess profitability in 2015 amounted to 0.638, at the mean for the entire food industry amounting to 0.585 (Florek, Czerwińska-Kayzer, 2018). It was also stated that these plants are willing to use native protein crops, on condition continuous supplies of contracted material of uniform quality are provided. Due to the scattered production and its small scale feed enterprises in Poland would be forced to develop the system

of procurement of this raw material from a large area. These plants thanks to the readily available resources of imported quality soybean meal as well as the well-organised market are not interested in the organisation of a market for native plant origin protein.

It was found that in order to ensure the country's security in terms of supplies of plant origin protein and secure a 50% share in the market for native protein-rich raw materials, not only the suitability of this raw material for feeding purposes needs to be accepted, but marketing activity needs to be undertaken to provide a competitive edge in relation to the imported soybean meal.

Thus directions of actions to be undertaken by the government were proposed in order to increase Poland's security for this plant origin protein. This proposal includes:

- studies on improvement of legume cultivars and cultivation technologies;
- a promotion campaign for native protein crops among agricultural producers and feed mills,
- dumping pricing of native protein crops,
- administrative obligation to use specific amounts of native protein crops to produce feeds.

Within the framework of the Polish Ministry of Agriculture project workshop and training sessions and direct marketing activities are being implemented. In turn, for financial reasons it was decided to reject the dumping pricing option. Within the framework of administrative actions aiming at increasing the supply of native protein-rich material for the feed market the following actions were proposed:

- promotion of supply thanks to subsidies to the commercial production of legumes,
- promotion of demand by introduction of the target objective for plant origin protein defining minimal use of native sources of plant origin protein by feed mills.

It was decided that under the current market situation partial independence of Poland from protein originating from imported soybean meal will be facilitated by the temporary application of selected state interventionism instruments, including e.g. the National Index Target for Plant Origin Protein. This concept is understood as the volume of production for native plant origin protein, which will ensure food security for the nation. In terms of its structure it shows consistency with the index target specified for biofuels. The National Target Index for plant origin protein will specify the amount of native plant origin protein, which should be used by feed producers in their products. For this reason the primary element connected with the functioning of this state interventionist tool in the case of plant origin protein may be connected with the gradual reduction of the use of imported soybean meal in feed production, at an increase in the share of protein coming from native protein materials. Simulations concerning the application of the Target Index algorithm are presented in Table 2.

Table 2. Simulation of use of the National Index Target

Variant 1. Decreasing soybean meal import by 20%	
Assumed total production of native vegetable protein (in tonnes)	Production of commercial feeds (in tonnes)
722 000	8 500 000
$(722\ 000/8\ 500\ 000) * 100\% = 8.4\%$ per 1 kg feed	

Source: the authors' study based on FAO data

An algorithm was developed to specify the National Index Target for plant origin protein for feed purposes in Poland. It was assumed that security in terms of plant protein supply will be reached when

the level of utilisation for protein from native sources is min. 50% total demand. The current share of protein from rapeseed meal, legumes and stillage is approx. 30%, thus in order to attain the assumed level of utilisation for native crop protein, imports of soybean meal need to be reduced by as little as 20% and be supplemented with domestically produced protein materials. Within this variant the predicted increase in the native production of protein raw material would be 440 thousand tonnes, while the assumed total production of native plant origin protein would reach the total level of 772 thousand tonnes. To reach such a production level the arable land area cropped to native legumes should be 361 thousand ha. In such a variant assuming the limitation of soybean meal imports to Poland by 20%, the Index Target would be 8.4%. This means that 1 kg of feed for pigs and poultry should contain on average 8.4% native crop protein. It is the mean value, thus depending on the nutrition recommendations for poultry lower values could be adopted, e.g. 5%, while for pigs the value would be higher, around 12% share of native crop protein in feed.

4. Conclusion

1. In view of the strong competitive market position of imported soybean meal, the market for native protein materials was marginalised.
2. Further actions to reach the assumed objective require the implementation of the Index Target for native plant origin protein in feeds. While it is a mechanism being a form of state interventionism, the practice connected with rape seeds for biofuel production indicates high probability for successful outcomes of the intended actions.
3. Reaching the assumed security level in the supply of plant origin protein in Poland will be feasible at the specification of the National Index Target for plant origin protein at minimum 8.4%.

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PERMANENT AND GLOBALLY UNIQUE IDENTIFICATION OF COPYRIGHT ENTITIES

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Annotation: There is a growing tendency to use electronic databases of scientific information, which could be used to rural development or in agriculture. These databases serve various purposes, including the peer-review process of documents submitted for publication in scientific journals. Most scientific journals now use a peer-review web system that offers editors, expert reviewers, and publishers the ability to review previous publications published by authors who submit a paper for review. Nowadays, all those working in scientific research raise the concern of how to clearly define their identity and put their name under their own publishing activities, quotations, research agriculture projects or patents. There are different solutions; however, these are often very heterogeneous tools with a number of different specifics and problems. Thus, it is not possible to establish a simple methodology for creating a unique signature or identity that could be used to clearly identify the author of a paper, scientific project or a patent. Problems often occur when a large number of authors have the same surname and same initial of their first name. In addition, authors of scientific publications with more than one first name (this occurrence is more common outside the countryside of the Czech Republic) often do not use all of their initials, which contributes to confusion over the allocation of publications to the author. It often requires a lot of effort and time to assign the publications to the correct authors. Whether they are authors who share the same surname and first initial, or for some reason do not use their second name.

Key words: Identifier, e-Science, indexing, open access, research support, research profile, scholarly identification

JEL classification: D83

1. Introduction

The current scientific research community has access to an increasing number of information sources and results of activities in all fields, in various forms, relevance and availability. Currently, we use identifiers to link authors with their results in scientific research across databases (Bartling and Friesike, 2014). These are often publisher database products, which means there is no one universal permanent identifier for the author entity (Copiello and Bonifaci, 2018). These identifiers can be used to search for collaborations in the given field; they can solve the problem of searching for articles with frequent occurrences of some names. Another issue is the common use of the initials or using names and surnames with or without diacritics. The problem also arises when the author (in the vast majority of cases is a woman) changes her surname (e.g. wedding, divorce, etc.).

Open Access (OA) is an initiative within the scientific and research community, and can be defined as: "Free, instant, free and permanent on-line access to full texts of high-quality scientific publications - primarily reviewed articles in scientific and scientific journals and conference proceedings." (Cacchione, 2017) The purpose of this publishing approach is to try to eliminate financial, legal and other access barriers to sharing and obtaining scientific information (Stuart et al., 2017). It seeks to democratize access to outputs, especially to those from publicly funded research (Mikki, 2017). It also helps to overcome certain shortcomings in the traditional system, such as lengthy process of publishing, certain lack of transparency and elitism in the selection of articles for publication, utilization of the potential of internet technologies, or the impossibility to reuse the result by the author or other user, etc., and thus contributes to rural development. (Beck and Neylon, 2012).

The Initiative for Open Citation is a project that was publicly opened in April 2017 and describes itself as a collaboration between scientific publishers, researchers and other stakeholders to support unrestricted availability of scientific citation data (Kemsley and Widener, 2017).

For high-quality scientific research, English is the main language used by international scientific communities to disseminate knowledge. The alphabet letters are thus arranged into names and surnames that could be called non-standard (heterogeneous) patterns. In the early years of modern day research, names and surnames could be relatively unique thanks to the low amount of people in the field. However, this situation is not up to date. Therefore, today, it is harder to distinguish between two researchers (scientists) who share the same or similar names and surnames.

Just like modern digital object identifiers (DOIs) for unique electronic documents, there is a need to find a system that uniquely identifies authors.

In the 20th century, the authors did not spend much time looking for bibliographic predecessors for published documents, which has a great impact today. The Science Citation Index (Elsevier) attempted to address this. In countries with developed scientific communities, there is a need for an index that would quantify the productivity of individual researchers to calculate the h-index. However, this method is rendered impossible for common names and surnames (for example, in Asian countries where the full names consist of several very common first names and surnames). Then it was supposed to be extended to databases that are used in rural development, agriculture and countryside of scientific research (Zhang et al., 2015).

Most scientists are forced to work with multiple applications. In each application, the user is prompted to create a profile and upload metadata for each scientific publication. Each application creates its own identifier for the user and his Metadata Formats for Data Sharing in Science Support Systems publications. It is difficult for the enriched data created in this system to be exported or transferred from one application to another. (Stočes et al., 2017) It is clear, that the solution to this problem requires innovation and leadership. There are already many unique author identifier systems: ORCID, Google Scholar, Mendeley, Scopus, ResearcherID, ResearchGate, etc. Some have open access, others are owned by databases. Some of them are based primarily on self-control, but all contain an automated component. Several of them are even inter-connected. However, each author / researcher cannot feasibly create and maintain dozens of "unique" identifiers. It is time for "DOI for authors". In addition to reviewed publications, a universal, unique author identification system should allow researchers to better monitor and document their true scientific productivity: manuscripts, books, patents, grants, and so on (Falagas, 2006).

2. Materials and Methods

The “Digital Trends and the Global Library Community” column examines technological advances internal and external to libraries. The focus is on how technology is changing the way services are provided to users, the methodologies used in the provision of those services, and the resulting scope of responsibilities of libraries and parent institutions. Interested authors are invited to submit proposals and articles to the column editor at marta.deyrup@shu.edu. Please include “ILR Submission” in the subject line of the e-mail.

Comparing five international scholarly identification systems (Google Scholar Citations, ORCID, ResearcherID, ISNI, and VIAF) in the new Web-based global scholarly communications market, it was found that the non-profit organization ORCID has emerged as the leading global scholarly ID registry. (Cave, 2006)

ResearchID

ResearcherID is an identifier that works within the Web of Science. Its creation requires registration in ResearcherID. In return, it allows you to create a public profile where your affiliations and bibliographic information about WoS index works are available to everyone without having to buy WoS. Data from the ResearcherID profile can also be converted to ORCID.

ORCID

ORCID (unlike ResearcherID or Scopus Author ID) is managed by a nonprofit organization and is supported by an international community of research institutions, publishers, sponsors, professional organizations and other important stakeholders in the science and research environment.

Main reasons to establish an ORCID profile are:

- Academic profile
 - better visibility of your research
 - information about your research in one place
- Fixing the diacritics problem in Czech names
- Differentiation of scientists with the same name
- Linking profiles after changing your surname

The ORCID (Open Researcher and Contributor ID) registry helps disambiguate authors and streamline research workflows by assigning unique 16-digit author identifiers that enable automatic linkages between researchers and their scholarly activities. This article describes how ORCID works, the benefits of using ORCID, and how librarians can promote ORCID at their institutions by raising awareness of ORCID, helping researchers create and populate ORCID profiles, and integrating ORCID identifiers into institutional repositories and other research information systems.

DOI

A not-for-profit membership organization that is the governance and management body for the federation of Registration Agencies providing Digital Object Identifier (DOI) services and registration, and is the registration authority for the ISO standard (ISO 26324) for the DOI system. The DOI system provides a technical and social infrastructure for the registration and use of persistent interoperable identifiers, called DOIs, for use on digital networks.

Scopus Author ID

Scopus Author ID is an identifier that works within the Scopus citation database. It is the internal identifier assigned to each author in the system. If you have several Scopus IDs in Scopus (name change, different diacritics), you can unify them when linking to ORCID using a simple tool.

3. Results and Discussion

At the time of digitization, the availability of different platforms for expert article archiving and the creation of individual profiles makes it easier to identify and evaluate academic records. Examples of such platforms are Scopus (Elsevier), ResearcherID (Clarivate), ORCID, Google Scholar Quote and ResearchGate (Polychronakos, 2016).

Different mistakes with authors' names can be seen in published articles. Even high impact journals are not immune to these errors. A recent analysis of copyright policies of 600 journals with impact

factors has shown that only 62.5% of journals, particularly in biomedical and social sciences, have declared a policy of providing guidance on copyright criteria and related ethical standards. None of the sampled journals included points on listing standards and abbreviated names. The statement on authors' names and support for non-anglophone authors with authors' names and traditions other than Western standards should help avoid some of the related technical problems.(Polychronakos, 2016)

Renowned publishers have introduced post-publication correction guidelines. In a peer-reviewed analysis of published articles with Greek names and renamed surnames, (Trikalinos, 2009) found 113 articles published from 1997 to 2008 in 101 journals from different categories of biomedical subjects. Among those, there were five articles with mistakes in the names of authors published in the same journal. Author names were corrected in errata for only 20 (17.7%) articles after a median of 6.5 months. It seemed that the time to appoint a correction was shorter in journals with a large impact factor (Gasparyan et al., 2014).

Many publishers have now joined the worldwide CrossMark® initiative, which enables to fix mistakes by publishers or authors by providing option for errata. These changes are then retroactively applied in the online versions of the articles (available at: <http://www.crossref.org/crossmark/>).

Importantly, an open researcher and Contributor ID (ORCID) initiative, which was launched in October 2012, overcame the ambiguity of the author's name and linked the unique digital ID with the names in the articles. (Taha, 2015) Since February 22, 2018, 4,353,836 people have registered with ORCID profiles (Live ORCID identifiers). Setting up such a unique digital profile allows individuals to better share their scientific results within the scientific community. ORCID identification can be especially useful for authors with common or inconsistently written names and for authors with related national traditions (eg Chinese, Korean, Japanese, Iranian, Russian). Identifying authors, reviewers, and editors by reference to their ID is increasingly applied in scientific journals. More than 100 publishers have already supported the ORCID initiative and more than 1,000 magazines integrate their website and editorial management systems into the registry (Anstey, 2014). In an effort to improve the visibility of publications, the Korean Association of Journal Magazine Publishers with 255 Magazines established a practice of including author ID in the footnotes. This a good example of ORCID author ID support (Gasparyan et al., 2016).

There are now several options to properly identify scientific authors (Figure 1). All these options may be employed to resolve the issue in complex scenarios. The journal editors' familiarity with all these options can be instrumental for incorporating related points in their instructions for authors, correctly identifying author names during the proof reading, and connecting published articles with author identifiers. The renewed and enforced instructions may potentially resolve the issue of author name ambiguities and avoid related errors. Technical editors are in the best position to ask the authors to correctly identify their first and last names and preferred abbreviations during the manuscript proof reading (Akers et al., 2016).

Figure 1. Options for identifying and comprehensively evaluating scientific authors.

Options for identifying and comprehensively evaluating scientific authors
Accurately spelled / abbreviated first, middle name(s) and surname
Linked affiliations
Postal and electronic mail contacts
Signature
Photographs in articles and on institutional and individual platforms
Biographical notes on academic, institutional, and social portals, including Wikipedia pages
Video abstracts of articles
Open Researcher and Contributor ID (ORCID)
Academic records on bibliographic databases/platforms (PubMed, Scopus, Web of Science, Google Scholar)
Profile on scholarly networking sites (ResearchGate®, LinkedIn®)
Profile on social networking sites (Facebook®, Twitter®)
Academic writing style

Source: (Gasparyan et al., 2016) (“AP source” Font)

The uniqueness of author identity is still a problem, mostly in systems that publish digital artifacts (Gasparyan et al., 2017). ORCID - identification of authors and DOI - identification of digital objects are the two identifiers that are being increasingly used. ORCID tries to link the two proprietary IDs of ResearchID and Scopus Author ID (Classe et al., 2017).

Based on the available high-profile articles and publications, it can be confirmed that there is no unified approach or methodology in the area of permanent and globally applicable authoritative entities for storing scientific research results for their subsequent presentation, publishing and sharing. The space for innovation (identifying opportunities) in this area lies in particular in:

- analysis of tools for identifying authors' entities and the results of their scientific research activities
- analyzing systems and tools for publishing (presenting) and sharing the results of scientific research activities
- developing a methodology for the permanent identification of authors' entities, data or results of scientific research activities

4. Conclusion

To some extent, the editorial policy on identifying the correct authors' names addresses issues of inappropriate authority. At the same time, they provide trusted scientific records to readers, indexers and information professionals in agriculture, rural development, countryside, etc.

The analogy of DOI, which can assign numbers to authors under CrossRef headers, is still an appropriate solution. These numbers would be in a database for each article, and their aggregate publication activity would be easily traceable in the above-professional database. This database is paid, but in this scenario, it benefits the case to contribute rural development, countryside or agriculture.

Citation registers (databases) find themselves in a complicated situation. Due to the very long development, they are definitely struggling with greater rigidity of their databases and tools. At the current level of technology, it is not a problem for smaller databases to also track quotes and add simple tools to evaluate them. For the real science appraisal process for the main actors in science and research, the clear identification of the author is a tool that will make it easier to review the publicity work of individual scientists and track their scientific development in the future.

The way to solving this problem is not trivial, and there are many ways to get to it.

The path to achieving a solution to this issue is not trivial and there are many ways on how to approach it.

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FACTORS AFFECTING CONSUMER'S FINAL DECISION WHEN BUYING FOODS IN THE CZECH REPUBLIC

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Annotation: In the foods market in developed countries there is a wide range of products of different quality levels from various producers. Thus a potential customer has to decide what products to buy, in relation to their income limits. There can be various factors, affecting this decision-making process. The objective of this paper is to evaluate the impact of factors, affecting consumer's final decision when buying foods in the Czech Republic.

The theoretical framework of submitted paper was carried out by means of scientific and professional papers and supported by contemporary information coming from relevant Internet resources. The method of studying documents was used. The primary data was obtained by means of quantitative research, using a questionnaire survey. In the whole amount of respondents (n=1220) there were 47 % of men and 53 % of women. They were 18-year-old and older inhabitants from general population living in the Czech Republic. The questionnaire survey was conducted in autumn 2016.

The results show that when buying foods, the respondents make the final decision according to the following significant factors: price (59 %) and pleasure (35 %). The responses „the awareness of food ingredients“ and „the importance to health“ were chosen by one third of respondents approximately, and the response „the food origins“ was chosen by one fourth of respondents approximately. The objective of this paper is to evaluate the impact of factors, affecting consumer's final decision when buying foods in the Czech Republic. Based on the questionnaire survey, it can be stated that Czech customers are interested in quality of foods when buying them, nevertheless, the price is the main factor in their decision-making process.

Key words: customer, price, pleasure, food market, foods, Czech Republic

JEL classification: P25, R11, R23, R58

1. Introduction

Dining can be influenced by many factors where cultural backgrounds can play a role. Catering and final consumer choice when purchasing food can be influenced by many different factors. Role plays biology and balanced energy intake, physiology, psychological decisions. Sociology, culture, tradition, also has a significant share in the decision-making component. Consumers are to some extent influenced by advertising and the economy (food availability, budget, food prices) (Koster, 2009). Consumers are very often involved in the development of new products and services, and it is very important to monitor their desires, needs and motives so that the consumer market can get a good position (Gagic et al., 2014).

Understanding how consumers choose to buy and buy is important for a number of other reasons. They are interested in food businesses, whether they produce well-established foods or develop new ones, but also experts who are better able to formulate nutritional recommendations and, possibly, national nutrition policies. An inventor of these factors also needs an advertiser (Honkanen and Frewer, 2009).

Previous studies have shown that the consumer decides on the sensory properties of food, but also on social interactions, environmental, cultural and contextual influences. It has also been identified which motives consumers consider to be the most important (Honkanen and Frewer, 2009). These include health and health restrictions, positive or negative moods, comfort, ease of preparation and availability, sensory properties, natural composition of products, price, weight control, life

balance and associated calorie and fat content control, but also knowledge and personal convictions (Sun, 2008; Ares and Gambaro, 2007). The role in choosing a food can be whether the food falls into the fair trade category. In terms of its volume, it plays a negligible role in global international trade but its social and environmental dimension is significant (Navrátilová and Beranová, 2017). The role played, not only in the Czech Republic, is the origin and processing of the product. For many consumers, organic agriculture and ecology itself is very important (Brožová and Beranová, 2017). The results of the survey (e.g. Navrátilová et al., 2017) show that it is important for the consumer who chooses a particular food to know where the food comes from. The results show that the consumer likes to promote food from a region with a regional brand.

2. Materials and Methods

The theoretical framework of submitted paper was carried out by means of scientific and professional papers and supported by contemporary information coming from relevant Internet resources. The method of studying documents was used. The primary data was obtained by means of quantitative research, using a questionnaire survey. In the whole amount of respondents (n=1220) there were 47 % of men and 53 % of women. They were 18-year-old and older inhabitants from general population living in the Czech Republic. The questionnaire survey was conducted in autumn 2016. With regard to the focus of the article, the survey does not have a quota character and therefore does not respect the distribution of the population by selected variables in the Czech Republic. The purpose of the text is to assess possible differences in patterns of purchasers' behavior with respect to the variables specified. The text in this context works especially with different ages, the highest education attained, the place of residence and the number of children in the household. The distribution of respondents' answers and their categorization is shown in Table 1 below.

Table 1. The importance of pricing when deciding to purchase food by age

Age	%	Educational attainment	%
Up to 23	23.52	elementary School	4.02
24-33	20.49	Trained	11.72
34-43	15.33	h. sch. without maturity	5.57
44-53	18.93	high sch. with graduation	48.61
54-63	10.49	higher vocational school	4.59
64 and more	11.23	college - bachelor degree	8.36
		college - master's degree	17.13
N	1220	N	1220
Region	%	Nmber of children in the household	%
Prague	50.49	0	65.08
Centr. Bohemian Region	15.57	1	17.95
other regions	33.93	2	14.10
		3	1.97
		4 and more	0.90
N	1220	N	1220

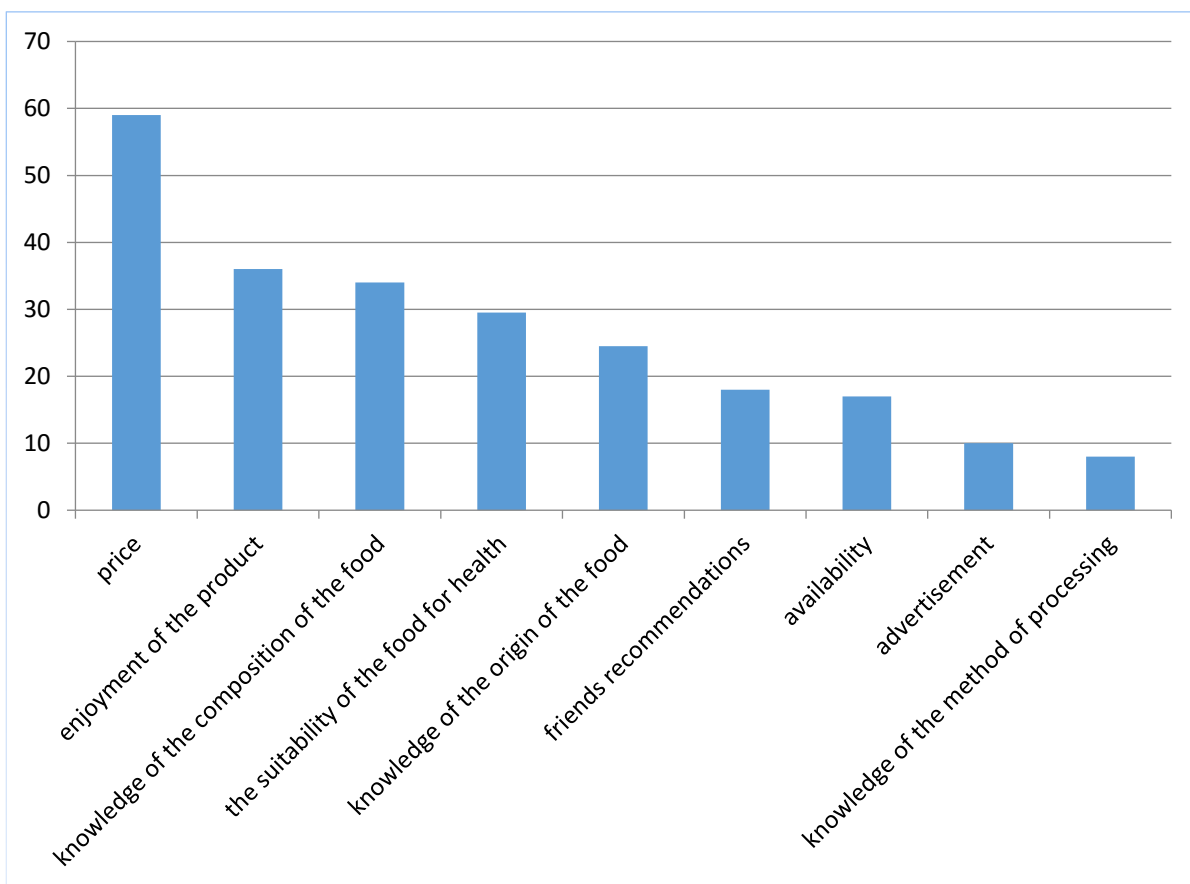
Source: Survey, 2016

To evaluate the outcomes of the survey, methods of descriptive statistics (absolute and relative frequency, testing of independency between set qualitative characteristics and power dependency measures), The Pearson's Chi-square test were applied. If the calculated χ^2 value was greater than the selected critical value on selected level of significance $\alpha = 0.95$, null hypothesis about independency was rejected. Association of variables was measured by Cramér's V.

3. Results and Discussion

The Czech food market has traditionally been characterized by a considerable degree of consumer inclination to buy goods by price. When choosing between multiple alternatives to the same foodstuff, the price for most buyers is decisive. Sales chains that sell more than two-thirds of the total food in the Czech Republic work with this formula of consumer behavior. Cost as a push to buy is one of the most important tools of marketing. The price has thus become a food crop cultivation variable. Consumers track sales promotions and respond positively to them. Based on the questionnaire survey, it appears that the price is the most important factor shaping consumer behavior. Of the total number of respondents, almost 59% said that the price of the goods is influenced by their purchasing decisions. Other purchased purchase variables are far from meaningful. The benefit of the product to the customer is important for approximately 35% of respondents. The significance of other potential reasons for buying is even lower. The overview of reasons for choosing to purchase food is shown in Figure 1.

Figure 1. Reasons for purchasing food (%)



Source: Survey, 2016

The distribution of responses does not differ significantly from the analytical view of the different segments of the respondents. It turns out that the price remains a key decision-making variable in dividing the respondents into groups by gender. Both men and women evaluate the importance of price in making decisions very similarly. Of the total number of men who participated in the questionnaire survey, 57.8% said the price was the decision maker. For women, this is 59.7%. On the basis of a statistical analysis of dependence, it cannot be shown that the tendency to purchase food is related to the sex of the purchaser - the hypothesis "Price as the main factor in the purchase of food does not depend on the gender of the respondent" cannot be rejected. (at a significance level of 5% using the Chi Square test the value is 0.293 $P = 0.589$). The variable that plays a role in the tenderer's bid for the price of the grocery offered is age. The questionnaire survey shows that

the price of the goods offered is different for the different age categories of the respondents. Hypothesis "Price as the main factor in buying food does not depend on the respondent's age" can be rejected ($\chi^2 = 27,381$). The price is most affected by senior citizens and young people. At least, people in a higher working age are affected by purchasing decisions. The distribution of answers to the question about the importance of the price according to the age of the respondents is shown in Table 2.

Table 2. The importance of pricing when deciding to purchase food by age

Age category	Positive answers in %
up to 23	67.6
24-33	58.2
34-43	51.3
44-53	50.2
54-63	55.5
64 and more	68.6

Source: Survey, 2016

It is clear that the price as a purchasing decision variable reflects consumers' budgeting potential. The average income generated by people above the age of 64, mainly due to old-age pensions, was approximately 42% of the average income of the working person (Czech Social Security Administration) in 2016. Young people (under the age of 23) are to a large extent dependent on their parents' income. Young people at the top of the selected age range are not negligent in college education. Their ability to source their own resources through work is so limited. Approximately half of the population age of university students is also actually studying. On the other hand, middle-aged people (ages 44-53 and 54-63 years) have the best budgetary options. This is due to the fact that they reach the top in their own professional careers, which also make it possible to achieve the highest earnings. An important fact in this context is also that these people are not usually kidding small children, which are a necessary "cost item" in the structure of household spending. Based on the data from the questionnaire survey, it appears that respondents in these age categories are least susceptible to the price.

The relationship between the purchaser's budget options when perceiving the price of goods in purchasing decisions is also indirectly indicative of the region where the buyer comes from. The Czech Republic is characterized by internal heterogeneity in terms of the economic performance of individual regions. According to the performance, measured by, for example, a regional gross domestic product, it is clear that the most prosperous region is Prague whose GDP per capita (937 thousand CZK in 2016) is more than three times higher than the least performing regions (the GDP per capita of the Ústí Region was 2016 in CZK 333 thousand and Karlovy Vary CZK 300 thousand). Of course, the performance of the regions is also reflected in the budgetary capabilities of households. In general, people in the economically more advanced areas of the Czech Republic are earning higher income. Comparing the two regions of the Czech Republic, one of which is made up of the two most prosperous regions of the Czech Republic (Prague and the Central Bohemian Region) and the other is constituted by the remaining regions, the price is assumed to be more important for purchasing decisions for respondents coming from the second group of selected regions. In this case, 63.3% of the respondents (63.7% of respondents from Prague or the Central Bohemian Region) stated the award criterion.

As in the case of the previous variables "respondent's region of origin" and "respondent age", it can be assumed that buying preference preferences will influence respondents within variables that can be categorized into groups with different economic attributes. These include "the highest education

achieved" and "the number of children in the household". In general, it is to be expected that the higher education attained by the respondent is also linked to a higher income (The predominant consistency of the social status of the population of the Czech Republic has been repeatedly proven in the past (e.g. Matějů and Kreidel, 2009; Katrňák and Fučík, 2010, Matějů and Vlachová, 2000)). Better budget options may also lead to richer consumer behavior, which may lead to a reduction in the price of purchasing decisions. This also shows the test. The Hypothesis "Price as the main factor in the purchase of food does not depend on the highest education achieved by the respondent" can be rejected ($\chi^2 = 16.459$). In the case of the number of children and the number of adults forming a household, it is not easy to estimate the outcome of the hypothesis test. In general, households with more children may be expected to have smaller budget options per household member. However, it can also be the case that households that purchase more children do so because their budget opportunities make it so rich. The percentage of positive responses to the price of consumer decision making is shown in Table 3 below by category.

Table 3. The importance of the price when deciding to purchase food by the number of children in the household

Age category	Positive answers in %
do 23	67.6
24-33	58.2
34-43	51.3
44-53	50.2
54-63	55.5
64 and more	68.6

Source: Survey, 2016

The analysis of available data shows that the very fact that people are making children may not create a higher propensity to consume cheaper goods as a result of restricting household budgets. As Table 2 shows, childless households are watching prices more than households with two children. This, of course, can be attributed to the fact that it is predominantly households of seniors whose children have already grown and do not live with their parents in a common household. At the same time, families with at least four children, which are relatively uncommon in Czech conditions, are not usually families with limited financial possibilities because the price is not as important as in other family categories. The dependency test shows that the hypothesis "Price as the main factor in the purchase of food does not depend on the number of children in the household" cannot be rejected ($\chi^2 = 4.748$).

4. Conclusion

The price is definitely one of the most important variables of consumer behavior in the conditions of the Czech Republic, which is also evidenced by the conclusions of the investigation. Inclusions to deciding on the purchase of goods are linked to the consumer's budget choices. The price tends to be more prone to assess people who generally have less money to buy. These include, for example, young people who are more dependent on financial contributions from parents or senior citizens who live from a retirement pension given by the social system of the Czech Republic. The buyers living in economically less developed regions are also perceived as important. On the other hand, it cannot be unequivocally demonstrated that the price of purchasing a prize is higher in the case of families with more children. The question remains, however, what is the factual distribution of the family's economic incomes according to the number of children in their households.

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THE OCCURRENCE OF NON-ORTHODOX APPROACHES IN SCIENTIFIC RESEARCH ON TAXATION IN AGRICULTURE WITH PARTICULAR EMPHASIS ON INCOME AND ENVIRONMENTAL TAXES

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Annotation: The aim of the article was to determine, based on the analysis of papers published in the world scientific literature, whether non-orthodox approaches (here understood as all identifiable manifestations of the utilization of assumptions and/or methods from beyond the broad economic mainstream) are present in research on taxation in agriculture, with particular emphasis on studies regarding the imposition of income and environmental taxes on farms. The research methods used in the article included systematic review and meta-analysis, with elements of text mining and literature review (desk research). It was found that in the literature concerning taxation in agriculture, non-orthodox approaches are represented to a very small extent, and if at all – by the use of unorthodox research methods (experiment in particular).

Key words: non-orthodox approaches, systematic review, meta-analysis, text mining, taxation in agriculture, income tax, environmental tax

JEL classification: B50, H23, H24, Q14

1. Introduction

Systematic review and meta-analysis, especially combined with analysis based on text mining, have been rarely used in agricultural economics literature so far. One of very few examples is the article by Marr et al. (2016). There are even fewer studies which not only utilize methods of systematic review and meta-analysis, but use them to a specific purpose of identifying currents/approaches/schools (both theoretical and methodological) present in the literature dedicated to agricultural finance. Noteworthy here are the articles by Soliwoda (2017) as well as Konat and Soliwoda (2018).

The fact that studies using systematic review and meta-analysis in research on agricultural economics—and on currents and trends that occur in it in particular—are so rare, justifies the need for an in-depth analysis in this regard. The objective of this article is therefore to establish, based on analysis of scientific research published in the literature, whether studies in the field of agricultural economics concerning taxation, with particular emphasis on income and environmental (ecological) taxes imposed on farms, utilize non-orthodox approaches.

The structure of the article is as follows: following this introduction, the second part presents a definition of non-orthodox approaches in economics and discusses the research procedure used. The results obtained, including the identification of non-orthodox approaches in contemporary economic sciences based on the literature review, are presented in the third part of the article. The study is concluded by final remarks.

2. Materials and Methods

Since the aim of this article is to identify non-orthodox approaches in scientific studies on taxation in agriculture, in the first instance the very use of the term “non-orthodox approaches” requires explanation. There are numerous definitions of orthodoxy and heterodoxy in economics. For example,

Landreth and Colander (2012) focus on theoretical differences between both conceptual constructs, while Dow (2007): on methodological ones. Other authors focus on terminology: e.g. Karpińska-Mizielińska et al. (2016) discuss the issues related to the very use of the “school of thought” concept. A broader discussion of these problems goes beyond the scope and volume of this paper. Here we will limit ourselves to explaining that in using the term “non-orthodox approaches” our goal is to take into consideration the widest possible scope assigned in the literature to the referents of the categories “school”/“current”/“trend”⁵ (hence here: approach) and “heterodoxy” (here: non-orthodoxy).

By non-orthodox approaches we therefore understand all identifiable manifestations of the utilization of assumptions and/or methods from outside the widely understood, well-established economic “mainstream”. This category includes both heterodox schools of economic thought (we disregard here, out of necessity, numerous and extremely heterogeneous in their conclusions discussions on which schools precisely can be considered as such), as well as alternative methodological and even methodical approaches. Our understanding of the term non-orthodox approaches is therefore based on the expression of the problem which is opposite to that used so far: instead of defining heterodoxy as something complementary to orthodoxy, we understand the latter as everything which is not heterodoxy (in this case, the non-orthodox approach).

To identify thus defined non-orthodox approaches in scientific studies on taxation in agriculture, we used a four-stage procedure, utilizing methods of systematic review/meta-analysis and text mining, as well as in-depth literature studies (desk research).

Firstly, we searched for papers on taxation in agriculture using the scientific abstract and citation databases: Scopus (S) and Web of Science (WoS). The relevant search criteria were: a string of keywords corresponding to the subject studied, time interval as well as belonging to appropriate scientific discipline. Consequently, the lists of titles and abstracts (WoS), or titles, abstracts and keywords (S) of such identified articles were created. Then, the lists from both databases were combined into one, while eliminating duplicate records. In the resulting database, using the method of abstract analysis, we eliminated those records, which, although they met the initial (“mechanical”) search criteria, did not actually pertain to taxation in agriculture, with particular consideration given to income and environmental taxes. The next stage of the study was to develop, based on an in-depth literature research, a summary of non-orthodox approaches in economics. On this basis, the list of keywords was created in order to identify such approaches present in the articles selected at previous stages. Consequently, those keywords were sought out in the list of selected papers on taxation in agriculture. The last stage was to identify papers that can actually be classified as presenting non-orthodox approaches, based on author’s substantive analysis of the content of titles and abstracts (and, when possible, keywords).

Naturally, the applied research procedure has its limitations. The most significant are:

- in this study, we consider only articles available in two databases: Scopus and Web of Science; consequently, there may exist (and most likely exists) literature regarding the problem under investigation, which we do not include in our analysis,
- the lists of articles on taxation in agriculture—developed at the initial stage of the study—are drafted “mechanically”, and therefore they may not take into account a certain group of papers published in the analyzed period which did not meet the adopted search criteria,
- the search for keywords associated with non-orthodox approaches in selected papers is limited only to titles and abstracts (and—when possible—papers’ own keywords) available

⁵ For a discussion of differences between these terms see: Karpińska-Mizielińska et al. (2016).

in the databases; we therefore do not identify a strictly understood “belonging” of those works (all the more the “belonging” of their authors) to non-orthodox approaches, but only the existence of references to those approaches, attesting to the significant presence of such in given papers,

- the adoption of the list of keywords, which are to enable the identification of non-orthodox approaches in the previously developed summary of works on taxation in agriculture, may itself lead to failure in including some papers representing non-orthodox approaches: supposing their titles and/or abstracts did not contain the keywords adopted in the study,
- the list of keywords that are to enable the identification of non-orthodox approaches is subjective, i.e. it reflects the author’s views on what is and what is not a non-orthodox approach in economics,
- considering any given paper as characterized by an non-orthodox approach can also be deemed subjective.

Some of the above-mentioned critical points constitute an inherent part of the adopted research method. In some cases, however, certain remedies can and should be used. For example, the subjectivism/arbitrariness of the list of keywords and its use has been overcome in two ways. Firstly, the very extensive list was used, and in particular—secondly—it also included keywords such as “heterodoxy”, “orthodoxy”, “mainstream”, “school of thought”, etc., aimed at identifying non-orthodox approaches in a very general way. Moreover, in order to increase the search “range”, some keywords were used in more than one variant, related to the various possible word order (e.g. “choice” and/or “public choice”). A more detailed discussion of the critical points likely to occur in this type of study and the potential ways to overcome them can be found in Konat and Soliwoda (2018).

3. Results and Discussion

Based on an in-depth literature research⁶, 43 non-orthodox approaches present in modern economics were identified. These are: Chicago economics, institutionalism, neo-institutionalism, new institutional economics, post-Keynesianism, orthodox Keynesianism, Kaleckism, Marxism, neo-Marxism, post-Marxism, radical economics, Austrian economics, neo-Austrian economics, evolutionary economics, behavioral economics, experimental economics, public choice theory, regulationist economics, monetarism, supply-side economics, managerial economics, feminist economics, raffianism, new political economy, black (race) economics, libertarian economics, neo-Ricardianism, Schumpeterian economics, ordoliberalism, historical economics, economics of conventions, Swedish school, cliometrics, new economic history, post-autistic economics, real-world economics, cognitive economics, psychoeconomics, neuroeconomics, econophysics, neo-Walrasian approach, post-Smithian approach and interdisciplinary approach. On this basis, a list of 45 keywords (in English, some in multiple variants) to be searched in the selected articles has been created.

⁶ The list of schools/currents/trends that can be considered as non-orthodox approaches has been developed based on both theoretical works (e.g. Beaud (1997), Snowdon et al. (1998), Perlman (2007), including textbooks: inter alia, Screpanti and Zamagni (2005), Stankiewicz (2007), Lavoie (2009), Landreth and Colander (2012), or Chang (2015)), as well as empirical studies (e.g. Frey et al. (2010), Di Maio (2013), De Benedictis, Di Maio (2014) or Karpińska-Mizelińska et al. (2016)). It should be noted that in the above-mentioned literature there are references to at least three heterodox currents (demand-side economics, endogenous growth theory and new welfare economics), which have not been included in the article, since, on the one hand, their non-orthodoxy raises serious doubts and, on the other, there were methodological objections (it would be very difficult or even impossible to identify those schools in the literature by means of the method used herein).

The lists of articles based on the data from Scopus and Web of Science databases were developed on 26th April 2018, by searching for references to agriculture and taxation. The criterion took the form of:

("agri" OR "farm*" OR "land" OR "soil") AND ("income tax*" OR "environment* tax*" OR "ecologic* tax*" OR "carbon tax*" OR "nitrogen tax*" OR "labo* tax*" OR "capital tax*" OR "PIT" OR "CIT"))*

and the following criteria were adopted:

- Scopus: search in the content of titles, abstracts and keywords (TITLE-ABS-KEY) of the articles published since 2000, and classified as falling within the category “Economics, Econometrics and Finance” or “Business, Management and Accounting”,
- Web of Science: searching the “Topic” (TS) of the articles published since 2000, classified as falling within the category “Economics”, “Agricultural Economics Policy”, “Planning Development”, “Management”, “Business” and “Business Finance”, in all indexes available in this database.

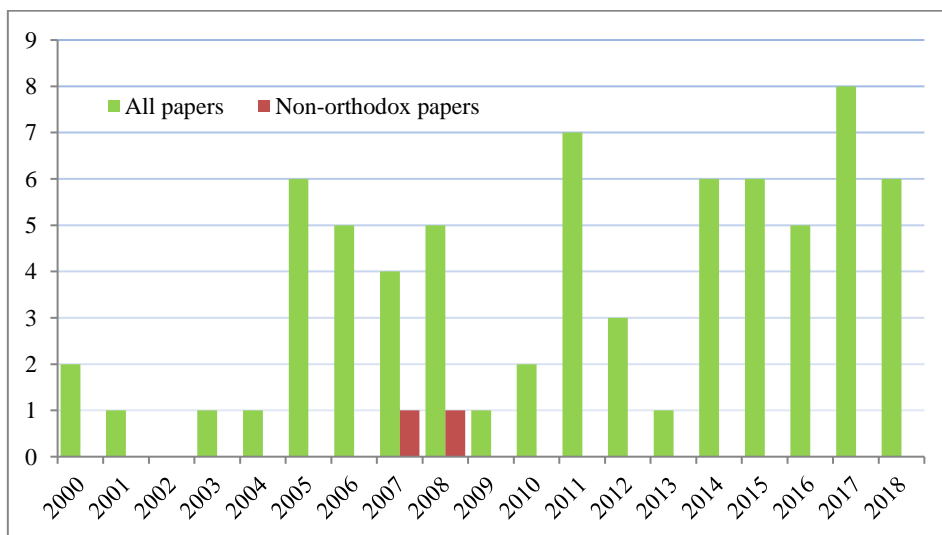
The search returned 156 records in Scopus database and 179 records in the Web of Science, of which 54 constituted a common set. The number of considered articles from both databases combined was 281. Out of this number, following the analysis of abstracts, 211 records was eliminated as not pertaining to the issue of taxation in agriculture (income and environmental taxes in particular). The set of remaining 70 articles has therefore been included in our text-mining analysis: 45 keywords were searched for and analyzed. Only one of them—“experiment*”—returned significant results: present in two articles (see Moran et al. (2007), Chalak et al. (2008)).

The final result of the study may be expressed as an indicator (W) of the share of articles presenting non-orthodox approaches in the total number of articles identified as relating to taxation in agriculture. Its value amounted to:

$$W = 2/70 = 2.86\% \quad (1)$$

Unfortunately, the occurrence of only two articles presenting the non-orthodox approach in the database prevents any relevant inference for the temporal distribution of their publishing (see Figure 1).

Figure 1. Temporal distribution of analyzed publications.



Source: own study

4. Conclusion

The value of the indicator should not be deemed definitive, but rather considered as an indicative guideline (a determinant of a general tendency) as to the order of magnitude of the share of articles presenting non-orthodox approaches in the total number of articles relating to income and environmental taxes in agriculture. Assuming this point of view, it should be concluded that non-orthodox approaches are poorly represented in the studies on taxation in agriculture.

There are several possible explanations for such a result. Firstly, it is possible that journals in the field of agricultural economics are not interested in publishing articles openly presenting non-orthodox approaches in general, and “hard” (theoretical) heterodoxy in particular. Another explanation is that, on the contrary, it is representatives of non-orthodox approaches in economics who do not conduct research on agriculture. On the other hand, it is also possible that in a fairly limited sample, narrowed both temporally and thematically, a relatively small number of articles containing non-orthodox threads is somehow “random”, i.e. that the indicators for the adopted period and subject-matter deviate significantly (in minus) from hypothetical analogous indicators for longer periods, and in particular from (also hypothetical) indicators for agricultural economics in general. However, this notion would require further research going beyond the scope of this study.

Finally, as far as theoretical scope of non-orthodox approaches identified in the study is concerned, it may indicate a certain shift in the structure of economics towards such schools as experimental economics.

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ANALYSIS OF THE AGRICULTURAL INSURANCE MARKET WITH REGARD TO STATE SUPPORT IN RUSSIA

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Annotation: The aim of the article is to evaluate the current development of the agricultural insurance market in Russia According to Food Security Doctrine of the Russian Federation. Data sources for the investigation are the web site Statistics of Russia and the web site of The Ministry of Agriculture of the Russian Federation. Data has been subjected to a cleaning process and its relevance proved. The statistical software used for the investigation is Statistica. The linear regression model of the agricultural insurance market is based on a time series of 4 selected variables (insurance premiums, value of gross agricultural production, damage due to the hydrometeorological phenomena, and quantity of agricultural organizations that have insurance contracts) and covers annual data in the period 2007-2016. The research results indicate that the model of agricultural insurance in Russia does not absolutely contribute to the leveling the consequences of risk events in the agricultural sector. At present, the Russian agricultural insurance market is in imperfect condition. It is not regulated by market laws of supply and demand, but rather is strictly administrated by the government. The number of agricultural companies having an insurance contract decreased five-fold in the past 6 years because of decreasing government insurance support, oligopoly in the insurance market, and unprofitable terms of insurance for farmers. All of the above factors do not allow full implementation of the decree of the President of Russia on ensuring food security.

Key words: agricultural insurance market, risks, agriculture, insurance premium, insurance tariff, statistical analysis

JEL classification: G22

1. Introduction

Food security is a foundation of trouble-free life of a country. According to Food Security Doctrine of the Russian Federation, which is intended for development of import phase-out areas and proved by Decree of the President of the Russian Federation No. 120 dated 30th of January, 2010 (Consultant plus, 2018), production of agricultural products in the Russian Federation should be 80% and more (grain – 95%, sugar – 80%, vegetable oil – 80%, meat and meat products – 85%, milk and dairy products – 90%, fish products – 80%, potatoes – 95%). The Russian Federation is situated in 4 climate zones (from arctic to tropical). Moreover Overall area of agricultural lands in Russia is 386,1 million ha but its significant part is uncared and unusable for cultivation or belongs to risky agricultural areas. Therefore, state support for agriculture is essential. In this research, we will investigate type of state support as Agricultural Insurance.

Seasonal income instability and long terms of capital turnover in agriculture determine a paradoxically specific feature of this industry – the high risks of doing business with a relatively low level of average profitability in the industry (Zaruk and Tagirova, 2015).

The key drivers of farm profit or loss are production risks pertaining to price and the yield volatility of agricultural commodities. Because of the existence of heterogeneous agricultural policies around the world, recently changed due to the global economic crisis, it is highly topical to focus on the risk-related effects of the past and current public support of agriculture (Spicka, 2010). Agricultural export

from Russia is one of the main factors influencing the current state of agriculture in the country. The most attractive commodities for export are cereals, fish and vegetable oils (Benesova et al., 2017). Moreover, an agrarian import ban brings additional destabilization over the short term to Russian agriculture (Smutka et al. 2016).

Meuwissen (2001), in his work on sharing risks in agriculture, mentioned that farmers prefer a strategy of “insurance in risks are shared with others” and this insurance strategy of risk-sharing tools is in principle advantageous to both individual farmers and the whole society.

One of the main mechanisms for managing risks in agriculture is a system of agricultural insurance with government support. The role of agricultural insurance in ensuring Russia's food security is huge. It acts as a financial stabilizer for the level of farmers' incomes, allowing compensation for losses arising from the onset of adverse natural and man-caused events. Being an effective tool for reducing production risks, it provides an opportunity to increase food supplies and stabilize food prices, ensuring the long-term financial stability of farmers.

Legislative control and the legal regulation of relations in the field of agricultural insurance is carried out in accordance with Federal Law No. 260-FZ of 25 July, 2011, "On Government Support in the Field of Agricultural Insurance" (Consultant plus, 2018). According to the Law, support for agricultural insurance by the Government takes the form of transfers to insurers from the federal budget of 50% of premiums written under contracts with agricultural producers; the criterion of an insured event in crop production is the loss (destruction) of more than 20% of the harvest and for perennial plantations the loss of viability for more than 30% of the area of land plots occupied by perennial plantations. Damages in animal husbandry are associated with the death of insured objects of each species of livestock. By way of comparison, the government support for agricultural insurance is 60% of premiums (Du et. al., 2017).

High levels of government support of agriculture exist in European countries, also. The Czech Republic and Poland are countries with comparable conditions in agriculture as post-socialist states. The situation on crop and insurance markets is very unstable, affecting strong fluctuations in a strong damage ratio (Soliwoda et al., 2017).

The hypotheses of the research.

The null hypothesis: there is no correlation between insurance premiums, the quantity of agricultural organizations that have insurance contracts, the value of gross agricultural production and damage due to hydrometeorological phenomena. The alternative hypothesis states that there is significant correlation among the abovementioned factors.

The aim of the article is to evaluate the current development of the agricultural insurance market in Russia.

The article involves the following key items:

- A description of the specificities of the agricultural insurance market to find determinants of insurance premiums.
- The reasons for and consequences of low insurance attraction for agricultural companies.
- Extra-ordinal profitability of an agroinsurance company.
- Econometric modeling of the agricultural insurance market.

2. Materials and Methods

Data sources for the investigation are the web site Statistics of Russia and the web site of The Ministry of Agriculture of the Russian Federation. Data has been subjected to a cleaning process and its relevance proved. The statistical software used for investigation is Statistica. The model of the agricultural insurance market is based on a time series of 4 selected variables - insurance premiums (In_P), the value of gross agricultural production (Q), damage due to hydrometeorological phenomena (G), and the quantity of agricultural organizations that have insurance contracts (N).

$$In_P = f(Q_t, Q_{t-1}, G_t, N_t) \quad (1)$$

The investigation covers annual data in the period 2007-2016, $t = 10$

Parameters for the model were estimated using the Ordinary Least Squares Method (OLSM). The significance of the model and its individual parameters were verified using appropriate test, such as Fisher and Student, at a critical significance level of 5%. The model as a whole, and the individual parameters according to these criteria, are statistically significant for an autocorrelation of residuals, normal distribution of error terms etc. The model was checked for heteroscedasticity using the Breusch-Pagan test. As a result, the zero hypotheses on the absence of heteroscedasticity was confirmed. R^2 adj is equal to 0.91. A test of multi-collinearity shows a lack of perfect multicollinearity.

The description of the econometric model specification and verification were supported by Stock and Watson (2010).

3. Results and Discussion

The results of the analysis of the statistical data presented in the annual reports of the Ministry of Agriculture of the Russian Federation testify to the crisis in the domestic system of state-supported agricultural insurance in Table 1.

Table 1. The dynamics of the parameters of the market for government-supported insurance of agricultural crops in 2011 – 2016

Indicator	2011	2012	2013	2014	2015	2016
Number of agricultural companies with an insurance contract	4452	5145	4663	5827	2751	913
Crop area of insured crops, in millions of hectares.	14.20	12.90	11.70	12.80	8.30	3.82
Share of area with insured crops, %	19.40	17.72	15.66	17.07	10.94	5.00
Sum of insurance, millions of EUR	1 951.04	2 506.76	2 616.46	3 036.91	2 224.39	1 638.57
Insurance premium, in millions of EUR	196.23	138.57	152.19	175.22	124.38	82.83
Total subsidies, in millions of EUR	85.93	69.61	75.09	86.19	61.13	39.26
The share of the insurance premium compensated from budgets, %	43.79	50.24	49.34	49.19	49.14	47.39
Insurance compensation (payments), in millions of EUR	55.22	31.16	20.78	22.30	15.33	8.20
% to the insurance premium without government subsidy	28.14	22.49	13.65	12.73	12.32	10.10
% to the insurance premium with government subsidy	50.06	45.20	26.95	25.05	24.23	18.82
% to losses of agricultural companies	73.60	57.60	40.90	68.70	70.30	86.40

Source: Ministry of Russian Agriculture, Rosstat, own calculations

In the crop production sector in 2016, there was a five-fold decrease in the number of organizations that used the services of agricultural insurers (from 4,452 in 2011 to 912 in 2016). This factor, together with a reduction in the share of insured areas with crops by 25%, contributed to a reduction in the total

amount of insured amounts (obligations to insurers) by 16.01%. The volume of the agricultural insurance market in monetary terms (the size of insurance premiums) in 2016 decreased by 113.4 million EUR. - by almost 60% in relation to the value of the similar indicator for 2011.

The indicated negative trends are due to the following circumstances:

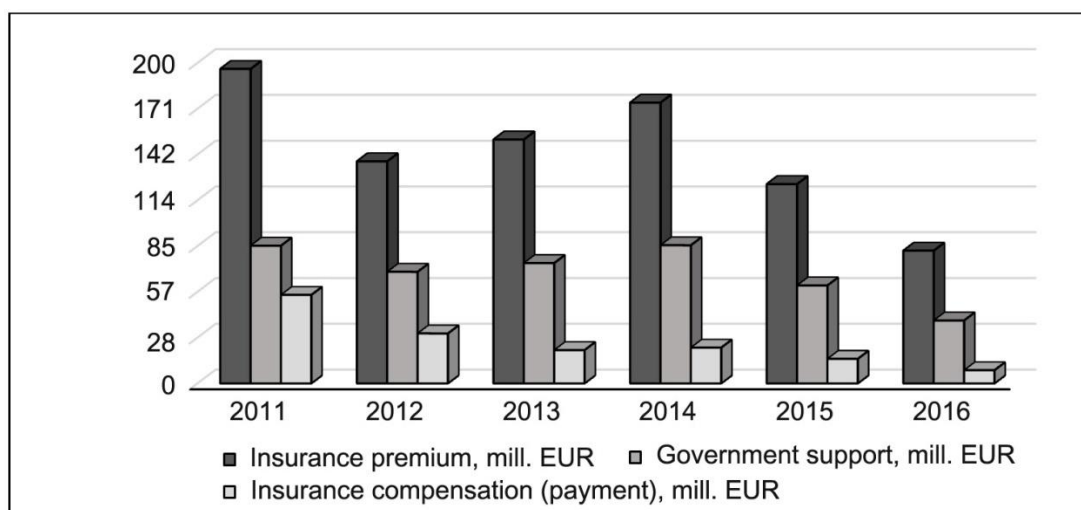
Firstly, the protection of crops in the current model of agricultural insurance is mainly aimed at leveling the consequences of catastrophic risks, while the most demanded insurance product is protection against partial loss or shortage of crops (Zaruk and Galkin, 2016).

Secondly, during 2015 – 2016, due to the withdrawal and suspension of licenses and a voluntary withdrawal from the market of agricultural insurance, 28 insurance organizations ceased operations in this segment. Finally, in January 2017, there are 23 insurance organizations in the National Union of Agricultural Insurance. The top three in terms of insurance premiums received in 2016 include “Rosgosstrakh”, “RSKB-Insurance”, and “Avangard-Garant”, accounting for 40%, 15%, and 11%, respectively.

Since 2017, the mechanism of a single regional subsidy has been put in place, according to which there is no regulated line-item detailing of budget allocations. The governing bodies of the agrarian and industrial complex of the constituent entities of the Federation independently determine the proportions of financing the areas of support for agriculture. In accordance with this, the forecasts of a further decrease in activity in the agricultural insurance market are justified against the background of the declining demand for insurance products and a reduction in the subsidization of agricultural insurance operations. Unfortunately, in many cases agriinsurance does not belong to regional priorities. According to the List of Priority Directions for the Development of Agriculture of Subjects of the Russian Federation, out of 86 subjects only 52 subjects indicated insurance in the field of plant growing as a priority development, and 53 subjects consider livestock insurance to be a priority (Schastlivtseva et al., 2017).

Along with the reduction in the volume of the state-supported agricultural insurance market, there is a decrease in the efficiency of using insurance products from the position of agricultural producers. During 2011 – 2016, there was a steady tendency to decrease the insurance premium ratio - the ratio of the volume of insurance compensation to agricultural organizations (effect) to the amount of insurance premiums (costs) paid by them.

Figure 1. The ratio of insurance premiums and insurance indemnities in the agricultural insurance market in the sub-sector of crop production



Source: Ministry of Russian Agriculture, own calculations

In general, for the period under review, this indicator decreased almost threefold - from 28.14% to 10.1%. The standard that determines the specific weight of insurance payments in the insurance premium is set in the Law at 80%. The actual values of the indicator in 2014 and 2016 were 12.73% and 10.1%, respectively. Multiple deviation of the insurance benefit ratio from the normative value indicates the ineffectiveness of the current mechanism of state-supported agricultural insurance (Figure 1). Of the funds generated because of the difference between the insurance premium received and the compensation paid, insurance organizations must pay contributions to the compensation fund in the amount of 5% of the insurance premium and make settlements on tax liabilities. With the significantly reduced value of the insurance payments ratio, significant cash balances are formed in insurance organizations. This is confirmed by the calculations in Table 2.

Table 2. Calculation of cash balances in insurance companies after payment of insurance claims under insurance contracts in crop production

Indicator	2013	2014	2015	2016
Insurance premium, mill. EUR	152,19	175,22	124,38	82,83
Government support, mill. EUR	75,09	86,19	61,13	33,47
Insurance compensation, mill. EUR	20,78	22,30	15,33	8,20
Insurance compensation in the insurance premium, %	13,65	12,73	12,32	9,9
Contributions to the compensation fund, mill. rubles.	7,61	8,76	6,22	4,14
Tax burden, as% of revenue	4,19	4,06	5,40	4,55
Tax payments, mill. EUR	6,38	7,11	6,72	3,77
Net Profit, mill. EUR	117,42	137,04	96,12	66,72
in% to the insurance premium	77,16	78,21	77,28	80,55
Share of government support in the net profit of insurance company, %	63,95	62,89	63,60	50,17

Source: Ministry of Russian Agriculture, Rosstat, own calculations

The results of the calculations show that, after paying insurance claims and taxes, significant amounts of money remain at the disposal of insurance organizations - about 80% of the total amount of insurance premiums received from agricultural producers. More than 60% of this cash flow is formed at the expense of budgetary funds, which as a result are not used for the intended purpose. In accordance with this, the functioning system of agroinsurance with state support in the sub-sector of crop production absolutely does not ensure the achievement of the objectives of budget support and interests of agricultural producers. The state spends 3-5 times more than the insurance reimbursements paid by insurers to the subjects of the agrarian sphere. In accordance with this, the question arises as to whether the established insurance tariffs correspond to the volume of damage to agricultural producers in the event of insured events.

In this sector of the agricultural insurance market, there is also a one-sided focus on protecting mainly against catastrophic risk events - mass epidemics and natural disasters. The death of animals from diseases not classified as particularly dangerous, and the death of a small number of animals does not apply to insurance cases. This does not promote the involvement of agricultural producers in the insurance process, and, accordingly, does not provide an acceptable reduction in the level of risks associated with managing livestock operations.

To summarize the analytical conclusions, we will construct a regression model reflecting the dependence of insurance premiums (In_P) on the value of gross agricultural production in value terms (Q), the number of hydrometeorological phenomena that caused damage to the population and economy (G) and quantity of agricultural organizations that have concluded agricultural insurance contracts (N). The cost parameters in the model are reduced to comparable prices.

The regression model of the insurance market in Russia's agriculture will take the following form:

$$In_P = 19,94 - 0,0064Q_t - 0,0018Q_{t-1} + 0,0014N - 0,031G$$

(1,24)
(0,0007)
(0,0003)
(0,0004)
(0,002)

The coefficients of net regression show that with the growth of volumes of gross agricultural production, the size of insurance premiums steadily decreased. A similar dependence is also observed between the number of cases of natural disasters and the volume of insurance premiums. The indicated trends show that the existing model of agricultural insurance absolutely does not contribute to leveling the consequences of risk events in the agricultural sector. At present, the Russian aggroinsurance market is imperfect and is not regulated by market laws of supply and demand but is subject to strict administration by the government.

Government support of agriculture is a widely discussion question. Grushina and Semenova (2009) argue that the main reason for the unpopularity of aggroinsurance are a lack of information and the low educational levels in agricultural companies. As a result, insurance contracts have wrong specifications leading to loses in insurance compensation. If agricultural companies have access to actual, relevant and full information, they would be more active and enthusiastic.

4. Conclusion

The situation in agriculture, with high levels of risk and low profitability, is the expectation of active government support. In Russia, 50% of insurance compensation is provided by government subsidies.

Firstly, according to the results of this analysis, the number of agricultural companies that have an insurance contract has decreased in the last 6 years. The reasons for this situation are:

- The government provides a unified agricultural subsidy and the local government decides how it is spent. Unfortunately, aggroinsurance is not in priority.
- Insurance payments occur when a farmer loses 20% of a harvest or 30% of a crop area. Farmers prefer to have insurance contracts with lower losses contributions and don't want to sign inferior contracts.
- A lot of insurance companies ceased operations and voluntarily left the market of agricultural insurance.
- Russia has an oligopoly style agricultural insurance market; 3 companies have 60% of the market, resulting in unprofitable tariffs and conditions.

Secondly, the biggest problem in the Russian insurance market is corruption. Insurance payments in the total insurance premium are 10%, although according to legislation, 80% of a total insurance premium must be paid. Thus, the government subsidizes not agriculture, but the super-profits of insurance companies.

Finally, the model of agricultural insurance absolutely does not contribute to leveling the consequences of risk events in the agricultural sector. At present, the Russian aggroinsurance market is in imperfect condition. It is regulated by strict government administration, not by market laws of supply and demand.

All of the above factors do not allow full implementation of the decree of the President of Russia on ensuring food security.

An opportunity for further research would be a deep analysis of risk-management behavior in Russia.

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PERFORMANCE OF PRODUCER GROUPS IN POLISH REGIONS

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Annotation: Collective cooperation in rural areas is not just a phenomenon of the past. Marketing cooperatives in the agricultural sector are debated worldwide. At a time when the Poland had joined the EU, that is, fifteen years after the beginning of the process of economic transformation, cooperation among producers despite various support from both national and European sources still has not regained its former popularity. Main aim of the article is to define performance of established producer groups between 2004 and 2017 on regional level in selected commodities (cereals and oil crops, eggs, milk, potatoes). Secondary aim is to define share of regional groups on regional agricultural production from the perspective of achieved concentration. The conducted analysis indicates regional differentiation among various types of agricultural commodity. The biggest share on total production could be observed among groups and selected commodities mainly in voivodeship Wielkopolskie, Dolnośląskie, Opolskie and Zachodniopomorskie. Also, among different region average prices per unit differs.

Key words: Poland, rural development programme, cereals and oil crops, eggs, milk, potatoes, voivodeships.

JEL classification: Q11, Q13

1. Introduction

Collective cooperation in rural areas is not just a phenomenon of the past. Marketing cooperatives in the agricultural sector are debated worldwide (Milovanovic et al., 2016; Shiferaw et al., 2016, etc.), while they are seen as drivers of economic development and innovation. In Europe, they played a key role in rural development in the first half of the twentieth century and currently they are no less important in developing countries. The importance of marketing cooperatives has been highlighted not only by the Food and Agriculture Organisation of the United Nations (FAO) but also by other bodies, such as the Organisation for Economic Co-operation and Development (OECD)

At a time when the Poland had joined the EU, that is, fifteen years after the beginning of the process of economic transformation, cooperation among producers despite various support from both national and European sources still has not regained its former popularity. Still in Poland, there exists a large number of small farmers who farm relatively small plots (Hornowski and Kotyza, 2017), which places them in comparison with the Czech and Slovak economic agricultural producers at a disadvantage. This situation is due to a historical development, whereby in Poland, socialist collectivisation has never been completed to the same extent as in the Czech Republic. During the preparation process for EU accession, Polish government had decided to support the creation of marketing organisations by providing public financial support for newly established producer groups as there is a lot of evidence about positive impact on social capital (Wesłowska, 2016) and economic performance of stakeholders (Czapiewska, 2013).

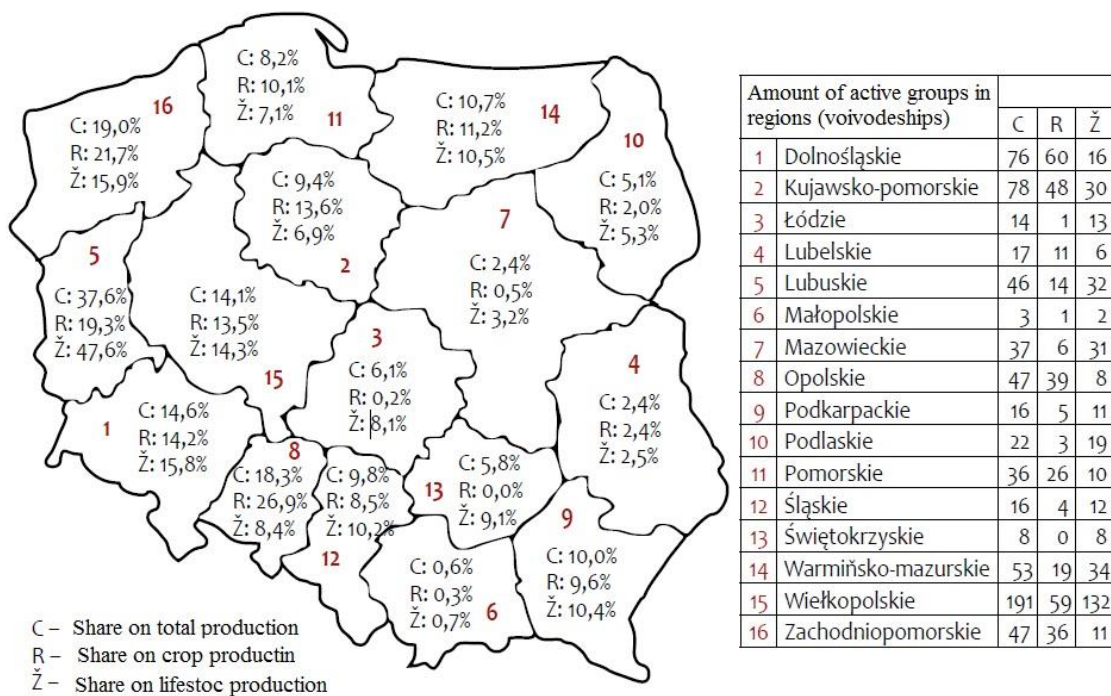
Support for newly established producer groups was realized on the basis of the SAPARD programme (before the EU accession) and Rural Development Programme with the aim, among others, to increase market share potential of individual farmers. It has been confirmed, that market concentration in food process industry leads toward positive influence on sectoral profitability (Blažková and Dvouletý, 2017). This measure was enshrined in European legislation. Under

the legislation, recognized producer groups (official name for marketing organisations of a cooperative type) were allowed to draw for 5 years financial resources, the level of which depended on the value of production supplied to the market, to a maximum of € 390,000. From the new financial perspective, (2014-2020) total amount available to producer groups even increased to € 500,000. In Poland, Rural Development Programme of the EU is referred as PROW (Program Rozwoju Obszarów Wiejskich).

Relevance of Polish national support is discussed by multiple authors (Czubak and Bajan, 2016; Lipińska, 2008; Chlebicka, 2011). But only few authors work with regional data (Czapiewska, 2013; Hasiński, 2013; Wesłowska, 2016).

Kotyza (2017) analysed regional performance of producer group in Polish regions in crop production and animal production. Figure 1 presents market share of *active* (for explanation what does “active” means see Kotyza, 2017, page 82) producer groups in Poland in 2013 in individual Polish voivodeships, based on groups’ sales performance and regional crop and livestock production expressed in values. But, due to the fact, that more detailed data are available for individual regions, authors decided to follow up with production shares in selected commodities - cereals and oil crops, eggs, milk and potatoes. Limited amount of commodities was selected, to prevent large scope of this contribution.

Figure 1. Share of active producer groups in individual Polish regions (in value).



Note: Data valid and estimated for 2013.

Source: Kotyza, 2017 according to Polish paying agency, Polish Ministry of Agriculture, Polish Central Statistical Office.

2. Materials and Methods

Main aim of the article is to define performance of established producer groups between 2004 and 2017 on regional level in selected commodities. Secondary aim is to define share of regional groups on regional agricultural production (formula 1) from the perspective of achieved concentration.

$$\text{Share on regional production}(\%) = \frac{\text{volume delivered by groups}}{\text{volume of regional production}} * 100 \quad (1)$$

The research period covered years 2008, 2010, 2012, 2014 and 2016. But due to the spatial limitation years 2008 and 2010 are not included in Tables 3–6. Support provided was from two programming periods: (i) PROW 04–06 and (ii) PROW 07–13. Due to the fact, that support was provided for 5 years from groups’s recognition, year 2012 was the last one when groups was able to claim financial support from PROW 04-06. Data from PROW 14–20 programme was not taken into account due to the lack of data in the statistics for the year of 2017 (latest macro and regional data available are for 2016) and also due to the fact, that first groups were supported in 2016 and therefore data of 2016 are of limited quality.

The article uses unpublished data from Polish paying agency (Agency for Restructuring and Modernisation of Agriculture; ARiMR) on the production volume and production value of regional (voivodeship) producer groups benefiting from support. Available data are reflecting products delivered to the market by producer groups, which applied for support in particular year. When 5 year period of possible support passed, no entities are providing data of their market deliveries to ARiMR any more. This limits, to certain extent, gained conclusions. In addition, mass statistic data from the Central Statistical Office of Poland (GUS) was used.

Based on 2016 values, also average unit price was calculated from total volume sold and value of sold production.

The article distinguishes 4 types of products for which analysis was carried out (eggs, milk, cereals and oil crops and potatoes). Meat products (beef, pork and poultry) were omitted due to incomplete data and discrepancies in used units between ARiMR data and national regional statistics.

3. Results and Discussion

The measure supporting establishment of producer groups was introduced in Poland under Rural development programme after EU accession in 2004, within the first programming period it supported 95 group. During the second programming period, the total number of supported groups increased significantly. Totally, over 7 years, there has been registered 1,253 groups, out of which 914 were able to include their sales into year 2012, 1,009 into year 2014 and 751 in the year 2016. Within PROW 2014–20, until 11/2017 92 groups were registered under more strict conditions than in previous programming periods, but only 42 already asked for support based on their activity.

Table 1. Development of registered producer groups within PROW 2004–06

Year	2004	2005	2006	Total
Amount	19	31	45	95

Source: Authors based on data from ARiMR

Table 2: Development of registered producer groups within PROW 2007–13

Year	2007	2008	2009	2010	2011	2012	2013	Total
Amount	102	142	119	139	193	219	339	1253

Source: Authors based on data from ARiMR

In total, 19 different commodity groups has been registered by newly established groups in PROW 07-14; while 11 commodity groups occurred in previous programme. The total list of commodities (number of groups included) is sorted according to the number of groups included: cereals and oil crops (494); pork (305); poultry (283); milk (102); cattle (53); potatoes (27); eggs (19); sugar beet (16); flowers and ornamental trees (10); energy crops (7); tobacco (7); products of organic farming (6); sheep and goats (3); hops (3); rabbits (2); honey, bee products (2); horses (1); medical, aromatic, spice plants (1); animals kept for the skin (1). Authors had an ambition to proceed with most important

commodity groups, but as data for livestock (poultry, pork and cattle) from agency are not usable, these commodities were omitted.

Table 3 express data about individual regions connected to production of cereals and oil crops. It can be observed that significant position has groups in Dolnośląski (almost 252 ths. tonnes in 2016), Opolski (152 ths. tonnes in 2016) and Wielkopolski (almost 214 ths. tonnes) region. In these regions total value of production of supported groups ranged from between 100 and 200 thousand PLN in 2016. In 2014, when most supported groups applied for support, in Wielkopolskie sales even exceeded 350 million PLN. On contrary to these regions, for example in Łódzkie only 2012 total share of producer groups on regional cereal and oil crops production was minor. In Zachodniopomorskie, groups were able to get highest average price (934 PLN), which is 257 PLN higher to lowest price observed in Opolskie region. Average prices (around 800 PLN/t) are reached in regions where market activity of producer groups is negligible (Lubelskie, Podlaskie) and lowest prices are observed in regions with more significant integration activities (Lubuskie, Mazowieckie, Opolskie).

Table 3. Value and volume of sold cereals and oil crops by supported groups from PROW 04-06 and 07-13

	2012			2014			2016			PLN/t 2016
	PLN	tonnes	%	PLN	tonnes	%	PLN	tonnes	%	
Dolnośląskie	259,655,330	279,110	10.4	162,824,251	180,468	5.6	198,324,782	251,642	8.2	788
Kujawsko-Pomor.	160,062,158	185,704	7.1	158,386,377	182,037	5.6	72,640,957	91,685	3.2	792
Lubelskie	14,794,711	17,110	0.6	15,795,997	18,600	0.6	9,446,164	11,776	0.3	802
Lubuskie	75,541,013	65,834	6.5	40,128,583	47,708	4.4	38,214,267	55,307	6.1	691
Łódzkie	1,570,087	1,431	0.1							
Małopolskie	1,788,799	1,796	0.2	8,803,433	11,640	1.3	11,671,022	17,103	1.9	682
Mazowieckie	2,147,287	7,596	0.3	5,633,293	5,745	0.2	4,603,885	5,826	0.2	790
Opolskie	249,771,287	275,838	13.1	219,403,408	253,003	11.4	103,239,862	152,465	6.8	677
Podkarpackie	34,302,372	43,031	5.1	34,499,648	48,513	5.0	46,746,222	68,928	7.6	678
Podlaskie	1,911,116	2,112	0.2	1,664,231	1,965	0.1	1,821,304	2,254	0.2	808
Pomorskie	98,923,171	97,711	5.8	55,411,030	62,933	3.1	64,419,935	75,944	4.4	848
Śląskie	32,902,419	24,996	3.0	12,148,869	12,403	1.3	1,344,905	1,733	0.2	776
Warmińsko-mazur.	70,705,024	76,758	4.4	83,761,881	90,763	5.0	22,348,321	27,126	1.6	824
Wielkopolskie	282,826,652	288,737	6.2	353,421,108	409,746	7.4	165,848,219	213,870	4.5	775
Zachodniopomorskie	233,279,426	268,721	14.0	111,050,404	115,942	5.2	49,835,526	53,371	2.7	934

Source: Authors based on data from ARiMR and GUS.

Note: “%” represents share of supported groups’ production to regional production expressed in volume

Table 4. Value and volume of sold milk by supported groups from PROW 04-06 and 07-13

	2012			2014			2016			PLN/l 2016
	PLN	litre	%	PLN	litre	%	PLN	litre	%	
Dolnośląskie				7,940,263	5,880,345	2.9	3,816,216.30	3,358,403.00	1.9	1.14
Kujawsko-Pomor.	32,930,744	24,591,912	2.9	44,631,751	28,736,300	3.2	11,249,173.06	9,845,824.00	1.0	1.14
Lubuskie	61,450,363	44,533,495.0	38.3	43,012,995.5	32,487,301.0	30.7	4,965,035.6	3,627,598.0	4.3	1.37
Łódzkie	111,938,633	86,937,615.0	9.2	-	-	-	-	-	0.0	-
Mazowieckie	41,189,456	2,899.6	0.0	29,212,569.9	18,078,006.0	0.7	51,973,002.9	42,112,338.0	1.6	1.23
Opolskie	3,905,256	2,861,325	1.1	-	-	-	-	-	0.0	-
Podkarpackie	3,098,212	2,366,452	1.0	19,340,275	12,582,376	5.5	11,726,150.28	9,180,606.00	4.2	1.28
Podlaskie	92,876,059	74,147,120	3.3	-	-	-	--	-	0.0	-
Pomorskie	26,831,778	19,116,308	5.8	46,939,815	33,935,696	9.5	10,067,072.73	9,564,655.00	2.7	1.05
Śląskie	2,386,593	1,803,252	0.7	9,546,018	6,543,574	2.7	6,654,845.76	5,014,627.00	1.9	1.33
Świętokrzyskie	3,948,855	2,902,175	0.9	5,158,275	3,138,527	1.3	-	-	0.0	-
Wielkopolskie	112,574,431	82,398,202	5.1	418,945,952	279,653,729	17.0	338,349,753.31	285,080,144.00	16.2	1.19
Zachodniopomor.	32,633,612	23,545,502	12.9	28,697,368	17,265,249	9.9	71,704,315.95	58,288,214.00	39.6	1.23

Source: Authors based on data from ARiMR and GUS.

Note: “%” represents share of supported groups’ production to regional production expressed in volume

For milk (see Table 4), the most significant share in collective marketing of milk can be observed in Lubuskie region. In 2010 (due to spatial limitation years 2008 and 2010 are not included in tables),

over 66% of milk produced was delivered to dairy processing facilities through producer groups. Although the total share in table 3 decreases in time in Lubuskie region, the reason is not connected to failure of groups, but to specifics of data. The decreasing trend given by the fact, that majority of groups already sourced available finance and they do not appear in agency data, but they are expected, until certain extent, to continue with the activity. Significant improvement in collective marketing is also visible in Zachodniopomorski region. Group delivered only about 3% of milk in 2010, while almost 40% in 2016. Out of that it can be concluded that majority of milk marketing groups (in the form of cooperative or limited liability company) were established just before the end of PROW 07–13. Similar to Zachodniopomorskie, in Wielkopolskie situation improved significantly. While in 2008 and 2010, 0.9% and 2.8% of produced milk was marketed over established groups, in 2014 it was already 17%. In relation to milk, some more concentration could be expected also in other regions due to the fact, that within Common Organisation of Market, milk producers can only receive support in a case of market disturbances via registered producer groups or producer organisations. Due to the fact, that milk could be easily spoiled if not correctly stored; it needs to be delivered to processing plant short after milking. As proved by various authors (Muller et al, 2018; Hanisch et al., 2013; etc.) common sales organisations are able to provide better price and/or better conditions to its members (producers), but there is not visible any advantage in price related to concentration among polish groups. In Zachodniopomorskie average price was 1.23 PLN/litre, while in Śląskie with minor integration gained price was up by 11% (1.33 PLN/l). In general, Poland is considered to be a major EU milk producer and one of the most competitive exporters of liquid milk and cheese, but also face strong oligopoly within a dairy sector (Mach and Hošková, 2016). From that perspective, it is welcomed to continue with support milk groups establishment. Marketing of potatoes is not as common as marketing of milk or cereals and oil crops in observed years. Groups were established and active only in 6 voivodeships – Dolnośląskie, Kujawsko-pomorskie, Mazowieckie, Opolskie, Pomorskie and Wielkopolskie. Only in Wielkopolskie and Dolnośląskie activities of groups could have significant impact on the regional potatoes market. Their share on regional production accounted to be close to 10%. Average price of one tonne of potatoes was 470 PLN/tonne. Lowest average price (257 PLN/t; 45% below average) was obtained by groups in Kujawsko-Pomorskie region.

Table 5. Value and volume of sold potatoes by supported groups from PROW 04-06 and 07-13

	2012			2014			2016			PLN/t 2016
	PLN	tonnes	%	PLN	tonnes	%	PLN	tonnes	%	
Dolnośląskie	27,277,482	75,057	10.4	30,441,047	54,092	12.4	9,823,201.76	21,493.55	2.8	457.0
Kujawsko-Pomor.	1,886,075	7,831	1.6	687,287	2,611	0.7	667,646.22	2,595.29	0.4	257.3
Mazowieckie	2,780,707	5,691	0.6	2,384,831	4,661	0.6	2,042,577	4,266	0.4	478.8
Opolskie	6,308,479	15,068	4.3	6,434,797	10,887	4.6	1,585,734.96	3,109.73	0.9	509.9
Pomorskie	8,458,763	16,921	2.8	3,036,632	5,177	1.0	6,764,830.98	13,275.49	2.3	509.6
Wielkopolskie	17,851,896	34,345	3.2	68,151,649	114,179	13.2	54,499,405.53	89,598.67	9.3	608.3

Source: Authors based on data from ARiMR and GUS.

Note: “%” represents share of supported groups’ production to regional production expressed in volume

Performance of producer groups focused on eggs is expressed in Table 6. As seen, only in 11 out of 16 voivodeships, eggs are delivered to the market via supported producer groups from mainly PROW 07–13. Groups have significant market position in Warmińsko-mazurski (almost 50% in 2012), Opolski (35% in 2016) and Podlaski (22% in 2016) region. For Malopolskie no data are available in the Table 6, but in 2008 and 2010 (data not included in the table) total share of group on regional production accounted for 8 – 10%. Highest average price received is 0.8 PLN per one egg, while lowest is only 0.2 PLN per one piece. Significant difference can be caused by different quality, characteristics of customer (export or domestic consumption), packaging or level of finalisation/processing.

Table 6. Value and volume of sold eggs by supported groups from PROW 04-06 and 07-13

	2012			2014			2016			PLN/pcs
	PLN	Pieces	%	PLN	Pieces	%	PLN	Pieces	%	
Dolnośląskie	11,813,905	36,764,562	6.9	6,121,398	9,443,986	1.5	16,751,571	50,019,641	8.5	0.3
Lubuskie							11,077,072	13,855,888	5.3	0.8
Małopolskie										
Mazowieckie	1,608	3,216	0.0	25,031,399	33,668,133	1.7	37,907,467	49,037,233	2.6	0.8
Opolskie	3,974,949	19,383,630	11.7	13,797,031	18,170,939	14.8	25,365,286	55,731,276	35.2	0.5
Podkarpackie							2,701,329	9,484,951	2.8	0.3
Podlaskie				10,687,962	13,812,154	6.9	24,145,136	56,293,661	22.0	0.4
Śląskie	3,242,564	11,211,531	1.7	4,478,247	16,368,714	4.1				
Warmińsko-mazur.	20,180,652	75,407,238	46.2	22,449,661	97,025,734	37.1				
Wielkopolskie	0	0	0.0	30,120,016	144,671,050	4.4	38,542,472	167,207,890	4.4	0.2
Zachodniopomorskie	8,474,937	12,841,134	4.4	10,425,940	13,961,820	5.4	11,441,802	14,610,510	4.6	0.8

Source: Authors based on data from ARiMR and GUS.

Note: “%” represents share of supported groups’ production to regional production expressed in volume

Concentration on the level of agricultural producers is an important factor that needs to be taken seriously, unfortunately support does not, at this stage, leave to concentration building. EU Commission is aware of its importance and therefore applied a special exception for agricultural producers in the competition law (exceptions from the competition rules are defined in Regulation (EU) 1308/2013 in article 209). Supporting producer groups in Poland could be seen as a specific policy example used for supporting and building social capital. Fałkowski et al. (2017) used unique Polish dataset to argue how groups build on personal relationships tend to be smaller than groups using impersonal structures. Smaller groups where personal relations dominate evince higher heterogeneity, but as they are smaller, could be easily manageable. On the other hand, with respect to concentration, small units can be more flexible under high price variability (Chlebicka et al, 2010) but to face and compete with concentrated agriculture input industry and food processing industry, groups need to reach at least certain level of production to eliminate possible market imperfection which exists for example in dairy market (Stalgiene and Jedik, 2015), slaughtering market (Cechura et al., 2015) and others. Proposed policy supporting establishment of smaller groups can therefore hardly balance market imperfections in short-run, but could build needed social capital. From the long-term perspective, it could lead afterwards to more sophisticated co-operative structures, mainly if “second-level” cooperatives are established. Co-operative concentration and vertical integration is a long-term process, as for example documented in cereal sector in France (Fillipi, 2012).

4. Conclusion

In the Polish agricultural production sector of food raw materials, a steady increase in the number of producer groups can be observed in recent years. Undoubtedly, the EU subsidies granted for the first five years of the group's operation are a great incentive to create production groups. Therefore, it seems justified to outline the research and to examine the viability of the emerging groups of agricultural producers, although problems with group sustainability was observed by Kotyza and Tomšík (2014) for the Czech Republic and Slovakia and Kotyza (2017) also for Poland. The conducted analysis indicates regional differentiation among various types of agricultural commodity. The biggest share on total production could be observed among groups and selected commodities mainly in voivodship Wielkopolskie, Dolnośląskie, Opolskie and Zachodniopomorskie. This results also correspond to older observation presented in Figure 1.

From the analysis of ARiMR data on production volume, it was noted that in three voivodships production is decreasing in relation to previous years in all analysed types of groups (Kujawsko-Pomorskie, Śląskie and Warmińsko-Mazurskie voivodships), but as explained above, this fact is only given by the fact that some groups already finished with financing and therefore does not provide

data to agency. It will also be interesting to follow further development in Poland, where the large number of economic subjects that received a subsidy will be expanded by many more groups established in the third post-accession programming period (2014–2020). From the above-mentioned data (mainly Table 1 and 2), it could be concluded, that large number of supported groups has impact on total share in production, although their individual share is rather negligible. An unanswered question remain, to what extent are supported producer groups real partners in oligopolistic environment or whether they only can accept conditions of input providers and food industry. Also, another question should be answered in the further research. Is average price correlated to observed concentrations? How could number of farmers included in the group influence the market success?

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FOOD SAFETY OF EDIBLE INSECTS FROM A MICROBIOLOGICAL POINT OF VIEW

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Annotation: Since January 2018, edible insects have been recognized as novel foods in the EU, and their microbiological safety must therefore be considered. As a food of animal origin, edible insects may contain undesirable pathogenic microorganisms. This study was therefore focused on the identification and enumeration of microorganisms in adult house crickets (*Acheta domestica*), mealworms (*Tenebrio molitor*) superworms (*Zophobas morio*) in their raw states, after killing with boiling water, and after drying at 105°C.

Determination of the total bacteria count, the presence of bacteria of the genus *Bacillus*, and the presence of yeast was carried out by cultivation on Petri dishes. Detailed identification of bacteria was performed using MALDI-TOF mass spectrometry. The results of the enumeration of microorganisms indicated significantly higher values in raw and boiled samples than in the dried samples. In total, ten different bacterial species were detected by MALDI-TOF MS. The occurrence of the species was dependent on the sample processing.

In conclusion, the microbiological safety of edible insects should be monitored in the same way as in conventional foods. Insects can contain various microorganisms even after processing. Tested samples contained multiple bacterial strains that are known to cause nosocomial infections and possess antibiotic resistance. Our findings indicate that immunosuppressed individuals in particular could be at risk when consuming edible insects.

Key words: food safety; novel food; edible insects; microbiological risk

JEL classification: Q18, I10

1. Introduction

The production of food of animal origin represents a major environmental concern for future decades. Thirty-five percent of global crop production is allocated to animal feed, mainly for the meat and dairy industries, which does not produce food very efficiently (Krausmann et al., 2008; Foley et al., 2011). In the coming decades, it is assumed that population growth together with changes in consumption patterns will increase the demand for meat and dairy products (Godfray *et al.*, 2010; Herrero and Thornton, 2013), which would raise the proportion of global crop production allocated to animal feed. These demands could be partially satisfied by increasing the portion of plant protein in the diet (Smil, 2002). One of the other options is to incorporate the insect as a novel protein source (van Huis, 2003; Paoletti, 2005), as it could potentially be a more environmentally friendly alternative to conventional livestock production (DeFoliart, 1997; Premalatha et al., 2011). Rearing of insects is potentially more efficient in comparison to livestock production, as shown by Nakagaki and Defoliart (1991), and various insect species are already used in many countries all over the world, in both rural regions and in elite cuisine (Premalatha et al., 2011).

The nutritional aspects of insects are quite satisfactory regarding human nutrition. The amount of protein in dried insects is very variable (Banjo, Lawal and Songonuga, 2006; Xiaoming et al., 2010), influenced by many factors such as species, developmental stage, rearing technology etc.

Generally, protein content is either comparable to, or exceeds, the protein content of cooked meat from meat sources commonly consumed in developed countries, which is approximately 25 % (USDA, 2018). The content of essential amino acids represents 14–24 % of the total amino acids, also depending on the species (Xiaoming et al., 2010). These values indicate that insects could be reasonable source of protein.

The microbiological safety of edible insects is needed to be considered as there are little data regarding this topic. To date, it is known that insects contain various bacterial genera, including several potentially pathogenic species. Klunder *et al.* (2012) found members of the *Enterobacteriaceae* family in samples of fresh mealworms, and small and large house crickets. These were eliminated after heat treatment, but the heat treatment was not able to eliminate spore-forming bacteria. Grabowski and Klein (2017) analyzed several bacterial communities in various insect products, indicating that although there were not any salmonellas, listerias, *Escherichia coli* and *Staphylococcus aureus* present, some products were positive for other staphylococci, members of the *Enterobacteriaceae* family, bacilli (including *B. cereus*) and other potentially pathogenic bacteria, even when the samples were processed in some way.

The aim of this study was therefore to analyze the bacterial communities in samples of edible insects, assess their significance in food safety, and evaluate the influence of processing on the composition of their microbiota.

2. Materials and Methods

The microbial community was analyzed in three species of insect: house cricket (*Acheta domesticus* L.), mealworm (*Tenebrio molitor* L.), and superworm (*Zophobas morio* F.) larvae, purchased from a local commercial company (Carassius, Praha, Czech Republic). All three species were analyzed in September 2017 in the Laboratory of Anaerobic Microbiology at The Czech University of Life Sciences Prague (Praha, Czech Republic), in fresh form and after two processing techniques: killed by hot water and killed by hot water with subsequent drying at 105°C by hot air. Samples were added to glass tubes containing liquid broth consisting of Tryptone CM0075 4.5 g/l (Oxoid™), Nutrient Broth No. 2 CM0067 4.5 g/l (Oxoid™), Yeast Extract LP0021 2.5 g/l (Oxoid™), Tween Plysorbate 80 6-088 0.45 ml/l (Scharlau) and cysteine 0.225 g/l (Sigma-Aldrich), then homogenized in order to make a decimal dilution line for inoculation to nutrient media. The plate count cultivation method was used with the use of various nutrient media. Total counts of bacteria, presence of *Bacillus* spp. and *Clostridium* spp. spores, counts of yeasts and molds, and presence of salmonellas was analyzed. Total counts of aerobic bacteria were analyzed using Nutrient Agar CM 003 (Oxoid™) incubated for 48 h at 37°C. Counts of *Bacillus* spp. spores were analyzed using Yeast Extract Agar CM0019 (Oxoid™) with previous pasteurization (80°C/10 min) of samples in order to remove other non-spore-forming bacteria. The presence of clostridia spores was analyzed using Reinforced Clostridial Agar CM0151 (Oxoid™), also using pasteurized samples. Yeasts and molds were analyzed using Dichloran-Glycerol Agar DG18 CM0729 (Oxoid™) with addition of Chloramphenicol Selective Supplement SR0078 (Oxoid™) according to the manufacturer's instructions. The presence of salmonella was analyzed according to ISO 6579-1 (2017): the samples were pre-cultivated in Buffered Peptone Water CM0509 and then 0.1 mL of the broth was inoculated to Rappaport-Vasiliadis Enrichment broth CM0669 (Oxoid™), incubated (48 h/37°C) and then the broth sample applied by loop on Salmonella Shigella CM0533 Agar and cultivated (48 h/37°C).

After cultivation, the well-grown isolates obtained from plates with total counts of bacteria underwent identification by MALDI-TOF mass spectrometry on an AutoFlex Speed (Bruker Daltonik, Germany) mass spectrometer using ethanol-formic acid extraction. The colonies were grown using Wilkins-Chalgren Anaerobe Broth CM0643 (Oxoid™) with addition of Veggietones Soya Peptone

VG0300 5 g/L (Oxoid™). At first, 1 mL of each overnight culture was centrifuged at $14500 \times g$ for 3 min, the supernatant was discarded and the surface of pellet was washed by 70% ethanol in order to remove the residual growth medium. After another centrifugation, the ethanolic supernatant was discarded and the pellet was resuspended in 15 μL of 70% formic acid (Fisher Scientific) and 15 μL of acetonitrile (LC-MS Chromasolv®), centrifuged, and the supernatant used for MALDI–TOF analysis. The 1 μL of supernatant was applied to an MTP 384 polished steel target plate (Bruker Daltonics) and allowed to air dry. Then, all samples were overlaid by 1 μL of α -cyano-4-hydroxycinnamic acid dissolved in acetonitrile, water and trifluoroacetic acid (50:47.5:2.5) as a MALDI matrix (Bruker Daltonics).

The obtained results were analyzed by Statgraphics Centurion XV (StatPoint) using ANOVA multiple sample comparison, with Scheffé’s method for adjusting significance levels.

3. Results and Discussion

Three samples processed by three different methods were analyzed in this experiment giving nine experimental groups in total. All samples contained detectable amounts of bacteria. Yeasts were found in all samples except dried mealworms, spores of bacilli were found in heat-killed house crickets, raw and heat-killed mealworms and dried superworms. Salmonellas and clostridia were not detected in any of the samples. The results are shown in Table 1. Statistical evaluation (Table 2.) found that a combination of drying and heat-killing significantly reduced total counts of bacteria in the samples ($P < 0.05$). Klunder et al. (2012) counted total bacteria in fresh mealworms to 7.7 log CFU/g and 7.2 log CFU/g in fresh house crickets. These findings are in line with our results; we found 7.46 log CFU/g of total bacteria in mealworms and 7.81 log CFU/g of total bacteria in house crickets. Similar results are presented in analysis carried out by Stoops *et al.* (2016). They found approximately 8 log CFU/g of total bacteria in mealworms.

Table 1. Counts of bacteria in the tested insect samples

Insect sample	Total counts of viable aerobic bacteria	<i>Bacillus spp.</i> spores	Yeasts	Molds
House crickets, fresh	7.81±0.25	<2.00	3.46±0.04	<i>Aspergillus spp.</i>
House crickets, heat-killed	7.29±0.07	2.26±0.46	2.92±0.27	ND
House crickets, dried	6.68±0.20	<2.00	3.81±0.11	<i>Alternaria sp.</i>
Mealworms, fresh	7.46±0.48	2.15±0.27	4.09±0.06	ND
Mealworms, heat-killed	6.91±0.44	4.52±0.17	2.44±0.30	ND
Mealworms, dried	4.43±1.18	<2.00	<2.00	ND
Superworms, fresh	7.70±0.62	<2.00	2.58±0.50	ND
Superworms, heat-killed	6.94±0.14	<2.00	2.99±0.30	ND
Superworms, dried	6.84±0.09	2.91±0.16	3.31±0.12	ND

Values are means from three replicates in log CFU/g \pm standard deviation. *Salmonella* and *clostridia* were not detected in any sample. ND = not detected.

Fresh house crickets contained detectable amounts of *Aspergillus* spp., that seemed to be eliminated by processing, although the dried form of house crickets contained *Alternaria* sp. in one replicate and sterile mycelium in another.

Table 2. Comparison of different processing methods

Processing method	Total counts of viable aerobic bacteria	<i>Bacillus</i> spp. spores	Yeasts
Fresh	7.66±0.44 ^b	2.05±0.15 ^a	3.37±0.70 ^a
Heat-killed	7.05±0.29 ^b	2.92±1.22 ^a	2,78±0.36 ^a
Heat-killed and dried	5.98±1.31 ^a	2.30±0.46 ^a	3.04±0.81 ^a

Values are means of nine replicates in log CFU/g ± standard deviation. Different superscripts (a,b) show statistically significant differences ($P < 0.05$).

Total counts of bacteria did not significantly differ depending on the species ($P > 0.05$), although mealworms contained rather lower total counts of bacteria than house crickets and superworms.

MALDI-TOF MS analysis results (shown in Table 3.) identified various species of bacteria, most notably nine samples of *Enterobacter aerogenes* in heat-killed superworms, six samples of *Acinetobacter baumannii* in heat-killed house crickets and five samples of *Staphylococcus kloosii* in fresh mealworms. While *S. kloosii* seemed to be eliminated by processing, *E. aerogenes* and *A. baumannii* showed their resistance to hot water. Stoops *et al.* (2016) detected the presence of staphylococci and *Enterobacteriaceae* spp. in samples of fresh mealworm larvae, which corresponds to our data showing the presence of *S. kloosii* and *E. aerogenes* in the samples of fresh mealworms.

Enterobacter aerogenes is a known nosocomial infection agent (Sanders and Sanders, 1997) and thus should be considered a potential threat during the processing of superworms. *Citrobacter amalonaticus*, found in raw house crickets, is a low-virulent member of the *Enterobacteriaceae* family and, due to its persistence in host organisms, it is associated with nosocomial infections (Pepperell *et al.*, 2002). *Acinetobacter baumannii*, found in heat-killed house crickets, is also a well-known opportunistic nosocomial pathogen (Antunes, Visca and Towner, 2014). Its antibiotic resistance has been well-studied (Peleg, Seifert and Paterson, 2008).

Table 3. Identification of isolated bacteria using MALDI-TOF MS.

Identified species	House crickets			Mealworms			Superworms		
	Fresh	Heat-killed	Dried	Fresh	Heat-killed	Dried	Fresh	Heat-killed	Dried
<i>Citrobacter amalonaticus</i>	1								
<i>Enterococcus termitis</i>	3								
<i>Acinetobacter baumannii</i>		6							
<i>Enterobacter aerogenes</i>				3			1	9	
<i>Staphylococcus kloosii</i>				5					3
<i>Bacillus subtilis</i>						1			
<i>Enterococcus dispar</i>						1			
<i>Acinetobacter pittii</i>						3			
<i>Citrobacter koseri</i>							1		
<i>Citrobacter braakii</i>							2		

Note: Values stand for counts of identified isolates by MALDI Biotyper RTC. Isolates matching the 'secure genus identification' and 'probable species identification' according the manufacturer's instructions were included.

4. Conclusion

The microbial composition of edible insects depends on the method of processing. Tested insect samples contained substantial amounts of microorganisms even when being heat-killed or heat-killed and subsequently dried by hot air. A combination of heat-killing and drying was proved to be a more effective method of treatment in comparison to only heat-killing, but additional processing steps to cut down the number of microorganisms in edible insects would be recommended.

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REDUCTION OF EMPLOYMENT AS THE WAY TO BALANCE PRODUCTION PROCESSES IN THE POLISH AGRICULTURE

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Annotation: The aim of paper is to present changes in labour inputs in Polish agriculture in view of economic, social and environmental goals of sustainable development. The share of individuals employed in agriculture in the total labour force employed in the national economy in Poland was over 2.5-fold higher than the EU-27 mean. The high employment rate in Polish agriculture is reflected in the offered low wages and as a consequence – the income per capita in farmers' households being lower than outside agriculture. Excessive labour resources in agriculture discourage farmers from any attempts to modernise the production system, since investments or the use of specialist service providers are rarely economically competitive in relation to the use of cheap labour resources (employed for low wages). In the analysed years the share of individuals employed in agriculture in the total labour force employed in the national economy was systematically decreasing. This was made possible thanks to the absorption of labour resources released from agriculture by non-agricultural sectors, the occupational deactivation of older farmers and economic migration abroad. Without a further reduction in employment in agriculture it is impossible to limit the income disparity between the farming population and the individuals earning their living outside agriculture. Additionally, attainment of economic and social goals of sustainable agriculture will also be hindered since land use and capital utilisation may not be optimised.

Key words: sustainable development, labour force in agriculture, hidden unemployment

JEL classification: J11, J21, J43

1. Introduction

See Only sustainable and socially responsible agriculture may meet the requirements imposed by the increasing global population. Although the Malthusian paradigm (Malthus, 1798) was refuted by the cultivation engineering, biological and organisational changes continuously occurring in agriculture (Holzer, 2003; Okólski, 2005), individual countries are facing various problems in their efforts to ensure food security for their populations. Since for some time now we have been observing threats resulting from the depletion of environmental resources, this has led to the development of the initial concept and later the paradigm of sustainable development (Meadows et al., 1972; Zegar, 2007; Żmija 2016). In contrast to the traditional focus on increasing yields and productivity, which is characteristic of industrial agriculture, the concept of sustainable development in relation to agriculture comprises three aspects: economic, social and environmental. Sustainable production may only be ensured when agricultural production utilises capital, labour and environmental resources in an optimal manner from the point of view of both the present and the future, yielding food of high nutritional, health-promoting value, provided in the quantities and of quality adequate to meet the needs of the population (Pawlak, 2008; Czyżewski, 2012). Experience of the developing countries indicates that neglecting any of the sustainability aspects over a longer time scale leads not only to high costs incurred in terms of the three above-mentioned areas, but also to failure of agriculture as a sector responsible for food production (Komorowska, 2014).

One of the aspects of sustainable development in agriculture is connected with the labour force employed in this sector. Overemployment prevents the realisation of economic goals related to sustainable development and hinders efforts to attain social goals as well as preserve environmental

resources. Also, overemployment makes it difficult to increase labour productivity in the agriculture⁷, especially in view of natural, market and institutional restrictions. As a consequence, income disparity persists between agricultural and non-agricultural employees. However, reduction of employment in agriculture is not easy to implement. While in the case of quality of food produced on farms and conservation of natural resources institutional instruments seem to have a relatively high impact, in terms of employment optimisation the most important factors include the potential to gain employment outside agriculture for the farming population and demographic changes (Kołodziejczak and Wysocki, 2015). As a rule they are factors lying outside the scope of agriculture itself. However, the situation in agriculture influences the employment rate in farms, since modernisation and retrofitting processes in this sector enforce gradual reduction of labour inputs. In a situation when despite the resulting low technological demand for labour the employment rate in farms remains high, we observe overemployment manifested in excessive employment of inefficiently utilised labour force, also referred to hidden unemployment or the so-called agrarian unemployment.

Thus we may tentatively state that in Poland reduction of employment in agriculture is the most difficult challenge faced by our country in the efforts to attain sustainable agricultural production, particularly in the economic and social aspects. Thus it seems advisable to investigate the scale and conditions determining the problem. For this reason, the aim of this paper is to present changes in the employment level in Polish agriculture in view of economic, social and environmental aims of sustainable development.

2. Materials and Methods

The analysis was conducted based on data provided by the Eurostat, the Main Statistical Office of the Republic of Poland, reports submitted from the Labour Force Survey (LSF) and the Institute of Agricultural and Food Economics, information from the Local Data Bank of the Main Statistical Office as well as literature on the subject. The method of deductive reasoning and comparative analysis were applied. Analyses concerned the volume, changes and structure of labour resources connected with agriculture in view of income disparity of the farming population and the scale of overemployment in agriculture. Also, an estimation was made of excess labour force in the Polish agriculture which could be released to non-agricultural sectors if the share of agricultural employees in the total population employed in the national economy was 5% (which is approximately the average level for EU-15 countries). The discussion was presented in view of the efforts to attain the model of sustainable agriculture, particularly in terms of the minimisation of agrarian unemployment and income disparity of the rural population. The time frame for the study covers the years 2002-2017.

3. Results and Discussion

In 2014 in the European Union there were 12801 thousand economically active individuals working in agriculture, which accounts for approx. 1.9% all economically active. Within this population as many as 28% (3367 thousand, 6.9% occupationally active in Poland) were connected with Polish agriculture (Table 1). These figures were the highest in the entire EU. In this respect a worse situation was only observed in Romania, while it was comparable in Bulgaria and Greece. In 2014 the share of employed in agriculture within the total number of individuals employed in the national economy in Poland was over 2.5-fold higher than the EU mean (Kołodziejczak, 2016a). The high employment rate in Polish agriculture is a consequence of the past conditions, the primarily fragmented land use structure and adherence to the concept of private ownership, which effectively prevented not only

⁷ The need for increase in agricultural labour productivity has been widely overlooked in recent policy, and there are considerable challenges in raising agricultural labour productivity (Doward, 2013). See also: Mikula (2017).

Soviet-style collectivisation of agriculture, but also voluntary association into production cooperatives and hindered other forms of cooperation⁸.

In 2010 in Poland there were 1506.5 thousand farms involved in farming activity, which accounted for 12.5% all farms in EU-27. At the same time the mean area of farms in Poland was 9.6 ha, while in EU-15 it was 23 ha and in EU-12 6.8 ha⁹ (EUROSTAT, 2018). The large number of small family farms is reflected in considerable labour resources connected with agriculture (Table 1). However, in the analysed years the situation in this respect has improved slightly. The number of landless unemployed was decreasing, while the number of employed was increasing. However, this resulted first of all from occupational deactivation (in the investigated period the population of landless economically inactive increased by 2061 thousand, to a considerable extent due to demographic factors). At the same time the employment status of the rural population connected with agriculture improved, as the unemployment rate and the number of economically inactive in that population decreased. Despite the general improvement of the situation on the labour market, in the case of women their economic inactivity continued to be the main problem.

Table 1. Population aged 15 and more in rural areas in terms of sex, employment on farms and economic activity

Specification	Total			Population connected with agricultural farms			Population not connected with agricultural farms		
	total	males	females	total	males	females	total	males	females
2002 ^a									
Total	11 512	5 692	5 820	6 729	3 396	3 333	4 783	2 296	2 487
Economically active population	6 329	3 552	2 777	4 035	2 269	1 766	2 294	1 283	1 011
Employed persons	5 078	2 892	2 187	3 495	1 971	1 523	1 584	920	663
Unemployed persons	1 251	660	590	540	298	243	710	363	348
Persons economically inactive	4 916	2 012	2 904	2 589	1 077	1 512	2 326	935	1 392
1st quarter 2017									
Total	12 171	6 030	6 142	3 826	1 973	1 853	8 345	4 056	4 289
Economically active population	6 883	3 967	2 915	2 581	1 502	1 079	4 301	2 465	1 836
Employed persons	6 472	3 735	2 737	2 493	1 457	1 035	3 979	2 278	1 701
Unemployed persons	411	232	179	89	45	44	322	188	135
Persons economically inactive	5 289	2 062	3 227	1 245	471	774	4 043	1 591	2 453

^a The division does not include people with an undefined status on the labour market.

Source: Labour Force Survey in Poland (2003). GUS, Warszawa; Labour Force Survey in Poland 1st quarter 2017 (2017). GUS, Warszawa.

Overemployment is reflected in low wages in privately-owned farms. Table 2 presents the proportion of the average monthly disposable income (per person) in farmers' households to the average monthly disposable income (per person) in households of other socio-economic groups: salaried employees, self-employed, and pensioners (retirees) and disability pensioners. As it may be observed, despite the fact that Polish agriculture has been included in the direct payment scheme, the proportion of average monthly income of farmers to those of the other groups presented in the Table did not improve markedly. The relative parity with farmers' income may be found only in the case of two

⁸ However, we need to indicate a considerable reduction of employment in Polish agriculture, as in 2002 it employed as many as 19.4% all employed in the national economy (www.europa.eu, accessed: 20-01-2018 r).

⁹ It needs to be stressed here that the low figure for EU-12 is strongly influenced by the greatly fragmented agrarian structure in Romania, Bulgaria and Slovenia, while e.g. in Slovakia the mean farm area in that period was over 77 ha.

groups: manual workers and disability pensioners. In 2004 the farmer's income per capita was equivalent to 51% income of employees other than manual workers. This percentage share by 2015 increased to 59%, while it was highest in 2013, when it amounted to 68%. In relation to the self-employed, disposable income per capita in farmers' households was equivalent to approx. 60%, while in comparison to pensioners it ranged from 61% in 2004 to 69% in 2015. In all the groups the analysed relation was most advantageous for farmers in the years 2006-2013.

Excessive labour resources connected with agriculture discourage farmers from undertaking efforts to modernise production methods, since investments or use of professional service providers are rarely economically competitive in relation to the cheap labour resources (employed for low wages), particularly if it is labour performed by the farmer and family members helping them, while an increase in its input causes no changes in the actual costs incurred. The number of persons in the farmer's household is relatively constant and the actual share in the production process for some or all the individuals does not change the combined income from the farm to its division between household members, or the number of individuals, between whom this income should be divided. It is obviously both a conservative and over a long-term period irrational farm management strategy, while its adoption may result from a lack of knowledge, qualifications, capital or (more frequently) from a lack of opportunities to find employment outside the farm.

Table 2. The proportion of average monthly disposable income (per person) in farmers' households to average monthly disposable income (per person) in households of other socio-economic groups (%)

years	Households							
	total	employees			Self-employed	Pensioners and disability pensioners		
		total	Positions			total	Pensioners	disability pensioners
			Manual workers	Other than manual workers				
2004	74	69	97	51	58	61	62	88
2005	80	78	107	57	62	76	69	97
2006	83	83	111	61	63	79	73	101
2007	91	93	121	69	68	87	85	112
2008	85	85	109	64	66	86	81	111
2009	79	79	102	59	63	79	75	102
2010	86	85	114	64	63	87	82	111
2011	80	79	105	61	66	80	76	102
2012	85	85	113	64	71	84	80	110
2013	89	89	117	68	73	87	82	115
2014	78	78	101	61	64	76	72	98
2015	75	75	97	59	60	73	69	94

Source: IAFE, 2016.

Due to the limitations related with natural resources, market and institutional aspects, income from agricultural production may not be increased to a degree facilitating a marked reduction of income disparity between the farming population and the population earning their living from employment outside agriculture. For this reason the only method to achieve this goal is to reduce employment in agriculture. Otherwise the economic and social goals for sustainable agriculture may not be attained, since the use of the other production factors, i.e. land and capital, may not be optimised. The attempt to limit the negative impact of agricultural production on the natural environment will also be hindered, since refraining from retrofitting and modernisation means that rather obsolete, more harmful production technologies and techniques may still be extensively used.

Earlier studies indicate that the process of reducing employment in this sector is determined by demand for labour in non-agricultural sectors and structural adaptation of this demand to characteristics of the rural population, particularly the group connected with agriculture (Kołodziejczak and Wysocki, 2015). In order to attain labour efficiency and thus the level of income from agriculture per capita comparable to that in EU-15 it seems necessary to reduce employment in this sector in Poland to the level characteristic of these countries. There are many premises of economic and technical nature, suggesting advisability of such an assumption. However, in the case of reduction of employment in agriculture it needs to be remembered that this sector continues to serve as a buffer for this portion of the labour force, which may not effectively compete on the non-agricultural labour market (Frenkel, 2013). As such it also serves a social function.

Hidden unemployment is observed due to a lack of opportunities to find employment for the rural population outside agriculture, at the simultaneous income barrier related with the lack of chances to considerably increase profitability of farms. The high employment rate in agriculture results in a large burden of farms with incurred wage costs and potential problems on the labour market in the case of institutional stimulation to reduce employment in agriculture (Kołodziejczak 2016a). Table 3 presents the volume of labour resources, which would have to be released from Polish agriculture for the level of employment in this sector to be comparable to the level characteristic of the EU-15 countries (a rather lenient level of 5% all employed in the national economy was adopted).

Table 3. The total number of employed in Poland and the number of employed in agriculture, exclusion rate* and reduction of employment on farms in 2005-2015 - the initial status and data for the level of employment in agriculture of 5% all employed in the national economy.

List	2005	2010	2015
Initial status (actual values)	17.3%	12.3%	11.5%
Employed	13940	15627	15073
Including those working in agriculture	2411	1917	1736
Exclusion rate	54.5	49.3	47.6
At 5% employment rate in agriculture			
Employed	12226	14491	14091
Including those working in agriculture	697.0	781.4	753.7
Exclusion rate	60.1	53.0	50.7
Reduction of employment on farms	1714.0	1135.7	982.4

* the sum of the number of unemployed and economically inactive to the total number of economically active individuals (or simply: 100% minus the value of the employment-to-population ratio).

Source: Local Data Bank (accessed: 20.11.2016) and the author's calculations.

In the analysed years the share of those working in agriculture in the total number of employed in the national economy was decreasing systematically from 17.3% in 2005 to 11.5% in 2015, thanks to the economic development of Poland and structural changes in the rural areas. Thus the scale of reduction in employment in agriculture, required to reach the 5% level, was decreasing as well. The developing economy provided new jobs, which facilitated a systematic increase in the number of people working outside agriculture. A factor additionally stimulating decrease in employment on farms was connected with greater mobility of young people (gaining education outside their family towns and migrating either to cities or abroad in search of employment) as well as gradual deactivation of elderly individuals connected with the farms, who were retiring or becoming disability pensioners. This unique generational transformation frequently resulted in the liquidation of smaller, semi-subsistence farms and buyout of their land by economically stronger farms, carrying lesser burdens of inefficient overemployment (Kołodziejczak and Wysocki, 2015). The number of employed in agriculture at the reduction of employment in this sector to 5% of all employed in the national economy would have decreased on the national scale by 1714 thousand individuals

in 2005 and by 982.4 thousand individuals in 2015. Such a radical reduction of employment in agriculture, without a simultaneous, adequately rapid creation of jobs outside agriculture (or EU-15 countries facilitated a considerable relief of agriculture from overemployment. Modernisation of agriculture and increased land consolidation, resulting in a lesser actual demand for labour financed to a considerable extent from CAP funds and EU structural programmes, additionally stimulated the processes releasing labour resources from privately-owned farms. Decoupled payments also had an adverse impact on the release of excess labour force, especially as regards the structural aspect of this process. From the perspective of people related to economically non-viable farms, they played a similar role to unemployment benefits by reducing the incentive to seek jobs (Kołodziejczak, 2016b). Note also the research by Góral and Rembisz (2018) who indicate that remunerations in the agricultural sector are too high in relation to the actual productivity of labour. They also place focus on the adverse impact of these developments on the reallocation of labour force from the agriculture to more efficient sectors (industry and services). Thus at the same time labour resources released from agriculture were absorbed by non-agricultural sectors, while technological and organisational foundations were established to show a lack of feasibility of overemployment on farms. Despite these positive developments, the gap with the “5%” level continues to be relatively large on a countrywide basis. However, the situation varies from one voivodship to another (Kołodziejczak 2016a). Because of labour migration and rapid economic growth, in addition to areas characterized by high rates of agrarian unemployment, there are voivodships where agricultural production largely depends on foreign employees, mainly Ukrainians (Górny and Kaczmarczyk, 2018).

4. Conclusion

The aim of this paper was to present changes in labour inputs in Polish agriculture in view of economic, social and environmental goals of sustainable development. Based on the analysis the following observations and conclusions may be formulated:

1. Polish agriculture employs almost 1/3 of the total economically active population connected with agriculture in the EU-27. The share of individuals employed in agriculture in the total number of employed in the national economy in Poland was over 2.5-fold greater than the EU-27 mean. In this respect a worse situation is observed only in Romania, while it is comparable in Bulgaria and Greece.
2. The high employment level in Polish agriculture is reflected in low wages and as a consequence – in the income per capita in farmers' households being lower than outside agriculture. Despite the fact that Polish agriculture has been included in the direct payment scheme, the proportion of average monthly income of farmers to the income of individuals earning their living outside agriculture and transfers did not improve markedly in the analysed years.
3. Excessive labour resources connected with agriculture discourage farmers from attempts at modernisation of production, as investments or hiring professional service providers are rarely economically competitive in comparison to cheap labour resources (hired at low wages), particularly when this is own labour of the farmer and family members helping on the farm and increasing this labour input does not change the actual incurred costs.
4. In order to attain labour efficiency and at the same time to reach the per capita income from agriculture at the level of the EU-15 countries it would be necessary in Poland to reduce employment in this sector to the level characteristic of those countries. In the analysed years the share of employed in agriculture in the total number of employed in the national economy was systematically decreasing. This was facilitated by the absorption of labour resources released

from agriculture by non-agricultural sectors, occupational deactivation of older farmers and economic migration abroad.

5. It will be impossible to reduce income disparity between the farming population and the population earning their living outside agriculture without a further reduction of employment in agriculture. Attaining economic and social goals of sustainable agriculture will also be hindered, since otherwise land use and capital utilisation may not be optimised. The adverse effect of cheap labour on the rate of farm modernisation and retrofitting will also hinder the elimination of the negative impact of agricultural production on the natural environment.

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FOOD SELF-SUFFICIENCY IN EU COUNTRIES: AN ATTEMPTED PROJECTION TO 2080

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Annotation: Ensuring food security is a major problem of the contemporary world. The research problem analysed within this study was connected with a tentative answer to the question whether and to what extent agricultural production of individual EU-28 countries guarantees food self-sufficiency at present and may do so in the future. The aim of this study was to investigate the diverse agricultural production levels in EU countries in view of the potential permanent food self-sufficiency. The study was conducted using the deduction and comparative methods based on FAOSTAT, EUROSTAT and BFCN data as well as literature on the subject. The largest food producers in UE-28 are the countries belonging to the EU-15 group: Germany, Italy and Spain, and in the case of some products also Great Britain. Among the EU-13 countries only Polish agriculture has reached the volume of agricultural production comparable to the level in those countries. As a whole the EU-28 group as well as its "old" part, i.e. EU-15, and the "new" part (EU-13) presently are and until 2080 will continue to be self-sufficient in terms of food production. The only exception in this respect is fruit, the demand for which within the forecasted period is and will still be covered by internal EU production in approx. 2/3 in the EU-15, at the forecasted surplus in 2080 in the EU-13 countries. The degree of self-sufficiency varies in individual EU countries. Thus it is necessary to ensure effective mechanisms for surplus reallocation to regions suffering from shortages thanks to promotion of exchange of goods within the EU, while maintaining economic, social and natural sustainability of agricultural production.

Key words: agricultural production, food security, food self-sufficiency.

JEL classification: Q10, Q18.

1. Introduction

Assurance of food security is a major problem faced by the modern world. In simple terms we may assume that it consists in ensuring physical availability of food, economic availability of food and food safety (Mikuła, 2012). According to FAO (2014), food security is a situation when all people at all times are provided with physical, social and economic access to sufficient, safe and nutritional food, satisfying their nutritional needs and preferences required to conduct active and healthy lives. This paper focuses on the first pre-condition for food security, i.e. the potential assurance of physical availability of food. Physical availability may be attained by producing food within one's country or by imports. In the case when the needs of the country's population are satisfied, surplus production may be exported. It is one of the reasons why it is crucial to ensure food self-sufficiency. As it was reported by Pawolek (2015) after Małysz (2008): food self-sufficiency was simplified to an element of physical availability of food, i.e. provision of staple foodstuffs, based on international markets for raw materials and final food products. However, no attempts are made to achieve autarky in terms of providing all food products and nutrients. Thus potentially individual countries have at their disposal surpluses of certain food products, at the same time experiencing shortages of other food products.

Food production is mainly limited by land resources, followed by land productivity. Most countries around the world are incapable of ensuring self-sufficiency due to lack of natural resources. Therefore, even a self-sufficient country should not rely exclusively on domestic production (Gołębiowska and Stefańczyk, 2017). Although global food demand is going to increase in the next

decades, that process will vary from one region of the world to another and from one product to another. Apart from areas with a relatively stable population size there are countries and continents, in which the population is growing rapidly. Thus we face the need to ensure proper nutrition for the increasing population within individual countries, continents as well as the global scale. According to forecasts, in order to meet the global food requirements, the volume of food production must increase by 70% by 2025. Another issue is to ensure safety of food produced and devise a delivery method that makes food available to the population at different levels of development and income. Therefore, in addition to ensuring physical and economic availability of food, problems related to food distribution and safety need to be identified (Marvin et al., 2009, Gołębiowska and Stefańczyk, 2017).

The research problem investigated in this study was connected with the attempt to determine whether and to what extent agricultural production in individual EU-28 countries currently ensures their food self-sufficiency and whether it will do so in the future. The European Union produces food for its own needs and for exports. After satisfying the food demand of its population the EU may become in the future a leading exporter of food to the regions of the world suffering from malnutrition or famine. The aim of this study is to investigate the varied levels of agricultural production in EU countries in view of the potential to ensure sustainable food self-sufficiency.

2. Materials and Methods

The study was conducted using the deduction and comparative methods based on data provided by FAOSTAT, EUROSTAT and BFCN as well as literature on the subject. Values of the index of food self-sufficiency were estimated based on the mean food production food in the years 2011-2013 and mean consumption in that period corrected by the change in the population size, which took place by 2016. Moreover, the paper presents also values of this index calculated for the year of 2080 following the population forecast showed by EUROSTAT. The EUROSTAT forecast includes foreseeable changes in the scope of natural movement of population, migration and other socio-economic variables. Due to the very long, more than 60-year time frame of the forecast, it can be treated only as an approximation of the future real state, and thus, the food self-sufficiency indicators calculated on this basis are only a possible but not a certain picture of the future reality. However, it is difficult to look for more reliable projections, because in such a long period the impact of variables, for which it is not possible to estimate the statistical probability, can be decisive (as the time horizon increases, the random factor affects the forecast results more)¹⁰. For the same reason, the simplifying assumption was made that the volume of agricultural production in 2080 and consumption per capita will be identical to those means in the years 2011-2013¹¹.

3. Results and Discussion

The potential to ensure self-sufficiency depends first of all on the volume of agricultural production as well as the level of food demand. The volume of production is dependent on the agriculturally utilised area, intensity of land use and productivity. The level of demand depends on the volume and structure of consumption resulting from the number of inhabitants and their food preferences, as well as the level of food waste. In 2013 in the entire EU approx. 40% total land area was utilised

¹⁰ Adopting of the simplifying assumptions is necessary in this study, just like in almost every case of attempting to predict a distant future. For example, the authors of the report "The Limits to growth" (Meadows et. al 1972), went this way, recognizing properly that the more specific analysis is not justified in this case.

¹¹ This is only an assumption adopted for the purpose of the projection. The possibility of increasing the agricultural production is positively influenced by agrotechnical progress, but at the same time there is a loss of land related to the industrialization and suburbanisation. Production capacity is also institutionally restricted by the CAP regulations. Similarly, the size and structure of individual consumption is influenced by biological and cultural factors, non-quantifiable in the long-term perspective. Therefore, in the absence of reliable estimators, it was assumed that the food production and per capita consumption are constant.

agriculturally. Land and labour productivity are increasing systematically, particularly within the EU-13; however, the level of efficiency is still lower in those countries than in the EU-15 (Nowak, 2011). Considerable differences are also found in terms of food waste. It is estimated that within the entire EU-28 in 2012 approx. 20% total food produced was wasted, amounting to 88 million ton (173 kg per capita)¹². Sources of food losses and waste in the European Union are connected with all the stages in the food production and distribution chains. Households waste 53%, the processing industry 19%, the catering industry 12%, food production 11%, while wholesale/retail and distribution channels account for 5% food waste (BFCN, 2016). The European Union is a diverse entity. It comprises countries differing in their history, cultural patterns, economy and natural conditions. Among other things these factors affect the potential for development in food production as well as the volume and structure of food demand. It is impossible to eliminate differences concerning productivity of agriculture in individual countries, similarly as it is not feasible to unify the volume and structure of consumption for individual food products. However, the co-existence within the EU facilitates exchange of agri-food products between individual member countries within the common EU market. Thus it may be assumed that despite the above-mentioned differences the problem of food security, or in a narrow sense, food self-sufficiency may be investigated at the level of the entire EU, even when the situation in some of the member countries varies.

Table 1 presents the mean volume of agricultural production in individual EU-28 countries in the years 2011-2013. It clearly shows that the EU-15 countries produced much bigger volumes of food than the EU-13 countries. France and Germany were the largest cereal producers, while among the EU-13 countries the greatest quantities were produced in Poland. The largest amounts of fruit were produced in Italy, Spain, France and in Poland. Similarly as in the case of fruit, leaders in the production of vegetables included Italy and Spain as well as Poland and France. France was the largest potato producer, followed by Germany, Spain, Italy and Poland. In the case of meat Germany ranked first, followed by France, Spain, Poland and Great Britain. The largest amounts of milk were produced in Germany and France, followed by Great Britain, Poland, Holland and Italy. France was the largest producer of eggs, followed by Germany, Italy, Spain, Holland, Great Britain and Poland. In this way we may identify the leaders in agricultural production within the EU-27. They are primarily countries belonging to the EU-15, i.e. France, Germany, Italy and Spain, while in the case of some products it is also Great Britain. Among the EU-13 countries only Polish agriculture reached the volume of agricultural production comparable to that of the above-mentioned countries.

Agricultural production through respective distribution channels reaches consumers in individual countries. The volume of food demand depends on the population size, nutritional needs and the structure of preferences for individual agri-food products. In 2016 the EU-28 population was 510.3 million, of which 239.9 million people lived in the UE-15 countries and 270.4 million in the UE-13. In 2080 it will be 572.6 million, 297.2 million and 275.3 million people, respectively (EUROSTAT, 2017). Thus the total EU-28 population will increase by 12.2% (Table 2). However, it may be stated here that this increase will concern first of all the EU-15 countries, in which the population will increase on average by 23.9%. At the same time, the population size in the EU-13 will increase by as little as 1.8%. The highest population growth rate is forecasted for Luxemburg Sweden, Ireland, Great Britain and Belgium. In turn, the greatest population losses will affect Lithuania, Bulgaria, Latvia and Greece. Slightly smaller, but still high reduction in the population size is forecasted for Portugal, Romania, Poland and Croatia. Such large losses may be termed

¹² This estimate refers to the year 2012 and covers both edible food and inedible food by-products.

as demographic disaster for these countries. As the data clearly show, this phenomenon will affect mainly the EU-13 countries.

Table 1. Agricultural production in EU countries, means in the years 2011-2013 (thousand tons)

Country	Cereals	Fruits	Vegetables	Potatoes	Meat	Milk	Eggs
EU-28	296425	60416	66735	141192	45059	156205	6816
EU-15	208829	51501	53947	85937	37779	126702	5353
EU-13	87596	8915	12787	55255	7280	29504	1462
Austria	5354	1096	640	2363	908	3392	106
Belgium	2998	551	2331	1960	1784	3225	166
Bulgaria	7869	454	487	2937	218	1278	73
Croatia	2903	399	211	1171	199	789	38
Cyprus	72	164	110	116	89	207	10
Czech Republic	7469	238	196	2635	528	2811	123
Denmark	9138	69	294	3167	1980	4994	80
Estonia	913	6	78	332	71	729	11
Finland	3801	21	265	1362	389	2309	64
France	67440	8522	5440	27134	5709	24916	886
Germany	45025	2492	3610	17042	8264	30797	774
Greece	4789	3516	3745	4017	437	1971	96
Hungary	12550	1188	1428	5056	853	1771	140
Ireland	2348	56	233	879	927	5503	47
Italy	18274	16227	13870	16124	4169	11114	765
Latvia	1828	16	157	667	80	878	41
Lithuania	4119	73	300	1497	208	1762	48
Luxembourg	159	16	1	59	21	296	2
Malta	14	10	80	35	14	45	4
Netherlands	1699	693	4937	2443	2683	12054	689
Poland	27744	3844	5618	12402	3766	12618	555
Portugal	1171	1692	2664	1842	762	1949	123
Romania	18175	2195	3899	8090	969	5052	318
Slovakia	3388	117	148	1218	156	955	80
Slovenia	551	210	73	278	129	608	21
Spain	21373	16104	12898	16792	5619	7407	761
Sweden	4899	49	395	1781	508	2900	122
United Kingdom	20361	397	2624	7794	3618	13876	672

Source: the author's calculations based on FAOSTAT data (2018)

Table 3 presents values of the index of food self-sufficiency estimated based on the mean food production in the years 2011-2013 and the mean consumption in that period, corrected by the change in population size recorded by 2016. The values of this coefficient calculated for the year of 2080 following the EUROSTAT population forecast were also presented. In this case the analysis does not take into consideration agrotechnical change or the loss of land excluded from agricultural production and allocated for residential, industrial and infrastructure development. Other factors may not be considered over such a long timeframe, as they are unpredictable, such as e.g. climate change, natural disasters, wars, etc. Analysis of data contained in Table 3 indicates that the EU-28 as a whole as well as its "old" part (EU-15) and the "new" part (EU-13) currently are and to a large extent will continue to be self-sufficient in terms of food supply. The only exception is fruit, the demand for which is now

covered and in the period of this forecast will be satisfied by the production within the EU in approx. $\frac{3}{4}$ in the EU-15, at the predicted surplus in 2080 in the EU-13 countries. Apart from countries with a relatively small area and a considerable increase in population size the situation in terms of food self-sufficiency will not change markedly. Luxemburg and Malta will experience shortages in practically almost all agricultural products. Thus shortage will appear in the countries, in which the population will increase considerably. These shortages may be compensated for within the EU by excess food production in the countries suffering from depopulation.

Table 2. Projected population change, 2016-2080

Country	Change (%)	Country	Change (%)	Country	Change (%)
EU-28	12.2	Finland	1.6	Netherlands	16.2
EU-15	23.9	France	17.9	Poland	-23.5
EU-13	1.8	Germany	-5.3	Portugal	-26.7
Austria	15.9	Greece	-32.6	Romania	-26.5
Belgium	25.4	Hungary	-11.6	Slovakia	-13.1
Bulgaria	-35.8	Ireland	31.7	Slovenia	-6.1
Croatia	-21.8	Italy	-11.3	Spain	9.8
Cyprus	18.5	Latvia	-34.8	Sweden	46.1
Czech Republic	-7.4	Lithuania	-42.6	United Kingdom	26.1
Denmark	20.2	Luxembourg	85.1		
Estonia	-13.3	Malta	19.1		

Source: EUROSTAT (2017)

Thus it may be stated that while the level of food self-sufficiency varies in individual countries, the EU as a whole is relatively safe in this respect. The extent of stability in the case of food security depends on the provision of efficient mechanisms for surplus reallocation to the areas suffering from shortages. This is not equivalent to any proposal for to introduce any institutional reallocation mechanisms. Such ideas were implemented in many communist countries and inevitably ended with a decline of agriculture and in extreme cases - in famine and civil war. However, at the level of the EU institutions it is recommended to promote internal exchange of goods, while maintaining economic, social and natural sustainability of agricultural production. Assuming that, in the long term, the European Union is committed to convergence of many operational areas and makes efforts to ensure similar conditions for the functioning of economic operators and households in all member countries, it does not seem justified for each separate country to pursue the objectives of food self-sufficiency. Under some circumstances, it may be reasonable for certain products on a transitional basis (Woś, 1998; Baer-Nawrocka, 2014). However, because of various reasons including the specificities of different countries (mainly in terms of natural conditions) and in view of various comparative costs of production, national self-sufficiency is not justified in the long term, especially if food may be traded with other countries on a relatively unrestricted basis. Thus, without prejudice to the economic separateness and autonomy of Community countries, focus should rather be placed on self-sufficiency within the EU, having in mind its production potential and competitive position against non-member countries. Also, potential reserves should be identified which may be used provided that greater rationalisation efforts are made in the course of food production, processing, distribution and consumption. If in accordance with the proposals contained in the report by the MEP Biljana Borzan (S&D, Croatia), presented in April 2017 at the European Parliament¹³ the level of food

¹³ For more detail see: Initiative on resource efficiency: reducing food waste, improving food safety (2016) and Borzan (2017).

waste was reduced by half (i.e. from 20% to 10%), the European Union could become a significant net food exporter, with no need to increase cropped area or production intensity.

Table 3. Indexes of food self-sufficiency for EU countries, the current status and forecast for 2080 (%)

Country	Cereals		Fruits		Vegetables		Potatoes		Meat		Milk		Eggs	
	2016	2080	2016	2080	2016	2080	2016	2080	2016	2080	2016	2080	2016	2080
EU-28	108	106	77	74	101	101	104	102	106	103	111	108	101	98
EU-15	99	92	74	70	102	97	105	95	107	99	110	102	98	90
EU-13	135	173	95	120	97	125	99	129	101	127	114	146	116	147
Austria	102	88	60	52	62	53	91	79	114	99	129	112	82	71
Belgium	39	31	62	49	127	101	183	146	225	179	101	81	98	78
Bulgaria	221	344	67	105	82	127	72	113	55	85	94	146	110	171
Croatia	114	146	75	95	60	77	80	102	73	93	81	104	98	125
Cyprus	22	19	190	161	109	92	298	251	107	91	122	103	117	99
Czech Republic	146	158	30	33	25	27	83	89	66	71	123	133	86	92
Denmark	110	91	10	8	44	36	103	86	352	293	231	192	82	68
Estonia	135	156	6	7	51	59	81	94	77	89	152	175	65	75
Finland	116	114	4	4	53	52	92	90	91	90	97	96	114	112
France	180	153	57	49	71	60	114	97	95	81	134	113	94	79
Germany	113	120	28	30	42	44	126	134	114	121	130	138	71	75
Greece	88	131	165	245	113	168	80	119	51	76	63	94	91	134
Hungary	182	206	120	136	143	162	84	95	123	140	99	112	98	111
Ireland	67	51	7	5	44	34	52	40	238	181	222	169	89	67
Italy	71	80	113	128	139	157	51	58	80	90	68	77	96	108
Latvia	209	321	15	23	67	102	102	156	62	96	168	257	144	221
Lithuania	197	343	42	73	80	139	95	166	94	165	143	249	115	201
Luxembourg	75	40	12	6	2	1	48	26	37	20	168	91	26	14
Malta	9	7	23	20	79	66	54	45	33	28	42	35	79	66
Netherlands	15	13	24	20	296	255	205	176	182	157	185	159	225	193
Poland	105	137	136	177	111	144	103	135	127	166	119	155	148	194
Portugal	25	34	81	111	134	183	50	68	80	110	84	114	108	147
Romania	148	201	91	124	101	138	107	146	93	126	103	140	109	148
Slovakia	116	134	32	36	35	41	58	67	52	60	102	117	99	114
Slovenia	65	69	67	72	40	43	58	62	80	86	112	119	93	99
Spain	70	64	168	153	179	163	62	56	127	116	71	65	111	101
Sweden	108	74	4	3	37	25	73	50	63	43	85	58	90	62
United Kingdom	89	71	5	4	38	30	73	58	66	52	79	63	85	67

Source: the author's calculations based on data of EUROSTAT (2017) and FAOSTAT (2018)

4. Conclusion

The discussion presented in this paper leads to the formulation of the following observations:

1. The largest food producers in the EU-28 are countries of the EU-15, i.e. France, Germany, Italy and Spain, and in the case of some products also Great Britain. Among the EU-13 countries only Polish agriculture has reached the volume of agricultural production comparable to that in the above-mentioned countries. The EU-28 as a whole as well as its "old" part (EU-15) and the "new" part (EU-

13) currently are and by 2080 will remain self-sufficient in terms of food supply. Fruit production is the only exception in this respect, as the demand is covered and in the timeframe of this forecast will continue to be covered by the EU production in approx. $\frac{3}{4}$ in the EU-15, at the forecasted surplus in 2080 in the EU-13 countries.

2. While the level of food self-sufficiency varies in individual EU-28 countries, the problem of food self-sufficiency should be considered at Union-wide level. Under some circumstances, the commitment to food self-sufficiency at national level may be reasonable for certain products on a transitional basis. However, because of agricultural specificities of different countries and in view of various comparative costs of production, national self-sufficiency is not justified in the long term, especially if food may be traded with other countries on a relatively unrestricted basis. Thus it is necessary to provide efficient mechanisms for surplus reallocation to areas suffering from shortages by facilitating exchange of goods within the EU, while maintaining the economic, social and natural sustainability of agricultural production.

3. Also, the high level of food waste in the European Union (reaching 20%) suggests there is an opportunity to address more fully the population's food requirements and to increase exports to non-member countries, provided that greater rationalisation efforts are made in the course of food production, processing, distribution and consumption processes.

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CRITICAL CONTROL POINTS DESIGN FOR MONITORING HACCP REQUIREMENTS

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Annotation: The HACCP (Hazard Analysis and Critical Control Points) is a precautionary approach to food safety from the biological and physical risks during production processes that can outlet the unsafe food product. Another benefit lies in measures estimation to minimize the risks to a safe level. The HACCP methodology can be used at any steps of a food production sequence, from food preparation processes to packaging and final distribution. There are seven HACCP principles, which are described in the international standard ISO 22000 FSMS (2011). The paper objective is to design the critical control points monitoring requirements (the fourth HACCP principle) for the meat-processing industry. Data is obtained in the processing of sausage in MP Krasno Company, Limited. The methodology is based on the two regression models designs to describe the progress of transmitted pathogens (bacteria, viruses, and fungus) that can result in the disease or death of the person. The second model describes the rate of sterilization after the control measurement. These two variables are put into balance, and then we have determined constant of a random vector cover the entire incidence of pathogens by using the integral calculus of more variables. We have equilibrated these two variables and then determined a constant by using the integral multiplicity of functions covering the entire random vector of the pathogens.

The constant is covering the random vector of the pathogens and can be used to determine control area monitoring in the fourth HACCP principle. We have formulated two research questions to verify the practical benefits. First, we focused on the use of a factorial design to reduce the occurrence of pathogens, and then we investigated the use of the random vector M region to downsize the production variability. We statistically verified the answers to these questions. The designed checkpoints area M was applied in the production process of MP Krasno.

Key words: food safety, control points, HACCP, integral multiplicity

JEL classification: Q16

1. Introduction

HACCP is an approach where food safety is deal through the control and analysis from of physical, biological and chemical risks from natural stuff production, acquirement. Besides these, the HACCP approach is handling, from manufacturing to distribution and consumption of the food product. There is a strong dedication to the managers for successful implementation of a HACCP plan into the everyday practice. A company engagement to HACCP by the managers gives company operators with an understanding of the significance of safe food production (Tobias at al, 2014). The HACCP design can be widely used for any segments in the food production from growing to arranging food for consumption (Roncesvalles et al, 2016).

Essential programs (eg Good Manufacturing Practices) are a crucial framework for the food quality development through implementation of the HACCP concept. Food safety rules based on the HACCP approach have been successfully used in food processing manufactories and food service regulations. The food industry around the world completely admits the well known seven of the HACCP principles (Garmendia et al, 2016).

Principle 1 - Conduct a Hazard Analysis. The application of this principle suggests listing the steps in the process and identifying where significant hazards are likely to occur; Principle 2 - Identify the Critical Control Points. A critical control point (CCP) is a feature, at which direction can be applied, and a food safety risk can be eliminated or reduced to acceptable levels. Principle 3 -

Establish Critical Limits. A critical limit (CL) is the maximal and minimal values to which a physical or biological, parameters must be controlled to prevent or to eliminate. The critical limits are normally measures such as time, temperature, water activity (A_w), pH, weight; Principle 4- Monitor CCP. The HACCP team will describe monitoring procedures for the measurement of the critical limit at each critical control point. Monitoring scheme should define who is responsible for the measure and how frequently the analysis is practiced during food production (Lu et al, 2015). Principle 5 - Establish Corrective Action. Corrective action is the procedure that is performed when a deviation occurs in a specific limit. Principle 6 – Verification; These activities determine the validity of the HACCP program and whether this approach is running according to the HACCP standards; Principle 7 – Recordkeeping. An essential part of the HACCP plan is information for the improvement of the food production safely (Allata et al, 2017). The files also need to incorporate information about the product description, flow diagrams, the hazard analysis, critical limits, monitoring system of the HACCP plan (Lamboni et al, 2014).

Principle 3: Establish Critical Limits is often the most problematic principle (due to the difference of the input raw material and the difference in the technological process) (Garayoa, 2017). For this reason, the proposed part of the article focuses on identifying the process of identifying food production technology limits, covering the entire random vector of the pathogens. Identification of critical limits will be presented in the case study of the production of sausages.

Research questions

To determine the Establish Critical Limits HCCAP regulation, we can use the area an area (denoted below in M) that consists of the output variable from the heat treatment of the sausages y . In this mode of regulation, we can substantially improve (statistically significantly reduce) the variability in the quality of sausage production regarding the number of pathogens and taste properties.

To verify the research question, we will create a zero hypothesis:

H_{01} : The M area (designed in the smoked quality control article) has no statistically significant effect on the quality of production variability

H_{11} : The M area (designed in the smoked quality control article) allows statistically significant influence on the quality of production variability.

Factorial design can be used to optimize (minimize) pathogens in sausages by setting technological parameters.

To verify this second research question, we will create a zero hypothesis

H_{02} : The full factorial design of technological factors has no statistically significant effect on the mean value of pathogens in sausages.

H_{12} : The full factorial design of technological factors has a statistically significant effect on the mean value of pathogens in sausages.

2. Materials and Methods

The Critical Limits methods are used to determine non-stationary heat conduction in a low thermal resistance body (food/sausages). In these cases, the temperature of the food that affects the concentration of the pathogens in the food) is far too unrelated to the coordinates (i.e., the negligible heat conduction velocity is insignificant). After integrating the Fourier equation according to the volume of the heat conducting food (according to the Sestak et (2017)), we get the equation:

$$\rho c_p \frac{dT}{dt} V = \alpha (T_f - T) S \quad (1)$$

Where V is the volume of food, S is food surface, α is the coefficient of convective heat transfer, T_f is the ambient temperature.

To find the temperature in the cross-section of the food T , then by adjusting (1) we get:

$$\frac{dT}{T - T_f} = - \frac{\alpha S}{\rho V c_p} dt \quad (2)$$

This equation can be integrated:

$$\int_{T_0}^T \frac{dT}{(T - T_f)} = - \frac{\alpha S}{\rho V c_p} \int_0^t dt \quad (3)$$

And we will get:

$$\frac{T - T_f}{T_0 - T_f} = e^{-\frac{\alpha S}{\rho V c_p} t} \quad (4)$$

To verify the research questions and verify the normality of the obtained data, we perform two parametric tests. First, we use the F-test (Fisher's test) to verify the variability reduction. Then we will use the Student's T-test to confirm the decline of the pathogens in the sausage (a more detailed description of these tests can be found eg in Sleeper, 2012; or Kaba and Svatosova, 2012).

The F -test of imbalance reduction in terms of the quality of production is defined as follows:

$$F = \frac{n_1 \times (n_2 - 1) \times S_1^2}{n_2 \times (n_1 - 1) \times S_2^2} \quad (5)$$

Which has a Fisher–Snedecor distribution of $F(n_1 - 1, n_2 - 1)$.

If $F > F_{\frac{p}{2}}(n_1 - 1, n_2 - 1)$, we reject the hypothesis H_0 (H_1 is accepted). In this case, we chose a significance level of $p = 0.05$.

The T-test is to verify a significantly reduced mean value of the pathogens due to the factorial design of technological factors. The distribution is based on the $N(\mu; \sigma^2)$ basic set with n range with M - mean M value and S^2 dispersion.

Zero hypothesis:

$$H_0: \mu = \mu_0$$

Alternative hypothesis:

$$H_1: \mu \neq \mu_0$$

Test criterion:

$$T = \frac{M - \mu_0}{S} \times \sqrt{n - 1} \quad (6)$$

has a Student's distribution $t(n-1)$.

If $|T| > t_p(n-1)$, we reject the hypothesis H_0 (we accept H_1).

3. Results and Discussion

Results

The first step in the factorial experiment was to detect the factors and interactions influencing the mean of the number of pathogens responses. The results of the experiment are shown in Table 2. For the significance test, a significance level of $\alpha = 5\%$ (0.05) was selected. Then, if the p-value was less than the significance level (0.05), then the factor or interaction was statistically significant. This experiment showed that the main effects of heating time [min]; operation temperature [$^{\circ}\text{C}$] and no interaction effect were statistically significant. This finding is further supported by a Pareto plot (see Figure 1) and Normal plot of the standardized effect (see Figure 2).

In the Pareto plot (Figure 1), any factor or interaction effect extending past the reference line is considered significant. The calculated effect factor in the coded values (response factor to a change from -1 to $+1$) is shown in the first column of Table 2. The second column represents the regression coefficient (half of the effect of each factor).

Table 1. Sausages products parameters for heat transfer to ensure food safety

Heat transfer variable	Designation variable in formulas	Setting of values
Heat transfer coefficient	α	560 W m ⁻² K ⁻¹
Density of food (sausages)	ρ	875 kg m ³ (boneless)
Volume of food (sausages)	V	2.827×10^{-4} m ³
Food surface	S	0.0377 m ²
<u>Thermal properties of food (sausages)</u>	c_p	4360 J kg ⁻¹ K
Heating time	t	30 min $\leq t \leq$ 900 min

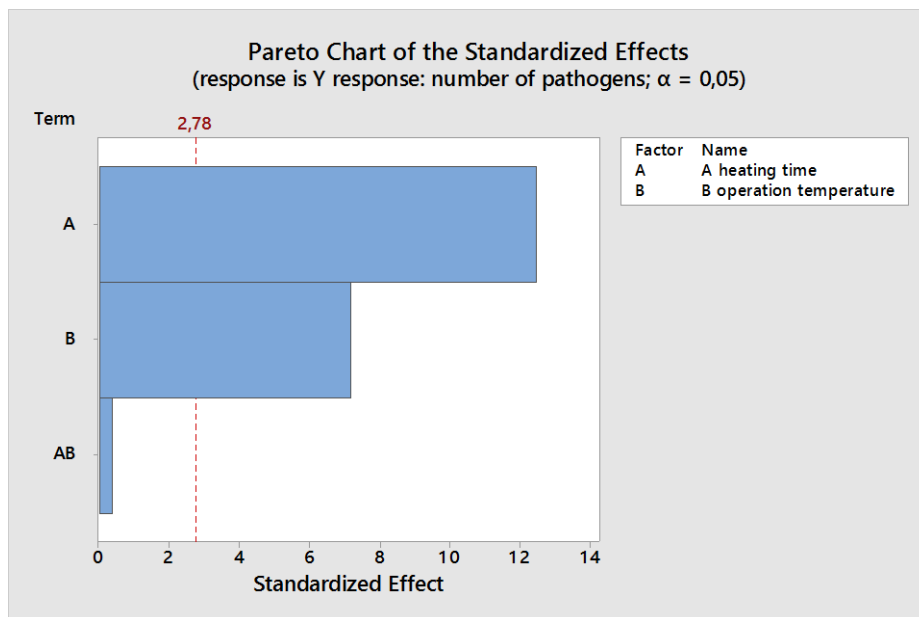
Source: Set values of our experiment (2018)

Table 2. List of process parameters for the experiment

Process parameter	Units	Low level setting	High level setting	Lower level setting (coded units)	High level setting (coded units)
Heating time	min	30	900	-1	+1
Operation temperature	°C	85	70	-1	+1

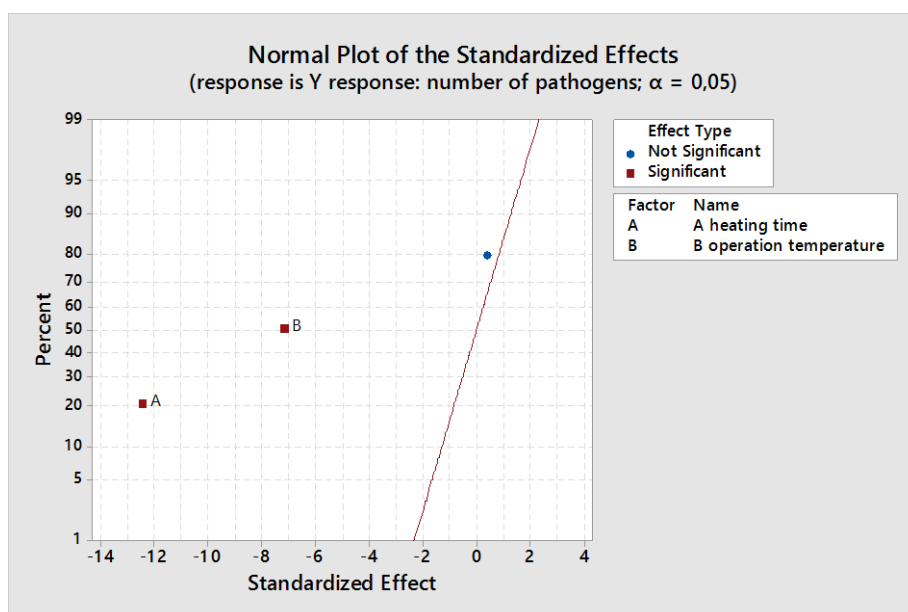
Source: Set coded values of our experiment (2018)

Figure 1. Pareto plot shows 2 significant parameters and no significant interaction



Source: Results from our experiment (2018)

Figure 2. Normal plot of the standardized effect shows the same results as Pareto plot



Source: Results from our experiment (2018)

The next table 2 shows the estimation of the coefficients to determine the predictive equations of the number of pathogens responses.

Table 2. Coded Coefficients

Term	Effect	Coef	SE Coef	T-Value	P-Value	VIF
Constant		31.625	0.992	31.88	0,000	
A heating time	-24.750	-12.375	0.992	-12.47	0,000	1.00
B operation temperature	-14.250	-7.125	0.992	-7.18	0,002	1.00
A heating time*B operation temperature	0.750	0.375	0.992	0.38	0,725	1.00

Source: Results from our calculation (2018)

Table 3. Regression Equation in Uncoded Units

<p>Y response: number of pathogens = 31.625 – 12.375 A heating time - 7.125 B operation temperature + 0.375 A heating time*B operation temperature</p>

Source: Results from our calculation (2018)

The procedure for calculating the regression parameters is introduced for example, in Anthony, 2003.

To determine the Establish Critical Limits HCCAP regulation, we create an area that consists of the output variable from the heat treatment of the sausages y . The x variable expresses the number of residual pathogens (CPU ml^{-1}) after heat treatment. The second variable, which forms the area of the associated random vector (which determines the quality of the heat treatment of food by HCCAP), is a variable x that associates all the variables that characterize the conductive heat transfer during the heat treatment of the food. Thus:

$$(t, \alpha, \rho, V, S, c_p)$$

Area M is determined by two variables (x and y). This area is a random vector of the number of residual pathogens depending on the conductive heat transfer. To determine the size of the M area, we use multiple integrals. The multiple integral is a definite integral a function of more than one real variable, for example, $f(x, y)$ or $f(x, y, z)$. Integrals of a function of two variables over a region in \mathbb{R}^2 are called double integrals.

Area M is defined by the following inequalities:

$$0,58 \leq x \leq 17.62 ; 0 \leq y \leq e^x ; x = x^* \times t ; x^* = \frac{\alpha S}{\rho V c_p} = 0.01958 ; x_{min} = 0.01958 \times 30 = 0.58 ; x_{max} = 0.01958 \times 900 = 17.62$$

We can use the multiple integral to determine the size of M:

$$S(M) = \iint_M 1 \, dx \, dy = \int_{0.58}^{17.62} \left(\int_0^{e^x} 1 \, dy \right) dx \quad (7)$$

And then we solve the integrals of the function of two variables:

$$S(M) = \int_{0.58}^{17.62} [y]_0^{e^x} dx = [e^x]_{0.58}^{17.62} = 44902317 \quad (8)$$

This area is an experimentally determined factor setting (t, v, s,) that guarantees compliance with HCAAP conditions. Also, it allows to modify parameter settings to suit, for example, the economic aspect (e.g., a lower final temperature to compensate for more extended durability or increased heat exchange area of the food).

Sausage makers have to control the condensation level of the sausage before and during the smoking process (Dehaut et al, 2014). That is obligated to produce a high-quality product. The cover of the sausage must be slightly moistened for the smoke to penetrate the casing adequately. If the product surface is too humid, the smoke process will cause streaking. If the casing is too drained, the smoke will not properly adhere to and permeate the casing. Sausage makers are therefore cautioned to ensure that the drying cycles are carefully controlled to ensure a consistently smoked product. In the last time, the process of optimizing the smoke process to ensure the required sensory properties and safety of the dried products are met.

However, these products are not entirely protected unless the product is partly dried, as was done before refrigeration was available. In non-traditional smoking, various new liquid smoke preparations are available for home or commercial sausage manufacture. Sausages may be smoked in the raw state or after previous salting, marinating, cooking, or other treatment, which may also be followed by additional processing.

Discussion

The results of the application the M area during heat treatment process were analysed before and after full factorial optimisation. We determined the required characteristics in both groups (swapping the order so that $F > 1$), and we obtained the following results:

Before full factorial optimisation,

$$n_1 = 25$$

$$s_1^2 = 2.841$$

After full factorial optimisation,

$$n_2 = 25$$

$$s_2^2 = 0.7983.$$

After substitution into (5), we obtain:

$$F = \frac{\sigma_1^2}{\sigma_2^2} = \frac{n_1 \times (n_2 - 1) \times S_1^2}{n_2 \times (n_1 - 1) \times S_2^2} = 3.56088 \geq F_{0.025}(24;24) = \text{FINV}(0.025;24;24) = 2.270.$$

The test criterion exceeded the critical value (2.270) at 24 degrees of freedom of the first set and 24 degrees of freedom of the second set. Therefore, H_0 was rejected. There was a statistically significant difference between the variances; the M area (designed in the smoked quality control) has a significant influence on the quality of production variability. After accepting the alternative

hypothesis, we proceeded to the T-test to verify a significantly reduced mean value of the pathogens due to the factorial design of technological factors.

The mean standard value was below the mean normalized value equal to 100 CPU/ml before full factorial optimization. Then the mean values of the base file are equivalent to $\mu_{0(\text{CPU})} = 100 - 37 = 63$ CPU/ml = μ_0 . We made the full factorial design for a sample of 20 sausages with the following characteristics:

$$n = 21; M = 31.625; S = 15.417$$

Thus:

$$H_0: \mu = 100 \text{ CPU/ml}$$

$$H_1: \mu \neq 100 \text{ CPU/ml}$$

After substitution into (6), we obtain the test criterion which is equal to:

$$T = \frac{|M - \mu_0|}{S} \times \sqrt{n - 1} = \frac{|31.625 - 100.000|}{15.417} \times \sqrt{21 - 1} = 19.834 > 2.086 = t_{0.05(20)}$$

Critical value (calculated eg in Excel using the predefined TINV function): is equal to: $t_{0.05(20)} = \text{TINV}(0.05; 20) = 2.086$. The test criterion has exceeded the critical value, so reject H_0 . The full factorial design of technological factors has a statistically significant effect on the mean value of pathogens in sausages.

4. Conclusion

During a food production, the HCCAP standards often meet opposite requirements. On the one hand, it is necessary to minimize the occurrence of pathogens by combining the heat treatment with chemical and physical interventions, and on the other side, it is necessary to degrade the food as little as possible. As shown in Table 3 (Regression equation in uncoded units), it is desirable to maximize temperature and stamina to minimize pathogens in terms of heat treatment efficiency. In the real situation of food production is often more appropriate to find an acceptable area (in our case marked M) that reliably destroys the pathogens but also preserves the taste quality (to meet the minimum taste/nutritional degradation). This area M integrates heat conduction theory (providing heat treatment) and regression estimation of the optimum setting of heat treatment parameters.

It is not necessary to preserve the shape of the area M (ie the parameters do not have to be constant), but only the size of the area M must be the constant. This allows to modify the size of one parameter by setting another parameter. This method is useful in economically rationalizing food production (eg increasing the production cycle or reducing specific production energy).

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ANALYSIS OF RELATION BETWEEN SELF-SUFFICIENCY AND FOREIGN TRADE OF CZECH DAIRY MARKET

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Annotation: The article deals with the quantification of the relationship between economic variables which influence the milk and dairy market. Explained self-sufficiency in milk production is determined by the proportion of milk purchases to dairies and domestic consumption of milk and dairy products. It has been found that this self-sufficiency has fallen since 1991, on average by 1.4 % per year. In connection with this phenomenon, the following research questions have been asked: (i) which factors are essential explanatory variables, (ii) which one of these factors is most effective and (iii) is there a long-term relationship between the variables? The source of data was the time series of the CZSO and the Ministry of Agriculture from 1991 to 2017. As a tool of exploration, a simple LRM model was used, including cointegration analysis of time series to determine long-term relations between values. Significant variables influencing the changes in self-sufficiency were the export and import of milk in millions of litres and number of heads of dairy cows. The results determined the non-elastic responses of self-sufficiency to changes in these variables. Nevertheless, the most sensitively self-sufficiency responds to exports (export elasticity coefficient 0.4 %), followed by imports (-0.23 %) and the number of cows (-0.06).

Key words: self-sufficiency, milk production, dairy market, foreign trade, structural analysis, cointegration analysis

JEL classification: Q13, Q17, Q18

1. Introduction

Self-sufficiency is defined as independence from external resources. It is the ability of a society (an individual) to meet their basic life needs by using their own resources in specific conditions and times. It is often mentioned in the field of energy sector, healthcare and agriculture. In case of food consumption it is an ability of a country to secure the domestic market by food with domestic origin. The rate of food sovereignty is one of the important indicators among states.

According to European Commission (2018) total self-sufficiency in milk production in the EU-28 in 2017 was 114.3 %. As regards regional differences, this self-sufficiency was highest in the Baltic countries and Northern Europe (134 %) and Western Europe (Germany, Austria, Benelux, France and the United Kingdom - 126 %); a moderate surplus of production over domestic consumption was also in Central European countries (108 %). On the other hand, low self-sufficiency in milk production is evident in southern Europe, particularly in the Pyrenean peninsula, in Italy and Greece, where the self-sufficiency rate is 77 % on average.

It can be seen that after accession of the Czech Republic (CR) to the EU the food self-sufficiency, especially in animal products, is steadily decreasing. As many authors confirm (e.g. Gurčík et al., 2016), it is mostly about the new EU member states. In Slovakia, self-sufficiency in dairy production is as decreasing as in the CR, and the surplus of milk over domestic consumption is far lower. However, it should be noted that both countries still achieve more than 100 % self-sufficiency in milk production. This is also confirmed by Špička and Kontsevaya (2016), who stated that import and export of milk have quite big share in overall milk production. There are a lot of transnational companies among milk processors in the CR and export is here more than two times bigger than import. The problem is seen rather in the structure of imports and exports of dairy products.

According to Kvapilík (2015), the average annual volume of exported raw milk from the EU countries for the years 2011 to 2013 (excluding Croatia, Malta and Cyprus) was 6,248 ths. tonnes. Of this volume, the largest share of raw milk exported has Germany (21.2 %), France (9.6 %) and the Czech Republic (8.1 %). Over the same period, imports of raw milk into the EU reached 6,327 ths. tonnes, with the largest shares being bought by Italy, Germany and Belgium (approximately 29, 26 and 11 %), a negligible share (19 thousand tonnes and 0.3 %) purchased on average by the Czech Republic. Exports of goods are usually positively assessed. This statement does not apply (or only partially) to raw milk which is a valuable and quality raw material. Its processing adds value added to the states and companies that bought the raw milk. Exporting countries also lose a share of jobs linked to the processing of raw milk and dairy factories lose a part of their profits. Permanent loss of markets for dairy products and an increase in economically less favourable imports consequently often happen.

2. Materials and Methods

The article used data in the form of time series from 1991 to 2017 obtained from the databases of the Czech Statistical Office (CZSO) and the Ministry of Agriculture (MA). These were milk production balance tables, all of which are reported in millions of litres, and export and import data are converted from all dairy products to raw milk value. Data on the number of heads of dairy cows are given in thousands of pieces. Self-sufficiency is then counted as a share of milk supply for processing (dairy factories purchases) and total domestic milk consumption.

One of the areas of application of econometric models is a structural analysis, which aims to determine the determinants of the selected economic phenomenon, including the quantification of the relationship between them. In order to determine the relationships between the endogenous variable – “self-sufficiency” (SS) and the predetermined variables (export of milk – “export”, import of milk “import” and heads of cows – “cownumber”) a linear regression model is used in the form of:

$$self - sufficiency_t = c + \beta_1 export_t + \beta_2 import_t + \beta_3 cownumber + u_t \quad (1)$$

where: c ... constant,
 β ... structural parameter,
 u_t ... stochastic variable.
 $t = 1 \dots T$, where T is number of observed years.

To determine what the most effective variable is, a coefficient of elasticity, which expresses the relative relationship between the variables, is a suitable tool.

$$e_i = \frac{\delta y_i}{\delta x_i} \frac{x_i}{y_i} \quad (2)$$

where: e ... elasticity coefficient,
 y_i ... endogenous variable,
 x_i ... exogenous variable.

The advantage of non-stationary time series is the possibility of finding not only a short-term but also a long-term relationship that does not gradually disappear with time and is closely related to the equilibrium state to which the system approaches. The finding of this relationship is the subject of cointegration analysis, which only makes sense if the time series are cointegrated or connected by a common stochastic trend. This fact has to be assessed by the cointegration test, in which case the Augmented Dickey-Fuller (ADF) test was used. In this work, the Autoregressive Distributed Lag (ADL) model is estimated for this purpose in the form of:

$$self - sufficiency_t = c + \alpha_1 self - sufficiency_{t-1} + \beta_1 export_t + \beta_2 export_{t-1} + u_t \quad (3)$$

To quantify the long-term relationship, the EC error correction model will be calculated in the form:

$$\Delta self - sufficiency_t = c + \beta_1 \Delta export_t + \gamma (self - sufficiency_{t-1} - \beta export_{t-1}) + u_t \quad (4)$$

To derive a long-term relationship, we will use the calculation:

$$\gamma = \alpha_1 - 1 \quad (5)$$

$$\beta = \frac{\beta_1 + \beta_2}{1 - \alpha_1} \quad (6)$$

where: γ expresses by what force the long-term relationship is promoted between rows and β_1 then represents the short-term and β long-term relationship between time series.

The following research questions were examined in the thesis:

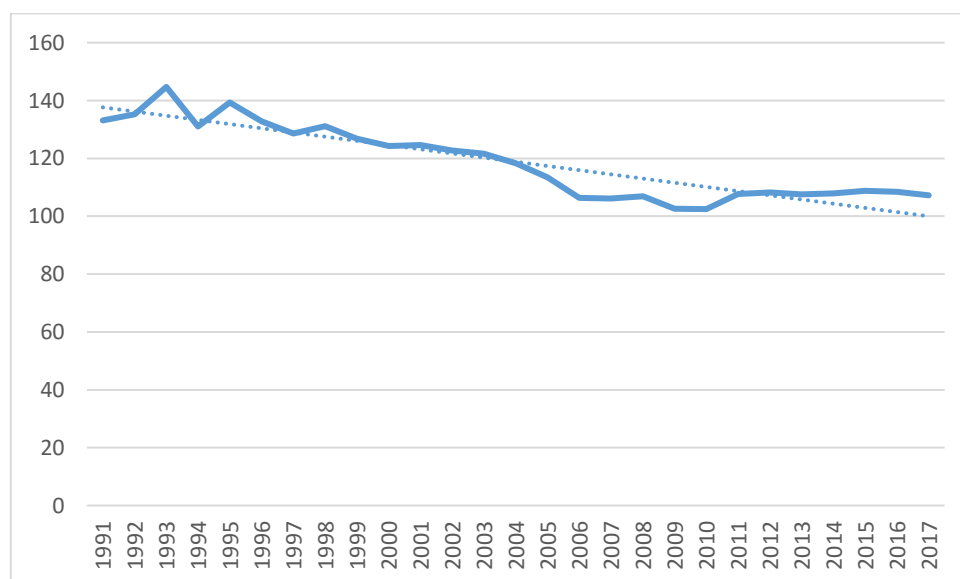
- 1) which factors are essential explanatory variables,
- 2) which one of these factors is most effective, and
- 3) is there a long-term relationship between the variables?

3. Results and Discussion

The self-sufficiency in milk production is very important for any country that wants to achieve total self-sufficiency in the production of basic commodities. Milk production is organizationally, materially, economically, and with regard to the labour force of the most demanding livestock sector (Bouška, 2006). The commodity “Milk and milk products” includes all possible areas that concern the key elements of the stability of agricultural systems and the agro-food complex (Heggum, 2011). Due to its versatility, the breeding of milking cattle supports the cultivation of fodder crops and produces manure that improves soil properties, helps to retain water in the soil, and consequently improves crop yields on farms. Self-sufficiency in this sector is therefore very desirable and its reduction would have a significant impact on the entire agricultural sector.

As can be seen from Figure 1, the self-sufficiency in the monitored period shows a decreasing trend on average by 1.4 % per year, with the most significant decline in 2009 and 2010.

Figure 1. Milk self-sufficiency (in %) in the CR



Source: Own calculation based on data from CZSO and MA

The time series of selected economic variables, that were included in the first model, have been priority tested using the ADF test with the purpose of verifying if they are stationary or not. Non-stationarity was confirmed in all cases. The results of the linear regression model LRM estimation according to formula (1) are presented in Table 1. The model has been successfully verified in statistical and econometric terms. The random component is stationary, has a normal distribution, no autocorrelation of residues or heteroscedasticity.

Table 1. Estimations of LRM model for milk self-sufficiency

	coefficient	standard error	t-value	p-value
const	1.0698	0.0347	30.83	<0.0001
export	0.000543	8.083e-05	6.716	<0.0001
import	-0.000573	5.493e-05	-10.44	<0.0001
cownumber	-0.000143	5.812e-05	-2.468	0.0214

Source: Own calculation based on data from CZSO and MA

Based on the estimated parameters, it is clear that all explanatory variables are essential variables, and according to the determinant coefficient, the changes in the endogenous variable are explained by 96 % changes of these variables. According to the elasticity coefficients given in Table 2, calculated according to formula (2), it is obvious that the most is self-sufficiency affected by exports, followed by imports and the number of cows. Here it is necessary to mention the fact that the export of raw milk is caused mainly by higher prices abroad (mainly in Germany) compared to prices offered by domestic processors of milk. This enables our farmers to achieve better economic results and thus to survive the unfavourable price conditions prevailing on the Czech market with raw milk. This, of course, also increases self-sufficiency, as part of the production is also offered to Czech dairies and subsequently included in self-sufficiency formula. On the other hand, we see that self-sufficiency is reduced by imports and the number of cows. In the case of imports, we can of course expect this and for the second variable we have to take into account the fact that dairy cow's numbers are constantly decreasing over the years, which negatively affects self-sufficiency, even if the milk yield per head is increasing.

Table 2. Coefficients of elasticities in %

export elasticity	0.4
import elasticity	-0.23
cow number elasticity	-0.06

Source: Own calculation based on data from CZSO and MA

Depending on the intensity of the coefficients of elasticity, it can be stated that none of the variables are elastic. Perhaps only the effect of export can be labelled as weak elastic, unlike the number of cows that do not cause a sensitive change in the self-sufficiency of milk.

To determine the short- and long-term relationship between self-sufficiency and other parameters, a cointegration analysis was used and the ADL model according to formula (3) was estimated together with the error correction model according to formula (4).

Table 3. Results of the ADL model estimation

	coefficient	standard error	t-value	p-value
const.	-0.134	0.1573	-0.851	0.4039
export	0.00041	0.0001	2.844	0.0094
export _{t-1}	0.00035	0.0001	-2.635	0.0151
self-sufficiency _{t-1}	-1.0585	0.0943	11.210	1.45e-10

Source: Own calculation based on data from CZSO and MA

From the estimated coefficients of the ADL model, it is clear that there is a short-term relationship between the economic variables self-sufficiency in milk production of the CR and the exported

quantity of milk from the CR. Therefore, it can be considered as a valid assumption that we only export raw material that the domestic processor is no longer interested in. This is consistent with the findings of Ratinger and Boskova (2013), who stated that Czech milk processors had not been competitive in the Central European dairy market and mentioned that some of Czech milk (about 15 % of the production) was delivered to the two German dairies situated close to the Czech borders and at the same time imports of processed products increased sharply (tripled between 2003 and 2011).

Thus, the export changes by 1 million litres will directly affect the self-sufficiency in % intensity expressed in the confidence interval (0.122; 0.698) with 95 % probability. After recalculation according to formulas (5) and (6), it is also possible to interpret the long-term relationship, which affects the export increase by 1 million litres, the self-sufficiency increase by 0.976 %.

According to the President of the Food Chamber of the Czech Republic Miroslav Toman (E15, 2017), dairy imports to the CR were 45.6 % in the year 2016. Imports up to one third of domestic production are considered as standard, just as it is in Western European countries. Tragic is the fact that Czech consumers consume 51 % of cheeses and curds and 52.8 % of butter from imports. The significant role of the retail chains that contribute to this is also being discussed for a long time.

Absolute self-sufficiency is a utopia; it is impossible to ignore the changes in the development and orientation of self-sufficiency. According to the Czech Ministry of agriculture, decrease of self-sufficiency for some basic commodities under 80 % is not hazardous. However, this value is not considered as optimal (Kotzya and Slaboch, 2014). The question is whether this value should be also applied to such an important sector as milk production. On the other hand, according to Höper (2000), in the past, the degree of self-sufficiency as regards milk and milk products in the U.K. was significantly under 90 %. The demand for consumable and innovative products was mainly satisfied by foreign companies, whereas the U.K. companies concentrated on the consumer-oriented supply with fresh milk, and on the production and export of standard goods. And this is an example of a country in which the climatic and structural conditions for milk production are very favourable.

4. Conclusion

It is correct to evaluate and assess the self-sufficiency in the food consumption from subgroups and groups point of view across the spectrum of conditions and contexts, to explain the reasons and causes of the changes. These are very diverse, ranging from the geographical location of our country, its integration into European structures, changes in eating habits due to population migration, tourism, price development, massive advertising and the availability of different types of food on the market. Milk self-sufficiency is perceived by authors as the most important of food self-sufficiency with impacts on the entire agricultural sector.

The results show that milk self-sufficiency is the most affected by exports, followed by imports and the number of cows. Here it is necessary to mention the fact that the export of raw milk is caused mainly by higher prices abroad (mainly in Germany) compared to prices offered by domestic processors of milk. Depending on the intensity of the coefficients of elasticity, it can be stated that none of the variables are elastic. Perhaps only the effect of export can be labelled as weak elastic, unlike the number of cows that do not cause a sensitive change in the self-sufficiency of milk. Authors proved that there is a short-term relationship between the economic variables self-sufficiency in milk production of the CR and the exported quantity of milk from the CR. Therefore, it can be considered as a valid assumption that we mostly export raw material which the domestic processor is not able to process.

More important than ensuring self-sufficiency is for future to focus on not exporting basic food (e.g. raw milk) and not import too much of finished products with higher added value (e.g. yoghurts, butter), which are more expensive. If milk cannot be processed successfully and cannot be meaningfully used (dairy products can be consumed “at home” or exported worldwide), there is a chance for a significant improvement of the situation in this important agrarian sector (despite many advantages such as long-term successful tradition, high milk yields, the largest herds in the EU, good quality of milk, etc.) in the Czech Republic very small.

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VOLATILITY AND LIQUIDITY OF CME CORN MARKET

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Annotation: The aim of this paper is to determine if there is a relationship between the volatility and liquidity in the corn market at CME. The sub-objective is to identify the seasonality related with the harvest of major producers.

The data set is based on closing daily prices, liquidity (volume) and open interest at CME futures market for the period 2006 – 2015. The historical volatility index was used to determine volatility in the data.

The seasonality pattern is obvious only for volume of individual contract months of corn futures. The analysis of daily closing prices found the more volatile second part of the calendar year, but this volatility decreases by the end of November and is the lowest in February. It was the year beginnings which were supposed to be more volatile, because the new harvest is traded via the December contracts. The liquidity is probably related with the business cycle. The observed volume reached its maximums during the years of world financial crisis (2008 – 2009). The seasonality pattern is obvious only for volume of individual contract months of corn futures. The volume is the highest for December contracts and then it gradually decreases for the rest of contracts. This findings corresponds with the assumption about the impact of harvests. Analysis of individual futures contract volatility didn't prove this assumption. Relationship for liquidity and volatility hasn't been found.

Key words: corn, volatility, liquidity, seasonality, futures, volume

JEL classification: Q13, Q17

1. Introduction

The main objective of this paper is to identify the impact of seasonality on liquidity and volatility for corn futures contracts at CME market.

There were stated following research questions:

Is there obvious volatility and liquidity increase after the harvests of major producers?

Does the seasonality affect liquidity and volatility of individual futures contracts?

Is there positive relationship between the liquidity and volatility at the CME corn market or for the individual futures contracts?

Commodity markets play a key role for agricultural production redistribution, and also for the price determination. This paper is focused on corn futures contracts traded at the Chicago Board of Trade within the CME group. This Exchange is one of the largest markets with millions of daily transactions and open interests (CME, 2014). Vaněk et al. (2006) estimated that approx. 20 – 40 % of world's agricultural production have been traded via commodity exchanges in 2006. It can be assumed that this number increased with development of commodity markets in South-East Asia (Klotz et al., 2014).

There are new issues and challenges related with globalization, increasing population, and IT development. The last mentioned phenomenon brought electronic trading of financial derivatives. The increasing availability to participate on arbitrage for speculators (an investor who doesn't want to accept delivery of the underlying assets) is broadly discussed. This development caused increasing

market liquidity which should contribute to the higher market efficiency and to the information asymmetry reduction (Overby and Clarke, 2010).

The electronic trading of commodities at the US market is characterized by huge liquidity. This liquidity, minimal barriers of entry, diverse localization of individual stakeholders, and not sufficient legal framework represent, according to the Jin and Chen (2014) risk which can be reduced by following of money management standards. These authors also reported increasing tendency of payments via the third sides. It is a specific form of B2B when these participants enter the market.

The next issue is the relationship between the liquidity and volatility of the market. As it is written above the liquidity is crucial for a good working market. But there are many authors who claim that the higher liquidity implies higher volatility in the markets, e.g. Kalimipali and Nayak (2012), or Luo (2010), etc. In the contrary of these authors there are also researchers who reject this causality, e.g. Kim, (2015), Wang and Zhuang (2006). The future realized volatility can be estimated from put option prices. This fact could particularly help to prevent volatility turmoil on the markets (Muzzioli, 2014).

The impact of volatility depends on the development of the market and economy. The higher volatility negatively affects mainly the developing and least developed countries (LDC) (Bourguignon, Lambert and Suwa-Eisenmana, 2004). Chandrasekhar (2012) published the negative impact of volatility on food prices in India. This volatility is a big problem especially for the poorest people.

According to GOI (2007) the risks in agriculture are related with biologic, climatic, and price factors. While in developing, and in the least developed countries, risks associated with arbitrage, or with optimal redistribution of given commodity, is the biggest issue in developed countries are risks related to huge amount of traded derivatives, using the leverage, and information asymmetry (Stieglitz, 1989). Thus the food security is linked with effectively working markets which can provide food distribution for consumers and fair prices for producers.

2. Materials and Methods

The data set is based on closing daily prices, liquidity (volume) at CME futures market for the period 2006 – 2015. The time series for closing prices are based on rollovers (fourteen days before the first notice day of the nearby contract). The prices of individual futures contracts were also used to determine the seasonality in data and the relationship between the liquidity and volatility.

The historical volatility index was used to determine volatility in the data. The historical volatility index (HV) is based on logarithmic ratio of daily price changes – historical returns for given period (time-frame).

$$LOGS_i = LOG\left(\frac{P_i}{P_{i-1}}\right) \quad (1)$$

Where:

P_i : The current price; P_{i-1} : The previous price

Then the logarithms for the time-frame are reviewing:

$$T_{logs} = \sum_{i=1}^n (LOGS_i) \quad (2)$$

Where:

T_{logs} : The total of the logarithm price ratio for the time-frame.

S : sum all n logarithms; $LOGS_i$: The logarithm of the price change for period i.

n : The number of periods for the specified time-frame.

Then the average of logs is calculated:

$ALOGS = Tlogs/n$; where:

$ALOGS$: The average of the logarithms; $Tlogs$: The sum of the logarithm

n : The number of periods for the specified time-frame.

The next step is the calculation of the sum of the squares of the differences between the individual logarithms for each period and the average logarithm:

$$SSD = \sum_{i=1}^n (LOGS_i - ALOGS)^2 \quad (3)$$

SSD : The sum of the squared differences; S : The total of the squares of all n differences.

Then the historical volatility is calculated as:

$$HV = \sqrt{\frac{SSD}{n-1}} * \sqrt{TP} \quad (4)$$

where:

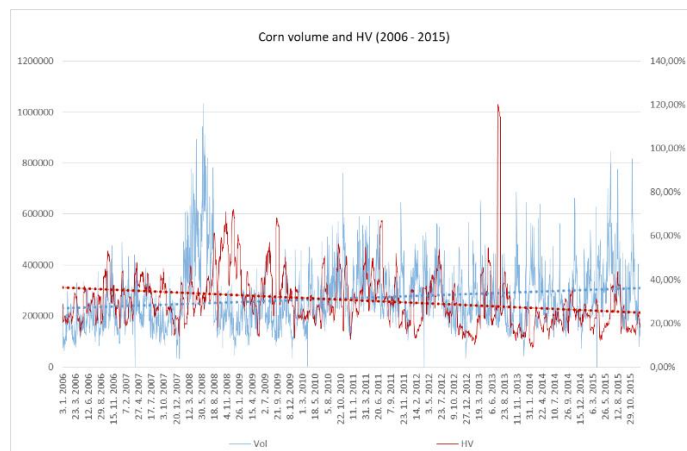
TP : The total number of trading periods for the year (Gecko SW, 2018).

This method allows to compare the individual years and contracts and asses their volatility. Based on the technical analysis and testing there was stated a threshold at 125 % of HV average for given year. This threshold is used to determine increased volatility of corn prices. The dummy of variables was set up to determine the number of volatile days (over of 125 % of its average) for given year, month and contract month (individual contracts). This method allows to identify the differences in volatility and liquidity, and the most volatile, liquid, years, months, and contract months.

3. Results and Discussion

The historical volatility has been calculated and compared with the liquidity of the market measured by volume (VOL) which indicates how many trades have been made over the given period. The daily data have been used. The comparison of results for HV and volume is represented by the figure 1. The linear functions have been implemented to determine the trend. There is no strong tendency for any of observed time-series. Volume of the market is slightly increasing and volatility is slightly decreasing. There is not present some obvious seasonality in the data.

Figure 1. Corn volume and volatility (2006 – 2015)



Source: Authors, 2018 based on the CME data

This fact does not correspond with the authors mentioned above who proved the relationship between the volatility and liquidity for the financial, and commodity markets. There is also noticeable increase

of volume followed by volatility in 2008. This year was related with financial crisis, which hit the commodity market with the delay of several months (compared to the stock market). According to the IMF (2008) the volatility over the period 2004 – 2014 was connected with the increasing prices (together with price turmoils, e.g. in 2008) which contributed to economy reinforcement of developing countries and LDC. There were recorded increasing export, import, foreign direct investments (which also contributes to share the know-how). The slightly increasing liquidity is connected with electronic trading using the GLOBEX platform, which has been introduced in 2006, and in the middle of this year the volume of electronic trading overcame the pit trading volume. The pit trading is becoming of past and many commodities are traded only via GLOBEX platform (CME, 2014). Liao, Lee and Suen, (2008) conclude that the electronic trading significantly influenced the conditional volatility for Brent crude oil which tend to clustering more for electronic, than for pit trading.

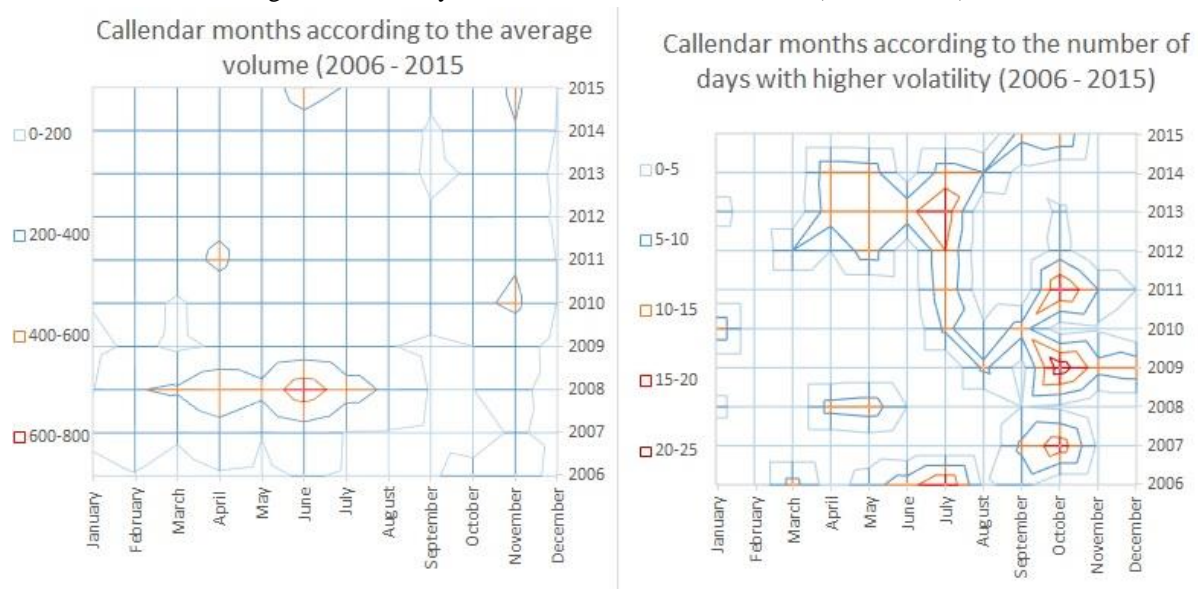
Corn is traded via futures contracts with expiration in five calendar months at CME. The contract months are March (H), May (K), July (N), September (U), and December (Z). The last mentioned – December is considered to be the contract month of the new harvest (Smith, 2000).

According to the CRB (2013) there are harvests from September until November in these states: USA (35.8 % of world production in 2014), China (21.38 %) EU (7.52 %), Ukraine (2.82 %). The share of these countries on the total world corn production was 67.52 % in 2014.

Harvests in South America start in February and finish in March in Brazil, and in May in Argentina. The share of these two countries is 8.43 %, resp. 2.63 %, 11.06 % in total of world’s production. There is an assumption that December as the month, when the major part of world production is starting to be traded, will be more volatile with higher liquidity (USDA, 2015).

The analysis of volatility according to the calendar months determined July as the most volatile month, than the high volatility has been found for May, August, and October. February was determined as the least volatile month. The results are displayed by the Figure 2. There is quite low volatility in December.

Figure 2. Volatility and Volume for calendar months (2006 – 2015)



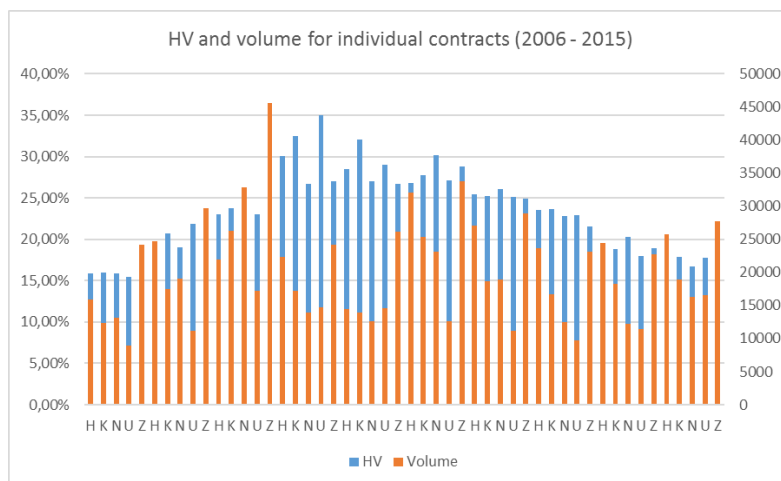
Source: Authors, 2018 based on the CME data

The liquidity for individual calendar months has been identified by using average of volume for each calendar month. Results in the figure 2 determined the highest liquidity for February, April, June, and November. The highest liquidity has been identified for years, 2008, 2011, and 2015. There is no obvious seasonality for volume.

This fact can be caused by using daily data based on roll-over method. Thus the volatility and liquidity of individual contracts have been examined.

The liquidity of individual contract months is represented by the figure 3. There is quite obvious pattern and seasonality. The volume is usually high for contracts expiring in December (Z) and then constantly decreasing and is usually the lowest for the September (U) contracts. This results confirm assumption of higher liquidity related with the new harvest of major producers.

Figure 3. Liquidity and volatility of individual contracts (2006 – 2015)

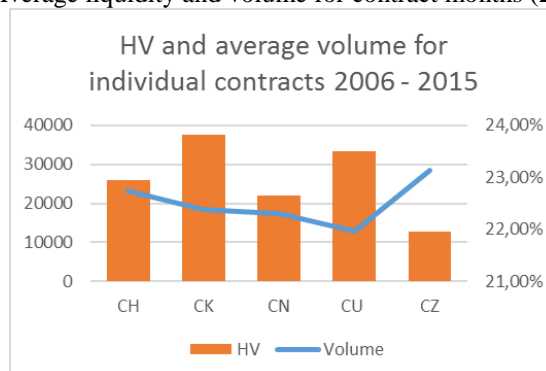


Source: Authors, 2018 based on the CME data

The averages of volatility and liquidity are compared in the figure 4. The trend which has been described above is still quite obvious and is represented by the blue line, which corresponds with the results for individual contract months. But the averages of historical volatility reach the maximum for May and September contracts. There is the lowest liquidity for September contracts. The relationship of volume a volatility hasn't been found for contract months.

Similar results have been reported by Adämmer and Bohl (2018), who made research for EU markets and conclude that the higher liquidity does not cause higher volatility for spot prices at EU commodities markets. Also Orłowski (2015) who addressed his research to the 10-year US Treasury note found that the electronic trading brings lower tendency of volatility to cluster after the price shocks, but he didn't find increasing volatility caused by increased volume. His research has been divided into four phases and the data indicate the inverse relationship. Similarly like the results showed by the Figure 4. The volatility is the second highest for September contract while this contract has the lowest liquidity.

Figure 4. Average liquidity and volume for contract months (2006 – 2015)



Source: Authors, 2018 based on the CME data

The seasonality has been identified only for volume of individual contracts. Volatility seems to be more or less related to the business cycle and bearish or bullish trends in the market. Many

authors suggest that markets should be more regulated. Swaminathan and Vepa (2012) pointed to control speculative trades and use special policies for food prices' volatility. The impact of these measures is an issue of discussion. Similarly Dehn et al. (2005), who are focused on risk management at commodities markets under the World Bank, recommend using of special measures for food prices in developing countries.

According to the results of this research the market regulation which would make more barriers for speculators to participate on the markets doesn't seem to be useful. Boonvorachote and Anurat (2012) who also researched the relationship between the liquidity and volume on Asian commodity markets in Thailand, Malaysia, China and Japan, conclude that the markets shouldn't be overregulated. The price should develop without interventions, or effort, to regulate its volatility. They proved these regulations to be counterproductive. State intervention in pricing should be the last option. These Authors recommend the transferring of knowledge to farmers so that they could actively participate in commodity markets themselves.

4. Conclusion

The aim of this paper was to determine if there is a relationship between the volatility and liquidity in the corn market at CME. The sub-objective was to identify the seasonality in the data related with the harvest of major producers. The seasonality pattern is obvious only for volume of individual contract months of corn futures. The analysis of daily closing prices found the more volatile second part of the calendar year, but this volatility decreases by the end of November and it is the lowest in February. It was the beginning of the year which was considered to be more volatile, because of the new harvests are traded via December contracts. The liquidity is probably related with the business cycle. The observed volume reached its maximum during the years of world financial crisis (2008 – 2009). The seasonality pattern is obvious only for volume of individual contract months of corn futures. December contracts have the highest volume. The volume is gradually decreasing for the rest of contract months. This finding corresponds with the assumption about the impact of harvests. Analysis of individual futures contract's volatility didn't prove this assumption. Relationship for liquidity and volatility hasn't been found. There is a big discussion about the markets regulation and their role during the financial crisis. There is no issue that some level of regulation is necessary. But on the other hand market overregulation, and effort to keep them off speculators, would probably bring more costs than benefits. The impact of these measures is an issue for further research. In developing countries and LDC, where the impact of price volatility has more serious consequences, the attention should be paid to the general functions of markets, which include functional legal framework, reduction of information asymmetry, and effective allocation. The next point for the future research can be to examine other determinants which could cause volatility, as the business cycle, price spikes, etc. This research can be useful especially for the developed countries.

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EMPLOYEES' PROSPECTS IN SELECTED SECTORS OF THE CR FOOD INDUSTRY

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Annotation: The authors are dealing with employees' prospects in selected sectors of the CR food industry. Foodstuffs production may not have expanded its share on the production characteristics of processing industry but it has remained a significant employer in many regions anyway, and it has kept holding a leading position in the processing industry. The main target of the paper is to identify factors influencing the employees' prospects in selected food industry sectors significantly. A partial target of the paper then is modeling of long-term development trends of selected employment factors in the CR food industry and forecasting of these. Using advanced statistical methods from the time series analysis area, long-term tendencies of a broad spectre of Czech food industry efficiency aspects have been described. Future development forecasts have been constructed based on selected indicators' development. The authors have exploited accessible data bases of the Ministry of Agriculture Czech republic. The analysis has been done based on time series over 2000-2016 years. In order to identify and verify statistically the factors affecting significantly employees' prospects in selected sectors of the CR food industry, regression and correlation analysis has been applied.

Key words: Food industry, employees, personnel costs, labour productivity, gross value added.

JEL classification: C21, C22, Q17, Q18

1. Introduction

Previous research in the field of wages and productivity has focused primarily on the comparison of individual average gross monthly wages in a given industry, such as agriculture, industrial and construction sectors, see Bílková (2015), or on labour productivity analysis across the whole agriculture industry or in comparison with Austria or the EU-27, see Boháčková and Mach (2015), or in the framework of an international comparison in the meat processing industry, see Náglová and Špička (2015). Also in previous research analysis of determinants has been done that affect employees' prospects, such as the financial crisis, see Klein (2012), trade unions see Petrakis and Vlassis (2014), the influence of the market structure see Davidson (1988) or relations between productivity, wages and employment in the manufacturing sector see Tadjoeeddin (2016). Based on the above knowledge, it was necessary to analyze the existing trends of employees' prospects in the individual sectors of the food industry in the Czech Republic and how they are affected by labour productivity. Consequently, the main aim of the article was to identify sectors of the food industry that are most attractive for employees and to predict the average amount of personnel costs per employee in the individual sectors of the food industry in the Czech Republic until 2020. To make those predictions we used the Holt's model of exponential smoothing. The partial objective of the article was to demonstrate and describe a statistically significant causal correlation between employees' perspective and labour productivity using a simple regression and correlation analysis of time series. Employees' prospects (attractiveness for employees in terms of wages) are understood as the average personnel costs in thousands of CZK. Thus, the article describes the attractiveness of individual sectors for the employees in the food industry in terms of personnel costs per employee and their possible prospects for the future. Subsequently, the relation of the employee remuneration through personnel costs per employee was studied in relation to employee productivity, measured by added value per employee. The reason why personnel costs were selected was that they reflect

the total cost per employee and thus reflect the total amount of costs measured, including social and health insurance contributions paid by the employer. The indicator of labour productivity measured by gross value added per employee was selected as another indicator of employees' prospects. This value represents the employees' share in the gross value added, i.e. the employees' share in the company's performance. Next part of the article is dedicated to the analysis of the employees' prospects (average personnel costs per employee) and how it is affected by the gross value added per employee.

In order to ensure continuity and measurability, only such sectors were selected which after the reclassification (the transition from OKEČ – industry classification of economic activities – to NACE – classification of economic activities according to the European Commission) still have the same industry orientation of activities after the transition to the new NACE classification. The article further uses the new NACE classification.

Table 1. Classification of sectors of the food industry

NACE code CZ-CPA	Title
10.1	Meat and meat products
10.2	Fish, crustaceans and molluscs
10.3	Fruit and vegetables
10.4	Vegetable and animal oils and fats
10.5	Dairy products
10.6	Mill and starch products
10.9	Industrial feeds

Source: Ministry of Agriculture (2017)

2. Materials and Methods

2.1 Data source

Statistical analysis is based on data from the Czech Statistical Office, CR Ministry of Agriculture and the Institute of Agricultural Economics and Information. Time series of selected economic indicators and selected factors of employment of the separate CR food industry sections over 2000-2016 have been analyzed and modeled.

2.2 Analytical smoothing of time series

The basic principle of a time series model is based on the assumption that, the only dynamic factor of the indicator presented in the time series is time. The models based on this principle are called univariate models.

The adaptive models have been applied in the trend description. Models of this type quickly react on the structural changes occurring in time and they are very suitable for prognosticating the future course of the time series loaded by irregularities and breaks in the trend.

The adaptive models start from the presumption that, the latest data from a time series are those most valuable for the future development forecast construction (*Hindls, Hronová, Seger and Fischer, 2008*). Therefore, the most actual data of the time series obtain the heaviest weights and the previous data either are quite excluded from study or they obtain lesser weights. In the present study, one adaptive approach has been exploited actually, the exponential smoothing method, that is. The parameter estimates can be obtained using the least squares method in the following format:

$$\sum_{k=0}^{n-1} (y_{n-k} - T_{n-k})^2 w_k = \min, \quad (1)$$

where y_{n-k} are the empirical values at the (n-k) moment,

$k = 0, 1, \dots, n-1$ is the age of the data at the moment n ,

T_{n-k} is the trend component at time (n-k),

w_k are the weights that are inversely proportional to the „age“ of the data, i.e., with the age growing, the weight is decreasing.

It is assumed at that time that, the w_k weight is an exponential function of the type

$$w_k = \alpha^k, \quad 0 < \alpha < 1, \quad k = 0, 1, \dots, n-1, \quad (2)$$

where the α quantity is the balancing constant.

As it is clear from the (2) relationship, the weights w_k are an exponential function of the age of the data. Smoothing of time series based on the principle shown is called the exponential smoothing. Estimates of the trend model component T_{n-k} can be obtained using the minimized expression

$$\sum_{k=0}^{n-1} (y_{n-k} - T_{n-k})^2 \alpha^k \dots \min. \quad (3)$$

The Holt exponential smoothing model has been applied for the selected indicators' of Czech food industry development forecasting. In case of the Holt smoothing procedure, two smoothing constants, α and γ are being estimated, from the (0;1) interval. The α constant is used for smoothing of the time series level (S_t), the γ constant for the (T_t) trend quantity balance.

$$\alpha_{Holt} = \alpha(2 - \alpha); \quad \gamma_{Holt} = \frac{\alpha}{2 - \alpha} \quad (4)$$

The α parameter adjusts the level of adaptation and it means, the higher is its value, the faster the method reacts on changes in the data. The γ parameter defines the levels of smoothing of the local linear trends (*Montgomery, Jennings and Kulahci, 2008*). On modelling a series using this method, the following recurrent relationships take place:

$$\begin{aligned} S_t &= \alpha y_t + (1 - \alpha)(S_{t-1} + T_{t-1}), \\ T_t &= \gamma(S_t - S_{t-1}) + (1 - \gamma)T_{t-1}, \\ \hat{y}_t &= S_t. \end{aligned} \quad (5)$$

For significance testing of the models and their parameters the significance level $\alpha=0.05$ has been chosen. Statistical computations have been performed in the STATISTICA statistical software, version 13.2 US, environment.

2.3 Correlation of time series

When examining relationships between time series it is possible to start from the assumption that, these can be described by certain additive model and expressed as a total of regular and irregular components. A time series is formed of values of periods subsequently mutually linking in time and another time series can have a very similar development over the time given without any apparent factual link. Comparatively high correlation measures obtained in such cases do not express any

relationship between the phenomena, rather a parallelism of the course of two or more time series (Arlt, Arltová, 2005).

In order to discover a causal relationship between time series it is needed to examine whether there is not a relationship between the random components. The long-term trend and the seasonal fluctuations namely can have a very similar course. That is why it is needed to look for existence of a relationship between the irregular (random) components of the time series analyzed. A causal relationship between variables can be assessed using the method of tightness of relationship measurement of the random component series, i.e., series deprived of trend, or possibly of the seasonal component, too.

In case, a relationship has been found between the random components, one can reasonably expect real existence of a causal relationship between the series analyzed (Hindls et al., 2008). If additive type time series have been processed:

$$y_t = T_t + \varepsilon_t; \quad t = 1, 2, \dots, n, \quad (6)$$

where for the given t the y_t denotes the time series empirical value, T_t the trend component value and ε_t the random component value, then, if the time series course of trend has been estimated, it is possible to correlate the residual values estimates denoted as:

$$e_x = x_t - T_x \quad \text{and} \quad e_y = y_t - T_y, \quad t = 1, 2, \dots, n. \quad (7)$$

When examining tightness of relationships in time series, choice of the trend function types describing the time series' analyzed development is very important. Credibility of the correlation coefficient obtained is in fact conditioned by correct choice of trend function types serving in subtraction of deviations to be correlated in the following.

In case, the correlation coefficient is significantly non-zero, then the x and y variables can be understood correlated in the sense of delivering a trace of symmetrical linear relationship (Cipra, 2008).

Pearson's correlation coefficient r :

$$r_{yx} = r_{xy} = \frac{n \sum x_i y_i - \sum x_i \sum y_i}{\sqrt{[n \sum x_i^2 - (\sum x_i)^2] \cdot [n \sum y_i^2 - (\sum y_i)^2]}} \quad (8)$$

3. Results and Discussion

3.1 Average personnel costs per employee in individual sectors of the food industry in CR

For the vast majority of sectors, average personnel costs per employee show a linearly growing trend. Between 2000 and 2016, the average personnel costs per employee in all sectors at least doubled. The highest growth was seen in sectors 10.6, 10.5 and 10.3 (an increase of 130 %), see Table 2. The highest figures were reported by sector 10.9, the lowest by sector 10.1. The values of the predicted average personnel costs per employee in the individual sectors of the food industry are summarized in Table 2. The selected prediction models of exponential equalization extrapolate the growing trend.

In terms of growth of personnel costs per employee, a positive trend is seen in selected sectors of the food industry, which means that the growth of personnel costs per employee imitates the situation in the economy as a whole. The most attractive sectors for employees are sectors 10.9.,

10.4 (over CZK 400,000 each), which show the highest level of predictions. These sectors can be considered the best employers in the food industry in terms of employees' prospects measured by personnel costs per employee both from a past perspective and in future predictions.

Table 2. Basic statistical characteristics of the development of average personnel costs per employee in the individual sectors of the food industry in CR (CZ-NACE) in 2000–2016 and their prediction

The production sectors –according to the CZ-NACE system	Average personnel costs in thousands of CZK	Basic index (2016/2000)	MAPE	Prediction for 2018*	Prediction for 2020*
10.1	253.2016	2.13	2.3824	336.97	389.77
10.2	270.3444	1.88	6.4028	382.50	403.71
10.3	270.1805	2.25	3.5234	382.53	407.41
10.4	407.0743	1.88	6.5713	565.49	596.67
10.5	317.4199	2.20	2.2369	446.57	475.12
10.6	325.5435	2.30	2.9975	471.31	502.42
10.9	408.6269	2.35	3.1011	573.65	612.13

**Own estimates based on the Holt exponential smoothing*

Source: Ministry of Agriculture reports; own calculations

3.2 Correlation of average personnel costs per employee and gross value added per employee in individual sectors of the food industry in CR

The aim of the analysis was to find what relationship existed between labour productivity (gross value added/number of employees) and the form of remuneration measured by personnel costs per employee; therefore, the correlation of average personnel costs per employee and gross value added per employee in thousand of CZK was analyzed for individual sectors of the food industry. To evaluate the causal relationship between the variables, the power of correlation of random components of time series, i.e. after removing the trend, was measured (see Table 3).

Table 3. Correlation between average personnel costs per employee and gross value added per employee in individual sectors of the food industry in CR (CZ-NACE)

The production sectors –according to the CZ-NACE system	Regression functions*	r*	r ²	p-value
10.1 - Meat and meat products	$y' = -1.7085E-6 + 0.179x$	0.4213	0.1775	0.0921
10.2 - Fish, crustaceans and molluscs	$y' = -8.0435E-7 + 0.266x$	0.6749	0.4555	0.0030
10.3 - Fruit and vegetables	$y' = -1.4274E-6 + 0.3121x$	0.8779	0.7708	< 0.0001
10.4 - Vegetable and animal oils and fats	$y' = -5.8826E-6 - 0.0038x$	-0.0247	0.0006	0.9250
10.5 - Dairy products	$y' = -2.2183E-6 + 0.1288x$	0.4450	0.1980	0.0735
10.6 - Mill and starch products	$y' = 7.8863E-7 + 0.1536x$	0.5068	0.2568	0.0379
10.9 - Industrial feeds	$y' = 2.8901E-6 + 0.0974x$	0.5893	0.3473	0.0128

Source: Ministry of Agriculture reports; own calculations

**Regression and correlation of residual value estimates.*

A strong correlation between average personnel costs per employee and gross value added per employee in sectors 10.2 and 10.3 was demonstrated with 95% confidence. For sectors 10.3 and 10.2, the changes in average personnel costs per employee can be explained by changes in value added per employee from 77.08 % and 45.55 % respectively. These sectors (10.2, 10.3) can be considered sectors that reward their employees on the basis of labour productivity more than other sectors.

Moderately strong correlation was demonstrated for sectors 10.6 and 10.9. For sector 10.6, the changes in average personnel costs can be explained by changes in value added per employee from 25.68 %, and for sector 10.9, the changes can be explained by changes in value added per employee from 34.73 %.

4. Conclusion

The system of wage remuneration related to labour productivity is stronger in some sectors than it is in others, which highlights the disproportion between the remuneration of the workforce in individual sectors. Apart from labour productivity, also other factors affect the system of remuneration (more in some sector, less in others), see Klein (2012), who considers factors like unemployment, labour absorption and the financial crisis. We can also take into account the role of trade unions in negotiations of wages, see Petrakis and Vlassis (2004), or see Davidson (1988), who assumes that trade unions have a positive impact on the increase of wages in an oligopolistic market structure. In the Czech Republic, also the common oligopolistic structure of the sector must be taken into account, which favours lower wages, as well as the fact that some companies – sectors do not reward the productivity of their employees like other companies – sectors (they are not willing to share their outcome – profit), or over time their operation led to higher automation, which in turn led to a lower demand for workers, see Matisková (2014), who analyzes the costs of automated equipment and the future economic effect. By analyzing the correlation between personnel costs (wages) and labour productivity and the highest values of average personnel costs in individual sectors it was found that the highest wages (10.9, 10.4) are not paid in sectors with the highest dependence of remuneration (wages) on labour productivity (10.3, 10.2). Classical theory of economy claims that labour productivity and remuneration (in our case, personnel costs) should directly correlate with one another, i.e. the growth of labour productivity should correspond to the increase of wages (personnel costs). Also Tadjoeeddin (2016) draws attention to this issue citing M. Keynes. However, the highest dependence of the wage growth on labour productivity is reported for sector 10.3 (a sector with one of the highest wage growth rates). Thus, we can conclude that remuneration based on labour productivity is affected not only by the abovementioned factors (with varying power in different sectors), but that it apparently has an upper limit. Once this limit has been achieved, employers cease to support wage growth. A sample survey in the given field is a prerequisite for further research that would answer the question concerning the weight of the individual factors that play a role in remuneration in the given sectors.

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REGIONAL PRODUCTS: LOCAL CONCEPT AND DIRECT SALES

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Annotation: In recent years, we have seen consumers' growing interest in the origin and composition of the products they buy. Especially in the case of food, we meet on the part of consumers with an emphasis on place of production, composition and authenticity. This interest grows along with the attention and space in the traditional and modern media dedicated to food fraud and adulteration. The regional product represents an alternative for the consumer, which, in the case of certification of this product, provides a relative assurance of authenticity guaranteed by an independent authority. This paper deals with the regional product, which, as previous research has shown, consumers associate mostly with food, agricultural and natural products. The aim of the paper is to identify the most appropriate distribution places for regional products. The research findings are supported by both secondary and primary data which derived from research conducted through a questionnaire survey, whose 1,390 respondents are residents as well as visitors of eight different micro-regions in the Czech Republic. Half of the respondents who have ever purchased a certified regional product have done so on the farmers' markets. The second most frequent place of purchase was then specialized stores. Almost a third of respondents purchased a regional product directly from the producer either to his own store or directly to the place of production.

Key words: Regional product, consumer behaviour, local concept, direct sales, authenticity, farmers' market, specialized store.

JEL classification: M31

1. Introduction

The food fraud is not a new problem, but it is a growing trend due to globalization, consolidation of manufacturing, urbanization (Spink and Moyer, 2011a). Johnson (2014) reports that the food industry has been experiencing food fraud thousands of years ago and some of the earliest reported food fraud involved e.g. olive oil, tea, wine and spices. Spink and Moyer (2011a) also associate food fraud with history, specifically with antiquity, and the difference compared to the present see on a scale previously limited and covering a geographically smaller area. At present, the food supply chains are considered to be more complicated, accelerated and prolonged, and the overall risk of spreading food fraud has expanded to include the entire global populations (Spink and Moyer, 2011b).

In the Czech Republic, Czech Agriculture and Food Inspection Authority (CAFIA) defines food fraud as a placing on the market of foods where the defect found relates to the substance, character or origin of the food, including the essential breaches of the requirements of food quality legislation (CAFIA, 2015). Spink and Moyer (2011b) state that food fraud is a broader term than either the economically motivated adulteration (EMA) defined by the Food and Drug Administration (FDA) or the more specific general concept of food counterfeiting. According to Johnson (2014) as part of a 2009 public meeting, the FDA adopted a working definition of EMA as “fraudulent, intentional substitution or addition of a substance in a product for the purpose of increasing the apparent value of the product or reducing the cost of its production, i.e., for economic gain.”

Existing research on product fraud and counterfeiting have defined seven distinct types of food fraud. These fraudulent incidents include: adulteration, tampering, over-run, theft, diversion, simulation, and counterfeiting (Spink and Moyer, 2011b). CAFIA (2015) provides examples of food-related health frauds such as the methanol case, melamine in dairy products from China, dyes as sudan I-IV,

rhodamine B, orange II, para red, bixin, then dietary supplements with pharmacologically active substances, handling of date of use of foodstuffs and examples of food fraud that are not associated with health hazards, such as sweetened honey, diluted young wine (Burcak), fake wine, low fruit jams, misleading offerings and deceptive labelling.

Globalization deepening the problem of food authenticity (Spink and Moyer, 2011b) necessarily leads a part of consumers to find alternatives, an inclination to regional or local production. Siamagka and Balabanis (2015) argue that many consumers prefer national products to foreign products, even though the quality of the former is lower and its price is higher. This prejudice is ascribed to consumer ethnocentrism (Siamagka and Balabanis, 2015; Fernández-Ferrín et al., 2018). The regional product may be approached as a product interlinked with a certain relatively bordered area, a place of origin (Kašková and Chromý, 2014), which, at the same time, represents the specifics of such area (Kaufmann and Durst, 2008). Fernández-Ferrín et al. (2018) state that a product's origin provides added value, which stems from the uniqueness of the culture, traditions, methods, and geographical and natural conditions associated with its production. Information about such products is communicated to consumers through various designations, guaranteeing, in particular, the origin of the product in the given region, the quality and uniqueness of the product in relation to the region concerned (traditions, local ingredients, manual or intellectual work, motif and specificity of the region, etc.), or the environmentally-friendly factor (ARB, 2014).

The notion “local product” generally indicates that the given products, or food, were produced in a certain geographical area, where these products are purchased and consumed. Martinez et al. (2010) points out that there exist no agreement as to requirements imposed on such proximity, but local products may be viewed as products that are grown, produced, placed on the market and consumed within a relatively small area. Local products are considered fresher, more nutritious and tastier than other products. Their higher quality is derived from the geographic proximity between production and consumption, which shortens transport time, thus allowing optimum maturation and the use of fewer preservatives. As an additional benefit of this proximity, local products are associated with values related to sustainability. The commercialization of these products is accomplished through short chains without intermediaries in which personal interaction between the producer and the consumer conveys authenticity and confidence (Fernández-Ferrín et al., 2018).

Important aspects of the viability of local and regional products, or the regional designation in general, primarily include the support directed at a horizontal and vertical cooperation among participants of the supply chain with the aim of creating short supply chains and local markets. Short Food Supply Chains (SFSCs) have established in parallel to conventional food chains, playing a key role in the emerging food networks that are continuously arising as an alternative to the globalized agri-food model. The diversities and particularities of the experiences existing all over the world (farmers' markets, on-farm selling, consumer cooperatives, internet sales, etc.) have attracted a growing interest from academia and policy-makers due to the nature of these initiatives, as well as for the socio-economic, territorial and environmental scope (e.g. Mundler and Laughrea, 2016; Tasca, Nessi and Rigamonti, 2017; Govindan, 2018).

The development of alternative food networks (AFN) in the Czech Republic is a consequence of a combination of factors attributable to producers who have sought sales channels for their goods since it was impossible for them to supply conventional food chains in the context of the national retail market controlled mostly by multinational chains, and factors attributable to consumers dissatisfied with the quality of food on offer in the conventional trade network (Syrovátková, Hrabák and Spilková 2015; Zagata and Boukalova, 2012; Miškolci, 2017).

The local concept, which promotes emphasis on the consumption of food as close to the place of its production as possible, signifies an important aspect of most AFNs and is their principal geographical element. Direct sale, representing a direct interaction between the producer/farmer and the customer/consumer, extends the geographical nature of the local approach by an organizational component (Syravátková, 2016).

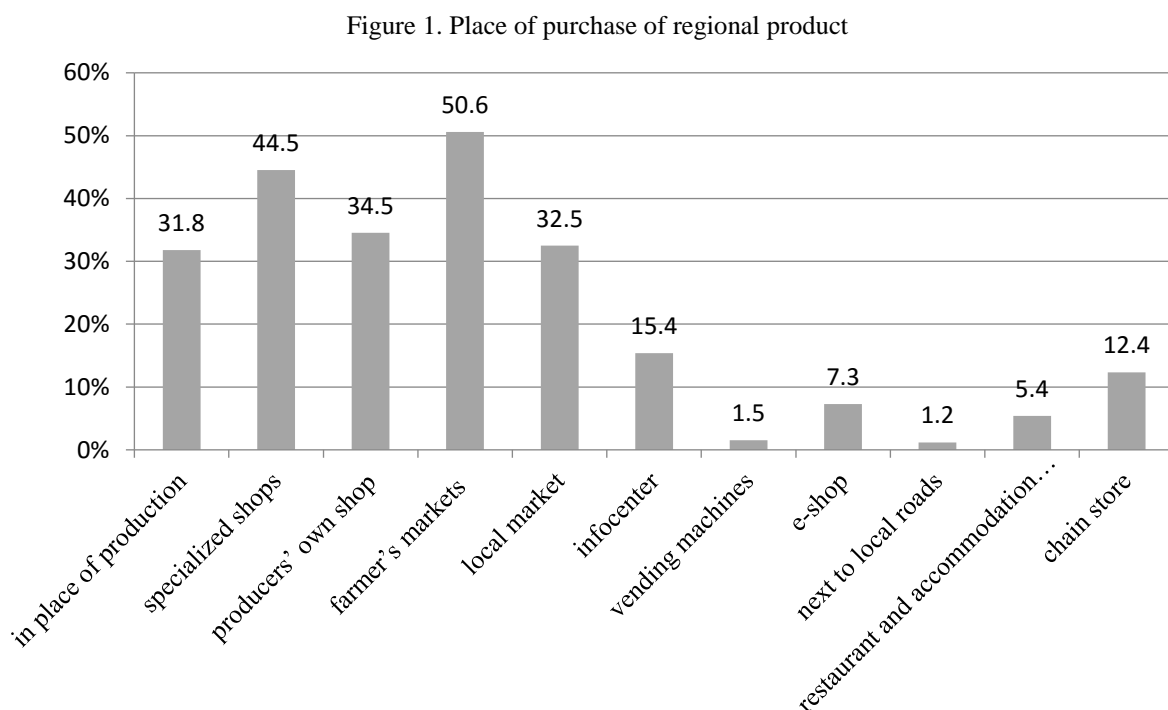
This paper attempts to find the answer to the question what marketplace is the most suitable for regional products in other words where consumer buy regional products the most often.

2. Materials and Methods

The methodological approach of this paper is generally based on the structure of explorative research. The research methods are based on an analysis of secondary data and primary data collection. Primary data was collected as part of a research project focused on regional designation of products in the Czech Republic. Respondents were contacted via an electronic questionnaire created using Google Docs. Snowball sampling method was used. The questionnaire contains closed, semi-closed and open questions. The article presents the outcomes of closed (dichotomous and multiple choice) and semi-closed questions. Data were collected in eight various micro-regions of the Czech Republic and obtained from as many as 1,390 respondents.

3. Results and Discussion

The research revealed that when buying regional products, customers tend to prefer direct distribution channel, as shown Fig. 1.



Source: own research, 2018

Farmer's markets were the answer that respondents indicated most frequently. It transpired that a half of the respondents used this distribution channel of certified regional products. A third of the respondents shopped directly on the producer's premises in producers' own shops or production places. Besides, a third of the respondents shopped at local markets. The option of online purchase of products was selected by respondents with a considerably lower frequency. As little as 7% percent of the respondents bought certified regional products online.

Indirect distribution channels considered, specialized shops is where the respondents go most often. These establishments include health food shops, farmer's shops or gift shops. This type of shops comes second after farmer's markets in terms of the respondents' preferences. The options "information centre" (15.4%) and "commercial chains" (12.35%) follow only after a certain distance.

If a comparison is made between the results gained and the research conducted by Nielsen Admosphere, focusing on aspects of the purchase of local/regional food, a considerable correspondence was determined. According to Nielsen (2017), respondents buy local or regional food most often at occasional markets and festivals within the given region (59%) and at regular farmer's markets in the place of their residence (58%). Respondents oftentimes mentioned purchasing products in specialized shops (40%) and during visits to producer's premises (34%). This similarity of results may be explained also by stating that even though the research conducted was not restricted to food, as was the case of the research carried out by Nielsen (2017), most of the respondents, in fact almost two thirds of them, associated certified regional products with food and agricultural produce (Margarisová, Vokáčová and Kuralová, 2018).

No significant differences were found with respect to the gender of the respondents. Farmer's markets turned out to be the most preferable place of purchase for both men and women. Women shop at specialized shops slightly more often (46% of women and 41% of men). On the other hand, men buy at producer's own shops more frequently than women (41% of men and 32% of women).

Results are essentially the same if a comparison is made as to the places where residents and visitors shop. The first two most frequented places of purchase match the results of the sample as a whole: accordingly, the respondents most often opted for farmer's markets and specialized shops. As a third option, the residents chose producer's own shops, whereby visitors selected the option of shopping directly in the production place. The study of Bavorová, Traikova and Doms (2018) shows that buying at farms is a preferred marketing channel, especially for those who do not have to overcome the distance barrier. The possible extension of farm shop activities through another direct marketing channel may be provided by e-commerce. Another additional marketing channel that may be used to overcome the distance problem, and can be managed through farm shops, is home delivery of food boxes, especially to large cities. The farmers' shop and a new box scheme combined with a web-shop are in accordance with the results Zagata and Boukalova (2012).

Regardless of the respondents characteristics (gender, status towards the region) as the most common place of purchase of regional products farmers' markets were chosen. Farmer's markets represent an essential direct distribution channel between farmers and their customers, who are thus able to purchase local products, very often grown within the sustainable production. This is a mutually beneficial interaction. One of the advantages of shopping at farmer's markets consists in the typical low-cost approach to regional products. In addition, customers can obtain information about the way these products are produced (Carson, Hamel, Giarrocco et al., 2016; Polimeni, Iorgulescu and Mihnea, 2018). For customers, shopping at farmer's markets brings a certain type of "shopping experience", in comparison with shopping at supermarkets (Ilbery and Maye, 2005). Farmers, on the other hand, benefit from higher profits since they need not use services of distribution intermediaries and can develop close relationships with their customers (Polimeni, Iorgulescu and Mihnea, 2018).

From the perspective of users, fruit and vegetables stand for the most interesting products sold at farmer's markets according to Pilař et al. (2017). "Fresh local products" enjoy the greatest competition advantage at farmer's markets. Findings from various countries, such as Germany, Austria, Spain, and elsewhere, show that foodstuffs that combine the characteristics of local, regional and traditional products are highly valued, whose natural character, taste and quality are also

highlighted by certified regional labels (Fernández-Ferrín et al., 2018). Differing from the results of the study by Rojík et al. (2016). In addition to looking for fresh and tasty food, consumers' efforts to support local producers and communities as well (Miškolci, 2017). The importance of alternative selling networks for sustainable production and consumption, which is also related to the reduction of the overall impacts of the supply chain on the environment, e.g. the absence of disposable packaging items, industrial processing, etc., is already evident here (Tasca, Nessiand and Rigamonti, 2017). In general, according to research results, Czech consumers of regional products most often buy these products through Short Supply Chains (SSCs) and it can be assumed that the motives of this consumer behavior are similar to those mentioned above / elsewhere in the world. This could be also supported by the partial results of the research carried out in the South Moravian Region by Rojík, Chalupová and Prokop (2015). There the respondents claim the support of regional producers to be the main reason for the purchase of regional products.

4. Conclusion

The theme of the local production is where the issue of sustainability of the globalized conventional food production (globalization with the aim to have everything at disposal irrespective of logicity, sources, seasons, local traditions, costs, environment, people, etc.) meets the problems of food safety.

Half of the respondents who have ever purchased a certified regional product have done so on the farmers' markets. The second most frequent place of purchase was then specialized stores. Almost a third of respondents purchased a regional product directly from the producer either to his own store or directly to the place of production. All of these distribution channels could be classified as alternative selling methods or as Short Supply Chains (SSCs) that bring producers closer to consumers.

SSCs are defined by two basic criteria, i.e. a physical and social proximity. SSC are a form of supplier-buyer relationships that highlights the importance of regional food and products, the use of regional food in catering facilities, gastronomy in general, local businesses and tourism. The importance of SSCs rests in the relationships among producers, consumers, business persons, schools, local authorities and associations, which together create a strong local community. These forms of a supplier-buyer relationship have a positive influence on environmental, economic, social and health and welfare spheres and contribute to the sustainability of these systems.

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AGEING AND FOOD SECURITY IN RURAL INDIA

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Annotation: India faces accelerated population ageing accompanied by a set of socio-economic changes, with the number of elderly projected to increase from current 130 million to 300 million by 2050. With less than 10 percent of elderly receiving pension of any kind, the transition from the traditional familial support system towards more nuclear family systems may further compromise their position. Food security, income, savings, and work participation are thus inseparable components of the wellbeing of India's rural population, and key variables in understanding the impact elderly farmers have on household income, spending and savings, and consequently, food security. Data was collected using a semi-structured questionnaire administered within Lakhisarai district, resulting in 388 household samples, and 203 elderly household member samples. Recorded household income, spending and savings, and the number and average age of elderly household members were used in the regression analyses, while the self-reported difficulty levels were used to calculate the work intensity indices by age, gender, and agricultural activity. They were supplemented with descriptive statistics, including the most common activities performed by rural elderly, and the most and least difficult activities. Regression output highlighted the statistically significant relationship between the number and average age of elderly household members, and the household income and spending, but not the savings. In other words, having an additional elderly household member contributed slightly more to household income than spending, although the predictive power of regression models was fairly low. Similarly, there was a statistically significant link between the age of elderly household members and the self-reported difficulty of performed agricultural activities, with difficulty being negatively correlated with the increase in age. Lastly, produce selling was reported as the least difficult activity, while transporting grains was rated the most difficult.

Key words: household income, rural ageing, rural food security

JEL classification: Q12, Q18, J11

1. Introduction

India faces accelerated population aging (Brendan and Sek, 2016), with the growth rate of individuals aged 60 and over being three times higher compared to the population as a whole (Table 1) (Sathyanarayana et al., 2014). Declining fertility rate, increasing longevity, and large cohorts advancing to older ages are the main drivers of the change (Lee, Kim and Welk, 2014), with projections for 2050 showing an increase in population aged 60 and over from current 130 million to 300 million (United Nations, 2015; Kardile and Peisah, 2017).

Table 1. Indicators of aging for the Indian population for census years 1961-2011

Census year	Number of older adults	% of older adults	Old-age dependency ratio (per 100 adults)	Sex ratio among older adults (per 1,000 older males)
1961	24,712,109	5.63	10.56	929
1971	32,699,731	5.97	11.47	938
1981	43,167,329	6.49	12.04	960
1991	56,681,640	6.80	12.19	930
2001	76,622,321	7.47	13.08	1,029
2011	103,849,040	8.61	14.22	1,033

Source: Bakshi and Pathak (2016)

Aging is a particularly acute problem in developing countries such as India, where less than 10% of the elderly receive pension of any kind (Uppal and Sarma, 2007), while less than a fifth can depend on their friends or family for financial help (Alam et al., 2014). The ongoing transition from the traditional familial support system of living arrangements for older persons towards more nuclear family systems, further compromises their position and exposes them to the inefficiencies of country's social and healthcare systems (Agrawal, 2012). With agricultural sector employing 51% of country's workforce (The World Bank, 2010), and close to three-quarters of Indian families depending on rural income, even at older ages (Alam et al., 2014), income, savings, and work participation of elderly rural population, as a result, remain inseparable components of their wellbeing.

Accordingly, the aim of the research is to understand how aging affects elderly farmers and their respective households in Lakhisarai district from the above-described perspective, and to explain the link between aging and agriculture in greater detail than previously attempted. The paper thus connects rural ageing to food security through elderly work participation, and household income, spending, and savings, by focusing on economic access as one of the four pillars of food security. As noted by the UN Committee on Economic, Social, and Cultural Rights, food insecurity is characteristically driven by the lack of access to available food, usually due to poverty, rather than by food scarcity (United Nations, 1999). Access is, therefore, primarily a function of household income, which is, in turn, partially influenced by the number and age of elderly household members. A set of hypotheses, each representing an individual objective, are thus defined and assessed using the regression analysis.

The H_{0a} hypothesis, as the first being tested, assesses whether the average number of elderly household members has any impact on household income and expenses, with a separate regression performed for each variable combination (i.e. farmer's age vs. income, expenses, savings).

H_{0a} : Household income, expenses, and savings of Lakhisarai farmers, increase with the average number of elderly household members.

H_{1a} : Household income, expenses, and savings of Lakhisarai farmers, do not increase with the average number of elderly household members.

H_{0b} hypothesis, on the other hand, tests the relationship between the average age of elderly household members and household income and expenses. Separate regressions are performed for each variable combination as in the case of the average number of elderly household members.

H_{0b} : Household income, expenses, and savings of Lakhisarai farmers, increase with the average age of elderly household members.

H_{1b} : Household income, expenses, and savings of Lakhisarai farmers, do not increase with the average age of elderly household members.

Lastly, the H_{0c} hypothesis, assumes that agricultural intensity, defined as the average self-reported difficulty of performed activities during the preceding month, declines with farmer's age. The hypothesis is also assessed by gender.

H_{0c} : Agricultural involvement of Lakhisarai farmers, measured by reported agricultural intensity index, declines with farmer's age.

H_{1c} : Agricultural involvement of Lakhisarai farmers, measured by reported agricultural intensity index, does not decline with farmer's age.

2. Materials and Methods

The research focuses on smallholder farmers in Lakhisarai, one of the 38 districts of the Indian state of Bihar. The district is composed of seven sub-divisions, with headquarters and major administrative centers situated in Lakhisarai (Government of India, 2015). Approximately 34% of district's population lives below the poverty line, 38% are illiterate, while as much as 67% are classified as non-workers. While the state of Bihar was selected for its exceptional level of poverty, the South Asian sub-continent was chosen for having one of the highest levels of population density in the world.

The target population were the heads of households whose primary occupation is agriculture, and who look after qualified dependents. As the study aimed at achieving the results with 95% confidence interval and 5% margin of error, about 400 surveys were collected using a structured questionnaire, a target chosen based on the availability of resource. The research was carried out in November 2017 with the help of five local student-researchers.

Simple random sampling was used to select the district and 12 villages within the district so that each village has an equal and known chance of being selected (Yates et al., 2008). In the field, systematic sampling was used to select every fifth house, the method applied as it allows sample size to be targeted. If the household was unavailable for the interview, the surveyor would skip the next four houses and move on to the fifth. No incentives were given due to potential bias (Gideon, 2012), and no repeat visits were made due to time and resource constraints. The approach generated the pool of approximately 611 potential respondents, thus providing the base large enough should some households be unavailable to participate.

To facilitate hypotheses testing, individual work intensity indices were constructed for each collected sample using the below formula, where WII is the work intensity index and ADL_n the activity difficulty level (1). Since the five-point Likert scale was used to record the difficulty of reported activities, with 1 corresponding to "very easy" and 5 representing "very difficult", in case all three activities were rated as "very easy", the total score (index) would be 1 (3/3). Similarly, if all three activities were rated as "very difficult", the final index would be 5 (15/3). At the same time, the collected data was structured and normalized using Microsoft Office software, before being regressed in SPSS 23 statistical package.

$$WII = \frac{ADL_n}{n} \quad (1)$$

The simple linear regression, in the context of this study, can be defined as a statistical technique that attempts to explore and model the relationship between two or more variables (NCSS, 2015). In a general linear regression equation (2), y is the response variable, x is the explanatory variable, β_1 the intercept, β_0 the slope, and u_i is the residual (random error component), that is being minimized. The betas are called regression coefficients and the slope β_0 can be interpreted as the change in the mean value of y for a unit change in x . Sample size, Pearson correlation, adjusted R-squared, ANOVA F-statistic, beta, and 95.0% confidence interval for beta will be reported as part of every statistically significant output ($p < .05$). At the same time, linearity between dependent and independent variables will be checked, along with homoskedasticity, skewness and kurtosis, and normality of the error distribution.

$$y = \beta_0 + \beta_1 x + u_i \quad (2)$$

While Pearson correlation tracks linear correlation between variables, returning values between +1 (positive correlation) and -1 (negative correlation), with 0 implying no correlation (Stigler, 1989), adjusted R-squared explains the variance in dependent variable by measuring how close the data is to the fitted regression line (Frost, 2013).

ANOVA, on the other hand, tests whether means of several groups or populations are equal and whether differences between the means are statistically significant (Rutherford, 2001). ANOVA is a t-test extension for independent samples, preferred over multiple t-tests due to a higher probability of making a type I error (incorrect rejection of a true null hypothesis) with an increased number of groups. ANOVA F-statistic, as the ratio of the mean squares, will be larger when there is more variability between the groups than within the groups and will be smaller (close to 1) when variability between groups and within groups is almost equal.

Lastly, beta coefficients are used to compare the relative strength of predictors within a model and are considered the most valuable output of an analysis. They measure dependent variable's sensitivity to changes in an independent variable, with a beta of 0 indicating that changes in an independent variable cannot be used to predict changes in the dependent variable (Baum, 2006).

Due to violations of data normality, which itself is likely result of violations of linearity (observed on a scatterplot showing residual vs. predicted values), a non-linear transformation (log transformation) was applied to household income and household expenses variables to address the issue. Post-transformation, data normality plot and histogram (used to assess skewness and kurtosis), seem improved and normal, although it should be noted that scatterplot, while without any significant outliers, continues to have two distinct data point clusters.

3. Results and Discussion

Descriptive statistics are introduced first, followed by regression findings. Reported agricultural activities ranked by their difficulty reveal that taking care of the animals, followed by harvesting, and planting, are the most often performed tasks. These three activities alone account for 47% of all reported activities. Not surprisingly, produce selling, taking care of the farm, and milling were identified as the easiest activities to perform, while transporting grains and harvesting were highlighted as the most difficult.

Accordingly, focusing mechanization efforts on the latter could potentially bring the benefits to the farmers in terms of household income, and consequently food security. A study in neighboring Bangladesh, comparing costs of select rice-farming operations performed using motorized equipment and manual labor, showed cost reductions ranging from 85% in case of rice transplanting to 92% for weeding (Milovanovic and Smutka, 2018). Similar economic gains may be achieved for other agricultural activities, thus further extending the benefits.

Table 2 highlights the average age of elderly farmers, the average reported agricultural intensity, and the average hours worked per day, along with several accompanying statistics. Although only 10% of farmers have reported not working during the preceding month, the difference in the average intensity and hours worked for all farmers and those who have worked, is significant. As most elderly farmers continue to work well after they retire, and consistently rank their daily tasks as "very difficult," the government efforts should be focused on improving farm productivity, which would rise household incomes and promote food security (The World Bank, 2016). Alam (2006) and Yadava, Yadava and Sharma (1996) point out that older family members, particularly in lower-income households, are aware of their dependency and choose to work for more favorable treatment by their respective families. Bakshi and Pathak (2016), confirm this notion and highlight the up to three times higher independence of employed older farmers compared to their unemployed peers.

Table 2. Descriptive statistics for select variables (main questionnaire and elderly section)

Variable	Average (all farmer)	Average (farmers who work)	Max	Min	Std. Dev.
Farmer's age	67.2	-	100.0	60.0	6.8
Agricultural intensity index	1.9	4.0	5.0	-	2.0
Hours worked	6.7	8.3	15.0	-	3.6

Source: author

As for linear regression outcome, although the predictive power of essentially all models was notably low, both H_{0a} and H_{0b} hypotheses were supported, with the average age and number of elderly household members expected to increase household expenses: 12% with each additional elderly household member, and 0.2% with each additional year in the age of elderly household members (Tables 3 and 4).

Table 3. Simple linear regression output for the number of elderly household members as independent variables (log-level)

Dependent variable	N	Pearson corr.	Adjusted R-squared	ANOVA F	B	95.0% confidence interval	
Household income	388	.283	.078	33.591	.143	.095	.192
Household expenses	388	.272	.072	30.888	.120	.078	.163

Source: author

One, however, cannot consider the effects of aging on household expenses independent from household income, which is predicted to increase by 14.3% with each additional elderly household member. Compared to the increase in household expenses, household income is, therefore, expected to grow 2.3 percentage points faster with each additional elderly household member. The finding not only debunks the commonly held notion that elderly household members are net negative contributors to household budget (Bloom et al., 2010), but also suggests that older family members contribute in other ways not measured by labor force participation or generated income.

Table 4. Simple linear regression output for the average age of elderly household members as independent variables (log-level)

Dependent variable	N	Pearson corr.	Adjusted R-squared	ANOVA F	B	95.0% confidence interval	
Household income	388	.203	.039	16.647	.002	.001	.003
Household expenses	388	.191	.034	14.574	.002	.001	.003

Source: author

Lastly, the regression results for agricultural intensity index support the H_{0c} hypothesis, as the model predicts a decrease of 0.05 with each additional year of age (Table 5). Although the beta is slightly higher for female respondents, the wider confidence interval makes the model, overall, less accurate. Moreover, the sharp decline in hours worked after the age of 80, signals a potential limit to how long farmers can stay active. With older farmers, therefore, expected to work less intense, shorter hours, and perform less difficult activities as they age, the importance of savings and other coping mechanisms becomes relevant.

Keeping the working population active for longer could, therefore, potentially drive economic growth, defer payments of pensions, unemployment, and disability benefits, and increase the tax base, although, as noted above, it has its limits. Instead, a universal and non-contributory pension system for all workers, as proposed by the Pension Parishad (Dogra, 2013), could be a more stable solution for income and food security. The group cites several examples of low and middle-income countries

where universal or near-universal non-contributory old age pension system was adopted, including Bolivia, Lesotho, Kenya, and Nepal, and reminds that ensuring that “people everywhere can grow old with security and dignity and that they can continue to participate in social life as citizens with full rights”, is achievable (UN, 2001).

Table 5. Simple linear regression output for the average age of all, male, and female elderly household members as independent variables (*level-level*)

Dependent variable	N	Pearson corr.	Adjusted R-squared	ANOVA F	B	95.0% confidence interval	
Intensity index - All	203	-.24	.05	12.65	-.05	-.07	-.02
Intensity index - Males	203	-.21	.04	7.60	-.04	-.06	-.01
Intensity index - Females	203	-.34	.09	4.32	-.08	-.16	.00

Source: author

4. Conclusion

Agricultural sector remains an essential source of income for majority of Indian population. With ageing projected to have a profound impact on country’s economy and society, understanding the position of older farmers becomes necessary. The self-reported difficulty of performed activities, along with hours worked per day, were found to decrease with farmer’s age. Household income, on the other hand, is expected to rise faster than household expenses with each additional elderly household member and each additional year in age of elderly household members. At the same time, produce selling was reported as the least difficult activity, while transporting grains was rated the most difficult. Although the predictive power of reported regression models was fairly low, it can be inferred that older farmers continue to contribute well into their old age and have a positive impact on household budget and food security. Lastly, although improving the productivity of older farmers could address some of the present challenges, a universal pension system would be a more suitable solution.

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QUALITY OF FOOD CONSUMPTION AS A CONDITION FOR ENSURING FOOD SECURITY AT THE HOUSEHOLD LEVEL

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Annotation: The report analyzes the main trends and differentiation of food consumption by the rural-urban differences and in different types of households in the Russian Federation. The information base of the study consists of official statistics of Federal State Statistics Service (Rosstat) of the Russian Federation, the results of "Selective Observation of Behavioral Factors Affecting the Health of the Population", conducted by Rosstat in 2013; results of the sociological surveys conducted by the Institute of Agrarian Problems of the Russian Academy of Sciences in one of the Russian regions (Saratov oblast) in 2011-2012 with personal involvement of the authors. Spatial differences in food and energy values of food products, in sources of their supply and consumption patterns are shown. A steady trend of increasing the food balance in different types of households, increasing of the homogeneity of the food structure in urban and rural areas is revealed. The features of the attitude to proper nutrition in households differentiated by the presence and number of children, the level of material well-being are analyzed. It is concluded that household consumption patterns, structure and failure of nutrition, are determined by the composition and socio-demographic structure of the family, the availability of children, their age, income level and the state of health of family members, as well as the influence of different socio-cultural factors (education level of family members, their system of values and cultural attitudes).

Keywords: consumption, food, households, rural-urban differences, Russia.

JIL code: D 12, D 19, R 29

1. Introduction

The most important factor of health preservation and promotion of the person, increase in duration and quality of life is a compliance of food and power value of the consumed food to physiological norms, as well as a balance and safety of food. There are three groups of risks associated with food consumption. Risks of the first group are caused by irrational, unbalanced food structure; the second group is caused by consumption of food of poor quality, violation of sanitary and hygienic rules of storage and cooking; the third one is by consumption of food containing dangerous and potentially dangerous ingredients (synthetic dyes, preservatives, stabilizers, traces of hormones and antibiotics, genetically modified organisms, etc.).

The quality of food consumption changes under the influence of economic, technological and social factors. The result of the joint impact of income growth of the population, the increase in the scale of territorial mobility, new technologies for the production and storage of products, manipulation of consumer behavior through marketing technologies, changing consumer perceptions regarding the quality and safety of food are changes in the structure of food consumption and consumer behavior of the population.

Trends in food consumption, transformation of consumer preferences in the food market are increasingly becoming the subject of research. On the one hand the processes of industrialization, rationalization and globalization made the process of food consumption is more effective, reduced the time spent on the acquisition and preparation of food, controlled its caloric content; on the other hand, it increased dehumanization, alienation, the spread of culturally-related diseases (anorexia, diabetes, obesity, diabetes, etc.). It is largely connected with the growth of opportunities

for manipulation of consumer behavior (Kravchenko, 2015). Many researchers note the growing concern of consumers about food quality and health safety (Filipovic and Stojanovic, 2013; Khoury, Ramadan and Zeeni, 2016). According to Kornekova (2017), that today the problem of food consumption is not only economic and has many cultural meanings. Food and health discourses are increasingly intertwined. The culture and patterns of consumer behavior in the food market are currently the subject of research by sociologists, doctors, economists (Halkier, 2001; Korneychuk, 2017; Varshavskiy, 2011; etc.). There were investigated dependence of the quality of food, the balance of nutrition on the style and way of life, as well as the peculiarities of health-saving behavior of different social groups (Szakaly, et al., 2012; Ermolaeva and Noskova, 2015), changes in consumer food quality requirements (Klopčic, Kuipers and Hocquette, 2013; Savelli et al., 2017).

The extent of new trends in food consumption at the household level is determined by income, age, education level of consumers, the size of the settlements in which they live, and the remoteness of settlements from district or regional centers.

2. Materials and Methods

The information base of the study consists of official statistics of the Federal Service of State Statistics of the Russian Federation, as well as the results of "Selective Observation of Behavioral Factors Affecting the Health of the Population" (Federal State Statistics Service, 2013). The sample is representative, 45,0 thousand of households with 103,5 thousand of respondents. The study is based on the results of the analysis of food consumption patterns in the spatial context (city-village) and in various types of households. The sample is representative. In accordance with the objectives of the study families with children were identified. The respondents' answers were evaluated by analyzing two-dimensional distributions and averages of features by group. The paper is based on the results of the sociological surveys conducted by the Institute of Agrarian Problems in the Russian Academy of Sciences in 2012 with personal participation of the authors (random sample, N= 353, represents the rural population of the Saratov region in working age).

3. Results and Discussion

In the last decade, there have been important qualitative changes in the structure of Russian nutrition. They include a decrease in the consumption of bread products and potatoes, an increase in the consumption of animal products, fruits and vegetables, a decrease in seasonal consumption, a reduction in food self-sufficiency, an increase in the consumption of processed products (semi-finished products and ready-to-eat). These trends were typical for both urban and rural households, and the difference in rates of change led to an increase in the homogeneity of consumption patterns in urban and rural areas.

Changes in the structure of the diet led to an increase in its nutritional value. With an increase in the energy value of consumption on average for all households from 2006 to 2016 by 5% (to 2674.8 kcal, on average per household member per day), protein consumption increased by more than 13%, including animal origin by 27%, fat by 23%. According to the recommendations of nutritionists, the share of basic nutrients in the energy value of the daily diet should be: proteins – 10-15%, carbohydrates – 55-60%, and fats – less than 30%. In 2016 this ratio on average for all households was: proteins - 12%, carbohydrates - 51%, fats - 37%. The energy value of daily ration is higher in rural household – 2854.7, on average per household member per day. But due to the higher rates of reduction of bread and potatoes consumption in rural households calorie nutrition is almost the same as in the city.

Table 1. Consumption of food products by main groups in households of the Russian Federation, on average per household member per year, kg

	Households in urban areas			Households in rural areas			Rural households in % of urban	
	2006	2016	2016% by 2006	2006r.	2016r.	2016% by 2006	2006	2016
cereal products	99.0	92.4	93.3	129.7	116.9	90.1	131.0	126.5
potatoes	66.1	56.5	85.5	92.0	70.2	76.3	139.2	124.2
vegetables and melons	86.4	105.3	121.9	92.3	104.2	112.9	106.8	99.0
fruits, berries	57.4	75.5	131.5	39.8	65.1	163.6	69.3	86.2
meat and meat products	69.9	90.5	129.5	58.9	81.9	139.0	84.3	90.5
milk and dairy products	260.7	277.1	106.3	233.4	260.7	111.7	89.5	94.1
eggs, pcs.	214	232	108.4	184	221	120.1	86.0	95.3
fish and fish products	17.1	21.5	125.7	16.7	21.6	129.3	97.7	100.5
sugar and confectionery products	29.9	30.6	102.3	36.8	36.0	97.8	123.1	117.6
vegetable oil and other fats	10.5	10.5	100.0	11.3	12.3	108.8	107.6	117.1

Sources: own processing based on the results of the "Consumption of food products in households 2008; 2016". Federal State Statistics Service.

The characteristic features of the traditional type of food of the rural population traditionally include a high level of self-sufficiency in food through private farms. But currently there is a strong tendency of increasing the share of products coming through the market channels. So, if in 2006 more than 86% of potatoes were consumed as natural receipts, then in 2016 – 70%, vegetables and melons – 66% and 49%, dairy products – 35% and 12%, eggs – 47% and 32%, fruits and berries – 36% and 28%, meat products – 31% and 17%, respectively. (Calculated according to "Consumption of food ... 2008; 2016").

In recent years, both in the city and in the rural area, there has been a steady increase in the level of consumption of foods that have undergone preliminary processing. From 2006 to 2016, the consumption of sausages, meats and semi-finished products increased by 19% on average for households, of dairy products and yogurts - by 32%, chocolate and other confectionery products – by 39%. The general trend is that today the population spends relatively more on ready-to-eat foods, while the time spent on growing products in private households and cooking is decreasing. The growing awareness of consumers about the possible negative consequences of eating foods containing chemical, synthetic and genetically modified ingredients leads to a change in the attitude of respondents to control the content of purchased food. According to the results of our research,

35.7% of rural residents of working age, when choosing food products, necessarily control their content, indicated on the label.

The attitude of consumers to the need to control the content of purchased products depends primarily on the level of their education and welfare. The level of education determines the level of awareness of respondents, and the level of well-being – material opportunities to choose food. The higher the income, the higher the product safety requirements. This is especially true for men, in women this dependence is expressed to a lesser extent, as in low-income groups there is a large number of mothers with young children, for whom the safety of products is very important. The level of satisfaction with the quality of nutrition increases with the level of income and level of education of respondents.

Table 2. Relationship to control the presence in the composition of purchased food genetically modified organisms and chemical additives depending on the assessment of the quality of food. (as a percentage of the number of respondents in each group)

How do you assess the nutrition of your family?	When choosing food products, do you control the presence of GMOs and chemical additives in their composition?			
	No	Sometimes	Yes	Total
Good (quality and diverse)	9.7	38.7	51.6	100.0
Not diverse, but quite qualitative	9.1	57.6	33.3	100.0
Sufficient	38.5	33.3	28.2	100.0
Bad in all respects	50.0	34.3	15.7	100.0

Sources: own processing based on the results of the sociological surveys conducted by the Institute of Agrarian Problems in the Russian Academy of Sciences in 2012 (random sample, N= 353).

As the results of the survey of The All-Russian Public Opinion Research Center show, in February-March 2018, the share of citizens who follow a meal plan was maximum in 12 years: 7% of respondents follow the diet recommended by the doctor, 12% of respondents follow the diet chosen by themselves, 41% of respondents try to eat healthy food (in 2006, 5; 9 and 32 % respectively). The share of respondents who have no opportunity to think of food quality and eats anything decreased from 29 to 14%. The share of respondents who say that they eat anything because they feel perfectly healthy is stable (23% in 2006 and 22% in 2018).

The results of the study show that a high level of education determines the availability of knowledge, skills and abilities related to the provision of an acceptable consumption level of quality food. Individuals who do not have professional education often do not even think about the need for proper and quality nutrition. Among the respondents with incomplete school education, about 35.1% indicated that they know nothing about the rational regime and daily diet (Here and below calculated according to "Selective observation of..., 2013"). Only 10.6% of respondents with higher professional education do not know about the rational diet with an average sample of 19.2%. The place of residence of the respondent also influences on the difference in the consumption culture. For example, rural residents are much more likely than rural residents to indicate that they do not know norms of the rational regime and daily diet (23.7 and 16.8%, respectively).

The assessment of the impact of income level in our study is based on the analysis of subjective perceptions of the material well-being of the household. Subjective assessment of the income level of the family let us identify families who are not in difficulties for money and are able to provide themselves with quality food; families with financial limitation, as well as families that are strapped for money. About 17.6% of families who are not in difficulties for money indicated that they did not know the norms of rational regime and the daily diet, and almost 39.3% of families that are strapped for money indicated this state. It is evident that among individuals with high financial possibilities,

the share of those who follow a meal plan (42.9%) is higher than that of extremely poor families (17.3%). About 33.5% of the rural population and 38.0% of the urban population follow a meal plan. Other people do not follow a meal plan because of lack of habit (39.4 and 32.3%, respectively). Respondents with a higher education, more often than those with incomplete schooling, point to a lack of time (25.5 and 9.6%, respectively). About 37.0% of extremely poor families and only 0.3% of families without financial pressure do not follow a meal plan because of lack of financial resources. "Rich" families often do not have time to follow a meal plan (24.0% compared to 13.5%) and "poor" families often do not have habits to follow a meal plan (37.8% compared to 29.8%).

The increase in cultural level of food consumption is the most important factor of food security at the level of individual households or at the micro-level. The choice of the consumption model is closely connected with the processes of socialization of the individual in the family, development of certain consumer preferences. Children are objectively dependent on their parents, on the models of socializing, educational, labor and health-saving behavior they have mastered. It should be mentioned that the features of consumer and health protection behavior of children in their future life depend on the value of healthy lifestyles and the culture of food consumption in the family.

In the views of the majority of Russians, children and a good family are the dominant of life values. The results of the study confirm these findings. To identify the system of life values and the place of children in it, respondents were asked to assess the value of the proposed benefits on a five-grade scale from "one" to "five" (where 1 means "does not matter" and 5 means "very important"). The analysis of the results was carried out by assessing the average of each value in the group. The hierarchy of life values in all groups differentiated by the presence and number of children is the same: children, health and a good family are considered to be the most important things, interesting work and a high level of education are the least important. However, there are differences in the average score between groups with different numbers of children. In the group of parents with one child, the average value of children is 4.66 points, and in the group of families with many children – 4.74. On the other hand, the value of interesting work is much higher for families with one child (3.86) compared families with many children (3.66), as well as a high level of education (3.55 and 3.36 points, respectively). Thus, it should be noted that material well-being, interesting work and a high level of education are more important for families with one child, while good health and a good family are the most important things for families with many children. These differences in the system of life values are important factors in differentiating family strategies for ensuring the material well-being of the household.

Families with cohabiting children under 18 years more often follow a meal plan (38.6 and 29.3%, respectively). In addition, families without cohabiting children more often than families with cohabiting children abuse by junk food (24.0 % of childless families and only 12.9% of the families with children). Almost 42.6% of families with children and 27.9% of families without children indicate that they almost never abuse by junk food, and almost indicate this fact. Almost 39.1% of families with one child and almost 48.7% of families with three or more children never abuse by junk food.

Development of both intra-family and individual culture consumption is also influenced by a number of other social institutions: the state, education, advertising, the media, etc. On the one hand, the model of consumer behavior is determined by the current system of family norms and values, on the other – by socio-economic and political conditions in society.

The study of food consumption patterns in different types of households, conditions and factors of their formation and transformation is an important condition for improving the effectiveness of public policies in the field of healthy nutrition and ensuring food security.

4. Conclusions

Improving the quality of food consumption is an important factor for ensuring food security at the household level. From 2006 to 2016, Russia maintained stable trends to improve the balance and nutritional value of food rations in different types of households, as well as to improve the uniformity of the food structure in the city and in the rural area. Reduced consumption of bread products and potatoes, increased consumption of animal products, fruits and vegetables reduced the prevalence of the eating patterns model with a high carbohydrates content. However, there is a steady increase in fats consumption, excessive consumption of which is typical today for almost all population groups. At the same time, the population is increasingly aware of the need for a healthy lifestyle and control over the quality of food, as its most important component.

Content, structure and mode of food consumption is determined by the composition and socio-demographic structure of the family, the presence of children, their age, income and health status of family members, their education level, the system of life values and cultural attitudes. The increase in the physical and economic accessibility of quality food does not automatically mean the population's transition to a nutritional pattern that is in the interest of preserving and promoting the health of present and future generations. The transition from the cult of consumption convenience to the priority of rational, healthy nutrition requires the development and implementation of a whole range of economic, legislative and organizational measures that take into account the processes of formation and transformation of consumption patterns in different types of households.

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EVALUATION OF THE FAIR TRADE CONCEPT IN THE CONSCIOUSNESS OF GENERATION Y IN SELECTED REGIONS OF THE CZECH REPUBLIC

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Annotation: Generation Y is a young generation born in the 1980s and 1990s. Now it is a generation in productive age that starts to accumulate financial funds. Generation Y is familiar with the technical progress of last 20 years and generation Y is interested in modern trends in technologies. This document deals with the interest of the generation Y in Fair Trade production. The research was made through questionnaire. The research sample was selected by quota selection by Czech Statistical Office. Data were analysed by descriptive statistics and chi square test. The survey was completed by 840 respondents aged 15-34. Almost half of respondents are familiar with Fair Trade. Most respondents with no awareness about Fair Trade are in the 15 to 19 age group. Almost half of respondents buy Fair Trade products, 7% of all respondents often. More than 30% of respondents are not interested in Fair Trade, and they do not even plan to buy them in the future for trying. Consumers of Generation Y buy mostly chocolate (72.7%, 141 people), coffee (59.8%, 116 people), tea (56.7%, 110 people) and cocoa (40.7%, 79). Fair Trade is still new label of production. This kind of trade should be fairer for producers in the context of sustainable development and Corporate Social Responsibility.

Key words: Fair Trade, sustainability, generation Y, label, questionnaire

JEL classification: F13, F18

1. Introduction

Fair Trade as an alternative business concept is attributed to the fact that developed Western nations realized global growth of the economy and trade is not equal to all countries and social groups (Steinrücken and Jaenichen, 2007). Fair Trade and other alternative forms of trade are currently being explored in various contexts through the world (Terstappen, Hanson and McLaughlin, 2013). Offer of Fair Trade production is constantly expanding. Mainstreaming of Fair Trade production is caused by consumers, non-governmental and media press (Karjalainen and Moxham, 2013). Fair Trade is also important for sustainable development in context of Corporate Social Responsibility (Öberseder, Schlegelmilch and Gruber, 2011). One of the tool which is representing international development and global solidarity is Fair Trade (Hejkrlík, Mazancová and Forejtová, 2013).

Definition of Fair Trade from year 2001 by organization FINE is: “*Fair Trade is a trading partnership, based on dialogue, transparency and respect that seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions to, and securing the rights of, marginalized producers and workers - especially in the South. Fair Trade Organizations, backed by consumers, are engaged actively in supporting producers, awareness raising and in campaigning for changes in the rules and practice of conventional international trade.*” This definition is generally accepted by most world organizations and experts (Staricco, 2016, Raynolds, 2012, Walton, 2010).

It is not easy to classify specific person to a particular generation according to the year of his birth (Cui et al., 2003). In general by many authors (Agheorghiesei Cordeanu, 2015; Bolton et al., 2013; Gurau, 2012, Reisenwitz and Iyer, 2009) is possible to agree that Generation Y are people born during the 80s - 90s of 20th century, although the exact timeframe is different in concepts of various authors.

Technologies are regular part of life of young people. None of the previous generations grow as closely linked to modern technology as generation Y. Millennials generation is largely using social networks and sharing information through social media platforms with which they are very well acquainted (Bolton et al., 2013). For this generation is more important ecology and generation Y is more active in solving of environmental problems (Vysekalová et al., 2011). The Millennials are young people who enter or are already in the productive age of their lives, and their consumer preferences will in the future significantly influence the structure of future demand in developed economies.

The aim of this paper is to evaluate the general awareness of Fair Trade and identify the consumer preferences of generation Y members when purchasing Fair Trade products.

The introduction of this paper includes a theoretical background of the examined issue. Section of materials and methods describes how primary data were analyzed and research was made. Section of results and discussion present results obtained, in discussion are compared final results of own research with similar studies of other authors on similar topics.

2. Materials and Methods

Theoretical background for this paper was based on an analysis of sources gained from scholar papers and special literature. Primary data were obtained through the survey.

Respondents were young persons from Generation Y, aged 15 – 34, from selected regions of the Czech Republic. Total number of respondents was 840. Respondents were selected by quota selection by classification of Czech statistical office. The questionnaire survey was held during year 2017.

General Sociodemographic information about groups of respondents are summarized in the following table:

Table 1. General information about respondents in quota selection

Gender	Females	417	49.6%
	Males	423	50.4%
Age	15 - 19 Years	170	20.2%
	20 - 24 Years	200	23.8%
	25 - 29 Years	210	25.0%
	30 - 34 Years	260	31.0%
Highest education level obtained	Elementary	194	23.1%
	Secondary with no graduation exam	194	23.1%
	Secondary with graduation exam	285	33,9%
	University	167	19.9%
Permanent residence	Prague	347	41.3%
	Ústí nad Labem region	229	27.3%
	South Bohemian region	176	21.0%
	Karlovy Vary region	88	10.5%
Net income of households - monthly	More than 50 000 CZK	144	17.1%
	25 000-49 999 CZK	305	36.3%
	Below 24 999	152	18,1%
	Didn't answered	239	28.5%

Source: Own research, 2017

Results were obtained by descriptive methods of statistics as relative and absolute frequency. Contingency tables were based and tested by Pearson's chi-square test. Significance level (α) was set at 0.05. If the value of χ^2 test was equal to or greater than value of critical χ^2 test on significance level $\alpha = 0.05$, null hypothesis about independency was rejected (Vaughan, 2001). In case when null hypothesis was rejected, Cramer's V is possible to count (Abbott and McKinney, 2013).

3. Results and Discussion

In questionnaire survey through members of Generation Y was tested general knowledge of Fair Trade. From answers, more than half respondents (54.0%, 454 persons) never heard about Fair Trade concept, 22.9% (192 persons) had a partial knowledge of the concept Fair Trade. Approximately same number of respondents said that already heard about Fair Trade concept and they are familiar with that term (23.1%, 194 people).

Null hypotheses were tested by χ^2 test with individual quota attributes.

H0₁: Knowledge of the concept Fair Trade is not dependent on the respondent's gender

Table 3. Knowledge of the concept Fair Trade by gender

Gender	Yes, I know Fair Trade very well	Yes, I already heard about it. But I don't know about Fair Trade nothing more	No, I never heard about Fair Trade	Total
Female	116	104	197	417
Male	78	88	257	423
Total	194	192	454	840

Source: Own research, 2017

The Calculated χ^2 value from table 3 is 5.99. This value is higher than critical value of the distribution by 2 degrees of freedom ($\alpha = 0.05$). Null hypothesis can be rejected. Knowledge of the concept Fair Trade is dependent on the respondent's gender. Cramer V was counted and dependence is weak ($V = 0.14$). Females showed higher awareness in fair trade. Taylor and Boasson (2014) confirm that women are willing to accept higher prices for these products in the context of fair trade. The results of the IESA survey (2014) show that the behaviour of females in the Czech Republic shows same tendencies.

From all respondents know Fair Trade very well only about 25 % of respondents.

Another monitored characteristic was knowledge of the concept Fair Trade by age. Respondents were categorized by age to groups.

H0₂: Knowledge of the concept Fair Trade is not dependent on the respondent's age.

Table 4. Knowledge of the concept Fair Trade by age

Age Category	Yes, I know Fair Trade very well	Yes, I already heard about it. But I don't know about Fair Trade nothing more	No, I never heard about Fair Trade	Total
15 - 19 years	17	35	118	170
20 - 24 years	54	46	100	200
25 - 29 years	62	54	94	210
30 - 34 years	61	57	142	260
Total	194	192	454	840

Source: Own research, 2017

The Calculated χ^2 value from table 4 is 0.21. This value is lower than critical value of the distribution by 6 degrees of freedom ($\alpha = 0.05$). Null hypothesis cannot be rejected. Knowledge of the concept Fair Trade is not dependent on the respondent's age. This is only one-generation sample that is largely homogenized by the new communicative technologies, due to this fact is clear that age differences will not play a significant role. Pedregal and Ozcaglar-Toulouse (2011) report that the best buyers of fair products are young people.

Results from other research confirm strong link between Fair Trade knowledge and the level of education. The link between knowledge of Fair Trade was also investigated.

Null hypothesis was determined H03: Knowledge of Fair Trade does not depend on the respondent's educational level.

Table 5. Knowledge of the concept Fair Trade by education level

Education level	Yes, I know Fair Trade very well	Yes, I already heard about it. But I don't know about Fair Trade nothing more	No, I never heard about Fair Trade	Total
Elementary	14	37	143	194
Secondary with no graduation exam	16	38	140	194
Secondary with graduation exam	77	72	136	285
University	87	45	35	167
Total	194	192	454	840

Source: Own research, 2017

The Calculated χ^2 value from table 4 is 168.08. This value is higher than critical value of the distribution by 6 degrees of freedom ($\alpha = 0.05$). Null hypothesis can be rejected. Knowledge of the concept Fair Trade is dependent on the respondent's education level. Dependence measured by Cramer's V is strong ($V = 0.32$). More than 75 % of respondents with elementary education or with secondary education without graduation exam never heard about Fair Trade. Group of respondents with Secondary education with graduation exam responded approximately in line with the average of the selection, which divides the ratio - knowledge: awareness: Fair Trade ignorance - in the ratio 1: 1: 2. Strong link between Fair Trade and respondent's education is also confirmed by Taylor and Boasson (2014) or Pedregal and Ozcaglar-Toulouse (2011).

The last variables, which were tested by χ^2 test was Knowledge of the concept Fair Trade by region of residence. Null hypothesis was set H04: Knowledge of Fair Trade does not depend on the respondent's region of residence.

Table 6. Knowledge of the concept Fair Trade by region

Region of Permanent residence	Yes, I know Fair Trade very well	Yes, I already heard about it. But I don't know about Fair Trade nothing more	No, I never heard about Fair Trade	Total
Prague	95	79	173	347
South Bohemian	37	44	95	176
Karlovy Vary	17	17	54	88
Ústí nad Labem	45	52	132	229
Total	194	192	454	840

Source: Own research, 2017

The Calculated χ^2 value from table 6 is 8.19. This value is lower than critical value of the distribution by 6 degrees of freedom ($\alpha = 0.05$). Null hypothesis cannot be rejected. Knowledge of the concept Fair Trade is not dependent on the respondent's region of residence. These results are not consistent with the results of Pedregal and Ozcaglar-Toulouse (2011), in their opinion fair trade products are most often purchased by large city residents. In the Czech Republic are made same conclusions by IESA (2014). Is necessary to mention that generation Y is the first global generation (Parment, 2013), and the place of residence lose importance.

Fair Trade products guarantee fair earnings to their producers. Products have higher prices than traditional market - based products. From all respondents were selected respondents which are interested in Fair Trade products ($n = 386$). More than half of respondents (56.4 %) which are interested in Fair Trade are willing to accept higher price of products. With this fact agrees Akaichi et al. (2016) and notes that consumers are capable to pay a higher price for Fair Trade label products. (Staricco, 2016) ads that higher price is a prerequisite for good manufacture conditions. A lower

or higher degree of lack of interest was reported by 34.8% of respondents. 8.8% of the respondents did not express any opinion.

Table 7. Frequency of shopping of Fair Trade products

Response/Number of respondents	Absolutely	Relative
Yes, often	28	7.3 %
Yes, I sometimes buy Fair Trade product	166	43.0 %
No, but I am thinking about it	73	18.9 %
I do not even plan it	43	11.1 %
I do not know, I am not interested in labelling of production	76	19.7 %
Total	386	100.,0 %

Source: Own research, 2017

From all respondents who declared Fair Trade knowledge (n = 386), half said that they had already bought Fair Trade food (50.3%, 194). Approximately one tenth (11.1%, 43) took a negative attitude to purchasing of these products and less than fifth of respondents (19.7%, 76) expressed that they are not interested in labelling of production.

Respondents could choose more answers for question why are they buying Fair Trade products. As a reason for buying Fair Trade, most of the respondents reported help farmers (55.2%, 107) and aid to people in poorer countries (54.1%, 105). Less than half of respondents answered that it is easy way how they can help good thing (47.9%, 93), and over 40% of their purchases were driven by trying something new and wanted to feel good about themselves. Higher quality was the reason for Fair Trade food purchases for 38.1% (74) and for a quarter was an important feeling that they were healthier (25.3%, 49). Contrary to what Vysekalová et al. (2011) asserted that for generation Y is very important reference from peer. Only 22.4 % (43 respondents) considered that recommendation of friends and peers could be important.

Respondents of generation Y are mostly buying chocolate (72.7%, 141 people), coffee (59.8%, 116 people), tea (56.7%, 110 people) and cocoa (40.7%, 79). From the point of view where Fair Trade products were bought most of them were bought in supermarkets or hypermarkets (57.7%, 112 people). Almost 30% bought them in specialized stores and more than a quarter (26.8%, 52 people) via the Internet. Approximately one fifth (21.1%) of respondents answered in "gastronomic establishments") relatively less young consumers buy the monitored range of food in regular retailers (16.0%, 31 people) and during promo - action (8.8%, 17 people). Structure of Fair Trade food shops corresponds to the general preferences of Czech consumers for GfK Czech Republic (2018) food purchases. Mainstreaming and popularizing Fair Trade production is causing expansion into a common consumer network (Yamoah et al, 2014).

4. Conclusion

Main aim of this paper is to present research in the field of consumer's awareness of Fair Trade label in Czech Republic. The research sample was selected by quota selection. The survey was completed by 840 respondents aged 15-34. Almost half of respondents were familiar with Fair Trade. Most respondents with no awareness about Fair Trade was in group aged from 15 to 19 years. Almost half of respondents buy Fair Trade products, 7% of them often. About 30 % of respondents were not interested in Fair Trade production and they do not want to buy some products for try. In general consumers of generation Y bought mostly chocolate (72.7%, 141 people), coffee (59.8%, 116 people), tea (56.7%, 110 people) and cocoa (40.7%, 79).

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COMPARATIVE ADVANTAGE: PRODUCTS MAPPING OF UZBEKISTAN'S AGRICULTURAL EXPORTS

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Annotation: This article provides the analysis of Uzbek foreign trade in agricultural products and foodstuffs from the following points of view: international competitiveness and the trade balance of the country. The main goal of the paper is identification of changes in agricultural trade character. Changes in commodity structure are specified and individual changes are explained. The comparative advantages are analyzed in relation to different groups of countries (Asian countries, European Union, other European countries, and developing countries). Both agrarian trade competitiveness and territorial and commodity structure changes are analyzed from the perspective of the last 20 years (1995-2015). Agrarian trade commodity structure is analyzed based on standard Harmonized System (HS 01 – HS 24). The basic source of data for the analysis is UN COMTRADE. The analyses are done through the application of the following methods: Revealed Symmetric Comparative Advantage, respectively Lafay Index, Trade balance index and also the “Product mapping approach”. Except for above mentioned methods also some other statistical characteristics are applied: basic index, chain index, geomean, import/export coverage ratio etc. The export of agricultural products of Uzbekistan is quite competitive especially in relation to the Asian countries and CIS countries, the comparative advantages in relation to other territories are limited. The most perspective aggregations (based on comparative advantage and trade balance) are the following: HS 07, HS 08, HS 12, HS 20, HS 22, HS 24.

Key words: Agrarian trade, Uzbekistan, Comparative Advantage, Balance, Products Mapping.

JEL classification: Q13, Q17

1. Introduction

The main role of agricultural exports is the ability to exaggerate the current state of the Uzbek agro-industrial complex and to use its competitive prospects. Uzbek agrarian export territorial structure in the period of 1995 to 2015 was heavily concentrated in relation to Asian and CIS countries. The dominant positions are kept by Russia, Kazakhstan and Belarus. Tradition role of Russia as the main trade partner is changing. The share of exports to Russia is decreasing. On the other hand, Kazakhstan has become the extremely important trade partner for Uzbek agrarian export within the last few years (Ilyina, 2016). Uzbek agrarian foreign trade experienced significant changes during the last few years. Only in the period from 1995 through 2015 its export value increased from 48 million USD to 561 million USD. The growth of exports even exceeded the growth of imports (from 339 million USD up to 1.2 billion USD). The performance of agrarian trade is growing year by year. Therefore, for the effective development of national exports, it is necessary to focus attention on those segments of agricultural production that are competitive and have comparative or absolute advantages especially in relation to the regional partners. The idea of this article is to examine the structure of Uzbek foreign trade in agricultural products from the point of view of its specialization and the competitive performance over the period 1995-2015. The aim of the analysis is to identify competitive groups of products. Another aim is to identify the most important change especially in commodity structure, which happened during the analyzed time period.

2. Materials and Methods

The analysis presented in this paper was conducted using the analytical tool, named “products mapping”. This tool enables to assess leading exported products from two different points of view, i.e. domestic trade-balance and international competitiveness. (Widodo, 2009) The classification of agricultural commodities used in the paper is the Harmonized system dividing agricultural trade into 24 aggregations (for details see e.g. UN Comtrade methodology¹⁴). All value figures are calculated at current prices in USD. There are two crucial variables for analyzing comparative advantage, i.e. domestic trade-balance and international competitiveness (Widodo, 2009). The figure 1 represents the matrix (Ishchukova and Smutka, 2013; Svatos and Smutka, 2010) for the distribution of the entire set of exported products into 4 groups according to the two selected indicators (RSCA a TBI). The Revealed Symmetric Comparative Advantage (RSCA) by Smutka, Benesova and Laputkova (2015) and Smutka, Steininger and Maitah (2015) is the indicator of comparative advantage.

Figure 1. Modified product mapping scheme

Lafay index	Group B: Comparative Advantage Net- importer (LFI > 0 and TBI < 0)	Group A: Comparative Advantage Net-exporter (LFI > 0 and TBI > 0)
	Group D: Comparative disadvantage Net- importer (LFI < 0 and TBI < 0)	Group C: Comparative disadvantage Net- exporter (LFI < 0 and TBI > 0)
Uzbek Agrarian Foreign Trade Commodity Structure	Trade Balance Index	

Source: own modification and processing (2018)

Trade Balance Index (TBI) by Lafay (1992) is the indicator of export-import activities. The RSCA index is a simple decreasing monotonic transformation of Revealed Comparative Advantage (RCA) or Balassa index (Balassa, 1991). In practice, Balassa index is a commonly accepted method for analyzing trade data (Bielik, Smutka and Svatos, 2013; Dalum, Laursen and Villumsen, 1998; Maitah, Rezbova and Smutka, 2016; Rezbova, Smutka and Purkrabek, 2014). This index tries to identify whether a country has a “revealed” comparative advantage rather than to determine the underlying sources of comparative advantage.

$$RCA = (X_{ij}/X_{it})/(X_{nj}/X_{nt}) = (X_{ij}/X_{nj})/(X_{it}/X_{nt}) \quad (1)$$

¹⁴ CN01 Live animals, CN02 Meat and edible meat offal, CN03 Fish and crustaceans, molluscs and other aquatic invertebrates, CN04 Dairy produce birds' eggs natural honey edible products of animal origin, not elsewhere specified or included, CN05 Products of animal origin, not elsewhere specified or included, CN06 Live trees and other plants bulbs, roots and the like cut flowers and ornamental foliage, CN07 Edible vegetables and certain roots and tubers, CN08 Edible fruit and nuts peel of citrus fruit or melons, CN09 Coffee, tea, mate and spices, CN10 Cereals, CN11 Products of the milling industry malt starches inulin wheat gluten, CN12 Oil seeds and oleaginous fruits miscellaneous grains, seeds and fruit industrial or medicinal plants and fodder, CN13 Lac gums, resins and other vegetable saps and extracts, CN14 Vegetable plaiting materials vegetable products not elsewhere specified or included, CN15 Animal or vegetable fats and oils and their cleavage products prepared edible fats animal or vegetable waxes, CN16 Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates, CN17 Sugars and sugar confectionery, CN18 Cocoa and cocoa preparations, CN19 Preparations of cereals, flour, starch or milk pastry cooks' products, CN20 Preparations of vegetables, fruit, nuts or other parts of plants, CN21 Miscellaneous edible preparations, CN22 Beverages, spirits and vinegar, CN23 Residues and waste from the food industries prepared animal fodder, CN24 Tobacco and manufactured tobacco substitutes

where x represents exports, i is a country, j is a commodity and n are a set of countries, t is a set of commodities. RSCA index is formulated as follows:

$$RSCA = (RCA_{it-1})/(RCA_{ij+1}) \quad (2)$$

The values of $RSCA_{ij}$ index can vary from minus one to one. $RSCA_{ij}$ greater than zero implies that country i has comparative advantage in group of products j . In contrast, $RSCA_{ij}$ less than zero implies that country i has comparative disadvantage in group of products j . (Svatos and Smutka, 2012). Trade Balance Index (TBI) is employed to analyze whether a country has specialization in export (as net-exporter) or in import (as net-importer) for a specific group of products. TBI is simply formulated as follows:

$$TBI_{ij} = (x_{ij}-m_{ij})/(x_{ij}+m_{ij}) \quad (3)$$

where TBI_{ij} denotes trade balance index of country i for product j ; x_{ij} and m_{ij} represent exports and imports of group of products j by country i , respectively. (Lafay, 1992). Values of the index range from -1 to +1. Extremely, the TBI equals -1 if a country only imports, in contrast, the TBI equals +1 if a country only exports. Indeed, the index is not defined when a country neither exports nor imports. A country is referred to as “net-importer” in a specific group of products if the value of TBI is negative, and as “net-exporter” if the value of TBI is positive. (Widodo, 2009; Zaghini, 2003).

3. Results and Discussion

Results coming from individual analyses provide the following findings. The agrarian trade of Uzbekistan is concentrated on European and central Asian countries. The most dominant role is represented by Asian countries, CIS members and EU members. The Asian share in the Uzbek agricultural export and import reached about 39% respectively 23% in 1995. The share of EU28 in agricultural export and import reached about 29% respectively 53% (in 1995). The share of CIS members in agricultural exports and imports reached 31% respectively 18.3% (in 1995).

Table 1. Uzbek agrarian foreign trade value development between 1995 and 2015 in USD

1995	Asia (without CIS countries)	Africa	EU 28	Other European countries (without EU and CIS)	CIS (without Asian countries)	North America	Latin America	Australia and Oceania
Export	19,125,435	67,379	14,275,793	2,641	15,139,841	2,181,042		
Import	80,859,051	636,358	180,904,505	9,072,518	62,152,922	1,793,607	5,227,238	
Balance	-61,733,616	-568,979	-166,628,712	-9,069,877	-47,013,081	387,435		
Balance/ Export	-322.78%	-844.45%	-1167.21%	-343425.86%	-310.53%	17.76%		
2015	Asia (without CIS countries)	Africa	EU 28	Other European countries (without EU and CIS)	CIS (without Asian countries)	North America	Latin America	Australia and Oceania
Export	140,100,653	1,356,616	32,917,097	3,647,255	376,957,292	6,057,608	527,356	35,196
Import	137,246,993	193,580	175,374,376	8,531,567	830,121,535	2,901,732	53,931,938	2,950,252
Balance	2,853,660	1,163,036	-142,457,279	-4,884,312	-453,164,243	3,155,876	-53,404,582	-2,915,056
Balance/ Export	2.04%	85.73%	-432.78%	-133.92%	-120.22%	52.10%	-10126.86%	-8282.35%

Source: COMTRADE database, 2018 and own calculations

During the next twenty years (1995 – 2015), the share of individual trade partners changed by the following way. The Asian share in agricultural export and import reached 25% respectively about 11% (in 2015). The share of EU28 in total exports and imports reached 6% respectively 14%. And the share of CIS countries in total agricultural exports and imports reached 67.1% respectively 68.5%.

The total value of agricultural trade performance recorded the significant growth. The nominal value of exports increased from cc 51 mil. USD up to cc 562mil. USD. The value of imports recorded the growth from 340 mil. USD up to 1,2 bill. USD. The total value of negative agri-food trade balance increased from 284 mil. USD up to cc 650 mil. USD. However, the negative trade performance is increasing, the inter annual growth of exports (10times growth) is much higher in comparison to inter-annual growth rate of imports (4times growth). Speaking about the last twenty years development, the specific paradox was recorded. Despite of constantly increasing negative trade balance, the export/import coverage ration significantly increased from 14% to 46%.

As could be seen (Table 1) the current agricultural trade performance of Uzbekistan is heavily focused on CIS and Asian countries. Those partners represents nearly 92% of export value and 80% of import value. During the analyzed time period their shares in exports and imports increased by 22% respectively 38%. The key aspect of the Uzbek agrarian trade is its competitiveness (especially low-price competitiveness). Based on volume (tons) and value (total value and unit value) analysis, the bulk commodities (e.g. vegetables, fruits) could be considered as the main driver of agricultural export growth.

Another very specific feature of Uzbek agri-food trade is its concentration on post-Soviet countries. Those countries' markets represents the key territory for export oriented activities. And mutual trade agreements (trade preferential agreements and free trade zone) could be considered as the key element supporting national export ambitions.

Table 2. Uzbek agrarian trade commodity structure in 2015 in ths. USD

All trade transactions worldwide 2015									
B-2015	Export	Share in export	Import	Share in import	A-2015	Export	Share in export	Import	Share in import
HS12	26,903,631	4.79%	44,912,528	3.71%	HS05	3,424,405	0.61%	3,108,094	0.26%
HS22	12,697,393	2.26%	19,986,639	1.65%	HS07	170,597,333	30.38%	17,170,850	1.42%
HS24	10,055,967	1.79%	16,827,360	1.39%	HS08	267,541,542	47.64%	3,812,486	0.31%
Total	49,656,991	8.84%	81,726,527	6.75%	HS13	6,509,791	1.16%	3,996,360	0.33%
					HS14	1,518,073	0.27%	59,349	0.00%
					HS20	13,612,764	2.42%	7,192,376	0.59%
					Total	463,203,908	82.48%	35,339,515	2.92%
D-2015	Export	Share in export	Import	Share in import	C-2015	Export	Share in export	Import	Share in import
HS01	3,135,358	0.56%	41,499,305	3.43%					
HS02	31,592	0.01%	52,420,679	4.33%					
HS03			3,778,216	0.31%					
HS04	3,056,285	0.54%	31,403,694	2.59%					
HS06	3,928,133	0.70%	10,064,254	0.83%					
HS09	6,322,794	1.13%	58,153,324	4.80%					
HS10	233,780	0.04%	261,849,919	21.62%					
HS11	24,456,766	4.35%	221,834,762	18.31%					
HS15	155,095	0.03%	192,982,132	15.93%					
HS16	8,240	0.00%	2,973,147	0.25%					
HS17	1,143,176	0.20%	10,082,444	0.83%					
HS18	2,173,528	0.39%	25,733,433	2.12%					
HS19	1,271,887	0.23%	35,518,941	2.93%					
HS21	448,792	0.08%	36,562,704	3.02%					
HS23	2,372,748	0.42%	109,328,977	9.03%					
Total	48,738,174	8.68%	1,094,185,931	90.34%					

Source: own processing 2018

Agricultural trade and also the whole agricultural sector passed the significant restructuring process. Production and also trade structure recorded important changes. But the process of Uzbek agrarian sector transformation still did not finish the restructuring process and its commodity profile is constantly changing. The significant share in total exports is still represented by low added value products (very low unit value). The value of Uzbek agrarian trade is typical especially because of its specific character in relation to individual partners/partner territories. As it was mentioned already before Uzbek agrarian trade is focused on CIS, Europe and Asia. If we compare the period between

1995 and 2015, it is possible to see the significant growth of export and import value performance in relation to all main territories representing the main Uzbek agrarian trade partners (CIS - export value growth by 2400%; Asian countries - export value growth by more than 600%). As it was mentioned already before, the positive feature of Uzbek agrarian trade is much higher relative inter annual growth rate of export value in comparison to import value. This trend could be seen in the case of all analysed territories. Export/import coverage ratio also improved in the case of analysed regions (Asia from 20% to 102%; Africa from 10% to 700%; EU28 from 8% to 19%; Other Europeans from 0.2% to 42%; CIS from 24% to 45%; North America 121% to 208%). The similar trade could be also seen not only at the level of agrarian trade territorial structure, but also at the level of commodity structure e.g. HS04, HS06, HS07, HS08, HS09, HS11, HS13, HS17, HS18, HS19, HS22 and HS24.

Table 3. Uzbek agrarian trade value commodity structure - modified product mapping approach (2015)

Value 2015 (in USD)	A		B		C		D	
	Export	Import	Export	Import	Export	Import	Export	Import
Asia (without CIS countries)	136,400,761	9,125,485					3,699,892	128,121,508
Africa								
EU 28	26,170,655	931,293	5,072,749	21,522,601			1,673,693	152,920,482
Other European countries (without EU and CIS)	3,502,336	187,946	144,616	159,776			303	8,183,845
CIS (without Asian countries)	361,391,350	24,194,949					15,565,942	805,926,586
North America	6,050,335	606,635					7,273	2,295,097
Latin America								
Australia and Oceania								
World	533,515,437	35,046,308	5,217,365	21,682,377	0	0	20,947,103	1,097,447,518

Source: own processing, 2018

The problem of Uzbekistan is rather limited export competitiveness heterogeneity (aggregations HS07 and HS08 represent the key pillar of agri-food export activities). The comparative advantages analysis based on LFI indicator proved the existence of comparative advantages existing on bilateral level especially in relation to post-soviet countries (the most important partners are Russian federation, Kazakhstan and Caucasus region republics) only in the case of limited number of trade items. The results presented by the product mapping approach provide the more accurate overview of the distribution of comparative advantages of Uzbekistan's agrarian exports. The majority of items representing agrarian trade commodity structure is distributed between two groups A (having comparative advantages: HS05, HS07, HS08, HS13, HS14, HS20) and D (without comparative advantages: HS01, HS02, HS03, HS04, HS06, HS09, HS10, HS11, HS15, HS16, HS17, HS18, HS19, HS21, HS23). Aggregations included into quadrant A represent nearly on the other hand, within the last twenty years, the significant changes in agrarian trade structure were recorded. Those changes can be considered as an evidence of still running restructuring process. The commodity structure is still looking for the optimal state. The Republic of Uzbekistan is not competitive at the general level, but it has only bilateral comparative advantages as it was mentioned before. Comparative advantages have been existing especially in relation to trade partners applying restrictive trade policies in relation to the world market. The mutual trade is not result of the real price competitiveness, but it is the result of political deal.

4. Conclusion

The last twenty years analysis provides the following results. The agrarian trade of Uzbekistan is constantly increasing its value and changing both commodity and territorial structure character. The relative value of exports increased three times faster in comparison to the value of imports. Unfortunately, there balance is still in negative numbers. The problem is especially the very low added value of Uzbek exports, while added value of imports is much higher. Another negative feature

is constantly decreasing food self-sufficiency. Agrarian trade territorial structure is becoming more and more concentrated. It makes Uzbek agricultural trade extremely vulnerable and dependent on limited number of partners (especially CIS). The commodity structure development is opposite (diversification trend was proved). The structure of commodity exports is based mainly on the variety of low added value items having comparative advantages - especially at the bilateral level. While Uzbek trade is quite competitive, especially with respect to CIS and Asian countries, competitiveness towards other territories (especially developing countries, European countries, North and Latin America) is limited. The combination of the TBI, LFI and product mapping approach analyses proved the comparative advantage of the following set of aggregates/trade items: fish, plants, meat products, cereals, live animals, vegetable oils, vegetable juices, dairy products, sugar, juices and weaving materials, products shredding, drinks and alcohol.

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SCALABILITY OF GIS APPLICATIONS WITH REGARDS TO IOT

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Annotation: GIS technologies are currently very well established and GIS applications and services cover a wide variety of important roles (analysis, processing, storage, visualization, decision support etc.) in an increasing number of fields (navigation, logistics, disaster management, urban planning, precision agriculture and others). However, the present-day technologies are struggling when handling huge volumes of data coming from growing network of IoT devices, especially with regards to the variety of used data formats and data velocity (periodicity). Increasing data saturation demands more efficient processing, but also provides possibilities with regards to higher interactivity of GIS applications. These current trends push GIS towards more dynamic solutions that can be more readily deployed. This is also evidenced by the increasing abandonment of classic software models and shift towards utilization of cloud-based solutions. The newly developed application models face many obstacles in terms of high demand on processing automation and scalability. The paper outlines several of these issue areas and discusses solutions that are currently being deployed or developed.

Key words: GIS, spatial data, Internet of Things, scalability, big data, cloud computing

JEL classification: C8/C80 General Data Collection and Data Estimation Methodology • Computer Programs

1. Introduction

In the past, the availability of geographic data has been limited mainly by the technologies used to obtain this data. The data came exclusively from remote sensing and was not updated very frequently. By incorporating new technologies, such as drones or stationary measuring devices from the area of Internet of Things (IoT), there is a significant increase in the volume of data processed, both in terms of the amount of input devices and the change in the periodicity of data acquisition (Li and Li, 2014). While satellite images were taken in the order of months or days, today's network of IoT devices can generate new data in hours, minutes or even seconds (Oliveira and Rodriguez, 2011).

Emphasis in GIS is placed on automation of transformation processes and data processing (Moirangthem et. al., 2017). It is important to find such technologies and ways of processing that the GIS application is as independent as possible, not very robust (so-called lightweight) but also scalable - both in terms of input data volume and number of end users (Isikdag and Pilouk, 2016). When designing methodologies for spatial data processing, it is also necessary to consider the appropriate security measures and the protection of personal data (Weber, 2010).

At present, the area of real-time applications is developing. Because of the availability of current data, it is possible to create applications that are either continuously creating outputs or working de-facto "while you wait" and processing the latest data. These applications are particularly useful in decision support areas (Nourjou and Hashemipour, 2017) or for the detection and resolution of crisis situations (Řezník, Horáková and Janiurek, 2011). The specificity of these real-time applications is the change of infrastructure and the view of data from the viewpoint of events - the so-called geo-event approach (Worboys, 2005), and especially the increased emphasis on the time component of the data. As shown, for example by (Zerger and Smith, 2003), classical GIS technologies that are used for spatial planning, are not suitable for the implementation of these real-time applications. Many of these

technologies are not able to handle large volumes of data fast enough, especially if the application also performs additional calculations, modeling, or prediction (Neukom, Müller Arisona, and Schubiger, 2018). Another feature of these applications is the need for shared use, for example, when several crisis management components or authorities are used concurrently by the crisis management application (Sun and Li, 2016).

2. Materials and Methods

This paper presents preliminary findings regarding GIS applications and their scalability with regards to new technologies such as IoT sensors. It is part of a continuous research effort conducted at Czech University of Life Sciences Prague within the Department of Information Technologies. It follows up on previous research that focused on deploying a solution for monitoring of wildlife animals, specifically deer. The results of this research have been published (Masner and Stočes, 2013), but to summarize, the research involving creating a web-based application that was fed data from sensors attached to individual animals and provided several functionalities for its users – mainly visualizing the movement and common places of incidence (via a heatmap) for given animal or group of animals. The follow-up research, which this paper is part of, aims to further analyze possible options for deploying GIS based applications while focusing mainly on the potential scalability by incorporating larger volumes of data (for instance if such an application was commissioned to be deployed in the whole area of the state). Our research currently focuses on analyzing available literary resources and compiling a list of know-how or best practices in the area of large scale GIS applications. We are also analyzing the old web-based application in order to determine if it could be utilized for the purposes of this follow-up research or if a new application for testing is needed.

3. Results and Discussion

There are three main areas of importance when it comes to developing large scale GIS applications:

- Data
- Software
- Hardware

The data is the most fundamental part of any application. The type of data, chosen data format, the amount of overall data as well as velocity (how often and how much data are being added to the system periodically) are the most important factor when it comes to developing new GIS applications. In the preliminary research (feasibility study) for each application, a list of functionality requirements must be compiled. The type of processing calculations will also have implications for selecting the proper data format. The software part seems to be a little less important thanks to long term progress in the area. Because GIS software had enough time to evolve on its basic platforms (desktop and server versions), most of current day GIS software is capable of handling majority of required tasks and operations. Almost every software solution available on the market is robust and advanced enough to handle required computations as well as work with the most prevalent data types at optimized speeds. Therefore, the choice of data format will have higher overall impact on possible scalability than the choice of software. In terms of hardware, the proper amount of hardware resources designated to run the application is usually of greater importance than the type of hardware (which model / manufacturer to purchase). Scaling applications up brings the increased difficulty of determining potential hardware bottlenecks. The best way to ensure that enough resources are allocated while not expending unnecessary equipment is to look for similar application (in terms of amount and type of data and types of calculation) that is already in use and use it as a benchmark. Other option is to deploy the solution in the cloud, start small and purchase additional resources as necessary while scaling up.

Data formats. Selected data format has great influence on the final solution in terms of storage capacity, speed of computation and response time. Not every spatial data format is suitable for every application. Certain formats can have higher speed of processing, but are bad in terms of compression, therefore resulting in greater storage capacity demands. The type of processing operations also matters greatly. For instance, the ESRI shapefile has proven to be best suited for simple lookup operations, whereas GeoPackage format is highly optimized for more complex queries and produces such results much faster, especially when dealing with large amounts of data. There is also the possibility to avoid using the specialized geospatial data formats and stick to basic formats such as .CSV or generic SQL-type databases.

These non-spatial formats can generally only be used when dealing with point data – therefore the location of the source can be stored as two values (GPS coordinates for instance), taking set amount of space in the database. However, when dealing with more complex vector shapes, it is necessary to utilize a specialized spatial data format.

There is also the possibility to use two types of formats simultaneously, one for storage, one for processing. In some applications, the processing is not conducted very often, but when it happens, the speed of the processing would be unacceptably slow on a given storage format. Therefore, it may be advantageous to convert from the storage format, which is optimized for lower space consumption, into a format that is suitable for fast processing of a given calculation. However, when dealing with interactive applications of the real-time GIS variety, there is a constant need for processing, so performing conversion every time a calculation is required is unfeasible. In those cases, it is necessary to search for an adequate data format that would provide acceptable performance in both storage and processing.

Deployment and scalability. The main issue with scalability of GIS applications is identifying future bottlenecks, when the application is scaled up. Generally, the important factors of an application include performance (speed, response time), throughput (number of requests handled in a given time period) and capacity (how many requests can be handled at once, how much data is the system capable working with). To maintain acceptable results with regards to these demands it is necessary to ensure appropriate hardware resources, such as CPU, RAM, storage, network connectivity etc. Before actual deployment, there is usually a lot of stress testing to ensure all these resources are present in proper amounts to prevent issues. It is therefore possible to purchase correct amount of hardware to run the application beforehand. However, when it comes to scaling up the application, it can be quite hard to predict which type of resource will end up being the bottleneck. Since not all requirements scale linearly, it is hard to optimize hardware resources beforehand. For this reason, we can observe a trend of moving the application to the cloud. In a hosting scenario, it is readily available to adjust the resources being utilized to run the application. Instead of relying on over-dimension of all the hardware parts, it is possible to simply purchase extra resources where necessary.

Standardization. Currently, most of the solutions being deployed are proprietary, especially in the Czech Republic, as pointed out by (Stočes et. al., 2016). They believe the main reason is the lag of Czech Republic behind other European countries in terms of the institutional involvement. The potential for GIS growth is enormous, however the investment of public money into the sector has only gradually started to increase in recent years. The market is therefore dominated by proprietary solutions that are mostly custom built, therefore quite expensive and thus highly profitable. The prevalence of custom proprietary solutions also negatively influences standardization efforts, because standards are not enforceable when the majority of funds comes from private sector. With higher governmental involvement, it is more likely that companies will start seeking more

standardized solutions, because for instance a cooperation between private and public GIS system may be a requirement for receiving grants or subsidies.

4. Conclusion

As the paper outlined, there are several key issues in terms of scaling GIS applications to accommodate higher rates and amounts of data being stored and processed. Currently, the biggest area of interest is choosing the proper data format. When dealing with lots of data, it is unlikely that one software will be able to vastly outperform different software given the same type and amount of data and processing power (hardware resources). Data and hardware are therefore the two areas where scaling plays a major role. In terms of hardware however, there aren't many solutions available aside from increasing the amount of allocated resources. While for some application it may suffice to expend more processing power to tackle scaling issues, however this approach cannot be used indefinitely, since most spatial calculation do not scale linearly. The highest improvements in terms of performance can therefore be achieved on the data level. Choosing the optimum amount, periodicity and format data has the biggest impact on the resulting application. It is necessary to conduct very thorough consideration of all the aspects of a given application in order to select the optimal solution for the data model. For instance, even if we use IoT sensors that are capable of sending information every 5 seconds, it is extremely important to consider, whether such periodicity is really necessary. The same goes for the density of the sensor network and requirements on storage for old data. Calculating a daily value output (averages, means etc.) instead of storing all the data for a given day can save enormous amount of resources when we consider the long-term deployment of the application.

We are going gather more knowledge in the area and start developing the real-time GIS application testing prototype as part of our ongoing research and we plan to publish more detailed results at a later date.

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AGRICULTURAL PRODUCTIVITY, TRADE AND FOOD SELF-SUFFICIENCY: EVIDENCE FROM POLAND, THE EU AND THE US

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Annotation: In the wake of the 2007-08 food crisis that brought higher and more volatile food prices, many countries expressed renewed interest in food self-sufficiency. The paper aims to provide an overview of different approaches to the understanding of food self-sufficiency and to present the relationships between agricultural productivity, trade and self-sufficiency in the agriculture of the EU countries, including Poland, and the US. The research was based on data of the European Statistical Office (Eurostat), the United States Department of Agriculture (USDA), and the Food and Agriculture Organization of the United Nations (FAOSTAT). The research results showed that Poland was self-sufficient in all basic agricultural products, while the self-sufficiency ratios increased in 2004-2013. In 2004-2013, the EU and the US improved their self-sufficiency in products of animal origin, whereas domestic production of commodities of plant origin was stable or even increasingly lower compared to available supply. The study confirmed that foreign trade either improves or does not disrupt self-sufficiency of the countries considered. Favourable production ratios and relatively high productivity levels of available land, labour and capital usually support adequate levels of agricultural production and promote achievement or improvement of food self-sufficiency.

Key words: food self-sufficiency, food security, agri-food trade, agricultural productivity, the EU, the US, Poland

JEL classification: Q11, Q17, Q18

1. Introduction

In the wake of the 2007-08 food crisis that brought higher and more volatile food prices, many countries expressed renewed interest in food self-sufficiency. Food self-sufficiency is an often-used term, but there is no universally applicable definition of this concept. As O'Hagan stated (1976), there are multiple concepts for the understanding of food self-sufficiency that can apply at different levels of analysis. In the most basic approach food self-sufficiency means that a country can produce sufficient food to meet its own needs. This definition refers to the early FAO concept of food self-sufficiency, which is generally taken to denote the extent, to which a country can satisfy its food needs from its own domestic production. In this concept, a country self-sufficient in food eschews all food trade and relies exclusively on domestic food production to meet its food needs (Clapp, 2017). Such an understanding of food self-sufficiency is equivalent to adopting complete autarky for the country's food sector. In practice, as a consequence of biological and technological progress as well as the process of globalisation, such an extreme policy of totally closed borders is very rare. All countries of the world, including large food exporters that produce far more food than they consume, typically import at least some food (Clapp, 2017). Moreover, it needs to be stressed here that the measure of food self-sufficiency considered within the framework of closed economy has no direct informative power concerning the level of satisfaction of food needs. In contrast, it actually states only whether and how much of a given commodity was produced (more or less) in a given period in relation to the actual consumption level, while surpluses or shortages in many cases may result from interventions in individual markets, thus they may only be superficial in character (Baer-Nawrocka, 2014).

Food self-sufficiency policies have faced heavy criticism over the past years. However, at the same time, the 2007-08 food crisis made the public realize that in the 21st century access to food for everyone at all times remains one of the key challenges for economic and agricultural policies in many countries worldwide, including the EU and the US with a poor, food-insecure population of 40 million. For this reason, a more pragmatic and broader application of the food self-sufficiency concept refers to the country's domestic food production capacity and does not exclude trade as a source of available food supply. Brooks and Matthews (2015) proved that trade openness plays a vital role in raising production and incomes, enabling production to be located in areas where resources are used most efficiently and facilitating the flow of products from surplus to deficit areas. The relationship between trade and food security was also investigated by Kang (2015). Based on a group of 111 least developed countries (LDCs), he found the U-shaped relationship between the international trade and food security. This indicates that in the initial stages of the international trade expansion in the LDCs, food security deteriorates, whereas thereafter it is shown to improve. The growing importance of food trade, either for food supply in importing countries or as a source of income for exporters, was showed by Porkka et al. (2013), while the dependency of food security on imports was investigated by Fader et al. (2013). The latter authors found that, globally, about one fourth of the food produced for human consumption is traded internationally, with the amount of food calories traded more than doubled between 1986 and 2009. Global food production has increased by more than 50% in the same period. A more productive and resource-efficient agriculture can increase availability of food and contribute to world food security, while at the same time preserving natural resources. For the EU agriculture this was proved by Noleppa, von Witzke and Carlsburg (2013). Productivity growth in the US agricultural sector has also implications for both US and global food markets (Wang et al., 2015). In this context, the main objective of this paper is to present the relationships between agricultural productivity, trade and self-sufficiency in the agriculture of the EU countries, including Poland, and the US.

2. Materials and Methods

The research was based on data of the European Statistical Office (Eurostat), the United States Department of Agriculture (USDA), and the Food and Agriculture Organization of the United Nations (FAOSTAT). The methods of descriptive analysis, as well as analogies and comparisons were employed in the research.

When conceptualizing food self-sufficiency, two measures were used, namely: simple food self-sufficiency [$FSS = \text{Domestic production} \times 100 / \text{Domestic consumption}$] and the self-sufficiency ratio [$SSR = \text{Production} \times 100 / (\text{Production} + \text{Imports} - \text{Exports})$]. The first ratio (FSS), determined as the rate of meeting the domestic needs in a given country (group of countries) by the domestic (internal) production (Baer-Nawrocka, 2014), refers to the basic concept of food self-sufficiency under the closed economy conditions. In this case domestic consumption comprises food consumption, processing for purposes other than human consumption, losses, while in the case of plant production also the volume used for feed and sowing material.

The self-sufficiency ratio (SSR) is defined as the percentage of food consumed that is produced domestically. The SSR can be measured either in calories or in volume of food produced by a country, although it may also be expressed as a ratio of monetary value (Clapp, 2017). In this paper, both the FSS and SSR are calculated in terms of volume expressed in thousand tonnes. The following items were considered: cereals, oil crops, vegetables, fruits, meat and milk. Such products as vegetables, fruits and milk are presented as the category of non-processed products and comprise also the amounts allocated for processing into foodstuffs (in the case of milk – processed dairy products except for butter).

The following was assessed to analyze agricultural productivity as a determinant of domestic food supply: the productivity of land, labour or capital (measured with the agricultural output value) and production ratios (land-to-labour ratio, capital-to-labour ratio, capital-to-land ratio). The period covered by this analysis, determined by the availability of comprehensive, internationally comparable data, extended from 2004 to 2012, 2013 or 2014, depending both on the country and the research problem.

3. Results and Discussion

Poland was self-sufficient in all basic agricultural products, while excluding cereals the values of FSS and SSR considerably exceeded respective levels reported for the UE countries (Table 1). This means that in Poland both the potential to feed the population based on domestic production (measured by the FSS value) and the rate of satisfying the consumption needs by domestic production (reflected in the SSR values) were greater than the respective levels for the EU-28 group. Moreover, in the years 2004-2013, excluding oilcrops, in the case of which an almost 2.5-fold increase in consumption (mainly for non-consumption purposes, e.g. biofuel production) was accompanied by an increase in production slightly over 1.5-fold (FAOSTAT, 2018), the scale of recorded production surpluses increased in relation to consumption. In 2013 Poland produced almost 40% more fruit (FSS=139.8%), 30% more meat (FSS=129.5%), approx. 15% more milk and vegetables (FSS=117.5% and FSS=113.7%, respectively) and almost 10% more cereals (FSS=108.0%) than the respective levels of their consumption. In the analysed period the rate of meeting consumption needs by domestic production also increased, which was observed to the greatest extent in the case of meat (SSR=107.9% in 2004 vs. SSR=132.3% in 2013). High and constantly increasing rate of self-sufficiency in the case of meat in Poland was also proved by Slaboch and Kotyza (2016). It needs to be stressed here that the greater level of self-sufficiency for meat, oilcrops and cereals was achieved by Poland thanks to trade rather than based on domestic production alone (SSR>FSS).

In 2013 the UE member states were able to meet their consumption needs for cereals, vegetables, meat and milk from domestic production (FSS>100%; Table 1). However, while market surplus supplies of vegetables, meat and milk increased, the increase in the consumption of cereals for human needs observed in the years 2004-2013 at a simultaneous reduction of their supply in the EU (FAOSTAT, 2018) resulted in a decrease in the thus perceived food self-sufficiency (comparable results in the analysis of self-sufficiency for the EU countries in 2001-2012 were recorded by Baer-Nawrocka (2014). It needs to be stressed here that within the same period the degree, to which consumption needs in the UE were met by domestic cereal production increased (SSR=102.4% in 2004 and SSR=109.8% in 2013). The deficits of production in relation to consumption were found in the EU in the case of oil crops and fruit. For both these groups of products domestic production covered the needs of the domestic market in at least 80% (71.8%<FSS<80.0%). The share of the EU production in the supply on the internal market, measured by the SSR values, was comparable. Due to the lack of food self-sufficiency in this respect, for years the EU has been one of the largest importers of oil crops worldwide, with very low tariffs applied on their imports (See Pawlak, 2016). Oil crops are imported to the EU e.g. from the US, which in the years 2004-2013 generated in this respect a growing surplus of production in relation to the domestic consumption (FSS=156.9% in 2004 and FSS=172.2% in 2013). The volume of US production of oil crops exceeded their total supply by almost 40% (SSR=138.5%) in 2004 and over 70% (SSR=171.5%) in 2013, thus indicating considerable export potential for this group of products. Surplus production in relation to the demand on the domestic market was also recorded in the US in the case of cereals and meat, with the level of food self-sufficiency (reflected both in the FSS and SSR values) decreasing for cereals, while increasing for meat. In the years 2004-2013 the US attained self-sufficiency also for milk, while its absence was felt in the case of horticultural produce.

Table 1. Food self-sufficiency in selected agri-food products in Poland, the EU and the US in 2004-2013 (%)

Specification	2004		2013	
	FSS	SSR	FSS	SSR
Poland				
Cereals	104.9	97.6	108.0	111.1
Oil crops	151.7	110.5	102.9	113.1
Vegetables	106.2	106.2	113.7	113.7
Fruits	132.8	127.1	139.8	138.2
Meat	104.0	107.9	129.5	132.3
Milk	116.9	116.9	117.5	117.5
EU				
Cereals	116.9	102.4	109.4	109.8
Oil crops	71.8	68.8	74.0	73.4
Vegetables	99.9	99.1	100.8	101.0
Fruits	80.0	79.1	77.2	76.2
Meat	103.3	103.4	105.7	105.8
Milk	107.6	107.2	111.5	111.1
US				
Cereals	140.0	128.7	126.4	113.9
Oil crops	156.9	138.5	172.2	171.5
Vegetables	95.5	95.5	90.0	91.1
Fruits	77.1	77.8	71.6	71.7
Meat	103.9	103.7	115.8	115.8
Milk	97.3	98.1	103.8	106.4

Source: FAOSTAT, 2018; own calculations

Table 2. Productivity of land, labour or capital measured by agricultural output value (in current prices) in the agriculture of Poland, the EU and the US in 2004 and 2014^a

Country	Year	Agricultural output (in Euro)		
		per 1 ha UAA	per 1 economically active person in agriculture	per 1 Euro of capital input
Poland	2004	864	6 164	1.46
	2014	1 562	11 647	1.43
	2004=100	180.8	189.0	97.9
EU-27	2004	1 866	25 760	1.51
	2014	2 234	41 704	1.28
	2004=100	119.7	161.9	85.2
US	2004	387	51 850	1.64
	2012	808	130 036	1.60
	2004=100	208.7	250.8	97.9

Source: EUROSTAT, 2018; FAOSTAT, 2018; USDA, 2009; USDA, 2014; own calculations

Note: a - in case of the US data for 2012; the EU-27, in view of a lack of comprehensive and comparable data for Croatia in 2004

Apart from natural conditions, another factor determining the level of agricultural production and as a consequence affecting the degree of food self-sufficiency in terms of supply, is connected with productivity of agriculture, which is influenced e.g. by the production ratios. An increase in agricultural productivity has been observed both in the EU countries (Serrão, 2003; Swinnen and Vranken, 2010), and the US (Wang et al., 2015). An interesting comparison of measures of productivity growth in European and US agriculture was presented by Bureau, Färe and Grosskopf (1995). The conducted analyses showed greater labour and capital productivity of the US agriculture in comparison to those in the EU countries, including also Poland (Table 2). In 2014 labour productivity measured by agricultural production per 1 economically active person in agriculture in the US exceeded 130.0 thousand Euro and it was over 3-fold and 11-fold greater than in the EU (41.7 thousand Euro) and Poland (11.6 thousand Euro). The potential of the US agriculture in the modification of available food supply is also evidenced by the high increase in labour productivity, exceeding by over 50% that recorded in the UE countries. The high labour productivity

in the US was facilitated by the fact that the economically active population in agriculture was equipped with land and capital well. In the analysed years in the US 1 economically active person in agriculture was farming over an area of approx. 130-160 ha UAA in comparison to slightly over 7 ha in Poland and 14-19 ha in the EU (Table 3). We need to stress here that the relatively large land resources in the US facilitate greater flexibility on terms of the structure of production as well as production of a lower degree of capital intensity – cheaper and considered more desirable for ecological reasons. This is manifested in the capital-to-land ratios. In 2014 in the US on average per 1 ha UAA capital input of 500 Euro were incurred, i.e. the amount 2-fold lower than in Poland and over 3-fold lower than in the EU countries. The low ratio of capital input to land resources in the US resulted in relatively low production intensity, as a consequence leading to proportionally lower land productivity than in Poland and the EU (Table 2). However, it needs to be stressed that in contrast to some farms in the EU countries (particularly in the EU-13, including Poland), where extensive agricultural production is necessary due to lack of capital and/or qualifications of farmers, low land productivity in the US is the consequence of a conscious decision by the farmers, resulting in cheaper production thanks to the lower capital consumption of the production process. Apart from being equipped with land resources, labour productivity was also influenced by its capital input. In 2014 per 1 economically active person in agriculture in the US the capital input amounted to 81.0 thousand Euro, i.e. approx. 2.5-fold more than the EU-27 mean and almost 10-fold more than in Poland (Table 3). Moreover, in the years 2004-2014 the advantage of the US agriculture in terms of the labour factor being equipped with capital was increasing, determining a greater growth dynamics for labour productivity in comparison to the EU countries. Productivity of capital input involved in the process of agricultural production was comparable in Poland, the EU and the US. In 2014 in the EU countries the capital input of 1 Euro contributed to the generation of 1.3 Euro of agricultural production, in Poland it was 1.4 Euro, while in the US it was 1.6 Euro, respectively (Table 2). In all the analysed countries productivity of capital was decreasing, with the rate of this decrease being slower in Poland and the US than in the EU as a whole.

Table 3. Production ratios in the agriculture of Poland, the EU and the US in 2004 and 2014^a

Specification	Year	Poland	EU-27	US
UAA per 1 economically active person in agriculture (ha)	2004	7.14	13.81	133.84
	2014	7.46	18.66	160.84
Value of capital input per 1 economically active person in agriculture (in thousand Euro)	2004	4.21	17.09	31.64
	2014	8.14	32.49	81.05
Value of capital input per 1 ha UAA (in thousand Euro)	2004	0.59	1.24	0.24
	2014	1.09	1.74	0.50

Source: EUROSTAT, 2018; FAOSTAT, 2018; USDA, 2009; USDA, 2014; own calculations

Note: a - in case of the US data for 2012; the EU-27, in view of a lack of comprehensive and comparable data for Croatia in 2004

Summing up it may be stated that favourable production ratios and relatively high productivity levels of available land, labour and capital usually support adequate levels of agricultural production and promote achievement or improvement of food self-sufficiency in most agricultural products. Similar conclusions may be drawn from the analyses of Wang et al. (2015), who investigated the trends in agricultural productivity and the drivers behind the productivity changes in the US in 1948-2011. In turn, Noleppa, von Witzke and Cartsburg (2013) proved that productive agriculture in the EU contributes to the increase in supply of primary agricultural products on both the EU and international market, while it is indispensable for improving the world food security situation.

4. Conclusion

The research results showed that Poland was self-sufficient in all basic agricultural products, while the self-sufficiency ratios increased during the period under consideration. In 2004-2013,

the EU and US improved their self-sufficiency in products of animal origin, whereas domestic production of commodities of plant origin was stable or even increasingly lower compared to available supply. The study confirmed that foreign trade either slightly improves or does not disrupt self-sufficiency of the countries considered. Such a situation results from the fact that the investigated countries are large food producers and exporters. In this context, it can be concluded that progressing agricultural trade liberalisation might become increasingly important as a supplement to domestic production in ensuring adequate food availability and improving food self-sufficiency, especially in deficit goods.

Favourable production ratios and relatively high productivity levels of available land, labour and capital usually support adequate levels of agricultural production and promote achievement or improvement of food self-sufficiency. For this reason a further increase in productivity of agriculture in the EU and the US would be crucial, thus contributing to the preservation of natural resources and biodiversity. For example, estimates presented by Noleppa, von Witzke and Carlsburg (2013) show that productive agriculture in the EU prevents both about 6.8 million tons of indirect CO₂ emissions globally and protects almost 38 million hectares of natural habitats in other world regions from being converted into agriculturally utilised areas. In order to gain from economies of scale and to improve the agricultural productivity in the EU countries, including Poland, it is necessary to increase the volume of production, which should be accompanied by reduced employment in agriculture and progressing process of farmland concentration.

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POSSIBLE IMPACT OF TURKEY'S ACCESSION TO THE EU ON FOOD SELF-SUFFICIENCY

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Annotation: Due to the importance of the agricultural sector in Turkey, its potential accession to the EU is expected to influence agricultural markets in both the EU and Turkey. The main objective of this paper is to provide a tentative assessment of the EU food self-sufficiency after Turkey's accession under the customs union conditions. The research was based on data of the United Nations Food and Agriculture Organization (FAO). The self-sufficiency ratio (SSR) for Turkey and the EU both before and after Turkey's accession was measured as the ratio of food produced to food consumed at the domestic level, using the following equation with respect to food production and trade: $SSR = \text{Production} \times 100 / (\text{Production} + \text{Imports} - \text{Exports})$. The following items were considered: cereals, fruits, oil crops, sugar and sweeteners, sugar crops, vegetable oils, vegetables, meat, animal fats, eggs and milk. The research results showed that potential Turkey's accession to the EU does not considerably change the EU self-sufficiency ratios. It is possible that EU self-sufficiency will decrease in some cereals, oil crops, animal fats and milk, whereas it is estimated to increase for fruits, vegetables, sugar and sweeteners, meat (excluding beef) and eggs. Self-sufficiency in the case of fruits may improve the most, although the EU will probably still be unable to satisfy its food needs. However, the abovementioned results imply that Turkey's membership in the EU does not conflict with one of the initial objectives of the Common Agricultural Policy, which was to promote increased rates of self-sufficiency for the EU.

Key words: food self-sufficiency, food availability, agri-food products, the EU, Turkey

JEL classification: Q11, Q18

1. Introduction

The global demand for food and feed is increasing and will continue to increase for at least another 30 years due to the continuous population and consumption growth, as well as dietary pattern changes (Godfray et al., 2010). The agricultural sector plays a strategic role in improving the availability of food and raw materials for non-agricultural sectors of the economy and achieving a degree of food self-sufficiency. Among others, this issue was discussed by Smutka, Steininger and Miffek (2009), Otsuka (2013), Smutka et al. (2015), Wegren and Elvestad (2018). In other words, agriculture is the backbone of an economy which should produce an amount of food that is equal to or greater than the amount of food that people consume in that country. That point of view refers to the basic understanding of food self-sufficiency, which defines the extent, to which a country can satisfy its food needs from its own domestic production (Clapp, 2017). The 2007-08 food crisis contributed to the fact that food self-sufficiency has gained increased attention in many countries, recognising food self-sufficiency as one of the key priorities of economic and agricultural policies, even in the absence of comparative advantages in the production of basic agri-food products. However, it needs to be stressed that while in a short-term perspective and under specific conditions the modification of the agricultural policy targeting domestic self-sufficiency in the case of strategic products seems justified, in the long timeframe maintenance of domestic self-sufficiency regardless of the comparative production costs is not rational (Baer-Nawrocka, 2014). Agri-food trade based on the comparative advantage principle in particular increases the availability of food by enabling products to flow from surplus to deficit areas, while it also improves the stability of food supplies and of peoples' access to food (Brooks and Matthews, 2015).

Food self-sufficiency policies have faced heavy criticism over the past years, but at the same time the idea has been widely accepted in rich and poor countries (O'Hagan, 1976; Barker and Hayami, 1976), because the loss of food self-sufficiency is not only a political and economic issue for policymakers, but first of all it may threaten the survival of both single households and entire communities (Barkin, 1987). In the wake of the most recent food crisis, the reestablishment of the extreme version of food self-sufficiency that envisions complete closure of borders as a policy goal, aroused widespread critique of the concept, while it was repeatedly stressed at the World Summit on Food Security of 2009 that the concept for each country to be self-sufficient in every single food item is nonsense (Blas, 2009). Also Gołębiewska and Stefańczyk (2017) stated that "a self-sufficient country should not rely only on its own production", whereas Blas (2008) declared that „the rejection of international trade as a solution to the problem of hunger, to support the vision of utterly infeasible food self-sufficiency in the region, is simply wrong". His opinion was commonly accepted. The growing importance of food trade for food supply was confirmed by Fader et al. (2013), Porkka et al. (2013), Brooks and Matthews (2015) etc. Given the prevalence of trade in today's global economy, a more pragmatic understanding of food self-sufficiency, which adopts open economy rules rather than complete autarky for the food system, seems to be justified.

Promoting rates of self-sufficiency for the EU was one of the initial objectives of the Common Agricultural Policy (Kennedy and Sonnier, 1997). Ensuring adequate levels of nutrition, increasing yields and outputs, as well as raising levels of self-sufficiency, while at the same time reducing the vulnerability of production to adverse weather conditions, providing stable incomes for agricultural workers, increasing export, and developing rural areas, are also the main objectives of Turkish agricultural support policies (Togan, Bayener and Nash, 2005). At the same time, integration with the EU is one of Turkey's key foreign policy priorities.

The process of Turkey's integration into the EU has had a long history. Turkey made its first application to join the EU (at the time: European Economic Community) in 1959. Forty years later, in December 1999, Turkey was officially accepted as a candidate country at the Helsinki European Council and accession negotiations started on 3 October 2005, when Turkey fulfilled the Copenhagen political criteria (For more see Nazlioglu and Erdem, 2010). More than half of Turkey's total land area, i.e. 41 million hectares, is utilised by agriculture, with more than one quarter of the Turkish workforce employed in agriculture and the sector accounting for 9.2% of Turkish GDP (van Leeuwen et al., 2011). Due to the importance of the agricultural sector in Turkey, its potential accession to the EU and implementation of the customs union is expected to influence agricultural markets both in the EU and Turkey (Fellmann, van Leeuwen and Salamon, 2011), including the self-sufficiency ratios for the enlarged EU. Therefore, the main objective of this paper is to provide a tentative assessment of the EU food self-sufficiency after Turkey's accession under the customs union conditions.

2. Materials and Methods

The research was based on data of the United Nations Food and Agriculture Organization (FAO). The methods of meta-analysis, descriptive analysis, analogies and comparisons, as well as the deductive approach were employed in the research. The self-sufficiency ratio (SSR) for Turkey and the EU both before and after Turkey's accession was measured as the ratio of food produced to food consumed at the domestic level, using the following equation with respect to food production and trade: $SSR = \text{Production} \times 100 / (\text{Production} + \text{Imports} - \text{Exports})$. The SSR can be measured either in food calories or in the volume of food produced by a country, although it may also be expressed as a ratio of monetary value (Clapp, 2017). In this paper the self-sufficiency ratios are calculated in terms of volume expressed in thousand tonnes. The following items were considered: cereals, fruits, oil crops, sugar and sweeteners, sugar crops, vegetable oils, vegetables, meat, animal

fats, eggs and milk. Such products as vegetables, fruits, eggs and milk are presented as the category of non-processed products and comprise also the amounts allocated for processing into foodstuffs (in the case of milk – processed dairy products except for butter). An estimation of the SSR was based on the most recent FAO data available for the year of 2013, when Croatia joined the EU as the 28th member state. When calculating the SSR for the extended EU it was assumed that the level of production and consumption per capita for the analysed agri-food products will remain at the level from the year of 2013 in individual countries. Such an approach was adopted by Baer (2002). The authors' own calculation was compared to the results of previously published simulations made by other authors (Nazlioglu and Erdem, 2010; Fellmann, van Leeuwen and Salamon, 2011; van Leeuwen et al., 2011).

3. Results and Discussion

As it was mentioned above, the agricultural sector in Turkey plays a much more important role in the national economy than in the EU, which is a typical difference between developing and developed countries. In 2013 the value of agricultural production in Turkey amounted to almost 52.5 billion Euro and it was equivalent to slightly over 13% value of the EU agricultural production. Plant production predominated in the production structure of the analysed countries, in the EU its share in total agricultural production amounted to approx. 45-55%, while in Turkey it was approx. 70% (FAOSTAT, 2018; TURKSTAT, 2018).

In 2013, Turkey was self-sufficient in most food items, excluding some types of cereals (maize or rice), oil crops, vegetable oils, and animal fats (Table 1). In that country oil crop production accounted for only 3% of total value of agricultural production (TURKSTAT, 2018) and it covered almost 70% of the domestic consumption needs (SSR=69.3%). To a similar degree domestic production satisfied the demand for vegetable oils (SSR=70.6%) and animal fats (SSR=69.9%), as well as rice (SSR=72.0%). A slightly higher, almost 85% share of domestic production was recorded for the supply of maize available on the Turkish market (SSR=83.7%). The highest level of food self-sufficiency was found in Turkey in the case of eggs and fruit. The domestic production of these food items exceeded their demand by over 37% (SSR=137.2%) and almost 32% (SSR=131.8%), respectively. For the former product, despite the limited domestic production, the consumption needs were met to a considerable degree due to the relatively low egg consumption, while fruits, thanks to the favourable climatic conditions and cost advantage, are a major food group produced in amounts constituting a surplus over their consumption levels and thus they were exported from Turkey. In 2013 fruit production in Turkey, mainly peaches, apples and citrus fruits, accounted for approx. 1/3 value of plant production and 1/4 total agricultural production value (TURKSTAT, 2018). Surpluses in relation to consumption needs were also recorded (SSR>100%) for poultry meat, sugar and sweeteners, vegetables and milk.

It may be stated here that except for cereals, oil crops, pork, animal fats and milk, Turkey exhibited a higher degree of food self-sufficiency in comparison to the EU countries (Table 1). The greatest advantage of Turkey in relation to the EU countries in terms of meeting domestic consumption needs using domestic production was observed for fruits, eggs, sugar and sweeteners, as well as poultry meat. While in the case of eggs and poultry the consumption needs of UE inhabitants were satisfied with a surplus from the EU production (SSR= 102.0% and SSR=106.8%), in the case of sugar and fruits the EU faced market supply shortages. In 2013 food self-sufficiency of the EU for sugar was around 85% (SSR=85.0%), while fruits produced in the EU countries met the consumption needs of the EU population in almost 80% (SSR=76.2%). Such a trend was maintained in the EU starting from 2001 (Baer-Nawrocka, 2014). The shortage of domestic production in relation to the recorded demand, ranging from 2% to 33%, was reported in the EU also in the case of beef, maize, oil crops, vegetable oils and rice, while surpluses were generated on the market of cereals, particularly wheat

(SSR=121.5%), pork, animal fats and milk. We need to stress here that in the EU the degree of food self-sufficiency for animal origin products was greater than for plant origin products.

Table 1. Possible changes in food self-sufficiency ratio after Turkey's accession to the EU

Item	Turkey	EU	EU after Turkey's accession	
			SSR (%)	Change in the SSR
Cereals (excluding beer)	96.6	109.8	108.2	↓
Wheat and products	101.3	121.5	118.3	↓
Maize and products	83.7	89.6	89.1	↓
Rice (milled equivalent)	72.0	66.7	67.9	↑
Fruits (excluding wine)	131.8	76.2	83.1	↑
Oil crops	69.3	73.4	73.0	↓
Sugar and sweeteners	117.6	85.0	87.4	↑
Sugar crops	100.0	99.9	99.9	=
Vegetable oils	70.6	68.6	68.8	=
Vegetables	106.2	101.0	102.5	↑
Meat	114.9	105.8	106.3	↑
Beef	99.7	98.0	98.1	=
Pork	0.0	111.9	112.0	=
Poultry meat	125.9	106.8	108.8	↑
Animal fats	69.9	111.2	109.6	↓
Eggs	137.2	102.0	105.5	↑
Milk (excluding butter)	101.0	111.1	110.0	↓

Source: FAOSTAT, 2018; own calculations

Potential Turkey's accession to the EU does not considerably change the EU self-sufficiency ratios. In the EU extended to include Turkey the level of food self-sufficiency would slight decrease in the case of cereals, oil crops, animal fats and milk (Table 1). Except for milk, these are all products, which Turkish production levels are by several to approx. 30% lower than the consumption needs reported by the inhabitants of that country and market shortages observed in this respect would require supplementation of their production by imports from the other EU countries. Despite a reduced scale of need satisfaction by domestic production for cereals (except for maize and rice), animal fats and milk, the EU maintained a relatively high degree of food self-sufficiency – following Turkey's accession the EU production would exceed the reported consumption needs by approx. 10% (108.2%SSR<110.0%). The degree, to which the demand for meat, eggs and vegetables could be met by the domestic production would increase by 0.5 to 3.5 percentage points. Additionally, the level of self-sufficiency for sugar and fruit could also increase by 2.5 and almost 7 percentage points, while in contrast to the three above-mentioned groups of products on the market of sugar and fruits shortages of domestic production in relation to the demand would still be recorded (SSR<100%). No significant changes in the share of domestic production in the total supply of a given product would probably be expected on the EU market for sugar beets, vegetable oils, beef and pork, while in the case of these products full self-sufficiency for the extended EU could only be expected for pork.

Table 2. The impact of Turkey's accession on the food self-sufficiency rate in selected EU agricultural markets assessed by Nazlioglu and Erdem (2010), Fellmann, van Leeuwen and Salamon (2011), and van Leeuwen et al. (2011)

Item	Own simulation	Nazlioglu and Erdem (2010)	Fellmann, van Leeuwen and Salamon (2011)	van Leeuwen et al. (2011)
Wheat	↓	↓	↓	↓
Maize	↓	↑	↓	↓
Rice	↑		↓	↓
Fruits	↑		↑	↑
Sugar	↑	=	↓	
Beef	=	=	↑	=
Poultry meat	↑	↓	↑	↑
Animal fats (or butter)	↓		↓	↓

Source: Based on Nazlioglu and Erdem (2010), Fellmann, van Leeuwen and Salamon (2011), and van Leeuwen et al. (2011)

A lack of any significant changes in the EU food self-sufficiency for beef and animal fats (a slight decrease in the self-sufficiency rate) as a result of the potential Turkey's accession was also forecasted by Nazlioglu and Erdem (2010), Fellmann, van Leeuwen and Salamon (2011) and van Leeuwen et al. (2011). Simulations conducted by those authors under partial equilibrium conditions indicate a possible reduction of the EU self-sufficiency in the case of cereals, while suggesting an increase in this respect for poultry meat and fruit (Table 2). Fellmann, van Leeuwen and Salamon (2011) and van Leeuwen et al. (2011) consider this situation to be associated with the growth rate for the production and consumption of the analysed products. While the increase in cereal consumption in the extended EU may prove to be greater than the increase in cereal production, in the case of fruit and poultry meat the growth rate for their production may exceed the growth rate for their consumption, causing a respective increase (cereals) or a decrease (fruit, poultry meat) in prices of the analysed products. Fellmann, van Leeuwen and Salamon (2011) also suggested that Turkey's accession to the EU may cause a decrease in the rate, to which consumption needs of the EU population would be met by the EU production of sugar. According to the estimates by Nazlioglu and Erdem (2010), the extended EU including Turkey should remain fully self-sufficient in the case of cereals (except for maize), poultry meat and sugar, while at the same time suffering from shortages on the beef market.

4. Conclusion

The research results showed that Turkey was self-sufficient in most food items, excluding some types of cereals (maize or rice), oil crops, vegetable oils, and animal fats. Except for the above-mentioned products as well as pork and milk, Turkey was characterised by a greater level of food self-sufficiency than the EU countries. The greatest advantage of Turkey over the EU countries in terms of meeting domestic consumption needs using domestic production was observed for fruit, which production in Turkey by almost 32% exceeded the demand on the domestic market, while the EU was suffering from approx. 20% market shortages. In the EU a greater degree of food self-sufficiency was attained for animal origin products rather than plant origin products.

Potential Turkey's accession to the EU does not considerably change the EU self-sufficiency ratios. It is possible that EU self-sufficiency will decrease in some cereals, oil crops, animal fats and milk, whereas it is estimated to increase for fruits, vegetables, sugar and sweeteners, meat (excluding beef) and eggs. Self-sufficiency in the case of fruits may improve the most, although the EU will probably still be unable to satisfy its food needs. However, the abovementioned results imply that Turkey's membership in the EU does not conflict with one of the initial objectives of the Common Agricultural Policy, which was to promote increased rates of self-sufficiency for the EU.

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FOOD LOSSES AND FOOD WASTE THROUGHOUT THE SUPPLY CHAIN: ESTIMATES ACROSS THE REGIONS

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Annotation: Reducing the scale of food losses and waste throughout the entire food system is a crucial step towards improving global food security. The exact causes and the extent of food losses and food waste vary throughout the world. The main objective of this paper is to provide a regional assessment of the scale of food losses and food waste along the entire food supply chain. Quantitative food loss, which is analysed in this paper, is defined as the decrease in the quantity of food available for human consumption throughout the different segments of the supply chain. Food waste refers to the removal from the food supply chain of food which is fit for consumption, or which has spoiled or expired. According to the FAO data, 32% of all food produced in the world was lost or wasted in 2009 (in terms of weight). If we converted the FAO's estimates into calories, global food loss and waste amounts to approximately 24% of all food produced. The distribution of food losses and waste varies significantly between developed and developing regions. Regionally, about 56% of total food losses and waste occur in the developed world, whereas the developing world accounts for 44% of the losses. In the developed countries most food losses and waste occur at the retail and consumption stage, whereas in the developing countries food is lost mainly during the early stages of the food supply chain. It should be noted that only a combined effort by farmers, the food industry, retailers and consumers made along the entire supply chain can contribute to improving food security at the global level.

Key words: food losses, food waste, food security, food supply chain, developed countries, developing countries, regional diversity

JEL classification: Q11, Q13, Q18

1. Introduction

The global population exceeded 7.5 billion people in 2017 (FAO, 2018) and is predicted to reach 9.3 billion by 2050, with a projected increased food demand of 50-70% (Bond et al., 2013). In spite of multifaceted actions taken to curb the problem of global hunger, nearly 790 million people are still undernourished, equivalent to around one in ten people worldwide (FAO, 2018). At the same time, FAO estimates that, one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year (Gustavsson et al., 2011). Other studies have shown a similar range (Beretta et al., 2013; Fox, 2013), while Lundqvist (2009) even stated that as much as half of all food grown is lost or wasted before and after it reaches the consumer. If we converted the FAO's estimates into calories, global food loss and waste amounts to approximately 24% of all food produced (Lipinski et al., 2013). It means that one out of every four food calories produced for humans is not consumed by them. According to Lundqvist, de Fraiture and Molden (2008), 1400 kcal per capita are lost globally every day. When counting the cost of food losses and waste, World Resources Institute indicates that globally food worth \$750 billion is lost or wasted each year throughout the entire supply chain (EIU, 2014).

Taking into account the abovementioned facts, it can be easily noticed that food losses and waste are an issue of importance to food security, which is one of the key priorities of the economic policy in many countries with different stages of economic development (Pawlak, 2016). Moreover, food waste contributes to excess consumption of freshwater and fossil fuels which, along with methane

and CO₂ emissions from decomposing food, impacts global climate change (Hall et al., 2009). Considering the limited and often exhausted resources we have access to, food loss and waste should be avoided as far as possible not to aggravate climate change and not to harm the environment (For more see Fox, 2013; Alamar et al., 2017). From this point of view, reducing the scale of food losses and waste throughout the entire food system is a crucial step towards improving both global food security and environmental balance. This issue is mentioned by Grote (2014), Šálková, Regnerová and Lustigová (2016), Thyberg and Tonjes (2016).

Waste reduction and recycling, together with reducing consumption and shifting consumption patterns to more sustainable ones, comprise one of the three areas of changes included in the concept of sustainable consumption (Ratinger et al., 2014). Ratinger, Tomka and Boskova (2016) pointed out that there is a worldwide range of policies applied or considered to reduce food consumption and waste, starting with restrictive measures, and ending with raising public awareness, education and voluntary measures. For example, the European Commission (2014) proposed that the Member States need to develop national food waste prevention strategies and endeavour to ensure that food waste in the manufacturing, retail/distribution, food service/hospitality sectors and households is reduced by at least 30 % by 2025. While the nature and extent of food waste differ across developed economies, economies in transition and developing countries, it is admittedly a vital problem for policy makers, food producers and processors, retailers, as well as consumers all over the world and as such it attracts increasingly public attention. The exact causes of food losses vary throughout the world and are dependent on the specific conditions and the local situation in a given country, region or production area. Therefore, the main objective of this paper is to provide a regional assessment of the scale of food losses and food waste along the food supply chain.

2. Materials and Methods

This paper presents estimates for food losses and food waste occurring along the entire food supply chain by regions. The following boundaries in the food supply chain were considered: agricultural production, post-harvest handling and storage, processing, distribution and consumption. The analysis covered seven regions of the world, i.e.: Europe; North America and Oceania; Industrialised Asia (Japan, China, South Korea); Sub-Saharan Africa; North Africa, West and Central Asia; South and Southeast Asia; and Latin America.

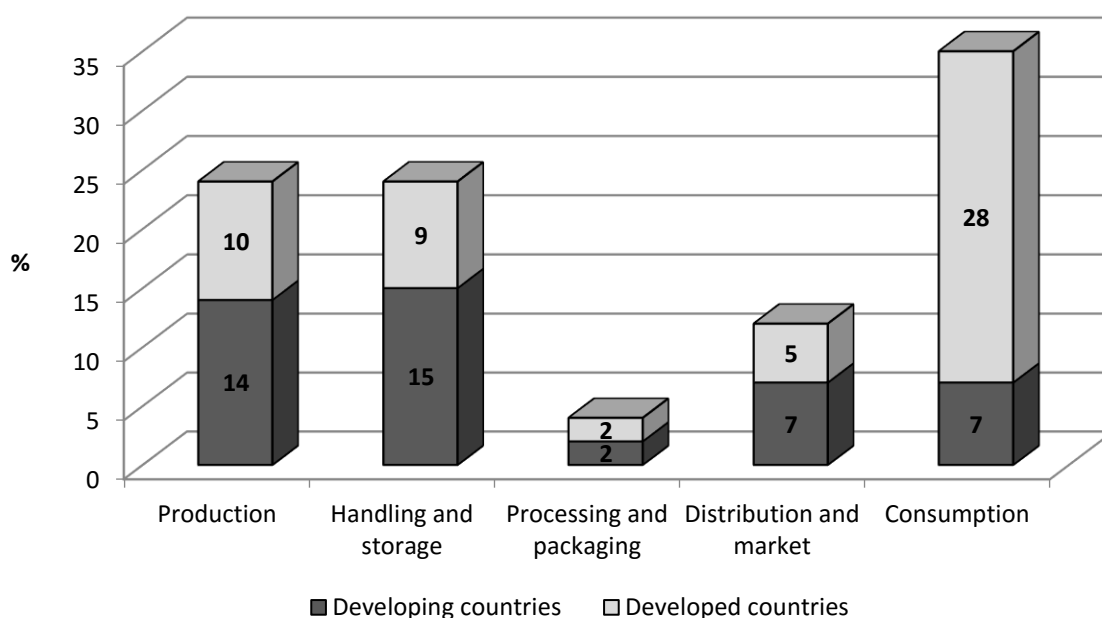
In the literature food losses and food waste are defined in different ways. Finding a commonly accepted definition is key to measuring food losses and food waste in a consistent way across sectors, countries or regions (Bagherzadeh, Inamura and Jeong, 2014). Food losses and food waste refer to the decrease in mass (quantitative) or nutritional value (qualitative) of edible parts of plants and animals produced or harvested for human consumption, but ultimately not consumed by people. Food losses refer to food that along the food supply chain gets spilled, spoiled or otherwise lost, or incurs reduction of quality and value before it reaches its final product stage. Food losses take mainly place at production, postharvest and processing stages in the food supply chain. Food waste occurs at the end of the food chain (retail and final consumption) and refers to the removal from the food supply chain of the food which is fit for consumption, or which has spoiled or expired (Cf. Parfitt, Barthel and Macnaughton, 2010; Gustavsson et al., 2011; Lipinski et al., 2013; Bagherzadeh, Inamura and Jeong, 2014). It is important to note that food that was originally meant for human consumption, but is removed from the food chain is considered food loss or waste, even if it is then directed to a non-food use (Lipinski et al., 2013). Additionally, food losses and waste may be disaggregated into three broad categories – avoidable, possibly avoidable or unavoidable (For detailed definition see Quedsted and Johnson, 2009). Quantitative food losses of the first two types are discussed in this paper. Food losses and food waste are presented in terms of both weight and calories.

The research was based on data of the United Nations Food and Agriculture Organization (FAO) and World Resources Institute (WRI). The methods of descriptive analysis, analogies and comparisons, along with the deductive approach were employed in the research.

3. Results and Discussion

Food loss and waste may be considered in terms of their volume (quantitatively), or treated as waste of the energy content of food, which may have otherwise been consumed by people. It results from a study by Lipinski et al. (2013) that the volume of food loss and waste, amounting to 1.3 billion ton annually, is equivalent to 1.5 quadrillion kcal. The distribution of food losses and waste varies significantly between developed and the developing regions. Regionally, about 56% of total food losses and waste occur in the developed world (North America and Oceania – 14%, Europe – 14%, Industrialised Asia – 28%), whereas the developing world accounts for 44% of the losses (South and Southeast Asia – 23%, Sub-Saharan Africa – 9%, North Africa, West and Central Asia – 7%, Latin America – 6%; Lipinski et al., 2013).

Figure 1. Share of total food losses and food waste by phase in the supply chain and stage of the countries' economic development (1.5 quadrillion kcal=100%)



Source: Based on Lipinski et al. (2013)

It results from the presented analyses that in the developing countries food losses are most typically observed in the initial stages of the food chain (agricultural production and post-harvest handling and storage; Figure 1). This is connected mainly with weather effects, less resilient crop varieties, poor soil quality and water shortages, low technical standard of agricultural production, inadequate harvesting techniques, poor post-harvest management, inadequate storage conditions (a lack of cooling facilities), deficient transport infrastructure, inefficient processing and defective packaging, as well as public market information systems that deal inefficiently with price information and consumer preferences (Cf. Lundqvist, de Fraiture and Molden, 2008; Bond et al., 2013; Fox, 2013). The scale of agricultural production is also a factor. Small-scale farming is exposed to a higher risk of food loss during this first stage of the food supply chain in many developing countries (EIU, 2014). In highly developed countries larger amounts of food are wasted at the stage of distribution and consumption. Such observations are reported at the national level, for example in the US (Kantor et al., 1997) or the EU countries (Secondi, Principato and Laureti, 2015; Stenmarck et al., 2016). In developed economies, food overproduction and bad consumer behaviour are main drivers of food

going to waste (See e.g. Visschers, Wickli and Siegrist, 2016). Two of the most common causes of food waste occur when too much food is cooked, prepared or served, or when food is not used in time (Parfitt, Barthel and Macnaughton, 2010).

Table 1. Distribution of food losses and food waste along the supply chain by region (%)

Stage of the food supply chain	North America and Oceania	Latin America	Europe	Industrialised Asia	South and Southeast Asia	North Africa, West and Central Asia	Sub-Saharan Africa
Percentage of kcal lost and wasted							
Along the entire supply chain, including:	42	15	22	25	17	19	23
Production	17	28	23	17	32	23	39
Handling and storage	6	17	12	23	37	21	37
Processing and packaging	9	6	5	3	4	4	7
Distribution and market	7	22	9	11	15	18	13
Consumption	61	28	52	46	13	34	5
Percentage of the volume of initial production lost and wasted							
Production	10.5	13.4	11.3	9.0	8.7	10.8	12.5
Handling and storage	3.5	7.5	3.4	6.6	9.6	7.8	12.7
Processing and packaging	3.4	5.0	3.9	3.1	2.7	6.3	4.5
Distribution and market	2.4	4.1	2.2	4.4	4.6	5.6	4.6
Consumption	12.6	3.7	10.6	10.3	2.6	5.5	1.3

Source: Based on Lipinski et al. (2013), HLPE (2014)

The greatest losses and waste of energy content of available food may be observed in North America and Oceania, followed by the Industrialised Asia, Europe and Sub-Saharan Africa (Table 1). While only in the highly developed countries 45-60% losses are incurred at the stage of consumption, in the latter of the above-mentioned regions approx. 75% all losses occur in the first two stages of the food chain, i.e. during production, and post-harvest handling and storage. When measuring food losses and waste in terms of their volume we may observe that the greatest losses at the stage of agricultural production were recorded in Latin America (13.4%) and Sub-Saharan Africa (12.5%), while at the stage of post-harvest handling and storage it is in Sub-Saharan Africa (12.7%), South and Southeast Asia (9.6%). In the highly developed countries the greatest amounts of food are wasted at the stage of distribution and consumption. The highest level of food waste at the stage of consumption was reported in North America and Oceania (12.6%). These regularities confirm e.g. the results of studies conducted by Fox (2013), who stated that with progress in the economic development of a country the food loss problem generally moves further up the supply chain. That author stressed that in mature, fully developed countries, more-efficient farming practices and better transport, storage and processing facilities ensure that a larger proportion of the food produced reaches markets and consumers. From that reason, in order to reduce food losses and food waste, FAO recommends the need of transfer engineering knowledge, design know-how and suitable technology from the developed economies to newly developing countries (Fox, 2013).

4. Conclusion

Food security is one of the key priorities of the economic policy in many countries with different stages of economic development. According to the FAO data, 32% of all food produced in the world is lost or wasted (in terms of weight). If we converted the FAO's estimates into calories, global food loss and waste amounts to approximately 24% of all food produced. Reducing food losses and food waste seems to be one of the milestones if we want to alleviate the global famine problem.

The distribution of food losses and food waste varies significantly between developed and developing regions. Regionally, about 56% of total food losses and waste occur in the developed world, whereas the developing world accounts for 44% of the losses. It results from the presented analyses that in the developing countries food losses are most typically observed in the initial stages of the food chain (agricultural production and post-harvest handling and storage). This is connected mainly with low technical standard of agricultural production, inadequate storage conditions and deficient transport infrastructure. In the highly developed countries the greatest amounts of food are wasted at the stage of distribution and consumption. Food overproduction and bad consumer behaviour are main drivers of food going to waste in those economies.

In view of the above it may be stated that actions aiming at the limitation of food losses and waste in countries with lower stages of economic development should be concentrated close to the field, while in more developed countries they need to be close to the table (i.e. the end consumer). Improving farming methods, as well as structural infrastructure, including transport, storage and processing facilities, can mitigate food losses in the developing countries, while in the developed countries the governments should implement the policy that corrects the undesirable retailer practices and consumer behaviour. The limitation of food losses and waste may be aided by a strategy consisting in the identification of reduction objectives both on the global scale, and within individual regions, as well as enterprises operating within the food chain. In developing countries it seems advisable to support investments aiming at limitation of losses at the stage of production, as well as post-harvest handling and storage. In turn, in more economically developed countries it is recommended to establish organisations promoting limitation of food loss and waste, e.g. thanks to the development of appropriate eating habits and desirable consumer behaviour.

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WHAT DOES 'SAFE FOOD' MEAN FOR YOUNG CUSTOMERS?

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Annotation: For food producers and regulators, food safety means that products must be free from any contamination, including microbial, parasitic or chemical contamination (FAO, 2004). However, research indicates that for a growing number of consumers, “safe food” means much more. This finding has implications for producers and retailers marketing their foods as healthy and high quality. The objective of this paper is to identify key hashtags that are communicated in connection to Safe Food on the Instagram social network. The study was conducted on a sample of 4,172 messages from 2,096 unique posters. Messages were captured as Instagram social media communications using Netlytic software. Based on the Eigenvector Centrality analysis, four of the most significant characteristics that Instagram users communicate in connection with the hashtag #safefood have been identified: 1) Healthyfood (Healthy) 2) glutenfree 3) vegan and 4) organic. These results can be used by food producers focusing on healthy foods in their marketing as well as their portfolio management. It is significant that for customers in the Safe Food area, it is more important that a product be gluten-free than organic, which can be related to the growing number of people on gluten-free diet and celiac disease.

Key words: Safe Food, Instagram Young Customers, Glutenfree, Vegan, Organic

JEL classification: Q13, M31

1. Introduction

Food safety means that food consumption is free from any contamination, including microbial, parasitic or chemical contamination (FAO, 2004). People nowadays are focusing more on food quality and safety (Korada et al., 2018). However, the quality of food is perceived by the customer not only on the basis of objective characteristics, but also on the basis of subjective feelings (House et al., 2005). Customers usually rate quality based on their own observations or through a network of friends and acquaintances. Previous studies have shown that food quality not only depends on the objective characteristics of the product, but is a compilation of aspects related to personal needs, such as food safety, environmental impact, support for local and rural communities and other ethical aspects (Rojík et al., 2016; Migliore et al., 2015). Products such as fresh fruit, fresh vegetables, fresh flowers and fresh seafood are perishable goods, and there is a need for the shortest time between production and consumption (Su et al., 2014). Private institution and customer pressure on food regulation and quality (Thankappan, 2009) and manufacturers are beginning to adapt these pressures – for example by including regional food labelling, which is the result of consumer pressure on food quality (McEntee, 2010). People are beginning to be interested in healthy and safe food, and there is a great variety of definitions what actually safe food is. Liu et al., 2013 defines safe food as a hazard free, green and organic food. It is a unique system of production standards in China (Scott et al., 2014). Within the EU, a concept „White Paper on Food Safety“ has been developed to „complement and modernize existing EU food legislation to make it more coherent, understandable and flexible and to provide greater transparency to consumers; in addition, to ensure a high level of food safety“ (European Commission, 2000). Understanding consumer perceptions of food safety is important in terms of reaction both from the private sector (farmers and dealers) and from the government sector (regulators). The objective of this paper is to identify key words and characteristics that are communicated in connection to Safe Food on the Instagram social network. Instagram users are young; 67.5% are 13-34 years old, and the biggest demographic group are between 18 – 24 years old

(Statista, 2018). These users communicate their feelings, emotions, and characteristics connected with product or situation (Pilař et al., 2017) – in our case connected with Safe Food. The examination of communication on this social network based on hashtag analysis in connection with Safe Food is useful to identify how these younger users communicate about foods – and what they value.

2. Materials and Methods

The study was conducted on a sample of 4,172 messages from 2,096 unique posters. Messages were captured as Instagram social media communications using Netlytic software (Grudz, 2016). Instagram does not allow to download age and gender data, unlike other social networks including Facebook, Twitter and Flickr. Only aggregated data can be obtained. Studies report 61% of Instagram’s global users are between the ages of 18-34 (Statista, 2018).

The base data sample contained 4, 172 messages. For further processing, all words that do not start with # were removed from the messages. Datový soubor tak obsahoval only the hashtags that users share with the Instagram posts. In their messages, Instagram users use hashtags to convey what they consider to be most important (Pilař et al., 2017). This data was then inserted into Gephi 0.9.2, where a network containing 8,325 nodes (hashtags) connected by 1,348,009 edges was created. To identify the significance of the individual hashtags, the following statistical methods were used:

Degree centrality

The degree of a node (hashtag) h is defined as the number of links incident to node (Antoniou and Tsompa, 2008):

$$k_i = \sum_{j \in \Pi(i)} a_{ij}$$

Eigenvector centrality

Eigenvector centrality is a relative score recursively defined as a function of the number and strength of connections to its neighbours and as well as those neighbours’ centralities (Ilyas and Radha, 2011).

$$X_i = \frac{1}{\lambda} \sum A_{xj} X_j$$

3. Results and Discussion

Based on degree centrality analysis, it is possible to identify the 5 most important hashtags in the network from the point of view of linking to other hashtags. Based on this value, we can identify the 5 most significant hashtags: #healthyfood, #glutenfree, #healthy, #organic, #vegan, see table 1.

Table 1. Degree centrality of hashtags connected with #safefood hashtag

hashtag	Degree	Degree range	Number of hashtags in the degree range	Percentage
#healthyfood	1,819	2,000-8,324	1	0.01%
#glutenfree	1,536	1,500-1,999	2	0.02%
#healthy	1,175	1,000 – 1,499	3	0.04%
#organic	1,082	500 - 999	21	0.25%
#vegan	999	1 - 499	8,298	99.68%

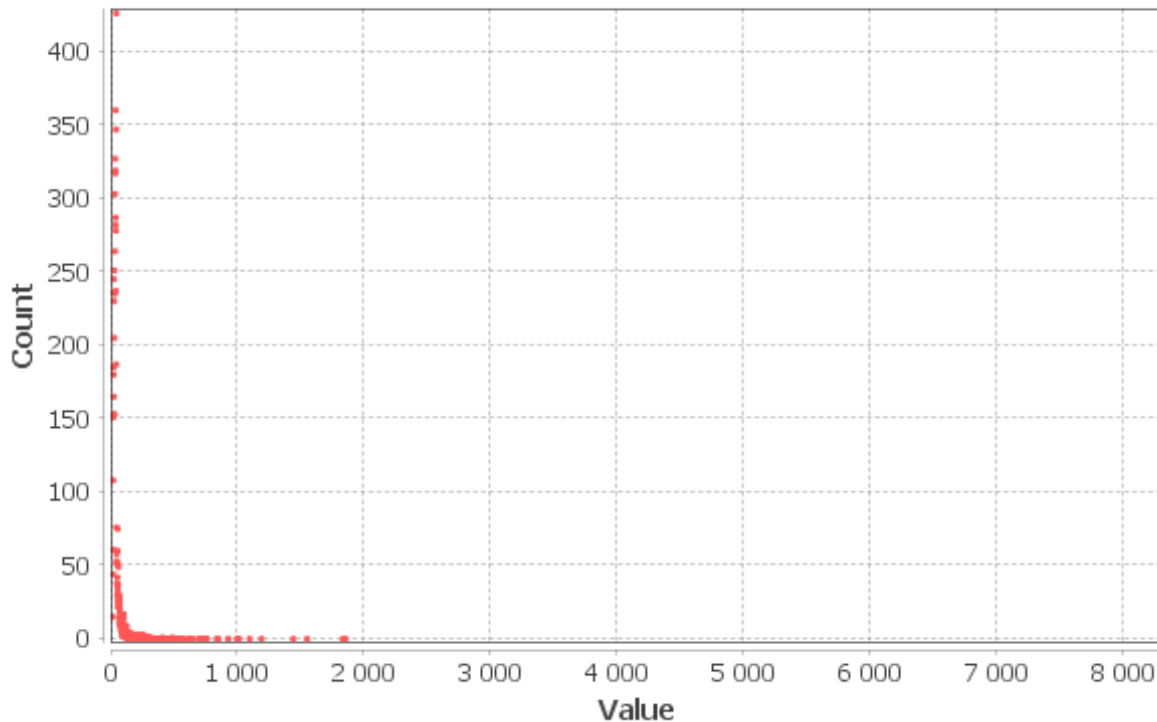
Source: own processing

Note: The highest degree: #safefood: 8,325

Degree distribution corresponds to the long tail characteristic. There are only 6 hashtags with a degree higher than 1,000. On the other hand, most of the hashtags fall into the category with a degree between 0 and 499. It is steeper long-tail characteristic than normal, indicating that there are fewer dominant hashtags and a larger number of hashtags with a smaller degree see tables 1 and figure 1.

Figure 1. Degree distribution of hashtags connected to #safefood

Degree Distribution



Source: Own calculation

Based on our eigenvector centrality analysis, it is possible to identify the 5 most significant hashtags in the network in terms of their connection to other important hashtags. This value allows for identifying the 5 most significant hashtags: #healthyfood, #glutenfree, #healthy, #vegan, #organic, see table 2.

Table 2. Eigenvector centrality of hashtags connected with #safefood hashtag

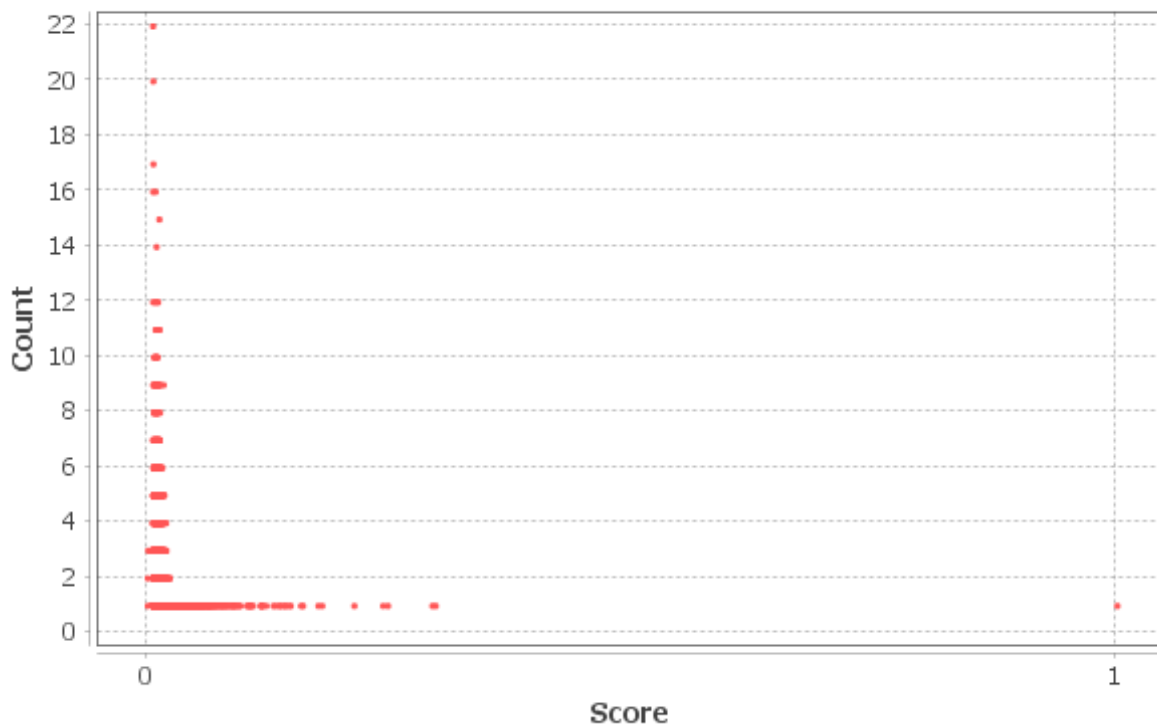
hashtag	Eigenvector centrality		Eigenvector centrality range	Number of hashtags in the degree range	Percentage
#healthyfood	1,819		0.8-1	1	0.01%
#glutenfree	1,536		0.6-0.79	0	0.02%
#healthy	1,175		0.4-0.59	0	0.04%
#vegan	1,082		0.2 – 0.39	5	0.25%
#organic	999		0 – 0.19	8,319	99.68%

Source: own processing

Eigenvector centrality distribution corresponds to the long tail characteristic. There are only 1 hashtags with a centric eigenvector higher than 0.4. On the other hand, most hashtags fall into the category with an eigenvector centrality between 0 and 0.19. This is steeper long-tail characteristic than ordinary, as well as degree distribution, which again indicates that there are fewer dominant hashtags and larger numbers of hashtags with a smaller degree see table 2 and figure 2.

Figure 2: Eigenvector Centralitz distribution of hashtags connected to #safefood

Eigenvector Centrality Distribution



Source: Own calculation

Based on the comparison of the most important hashtags in terms of the degree centrality of #healthyfood, #glutenfree, #healthy, #organic, #vegan, and eigenvector centrality: #healthyfood, #glutenfree, #healthy, #vegan, #organic, we can identify the same 5 important hashtags. The difference is the order of hashtag #vegan and #organic, where hashtag #vegan has a higher degree

(is linked to a larger number of hashtags), but #organic has a higher eigenvector centrality (it is linked to fewer hashtags that are more important – they have a higher degree).

The combination of Health and Safe Food in the first place in the degree centrality as well as in eigenvector centrality confirms the Chen study (2016), where it points to the motivation to buy safe food from a healthy living perspective. In the #glutenfree area is two possible explanations. One is safe food communication in connection with gluten-free diet, where users communicate what foods and practices are safe in the diet, for example safe food preparation at home (Sainsbury et al., 2018) or are gluten-free and safe for customers with food allergies (Hartmann et al., 2018), or the belief that such a diet is more healthy, when in fact, it may not be (Sheats, 2016). The vegan area can be seen in a very same way, vegan is accepted as a healthy lifestyle behavior (Tague and Dake, 2011) can be seen in the same way. Hashtag #organic indicates the connection to organic food. Previous studies focusing on motivation to buy organic food identified as a basic factors (1) the subjective norm (Zagata, 2012), (2) the health attribute (Yadav and Pathak, 2015; Lee and Yun, 2015) or (3) the ecological aspect (Teng and Lu, 2016). It is possible to identify both the motives – „to be more healthy“ as well as to be more ecological and environmentally friendly.

The article does not work with trends and is based on data published between January 28, 2017 and March 12, 2018. Considering the trend of using Instagram, there are only 217 messages from 2017 and another 3,955 messages from January 1, 2018 to March 12, 2018, which indicates a huge increase in activity in this area. This research can serve as a starting point from which trends can be traced based on the changing frequency or eigenvector centrality characteristics of hashtag usage by social network users.

Limitation of research

Due to the private legacy of Instagram social network, it is not possible to identify the gender or age of the users who sent the messages. Young customers are used in the article because 67.5% of Instagram users are 13-34 years old, where the biggest demographic group is those between 18 – 24 years old.

4. Conclusion

Based on the Eigenvector Centrality analysis, four of the most significant characteristics that Instagram users communicate in connection with the hashtag #safefood have been identified: 1) Healthyfood (Healthy) 2) glutenfree 3) vegan and 4) organic. On the basis of these results, it is possible to identify that a young generation considers safe food products to be those that are not just healthy, but also gluten free, not produced with animal products (vegan) or produced on the basis of organic farming principles. These results can be used by food producers focusing on healthy foods in their marketing as well as their portfolio management.

Also, it is significant that for customers in the Safe Food area, it is more important that a product be gluten-free than organic, which can be related to the growing number of people on gluten-free diet and celiac disease.

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MANAGERIAL ICT EDUCATION, INNOVATION OBJECTIVES AND BARRIERS TO EDUCATION OF AGRICULTURAL ENTERPRISES MANAGERS

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Annotation: In the following article, we present partial results of a questionnaire survey of current IT agricultural managers' education. We also focus on the barriers that stand out and hamper the possibilities of continuing education for managers today. At a time of high competition, when businesses have the same or similar technologies, the processes of the company, whether they are innovations, customers, production, but also sales efficiency, and others, are decisive for the success of the enterprise. This is why agricultural businesses should invest in the development of their employees. Investing in human resources leads to their overall appreciation, in particular through increased staffing and service levels, increased business competitiveness, employability of own resources to meet the needs of employees, self-reliance and employee satisfaction, loyalty to the company, time savings and financial costs. Formation of work skills goes beyond the limits of qualifications and increasingly involves shaping the social and personal characteristics of employees (behavior, attitudes, motivation and work performance). Therefore, education and the formation of work knowledge and skills should be considered as a lifelong process and an important part of personal work.

Key words: educational process, ICT, technology of education, digital literacy, interactive teaching, lifelong learning, education of managers.

JEL classification: Q19, C83, I25

1. Introduction

Work with information and use of modern information and communication technologies should be integrated into the methods and contents of different subjects. While these skills are now regarded as something extra, they should be taken as part of and essential to everyday life. Most of them are condition for the application at work (Nichols, 2003). Since the multimedia is a successful combination of images, animations and sounds, they represent good teaching aids and progressive method of transmitting information (Twigg, 2003). The curriculum discussed is thus enriched with attractive graphics or spoken word, everything methodically well elaborated, which is reflected in the quality of the acquired knowledge, retention time of such information, but above all the involvement of students in the learning process. It is not impossible to count how many teachers are using a particular piece of technology (Wong, 2000). It is far harder to judge pedagogic change. One tool which could prove useful in this respect is i-Curriculum Framework, developed by the European project of the same name. The framework was intended as a tool that can be used by educators to record the effects of their learner's activities. It is based on viewing pedagogic and curricula activities along three dimensions - an operational curriculum, an integrating curriculum and transformational curriculum. It is possible to approach pedagogies for using technologies for learning for the same subject and for the same intended outcomes on any one of those three dimensions (Tomsic and Suthers, 2006; Muilenburg and Berge, 2005; Katz, Goldstein and Yanosky, 2009).

Operational curriculum is learning to use the tools and technology effectively. Knowing how to word-process, how to edit a picture, enter data and make simple queries of an information system, save and load files and so on. Integrating curriculum is where the uses of technology are applied to current curricula and organization of teaching and learning (Pelgrum, 2001). This might be using an online library of visual material, using a virtual learning environment to deliver a course or part of a course. The nature of the subject and institution of learning is essentially the same, but technology is used for efficiency, motivation and effectiveness.

Transformational curriculum is based on the notion that what we might know, and how, and when we come to know it is changed by the existence of the technologies we use and therefore the curriculum and organization of teaching and learning needs to change to reflect this (Kanuka and Anderson, 2007).

Nowadays ICT provides a lot of attractive possibilities for creating new kinds of educational and learning projects. At solving of problems defined by us (i.e. supporting learning by the virtual learning environment) we are supporting by the fact that applications of new technologies is inevitable for creating educational environments. Learning in the virtual learning environment is targeted organized and controlled (Leach, 2008). Mostly there are possibilities interpreted by the Internet, however another electronic computer support belongs to them as well. The most demanded element of education connected with technologies is an interactivity with its determined role in the multimedia field (Warburton, 2009).

The development of an information society and the constant expansion of information and communication technologies provide an opportunity to learn and acquire new digital skills and competences that have become necessary for employment, education and training, personal development and social engagement (Šimek, Vaněk and Jarolímek, 2008). As society becomes more and more a knowledge-based society, it also changes the content of what people need to learn and know. ICT changes the way people work, learn and improve their skills. This process also affects managers of agricultural organizations and agricultural businesses. It is more than necessary to realize the importance of learning in this area, which is often overlooked. Only then will they be able to meet the requirements of their ICT skills and flexibly respond to the changes brought about by this digital era (Fink and Disterer, 2006).

Many authors defines IT managers' knowledge as "specialized knowledge, a useful set of facts and relevant concepts for a particular job position". Based on this definition, Dor and Elovici, (2016) identified three main areas of knowledge that managers should have in order to be able to use ICT in their own benefit and at the same time for the benefit of the organization as such:

- Have the latest information and overview of current ICT activities and opportunities (Ongori and Migiro, 2010),
- Understand the value and potential of IT (Bresnahan, Brynjolfsson and Hitt, 2002),
- Know the potential as well as the current and future IT constraints while also seeing how the competing companies use IT (Dor and Elovici, 2016).

Several authors believe that the main goal of IT managers' knowledge is to enable managers to communicate effectively with IT staff. Many authors define interconnection as a stage in which IT missions, goals and plans support business mission, goals and plans through their mutual alignment. Managers are increasingly aware of the need to constantly flexibly reflect on the current needs of organizations, and naturally expand their horizons through lifelong learning. The issue of lifelong learning is not only about managers but it is an all-society phenomenon that is also anchored

in the lifelong learning strategy and lifelong guidance as a tool for forming a knowledge society (Jones, Beynon-Davies and Muir, 2003). The most effective way to increase the level of information literacy of the agricultural managers is their continuous education (Fulantelli and Allegra, 2003). However, learning brings with it barriers that arise from both the external and the internal environment. Barriers arise in an educated subject, a sending organization, an organization providing education, but also a state with its legal regulations. Barriers in the literal sense of the word mean obstacles. We define them as factors that prevent us from doing something, in our case education. The barriers faced by managers in their education are often related to their family situation, education, employment, and last but not least their psychological condition (Pavic et al., 2007). Caha et al. (2017) concluded: “The education of managers should therefore be a priority within corporate education policy because it enables them to achieve the set company goals through the employees of the company”. The necessity of lifelong learning is dealt with by Šilerová and Havlíček (2011).

Adapting European education and training systems to new requirements dictated by an increasingly competitive international environment has, as already noted, become a reality. One of the main components is promoting basic skills to support this process (Salmon, 2004). Gradually, as part of the concept of lifelong learning, a reference framework of competences began to be formulated to identify the key competences that should enable individuals in Europe to be regarded as properly qualified to perform a successful and creative role at the workplace, as part of a professional career and while playing a competent role in society. This is all with the aim of providing effective support for the work of Member States in meeting the objectives set and at the same time creating an appropriate reference framework at European level. There are several important markers here. The European Commission communication on lifelong learning contains a new emphasis; it identifies ‘new basic skills’ as a priority and stresses that lifelong learning must cover the period from pre-school education to post-retirement age.

The report of the European Council on the broader role of education, adopted in November 2004 (CoM of Education, 2004), stressed that education contributes to preserving and renewing the common cultural background in society, and is particularly important at a time when all Member States are challenged by the question of how to deal with increasing social and cultural diversity. Moreover, enabling people to enter and remain in the world of work is an important part of the role of education in strengthening social cohesion. Penetration level e-learning in the educational system in Central Europe is different. Individual countries have their own characteristics in the education system and also access to the development of e-learning. In some countries, e-learning develops without established institutional coverage of the other countries created state-funded public institutions, which has long been involved in the development of e-learning as part of distance learning. This focus on a more strategic use of e-Learning has become important as the environment in which higher education institutions operate changes. Over the last decades higher education institutions have experienced profound changes in their external environment affecting both their primary and secondary processes of education, research and organization. It is generally acknowledged that technology, demography, governmental policy and economic factors are the main external drivers for change. Eight key competences have progressively been identified (and put into operation) within this reference framework. These are:

1. Communication in the mother language,
2. Communication in foreign languages,
3. Mathematical competences and basic competences in science and technology,
4. ICT competence,

5. Learning to learn,
6. Social and civic competences,
7. Sense of initiative and entrepreneurship,
8. Cultural awareness and expression.

For the purposes of our discussion, individual elements of these competences are not important. It is, however, important to realize that the key competences defined constitute a multifunctional package of knowledge, skills and values that all individuals require for their personal fulfilment and development, and for their social inclusion and employment. It is important to know and understand that these competences are conceived as a combination of knowledge, skills and attitudes adapted to individual circumstances and with very close common links (Tondeur, Van Braak and Valcke, 2006).

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There has occurred new didactic chain of events at e-learning. The occurred relationships shall express certain regularity, individuality and subjectivity. These relationships shall express a strategy of organization and control of activities connected with independent work of students. In terms of that we are aware that success depends mainly on the ability to learn how to learn. There is a question if the educational model is solving the problem of learning how to learn enough. This problem is not observed as the problem of a student only. Problems of learning how to learn fall into the theory field about teaching and learning styles. In the virtual educational environment, i.e. the e-learning course, there is not any mutual confrontation of these attributes of the education system, namely that at presentation study form the cognitive process of students is taking place under direct control of the teacher. The student at the e-learning course is alone without a contact with the teacher. It can be an unsuitable situation for the student. This negative effect is to be eliminated by means of the virtual reality or the interactivity simulating the teacher's assistance. From the above mentioned it is evident that the e-learning course is not only an information source, a set of organization instructions with control options, but also an instruction how to learn. The instruction how to learn can be identified in activities focused on analyzing mistakes in terms of their origin and their following removal (the student has a possibility to correct them). So an approach requires to judge chains of events between pedagogical-psychological effects and didactic-technological features of the virtual teaching. Because of it there is to be focused on activities observing following principles (Young, 2002):

- Digitizing the study materials shall be suitable for demands on independent work of a student with a computer,
- There is necessary to determine strategic ways of effective independent work in a virtual teaching environment in order to emphasize self-control and self-valuation,
- Elaborating a system of learning how to learn for the cognitive process by means of revealing key knowledge with options of their confrontation in cases of wrong decisions ,

- To create possibilities for students by means of the virtual teaching environment in terms of participating in development of tracking competencies (Erumban and Jong, 2006),
- Users of the course shall be informed about its functions, targets and factors according to them the level of their competencies shall be evaluated (each of the targets represents an indicator for the particular information element connected with a given chapter of the course).

2. Material and Methods

Data collection was processed in the form of a questionnaire in 2017. The sample of respondents consists of agricultural managers of three selected agro-sector organizations of Western Slovakia in the total number of 55. Of the total number of respondents, 71% were men and 29% were women. The questionnaire was made available to a company employee on a web site. Questionnaires were distributed electronically to employees of the company in order to create feedback and to gather respondents' views on the forms of education that the company provides for their personal development. We also tried to save time by means of a questionnaire that was not required to be written but was available in electronic form. The questionnaire was based on collected information about the problem. The questionnaire consists of two parts, where the first part contains questions aimed at identifying and categorizing the respondents. The second, research part, gives respondents the opportunity to comment on the learning opportunities that are provided to them or which they themselves use. The questionnaire contains a total of 20 questions and its output is a view of the satisfaction of the employees of the company with its training program. The questionnaire uses two types of questions. The first type is a closed question with a four-level scale to measure the degree of satisfaction with a particular area of the education system. The second type is semi-closed questions that reveal the gaps in educational programs through the opinions of the respondents. We also added an open-answer option to some questions in order not to limit creativity responses. When creating a barrier list, we learned from several literary sources of domestic and foreign authors. The basic and also the starting point was the analysis of available resources dealing with this issue, especially research conducted abroad.

Several statistical methods have been used for the statistical evaluation. Verification of dependencies between the traits was carried out by use of chi-square test (χ^2), respectively. (χ^2)- Square contingency. For the statistical analysis where the Chi-square test of independence could not be used, the Fisher's exact test was applied because the assumption numbers of cells in the pivot table was not followed. Fisher's exact test derives from the pivot table and verifies the null hypothesis of equality of the two units, namely the independence of two binary variables. This test is based on the assumption that all marginal frequencies (totals rows / columns) in the pivot table are fixed. This assumption is rarely met. They are mainly fixed in line frequency or in only the total frequency. If using the parametric methods was not possible because of failure in meeting the preconditions for their use, we applied nonparametric methods. Kruskal-Wallis H test is an extension of the Mann-Whitney test for three or more samples. The aim of the test was to find out whether the differences found in the sample medians of each group (according to the level factor) are statistically significant (between variables, the relationship) or could not be random (between variables, the relationship). The null hypotheses concerning equality of all medians, was tested. If the P-value is lower than the chosen significance level (0.05), the null hypothesis is rejected. This means that the difference between at least one pair of median values calculated from the sample is too large, it can only be the result of random selection. Therefore, it is statistically significant – there is the relationship between the variables. If the P-value equals to or is greater than the chosen significance level, the null hypothesis cannot be rejected. This means that the difference between each pair of medians calculated from the sample can only be the result of random selection, therefore, not statistically significant – there is not the relationship between variables. The questionnaire survey was evaluated with statistical

methods for the detection of relevance and relations of the data collected to confirm or refute the hypothesis of statistical indicators. A total number of hypotheses were chosen two for this article:

Hypothesis 1: The use of ICT technology and interest of education in the area of ICT partially depends on the manager's age.

Hypothesis 2: The education in the area of ICT depends on the employee attitude and does not depend on the gender.

3. Results and Discussion

All respondents agreed on the fact that education and staff development really affect the competitiveness of society. Almost 43% of surveyed managers consider development to be a key factor. The remaining 57% of managers are of the opinion that education and development are more likely to affect competitiveness. Up to 77% of surveyed managers are dissatisfied with the education and development opportunities provided by the employer in their company. Of this, 69% of managers are rather dissatisfied. Rather satisfied is 23% of managers. Absolutely dissatisfied with the learning opportunities provided is 8%, and no single manager is satisfied. The most common goal for managers in the field of education that is 45% is willingness to acquire new knowledge and skills. Ability to adopt new work processes is 25% of the managers asked. The same number is to overcome difficult obstacles. Only 7% of managers are satisfied with career growth opportunities and talent development in the organization. Enough support from the organization has 57% and insufficient 43% of managers. The manager lacks a number of areas of day-to-day activities, which the employer has no ambition to deal with. This may then be seen in a higher error rate when performing work tasks or a longer time frame within which managers are required to complete their work.

After quantifying the significance of individual barriers by gender, we tested the statistically significant gender impact on individual barriers. Most data were normally divided by $p > 0.05$. Statistical significance was tested using a parametric T-test. The statistically significant influence of gender was confirmed in the disability barrier, the non-systematic $p = 0.028$. The statistical significance was confirmed in the barrier of lack of quality education $p = 0.015$. After analyzing the significance of individual barriers according to the age group, we tested the statistical significance of the influence of age groups on individual barriers, at the level of significance $\alpha = 0.05$. Most data matched the normal data distribution condition $p > 0.05$. We then used the Anova method to test the normally distributed data. The statistically significant impact of the age group was confirmed by the lack of quality education $p = 0.0312$ and the lack of funding on the company side $p = 0.028$. The impact of the age group on perceptions was tested by a Kruskal-Wallis nonparametric test.

The most significant barrier that the managers consider is the lack of time to learn outside of work. The second most important barrier is the lack of time to learn alongside other activities at work. The third most significant barrier is the lack of funding for education on the part of respondents. As the least significant barrier was the fear. The vast majority of 99% managers use e-mail or computer network at work. Desktop is used by 21% of respondents, while 79% of managers use the laptop at work. The managers use videoconferencing systems especially when communicating with remote clients from abroad. Videoconferencing systems allow managers to share information with other countries in real time, without having to leave. This type of information and communication technology (ICT) is used by only 11% of managers. Out of smart mobile devices, managers use a smartphone that is used by 64% of respondents, while only 16% of respondents use the tablet. The share of respondents who adapt and learn to control information and communication technologies is 77%. The remaining 23% were managers who learned to control information and communication technologies with difficulties. The biggest problems for managers when working with ICT is setting the specific user settings for the application, as well as switching to higher versions

of applications, where user interfaces do not coincide with previous versions. Up to 73% of managers have this option.

Only 12% of respondents have a problem downloading and sending files, 4% searching for information and services on the Internet and using e-services. Using e-mail, using common applications and controlling their smartphone, tablet does not cause problems to any of the respondents. 44% of the respondents are trained. Their share is smaller than the proportion of managers who do not attend the training that is 56%. This has two reasons. The first is busyness and overloading of managers. In addition to their time-consuming activities and tasks at work, there is no time to further develop their skills and abilities. The second reason is the number of first-level and middle managers who often use standard office applications such as the Microsoft Office suite for their work. The management often does not feel the need to further educate their managers in ICT because they feel that the knowledge gained would not be used in their work and the company's investment in their education would not return. Up to 74% of respondents educate themselves in their free time. As a result, managers who do not have the opportunity to develop in their work are in fact interested in further development. For the reasons outlined above, however, this education and training goes beyond working hours. As a result of the previous question, up to 92% of managers said that education was done in the form of self-education.

Table 1. Significance of barriers according to gender

Barriers in the training ICT	Median	Standard deviance
Lack of time to learn	5.02	1.12
Lack of finance	4.85	0.93
The enterprise does not support education	4.33	1.25
Low education offer	4.71	1.16
Low quality of education	3.63	1.02
One – off, non - systemic	3.56	1.41
Unwilling access of a trainer	3.31	1.30
Fear	1.56	1.10

Source: own research and processing

4. Conclusion

What distinguishes victors from the defeaters today is actually information and knowledge. For this reason, management training is crucial to maintaining the competitiveness of an enterprise. Effective results and necessary change always depend on quality analysis of educational needs and on the choice of appropriate forms and methods of education. It is important for agricultural organizations to be able to predict the direction of their business development and to prepare their staff for it, not just to respond to emerging skills. Not every organization can define it. There are several educational institutions available to help organizations. But the organization must be clearly defined what it wants to achieve. When selecting a quality educational institution, consideration should be given not only to the attractiveness of the offer, but also to the seriousness and quality of the lecturers, to the training experience. If education is to be recognized as important and necessary for an organization, it must ensure that it meets its real needs. Such needs may be development that will bring a demonstrable positive change to existing practice, motivate people to develop, streamline processes, increase productivity, and motivate to support growth, return on investment, stability of key personnel and many others. Sikorska-Wolak and Zawadka (2016) came to the same conclusion, and they indicate the need for education, particularly for the development of farms and the whole rural environment. Education is a demanding and lengthy process that lasts certain

time and the personal attitudes of the trainees. These factors cannot be circumvented or omitted. Therefore, it is important to highlight the value of education and possible future benefits for the person concerned. Only 17.1% of ICT training is outside the routine office space. This involves self-learning or knowledge transfer or action learning. The effectiveness of these methods is mainly time saving, but the company should consider the amount of external training where employees would come into contact with other managers from other companies and bring new ideas, suggestions and insights into society, find out how similar situations are addressed in other companies. The suitability of e-learning is presented by Šilerová and Havlíček (2011), the cost of the above-mentioned way of corporate education can be up to 40% lower. The fact that foreign languages is an indispensable part of the everyday work of each employee is not clear why it is not done more or more systematically in this direction using some of the new educational methods. Improving the presentation, argumentative knowledge in foreign language communication can be a valuable asset. Our survey was aimed at identifying barriers in the education of ICT agricultural managers. An interesting finding is that in the last place and as the smallest barrier the respondents chose the fear of education.

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THE SITUATION OF SOCIAL FARMS IN THE CZECH REPUBLIC

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Annotation: The aim of this paper is to analyse the situation of social farms in the Czech Republic. The purpose of social farming is to provide social services when using agricultural resources. Thus, it is a concept where social issues are solved via agricultural activity. In the Czech Republic it is still a slowly developing concept, to which, however, considerable potential is contributed. Because the primary goal of a social farm is not to generate profit but a public benefit activity, the key factor for ensuring of their development and operation are subsidies. All social farms in the Czech Republic draw subsidies support for different activities, namely in social, agricultural, environmental, educational or cultural area. Also difference between institutions granting subsidies derives from it. From the point of view of granted subsidies the turning point was the programming period 2007 to 2013 when the biggest support ever was paid to social farms. Nevertheless, the subsidies support which has been paid in recent years has proved to be decreasing, even though the highest number of social farms ever was registered in the Czech Republic in 2017. Thus, it seems that social farms are beginning to be capable of self-funding. Although there are subsidy titles for social farms also in the programming period 2014–2020, until now the demand for subsidies has proved to be not as high as in the previous period. In comparison in particular with western countries in the European Union the number of social farms in the Czech Republic is at lower level. These countries are well aware of importance of services ensured by social farms. Thus, it is necessary to create further stimuli which would support social farms in the Czech Republic.

Key words: social farming, rural area, social economy

JEL classification: J43, L33, Q01

1. Introduction

The purpose of the concept of social farming is to contribute to integration of physically and socially disadvantaged persons into society via their employment, retraining, therapy, education, etc. when using agricultural resources. In the Czech Republic social farming may be described as an innovative approach to running business and a social dimension in which a very low number of social farms are engaged. Despite this fact it is an industry with high potential. The situation in individual member states of the European Union is significantly different. In the Czech Republic social farming is still in its infancy and it is necessary to continue with creation of conditions for its development (Ministry of Agriculture, 2016). Social farming benefits society and fits the concept of sustainable and rural development (Hromadová, Hanusová and Šťastná, 2017).

Nevertheless, in the Czech Republic exists certain legal conditions and economic environment in which social farms may be created and developed. On the other hand, a sufficient framework is missing at the European level which would provide legal certainty and good economic conditions for social farming. (Korcová, Kobzev Kotásková and Švejdarová, 2017).

Existence of social farming is designed in accordance with subsidy policy of the European Union and member states. Without funding, social farms would not be able to create services for the public and thus to aid with solution of social issues (Chovanec, Moudrý and Hudcová, 2015). The main provider of subsidies in the Czech Republic is the Ministry of Agriculture and Subsidiary and Social farming program PGLRF, a.s. These institutions provide grant support in fields of agriculture, social

services, the environment or education. Subsidies for social farming are mainly intended for non-governmental organizations (Hromadová, Hanusová and Štátná, 2017).

Target groups of the social farming have a wide range. From general point of view, it might be people who are disadvantaged on the labour market. According employment policy strategy of the Ministry of Labour and Social Affairs (2014) are in this group youth, old people, low-skilled persons, people at risk of social exclusion and persons with disabilities.

Production of social farms incorporates direct social benefits in employment, training, therapy or rehabilitation of groups at risk of social exclusion. Social farming gives society a return on public and private investment in the form of social contributions in four areas: social cohesion; empowerment of socially vulnerable groups; local development in rural and peri-urban settings; equitable balance between revenues and costs to society. In the European union can be categorized main types of social farms: first, public or religious organizations have adapted social farming to therapies used in health care to redirect young people who have not done well in school, or to support the reintegration of recovering drug addicts or those who have been incarcerated; second, associations and foundations created by families to provide work and better living conditions for individuals with physical or mental disability; third, private initiatives through cooperatives or businesses, often not-for-profit, that provide therapeutic services and attempt to combine the incorporation of at-risk groups into the working world with income generating activities (Tulla et al., 2017).

2. Materials and Methods

For assessment of the state of social farms in the Czech Republic mainly statistical analysis was used to reach representative results in the monitored area. The subject of the research was primarily subsidy policy for the period 1999–2017 forming key factor for operation and development of the concept and areas in which social farms are active. This is in development of subsidy policy, social services being provided, or agricultural production. Finally, a subsidy title currently usable for social farms was introduced. We also succeeded in contacting social farms for the next phase of the project „*The use of social farming to develop of rural municipalities with socially excluded localities*“, whose partial output is this article.

Data have been obtained primarily from the Central Register of Subsidies (IS CEDR III, 2018), Administrative Register of Economic Subjects (ARES, 2018) and further from the Portal of Social Farming, Ministry of Agriculture and State Agricultural Intervention Fund.

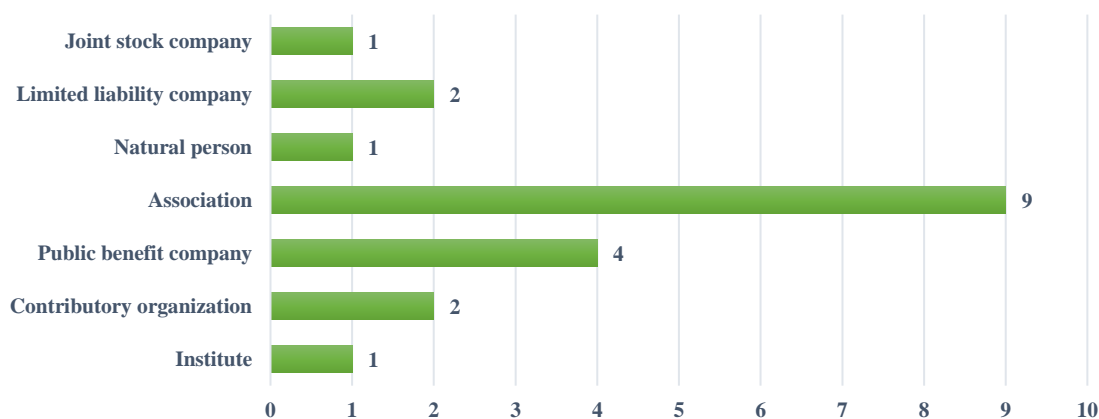
Social farming may be defined as a complex of activities using agricultural resources, both plant and animal, for purposes of creation of adequate environment for differently physically and socially disadvantaged persons and the general public with the aim to provide them with possibility of employment and to aid with their integration (Chovanec, Moudrý and Hudcová, 2015). Nevertheless, because the Ministry of Agriculture does not ensure registration of social farms, it is problematic to determine from what date an agricultural enterprise may be considered to be a social farm. One option is avowal of an entity to these activities. However, not every social farm publishes this information. Hence the official date of the commencement of activity pursuant to the Register of Economic Entities (ARES, 2018) has been used in the study. This method is not able to distinguish between an entity which commenced its activity as a social farm and an entity which avowed to the activity later. Nevertheless, this step has enabled a unified methodical approach to registered social farms. At the same time the social farms registered on the Portal of Social Farming had to be distinguished. A social farm is described there as both an entity whose primary activity is social farming and an entity which deals with social farming only within a specific internal project. In such a case the entity has a lot of other activities for which it usually receives subsidies support

by which the studied data would be distorted. For this reason, only, the entities registered on the Portal of Social Farming whose articles of association contains a provision that they deal with agricultural activity and they provide social services at the same time are regarded to be social farms. In this way 20 entities have been identified.

3. Results and Discussion

The legal personality of social farms in the Czech Republic differs. From Figure 1 is apparent that most often associations are established whose primary activity pursuant to the Act No. 89/2012 Coll., Civil Code, should be satisfying and protecting those interests it was formed to implement. Nevertheless, social farming represents at the same time a type of profit-making activity which has to represent in the case of an association its secondary activity. A potential gained profit should be invested by a social farm back to its primary activity, i. e into providing social services (Czech Social Entrepreneurship, 2014). Nevertheless, also social farms with personality typical for profit sector are registered, i.e. joint-stock company and limited liability company. An exemption is formed by two social farms registered as contributory organizations which represent through their form a public non-profit organization. Founders of these contributory organizations are higher territorial administrative units, namely the Vysočina Region and the Pardubice Region.

Figure 1. Typology of social farms



Source: Authors, Social Farming, 2018

In the Czech Republic 20 social farms were registered in total as at 2017 which represent the highest number during the monitored period. Still it is a very low number in comparison with Germany, Italy or Britain where social farms are registered in hundreds (Ministry of Agriculture, 2016). The situation of social farms may be demonstrated by an example of higher territorial administrative units. On one region in the Czech Republic in the current situation falls on average only nearly 1.5 social farms. From this point of view there is a good situation in the South Bohemian Region or the Region of Hradec Králové where the most social farms are registered. On the contrary in the Pilsen Region no farm has been registered (Social Farming, 2018).

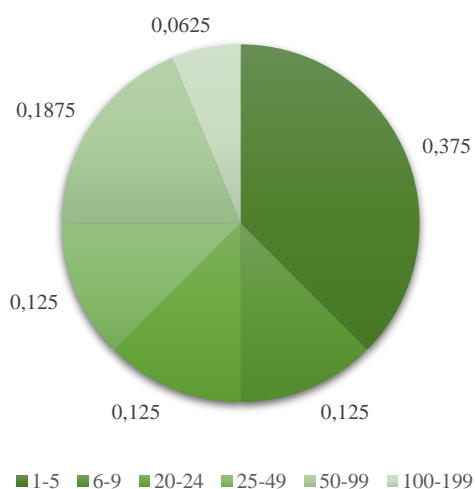
According research of Husák and Hudečková (2017) exist 1,123 organisations in Czech rural area which provide social activities, but most of these organisations are not focused on agriculture. An even worse situation is in the field of social inclusion in rural area, because there are only 7.5 % of sheltered employment and only 2.3 % of registered social services. The implementation of social farming in practise can improve social service in rural area and increase availability to people who live in rural area (in the Czech Republic 25 %). Deficit of social organisations in rural area is linked to a lack of social employees. The average number of clients per organisation providing social

services is 27.2, but the average number of employees is 9.6 per one organisation. This aspect of lack social employees can affect negatively next development of social farms.

The situation with employees in social farming is even more serious. Half of social farms in the Czech Republic employ less than 9 employees. These farms are usually small-family type of farms which are registered as association. The exception is the join-stock company and contributory organizations which employ dozens or in one case more than hundred employees as shows figure 2. More employees could be the key to providing more agricultural and social activities and take care of more clients. This could contribute to raising awareness of the social farming and it enhances the position of social farms in the Czech Republic. For this purpose, subsidies should not be targeted mainly to clients, but also to employees of social farms, which take care of the clients.

Moreover, the level of salaries is in agriculture one of the lowest in the economy which it reduces attractiveness for potential workers (Hromadová, Hanusová and Šťastná, 2017). From the economic view the employees represent the largest cost for the social farms (Social farming, 2018). Thus, recruiting new employees to social farms may be very problematic for social farms, because of lack of job candidate and low wages.

Figure 2. The number of employees in social farms



Source: Authors, ARES, 2018

The potential area for social farming in the Czech Republic may be social excluded localities. In the localities live approximately 100,000 people who are disadvantaged on the labour market. In the Czech Republic were registered 297 municipalities with social excluded area in 2015. Social farming could contribute to reduction negative social aspects as rate of unemployment which is 9.3 % (Agency for social inclusion, 2015).

Table 1. SWOT analysis of social farming in the Czech Republic

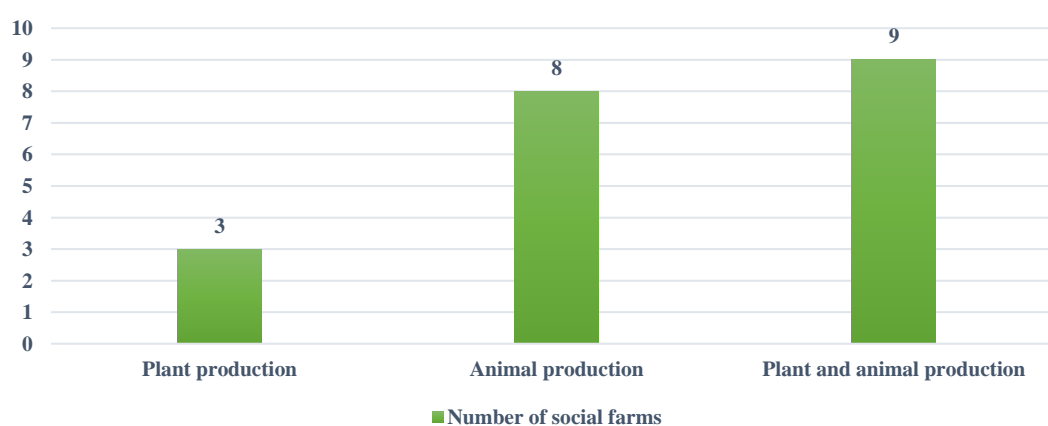
<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> • Diversification of farm activities • Contribution to the society • Quality of client's life improvement • Positive contribution to the local community • The quality of life of the disabled person's whole family 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • Scattered activities • Burnout syndrome psychological difficulty • Insufficient salary • Risk of an accident • Indifference towards a farming • Complicated administration
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Ministry of Agriculture • Social farming program PGLRF, a.s. • Rural Development Program 2014-2020 • Sale of farm products • Employment Operational Program • Integrated Regional Operation Programme • Substitute payments 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • Lack of employees (clients) • Adverse weather • Lack of product and service • Government's unwillingness to help develop social farming • Lack of appreciation of the social farming role • Adverse weather

Source: Hromadová, Hanusová and Štastná, 2017

The development of social farms in the Czech Republic may be defined as increasing; nevertheless, the pace of the increase is very slow. On average in the Czech Republic one social farm is added every two years. Since the accession of the republic to the European Union 9 social farms have emerged in total. On the other hand, only one dissolution in 2012 was registered in the Czech Republic.

Diversification of agricultural production is introduced by Figure 3, which contains data on the type of agricultural production performed by social farms. Animal production seems to be prevailing which is also often supplemented by plant production. Most often animals suitable for providing medical therapies are raised. Further, farm animals are raised, e.g. cows, rabbits, sheep, goats and also bees are not an exception. Plant production is mainly ensured in the form of fruit orchards and gardens where in particular vegetable and herbs are grown. In general, it is possible to claim that social farms focus on the types of animal and plant production which require low level of mechanization and specialization. The reason is effort for the highest possible engagement of persons who are provided with social services. An upward trend may be also observed in the case of an effort for getting certification of organic farming.

Figure 3. Agricultural production of social farms in 2017



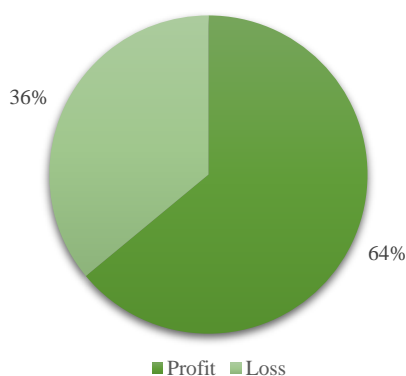
Source: Authors, Social Farming, 2018

Organic farming is very important for the social farms which want to distinguish their individual approach of social farming from conventional agriculture production (Foti, Scuderi and Timpanaro, 2013).

Some social farms, such as BEMARGO, a.s. or Biostatek are certified and included in the system of organic farming and other ones are seeking for the certification.

The recent financial situation of social farms is illustrated in Figure 4. In 2017, 64% of the social farms were profitable. This proves that social farming could be profitable and self-sufficient. However, it is necessary to mention that all social farms in the Czech Republic receive subsidies (IS CEDR III, 2018). And all social farms with a loss were either association or public benefit company.

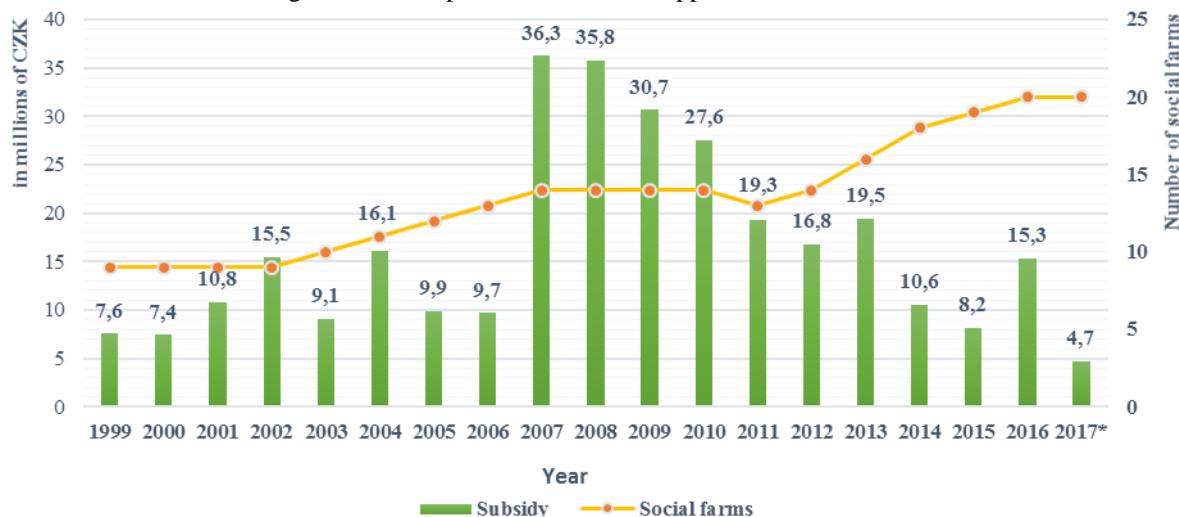
Figure 4. Economic result of social farms in 2017



Source: Authors, ARES, 2018

Subsidies may be regarded as one of the crucial variables in the context of support of agricultural and rural enterprises. Since the primary goal of social farms is not to generate profit but to render social services, subsidies titles are a necessary part ensuring their operation and development. Figure 5 depicts the development of all subsidies provided to social farms which were paid to them between 1999 and 2017.

Figure 5. Development of subsidies support and social farms



Source: Authors, IS CEDR III and Social farming, 2018

*The Financial Administration does not exclude an additional update of the data for the year 2017.

After the accession of the Czech Republic into the European Union in 2004 was size of subsidies without significant change. A turning point occurred in 2007, when the EU Programming period 2007-2013 started. Between 2007 and 2010 the highest grant support was provided. Nevertheless, the number of the social farms was constant. From this period the size of subsidies decrease,

but number of social farms increases. Also, the new programming period (2014-2020) did not change the trend.

Another view on subsidies support is offered by Table 2 in which all financial means for the years 1999–2017 provided by individual institutions to social farms are contained. Because the goal of social farms is to provide social services when using agricultural resources (European Economic and Social Committee, 2013), the institutions which provide the biggest part of subsidies are the Ministry of Labour and Social Affairs and the Ministry of Agriculture. These two ministries provided in the monitored period 75 % of the total allocated amount. Under the Ministry of Labour and Social Affairs was supported in particular the following: creation of new socially purposeful jobs, social prevention, social care or community service. The Ministry of Agriculture granted support mainly for animal production and veterinary treatment. In the education area subsidies titles were focused primarily on support for activities for children and youth and in the medical area the support related mainly to prevention.

The Ministry of Agriculture is the most important institution for social farming development. However, the largest financial support comes from the Ministry of Labour and Social Affairs. Social farms would lose without this support more than 60 % of total finance from subsidies which could cause the collapse of social farming in the Czech Republic.

The social farms as employers receive a contribution for the protected job from the Labour Office, which also contributes 75% of the actual expenditure on wages and salaries including social security contributions. However, this contribution will be received only by an employer who employs more than 50% of the total number of people with health or social disadvantage (Hromadová, Hanusová and Šťastná, 2017).

Table 2. Subsidies support broken down by institutions (1999–2017)

Institutions providing subsidies support	Share (%)	Absolute (CZK)
The Ministry of Agriculture	14.35	42,801,791.00
The Ministry of the Environment	1.22	3,628,425.00
The Ministry of Regional Development	4.53	13,508,549.00
The Ministry of Labour and Social Affairs	60.39	180,147,972.00
The Ministry of Health	4.24	12,655,000.00
The Ministry of Culture	0.11	316,522.00
The Ministry of Education, Youth and Sports	5.05	15,053,410.00
The State Agricultural Intervention Fund	1.03	3,074,235.00
The Labour Office	3.63	10,841,566.00
The Office of the Government of the Czech Republic	5.45	16,271,000.00
Total	100	298,298,470.00

Source: Authors, IS CEDR III, 2018

Organizations including social farms for the year 2019 they may also under the current conditions apply for support in the area:

1. Environmental protection and sustainable development,
2. Engagement in foreign programmes and activities,
3. Health support including care and assistance for disabled people,
4. Education and promotion,
5. Hobbies and other leisure activities for children and youth.

Thus, non-profit organizations for example in 2017 concentrated on environmental education of children, applied for support for enlightenment activities against food waste or in the form of projects they strived for development of organic farming (Ministry of Agriculture, 2018).

With regard to use of agricultural activities for decrease of unemployment in the form of social farms, on which this article is focused, the key institutions in the Czech Republic are managing operational programmes of the Ministry of Labour and Social Affairs, the Ministry of Agriculture and the Ministry of Regional Development. In general, calls which would be usable for projects connected with social farming target on a few groups of population, which are supported in various activities with the intention to create better conditions for endangered social groups on the labour market or to return them into work process. The intention is also returning of persons into the process of participation in public affairs and active participation in social life. The groups which are supported most often according to (Ministry of Labour and Social Affairs, 2018) are:

- Persons with low-level qualification
- Persons endangered on the labour market (national minorities, immigrants and asylum seekers, imprisoned persons or persons after their imprisonment, persons leaving institutional facilities, persons endangered by domestic violence or addictions)
- Disabled persons
- Long-term unemployed persons

The Ministry of Labour and Social Affairs manages the Operational Programme Employment (OPE). OPE focuses among others just on support for employment and social inclusion in relation to fight against poverty. As an example of a suitable call for submission of projects connected with social entrepreneurship in the agriculture area according to the executed analysis of subsidy programmes also with regard to its current topicality and whole-republic application (except for the capital city of Prague) the call No. 129 Support for Social Entrepreneurship has been chosen. As it is obvious from the name, the call aims for development of the social economy sector. Apart from common applicants (NGOs, self-employed people or business corporations under the Act No. 90/2012 Sb., on Business Corporations) applications may be submitted by municipalities which do not own a share in the concerned enterprise bigger than 50 %. Further associations of municipalities composed of at least three municipalities when no one of them has a majority share or agricultural entrepreneurs pursuant to the Act No. 252/1997 Coll., on Agriculture who pursuant to run agricultural production as a continuous and independent activity. The call supports two types of business activities connected with social entrepreneurship – integration social enterprise and environmental social enterprise. The second mentioned seems to be the more suitable option for social farms with regard to defined areas of benefit. A social farm would fulfil social benefit by employing disadvantaged persons on the labour market, condition of socially beneficial objective, economic and environmental benefit for the particular locality, and mainly local benefit in the form of employment of local citizens, by cooperation with local players and development of local economy (Ministry of Labour and Social Affairs, 2018).

4. Conclusion

The situation of social farming in the Czech Republic as of the year 2017 may be described as stable with the highest number of registered social farms ever which provide a wide range of social services. As the most widely used legal personality social farms in the Czech Republic use the form of association. At the same time social farms produce in particular animal production and to the lower extent also plant production, which is used primarily for employment, social care, therapy or education. Thus, solution of social issues in the case of target groups is aided.

The legal conditions are sufficient; however a common framework for social farming of the Ministry of Agriculture is still missing. The registration of social farms it is still not uniform in the Czech Republic. Therefore, there is a big difference between structure of social farms and their activities.

It may be an advantage, but on the other hand in this situation is difficult to provide effective state support.

An important role in the operation of social farms has subsidies, which were in the programming period 2007–2013 provided to the highest extent ever. Nevertheless, in this period no enormous increase of social farms was registered in the Czech Republic. On the contrary in the next years the subsidies support substantially decreased whereas the number of social farms increased. From this may be deduced that subsidies are obviously not the main stimulus which would initiate founding of new social farms; nevertheless, it is possible that the increase of social farms occurred as a result of providing subsidies, however due to insufficient awareness and delay it was not until the end of the programming period and finding out the achieved results that the public reacted by founding new social farms.

For social farms could be new opportunity for social excluded areas. In these localities with high rate of unemployment live a lot of new potential clients. For these people services provided by social farms can contribute to reducing negative social aspects. With this opportunity is connected the most significant threat for social farming in the Czech Republic, the lack of employees which limits them in their activities and development. However, low wages are the weakness of agriculture and social farming as well. Nevertheless, the recent situation of social farms in the Czech Republic is stable, but without targeted support to insufficient capacity of employees the development of social farms will be very slow.

Acknowledgements

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MILK ECONOMY AND SELF-SUFFICIENCY

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Annotation: The paper compares the economy of milk in the Czech Republic with the countries of the Visegrad Group and neighboring Austria. The paper evaluates the impact of subsidies on the milk economy and the influence of other factors, such as the work of family members on farms. Individual countries are compared in a given period in terms of several factors. The time period represents the years 2005 to 2014 or 2015 (in the case of the Czech Republic). In the case of the Czech Republic, more detailed information is available on the structure of dairy sales and subsidies for dairy farms. Dairy farms and subsidies are divided into size categories according to the EU classification. The paper is based on the use of secondary data. Information for this article was obtained mainly from the database of agricultural accounting data, the Statistical Office of the European Union and the Institute of Agricultural Economics and Information in the Czech Republic.

Key words: milk production, subsidy, gross margin, net margin, operating costs

JEL classification: Q02, Q12, Q14

1. Introduction

“A subsidy is money that is paid by a government or other authority to help a business or business or to pay for a public service” (Collins Dictionary of Economics, 2018). The subsidy is the opposite of the tax and its provider receives no consideration. It can be provided from the state budget or the European Union budget (Hamerníková and Maaytová, 2010). Livestock farming and associated milk production is a traditional part of agriculture. The self-sufficiency of the Czech Republic in milk production was 117% in 2017. Self-sufficiency in milk was 114.3% in the EU in 2017 (Clal, 2018). Farmers in the EU are facing problems resulting from high costs and low milk prices (Maitah and Smutka, 2012). But, the European Union is more than a self-sufficient area in the production of milk (FAO, 2005). Milk production in Europe is growing. The self-sufficiency (in milk) of the EU Member States is more than sufficient. There is an increase in milk trade due to rising demand in China (EDA, 2018). The total production value of the EU livestock sector is about 169 billion euros. Milk production value of the EU is about 59 billion Euros (Zrakić, 2015).

The Czech Republic and its neighboring countries have the necessary climatic conditions, material resources and skilled workers for the development of the sector (Lebacqz, Baret and Stilmant, 2015). However, it is a frequent phenomenon that the dairy farms are stagnating economically. This phenomenon is evident not only in the Czech Republic, but also in Slovakia or Hungary. Farm owners are not very happy with the proceeds of the sale of milk. In a better situation there are dairy farms in Poland or Austria.

The aim of this work is to assess the influence of individual factors on the milk production economy in the Czech Republic, Austria and the Visegrad Group countries.

2. Materials and Methods

The study is based on the use of secondary data. The main data sources are the Farm Accountancy Data Network, the European Statistical Office, the European Commission, the Czech Statistical Office and the Institute of Agricultural Economics and Information. From the obtained data, time series are created, which are then evaluated. The data are analyzed for the years 2005-2014 and 2015 (for the Czech Republic). The data on prices and costs are taken from the European Dairy Association. Based on these, the gross margin and the net margin are calculated. Data on milk subsidies are taken

from the FADN. These data are then calculated for the amount of milk produced (EUR/ton of milk) in each country. As a result, there are gross margin data with subsidies and net margin with subsidies. The content of each indicator is described under the appropriate table.

3. Results and Discussion

Table 1 shows the price of milk in the countries compared. The price of milk is in Euros per tonne of this commodity. In all years, the highest price per ton of milk was in Austria and the lowest price ever in Poland (European Commission, 2018), (FADN, 2018).

Table 1. Price (EUR/t milk)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	289.06	292.69	330.11	388.38	294.25	313.17	349.09	338.89	364.87	370.59
Czech republic	274.74	275.51	301.35	331.45	241.04	294.40	334.68	309.58	332.99	333.56
Hungary	280.42	244.81	292.33	335.18	231.14	264.71	308.75	305.23	332.24	343.34
Poland	228.12	237.15	278.80	288.57	205.92	260.37	285.86	275.97	307.21	319.21
Slovakia	246.35	258.14	300.54	312.32	224.43	286.14	334.37	314.68	338.10	330.44

Source: Own processing, data from the FADN

The highest total operating costs were recorded by farmers in Slovakia, with the exception of 2005 and 2007, when Hungary had the highest operating costs. On the other hand, farmers in Poland had the smallest operating costs (Eurostat, 2018), (FADN, 2018).

Table 2. Total operating costs (EUR/t milk)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	183.12	185.43	206.07	238.01	205.75	213.89	231.42	244.49	259.84	253.67
Czech republic	190.11	200.66	229.44	259.16	211.89	238.77	260.18	248.38	266.38	251.55
Hungary	202.96	182.14	251.39	271.17	197.10	221.37	268.60	273.72	291.16	263.57
Poland	119.03	128.01	149.50	174.09	128.96	147.72	163.49	170.01	178.84	158.83
Slovakia	200.32	227.17	224.87	299.62	280.91	326.40	347.98	341.05	320.98	302.15

Source: Own processing, data from the FADN

The gross margin indicator (price + subsidies – total operating costs) reached the following values (table 3). The highest gross margin was reached by Poland. Only in 2008 and 2009 was replaced by Austria. Slovakia scored the worst results. This country had a negative gross margin in 2009-2012. The following table shows gross margin values with subsidies. The highest subsidy per ton of milk was in Hungary and the lowest in Poland (European Commission, 2018), (FADN, 2018).

Table 3. Gross margin with coupled payments (EUR/t milk)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	126.05	136.54	124.04	150.37	88.50	106.20	122.56	99.87	110.44	116.30
Czech republic	84.62	74.85	71.91	72.29	29.16	69.77	88.16	68.76	74.32	89.44
Hungary	94.05	92.50	40.95	64.01	34.16	58.87	68.28	52.28	67.32	105.06
Poland	109.09	109.14	129.30	114.48	76.96	113.53	123.07	107.06	129.65	161.56
Slovakia	46.03	30.97	75.67	12.70	-56.48	-29.45	-0.85	-11.92	32.16	42.84

Source: Own processing, data from the FADN

Adding depreciation and external factors to the gross margin (with subsidies) will cause the loss of milk profitability in most of the countries for most of the period. This loss would be substantially

higher without subsidies. Poland had the best results. The worst values were in Slovakia. Data for 2014 is not available (European Commission, 2018), (FADN, 2018).

Table 4. Net margin with coupled payments (EUR/t milk)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	22.33	31.54	31.56	43.50	-16.52	2.47	19.30	-6.69	-3.14	-
Czech republic	-21.78	-35.82	-54.53	-74.52	-96.75	-79.85	-62.06	-70.77	-78.73	-
Hungary	-22.59	-2.30	-65.99	-50.65	-56.58	-44.83	-50.13	-53.22	-55.11	-
Poland	70.17	67.37	84.82	56.06	26.99	60.59	71.83	56.61	69.80	-
Slovakia	-106.66	-238.38	-166.08	-170.92	-258.46	-274.54	-217.36	-203.33	-165.37	-

Source: Own processing, data from the FADN

The indicator of net economic margin takes into account family factors because many farms employ family members. This work is often not included in the calculations. After inclusion of these factors, the net economic margin is negative in all countries. The net economic margin is not positive either with subsidies. The numbers in the tables represent the average for the whole country. Data for 2014 is not available.

Austria has the highest values of family factors (142.12 EUR/t of milk in 2011 and 207.35 EUR/t of milk in 2009). Slovakia has the lowest share of family factors (EUR 2.75/t of milk in 2006 and EUR 13.81/t of milk in 2008) (FADN, 2018).

Table 5. Net economic margin with coupled payments (EUR/t milk)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	-146.60	-145.62	-126.50	-130.63	-223.87	-177.69	-122.83	-170.57	-177.95	-
Czech republic	-43.09	-56.73	-73.04	-87.38	-133.32	-108.47	-82.78	-83.57	-94.51	-
Hungary	-34.85	-30.95	-74.30	-68.95	-90.89	-63.06	-67.21	-73.72	-92.28	-
Poland	-7.40	-19.31	-2.07	-46.07	-66.68	-47.80	-19.74	-31.85	-50.87	-
Slovakia	-116.35	-241.13	-189.91	-174.72	-272.27	-285.96	-220.68	-207.46	-172.16	-

Source: Own processing, data from the FADN

Most milk farms with positive gross profits are in Poland and Austria. On the other hand, it is Slovakia or Hungary (in 2005 and 2007) (European Commission, 2018), (FADN, 2018).

Table 6. Farms with positive gross margin

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	97.20%	97.81%	90.68%	96.45%	86.74%	88.82%	88.30%	83.92%	87.82%	88.94%
Czech republic	94.26%	91.18%	92.50%	89.51%	71.81%	87.36%	94.33%	85.32%	91.51%	93.63%
Hungary	71.12%	95.28%	83.54%	89.45%	65.79%	58.11%	80.81%	78.35%	76.75%	89.61%
Poland	96.72%	96.48%	96.83%	91.99%	88.73%	96.53%	96.08%	91.08%	94.51%	98.18%
Slovakia	80.31%	77.19%	87.71%	58.74%	39.90%	45.61%	52.08%	44.43%	61.71%	69.73%

Source: Own processing, data from the FADN

The percentage of farms with positive net economic margins is highest in Poland. Exceptions are the years 2005 and 2008, when this figure was the highest in Hungary. The worst in this comparison is Austria, which has a high share of family factors in farms. The indicator also shows low values in the Czech Republic. Unfortunately, the data are incomplete and therefore it was not possible

to compare with Slovakia (European Commission, 2018), (Institute of Agricultural Economics and Information, 2018).

Table 7. Farms with positive net economic margin

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Austria	-	-	5,39%	6,97%	-	1,01%	6,25%	2,14%	2,35%	-
Czech republic	14,41%	10,17%	11,88%	7,70%	-	-	9,30%	10,48%	10,23%	-
Hungary	27,86%	14,05%	21,46%	22,69%	-	8,28%	18,72%	15,37%	9,60%	-
Poland	27,37%	22,71%	29,20%	15,77%	7,71%	12,48%	21,98%	19,08%	14,77%	-

Source: Own processing, data from the FADN

Table 8 describes the situation in the Czech Republic. The table shows how many CZK of revenue is per CZK of subsidy. Farms are divided into size categories according to the EU methodology. These are dairy farms. Farms of small size have the best results. The lowest values are achieved by medium-sized farms. The highest milk sales prices have large farms. On the other hand, there are small sized farms (table 9). These data show that small farms have more efficient milk production and make better use of subsidies. The disadvantage of small farms is the lower selling prices of milk (Institute of Agricultural Economics and Information, 2018).

Table 8. Ratio of sales and subsidies (in CZK)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Large farms	1.33	1.26	1.59	1.81	2.10	1.87	2.14	2.60	1.97	2.19	1.86
Farms of medium size	1.71	1.61	2.00	1.70	1.65	1.59	1.75	1.82	2.10	2.01	1.59
Farms of small size	N/A	3.09	2.43	N/A	N/A	1.66	2.56	N/A	2.80	N/A	N/A

Source: Own processing, data from the FADN

Table 9. Average milk prices (CZK/l milk)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Large farms	8.25	7.85	8.5	8.32	6.37	7.5	8.25	7.78	8.69	9.27	7.8
Farms of medium size	8.16	7.73	8.23	7.55	6.55	7.6	8.25	8.02	8.72	8.82	7.36
Farms of small size	N/A	8.02	8.46	N/A	N/A	7.31	7.74	N/A	8.7	N/A	N/A

Source: Own processing, data from the FADN

4. Conclusion

The results show that Austria has the highest prices per ton of milk, but net margin (with subsidies for dairy) is not so good. The cause of this phenomenon is the high proportion of family factors in Austrian farms, which is the largest in comparison with other countries. Poland achieved the best results in net margin and in net economic margin, because Polish farms have very small operating costs. The share of depreciation in these farms is also low. The share of Polish farms with a positive economic margin is also high (table 7). The worst results have been achieved in Slovakia's milk economy. Slovakia has negative gross margin for several years. The share of Slovak farms with a positive gross margin is the lowest. The net margin is negative for each year under review, because farms in Slovakia have high operating costs.

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TRADITIONAL CZECH FOOD ON THE DECLINE

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Annotation: The paper deals with statistical analysis of production, consumption and self-sufficiency in the agricultural commodities that are traditional from the CR population's nutrition viewpoint but the consumption of which is declining in spite of this. The solution has been subdivided here into two parts. In the first part the long-term development tendencies of the typical primary farm production natural indicators and of the selected foodstuffs consumption in the CR have been discovered, described and modeled. The exponential smoothing methods have been applied in the forecasts for non-seasonal time series with local linear trend (the Holt method) and the double exponential smoothing method (the Brown method). In the second part the paper analyzes self-sufficiency level in traditional Czech farm products regarding possible alternatives in connection with the new Common Agricultural Policy and the efforts of the State for sustainable development of agriculture and the countryside and with the CR nutrition policy. Even despite the convenient natural and climate conditions of Czech rural landscape it has failed so far to increase volume or at least mitigate the decline of domestic production in economically demanding and traditional commodities. Socio-economic factors have been projected into the food consumption development, changes in purchase demand and life priorities and attitudes in particular. Globalization of food trade has played its role, too. An outcome of all the changes has projected itself in the traditional Czech food consumption decline, apart from other areas.

Key words: CR agriculture, farm commodities, production, food consumption, self-sufficiency

JEL classification: C22, Q10, Q18

1. Introduction

Population nutrition and eating habits support is an integral part of the policies connected with food and farm production and policies dealing with health, disease prevention but with education level and people's motivation at the same time, and economic accessibility of the health supporting nutrition, too. The nutrition problem is projecting itself not only in the food security questions, but in questions of production, processing and practical accessibility of good quality foodstuffs on the domestic market, too. In this shape nutrition is a strategic objective of primary importance what has been generally respected in the priority objectives EC (DG SANCO), WHO (Action Plan for Implementation of the European Strategy for the Prevention and Control of Non-communicable Diseases 2012-2016), and European Food Safety Authority (Ministry of Agriculture, 2014), as well.

The sector of food and agriculture is a significant component of the CR economy and for its specifics it is one of the sensitive areas of the economy. Agriculture and the fields connected have a fundamental importance for the food security, same as for other public issues (care for the landscape and environment protection). Alvarez-Cuadrado and Poschke (2011) present agriculture as a multi-functional industry having great importance for society as a whole with overlaps into other industries. The importance of food production is given first of all by securing nutrition of the population through production and sales of health conscious and safe foodstuffs. Among the main factors affecting consumption and demand for foodstuffs there are, according to Kotler et al. (2007): development of the consumer prices of foodstuffs and non-food products and services; population incomes development; advertising and promotion; products offer and availability on the market as related to the distribution network development. Food consumption is affected by the self-supply extent and quality development, level of saturation of the needs etc., too.

According to Mezera and Štiková (2000), the globalization process has been showing itself in food consumption and gastronomy. The nutrition needs are changing, too. Food sovereignty, food self-sufficiency, food security come to the forefront of the society's attention – these express the balance between the given area's nature resources and consumption. Food self-sufficiency of the Czech Republic has been on decline from the long-term viewpoint. The decline accelerated after the accession to EU. However, views concerning the importance of food self-sufficiency and its healthy level are differing. While according to supporters of an extremely liberal approach the self-sufficiency does not matter at all, according to others it is one of the strategic indicators. Most often it has been reported that self-sufficiency in key commodities (those serving to secure human nutrition) should not fall below 80 %. Clapp (2017) argues that the interest of politicians in food self-sufficiency increased in a number of countries after the extreme instability of food prices in the years 2007-2008. The issues analyzed in this study are important, especially due to economic and social reasons.

As Gebelová (2012) is giving it, self-sufficiency level belongs among the principal indicators referring to a given country's competitiveness and it shows at what percentage level the country can cover own population's consumption from own resources. According to Jeníček (1984), the self-sufficiency level can be defined as balanced payments relationship of a national economy in the outer economic relations, or as the balance between national resources and domestic consumption. Reaching self-sufficiency in basic foodstuffs of a given climatic zone is affected by both internal and external conditions of the country. Stress on own foodstuffs production is modified mostly by strategic intentions and the country's need for independence (Novotná and Volek, 2015). A self-sufficient country should not rely on its own production only. In most countries, there is no possibility of self-sufficiency, due to lack of natural resources. The main resource in food production is the land. Its limited resources can be a barrier to production (Golebiewska and Stefańczyk, 2017).

2. Materials and Methods

2.1 Data source

Statistical analysis here is mostly based on the resources of Czech Statistical Office and Ministry of Agriculture of Czech Republic. The data used have been obtained based on the new ESA 2010 method (CZSO). Other data sources for the analysis have been the National Accounts and other official statistics of agriculture (Ministry of Agriculture). In statistical modeling of farm production balance, food consumption and food self-sufficiency data have been analyzed from the 25 years published last (1992-2016).

2.2 Analytical smoothing of time series

Real economic criteria should form the basis for decision making based on the appropriate trend function type. Finding the appropriate trend function type is then mostly dependent on the analysis of empirical data. The paper offers a criterion based on the comparison of sums of squares of deviations of the empirical time series values from the smoothed ones:

Mean Absolute Percent Error (MAPE):

$$\text{MAPE} = \frac{100}{n} \sum_{t=1}^n \frac{|y_t - y'_t|}{y_t} \quad (1)$$

$y_t, y'_t \dots$ empirical and smoothed t. s. values.

The model with the lowest MAPE criterion values is generally preferred. It is important to realize, anyway, that none of such criteria is of a universal nature, rather they offer a partial information on the quality of the model studied (Hindls, Hronová and Novák, 2000).

Besides trend functions, the adaptive models, too, have been applied in the trend description. Models of this type quickly react on the structural changes occurring in time and they are very suitable for prognosticating future course of the time series loaded by irregularities and breaks in the trend. Adaptive approaches to time series of food consumption modeling have been recommended by Svatošová and Köppelová (2017), too. In development forecasting of selected traditional Czech foodstuffs the Holt and Brown exponential smoothing models have been applied. For significance testing of the models and their parameters, the $\alpha = 0.05$ significance level has been chosen. Statistical computations have been performed in the STATISTICA software, version 13, environment.

2.3 Self-sufficiency balance

Balance self-sufficiency is explained as reaching zero level of the balance of trade payments. It is expressed as value equality in money terms:

$$Q + D = P + V, \quad (2)$$

where Q - value of production output volume; D - value of imports volume; P - value of consumption volume; V - value of exports volume (Jeníček, 1984). In order to establish the balance level of the agrifood products foreign exchange it holds that, the degree of balance self-sufficiency is given as the relation of the domestic production volume value to the domestic consumption volume value:

$$S = (Q/P)*100 \quad (3)$$

3. Results and Discussion

After 1989 consumption of some foodstuffs changed significantly. It was affected by the consumers purchase power in particular, availability of separate foodstuffs on the market and prices of these, but by changes in eating habits, too. Significant changes appeared in the consumption volume and structure, too. The paper deals with statistical analysis of production, consumption and self-sufficiency in farm commodities, that are traditional from the Czech people nutrition viewpoint.

3.1 Analysis of changes in the production volume of selected traditional foodstuffs

The presumption for self-sufficiency balance analysis in selected agricultural commodities typical for traditional farm production and consumption in CR has been an analysis and statistical description of development trends in the primary farm production natural outputs. Since CR accession to the EU a significant change of Czech agriculture has arrived. While the areas where wheat, maize and oilseed rape have been cultivated, expanded until 2016 strongly, the areas of potatoes, vegetables grown, or the numbers of pigs and poultry bred, sank strongly (Table 1). This has been connected namely with profitability of the commodities given, which is based on the agriproducers' prices, the cost competitiveness of Czech producers, but with competitors' strength from the neighbouring EU countries, too. The changes in farm production volumes of Czech agriculture since 1992 and considering the pre-accession period are summarized in Table 1.

Significant changes in the farm crops grown structure can be observed here from the long-term viewpoint. Variety of the species decreased, species representation has been changing same as the share of areas sown. Growing of cereals (mostly rye and barley) has given way to the technical crops.

Table 1. Principal changes in the production areas and livestock numbers since 1992 and after CR accession to the EU

Commodity	Units	1992	Average 2001 - 2003	2016	Change (%) 2016/1992	Change (%) 2016/average 2001-2003
Wheat	Th. ha	757.5	808.1	839.7	+10.9	+3.9
Barley	Th. ha	636.0	512.0	325.7	-48.8	-36.4
Maize	Th. ha	30.5	67.6	79.3	+160.0	+17.3
Potatoes	Th. ha	110.5	42.8	23.4	-78.8	-45.3
Oilseed rape	Th. ha	135.9	302.7	393.0	+189.2	+29.8
Sugar beet*	Th. ha	124.2	77.6	61.0	-50.9	-21.4
Vegetables	Th. ha	33.2	20.4	10.2	-69.3	-50.0
Fruit orchard	Th. ha	20.3	17.9	14.5	-28.6	-19.0
Pigs	Th. pcs	4,609.2	3,465.8	1,609.9	-65.1	-53.5
Cattle	Th. pcs	2,949.6	1,525.3	1,415.7	-52.0	-7.2
Poultry	Mill. pcs	30.6	29.6	21.3	-30.4	-28.0

Source: authors, using Czech Statistical Office (CZSO), 2018 and Ministry of Agriculture reports

Note: * until 1993 including sugar beet for feeding

The area of potatoes has been decreasing over whole the second part of past century and the trend has not stopped with the new millenium arriving, either. In the Fifties of the past century the potato growers grew potatoes on an area larger than 400 th. hectares. Over the decade following this area was almost halved. In 1993 potatoes were grown on an area larger than 100 th. hectares for the last time. Interest in growing potatoes continued to decline. Over the 2012-2016 period potatoes were grown on an area not exceeding 25 th. hectares either. Since 1992 the areas for growing vegetables have fallen by almost 70 %, the areas of sugar beet by more than 50 %, the production orchards by almost 30 %. The long-term and distinct deviation from cattle breeding in the CR over 1992-2016 period brought a total reduction of the numbers by more than 1.5 million. Reduction of pig numbers started in the first half of the Eighties already, that means, over the period of socialism already. After 1990 the decline fastened. Pig numbers fell from 4.6 million in 1992 down to 1.6 million in 2016. Two thirds of pig numbers have disappeared from Czech farming.

3.2 Analysis of the consumption decline of selected traditional foodstuffs

Since 1992 outstanding changes have arrived in food consumption, both in the volume and structure. The largest volume decline of consumption over the last 25 years has occurred in the traditional Czech foodstuffs as listed in Table 1. The most significant changes happened in meat consumption. Beef consumption has fallen by almost 60 % since 1992. It is a long-term decline of consumer demand. Consumption reduction is affected by prices and the disadvantages, too, caused by longer kitchen processing, lower variation of dishes, unstable quality and competition of poultry meat and pork. Pork consumption has fallen by a total of 12 %, poultry meat consumption has grown rapidly, on the contrary.

Potatoes consumption has fallen by almost 18 %. The consumption reduction has taken place over the whole period referred. Consumption of eggs has fallen by a quarter, the reduction has taken place permanently, accompanied by comparatively significant annual fluctuations. Regarding the permanent people's self-supply of eggs, the effect of domestic market upon consumption has not been as significant as in case of other products. Consumption of milk has been declining persistently since 1952. Over the last 25 years the consumption of drinking milk has fallen by 21 %. As it concerns this group of products, one of the highest price increases has been recorded here within all the food groups. Consumption of cheeses and other milk products has risen. Rye flour consumption has declined significantly (almost by 60 %), same as bread consumption (by 34 %), but the consumption of pasta and common pastry has risen.

Over the recent years the changes of consumption have not been so significant any more and a trend has been noticeable towards reduction of the impact of consumer price changes of foodstuffs upon the consumption of these. As evidenced from the forecasts in Table 2, a slight decline of consumption can be expected during the following years in most of the traditional Czech foodstuffs, with the exception of rye flour and selected vegetables.

Table 2. Changes in consumption of selected traditional foodstuffs per head in the Czech Republic over 1992-2016 and the consumption forecasts of these (2018-2020)

Food	Units	Consumption 2016	2016/1992 Index	Mean growth rate	MAPE*	2018 Forecast*	2020 Forecast*
Rye flour	Kg	9.15	0.41	0.96	10.99	9.18🟢	9.20🟢
Bread	Kg	39.72	0.66	0.98	2.41	38.40🔴	37.26🔴
Pork	Kg	42.84	0.88	0.99	2.15	42.53🔴	42.37🔴
Beef	Kg	8.47	0.42	0.96	5.68	7.98🔴	7.52🔴
Rabbit meat	Kg	0.81	0.23	0.94	4.35	0.58🔴	0.35🔴
Drinking milk	Litres	58.64	0.79	0.99	4.18	57.31🔴	55.98🔴
Eggs	Ks	248.7	0.76	0.99	4.09	241.14🔴	233.8🔴
Lard	Kg	4.54	0.65	0.98	3.07	4.33🔴	4.13🔴
Forest berries	Kg	1.94	0.81	0.99	5.23	1.94🟡	1.93🔴
Cabbage	Kg	7.94	0.73	0.99	9.93	7.56🔴	7.31🔴
Brussels sprout	Kg	0.46	0.27	0.95	16.33	0.36🔴	0.25🔴
Carrot	Kg	6.87	0.84	0.99	5.09	6.93🟢	7.02🟢
Parsley	Kg	1.04	0.69	0.96	9.20	1.22🟢	1.46🟢
Potatoes	Kg	69.14	0.82	0.99	2.19	66.74🔴	65.50🔴
Suger	Kg	34.1	0.86	0.99	4.06	33.07🔴	32.07🔴
Poppy seed	Kg	0.43	0.86	0.99	8.09	0.43🟡	0.43🟡

Source: authors, using Czech Statistical Office (CZSO), 2018

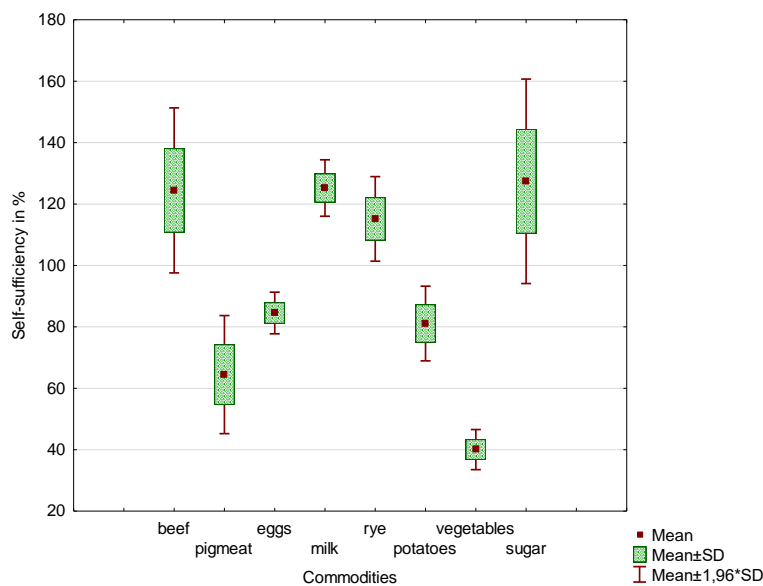
Note: *Own estimates based on the exponential smoothing

3.3 Self-sufficiency in the production of traditional Czech foodstuffs

The level of self-sufficiency, especially in the commodities not regulated at a more significant level by the measures of agricultural policy, can be connected to a high degree with the level reached of the total profitability of those and with competitiveness of the processing industries following. Self-sufficiency level in the production of basic traditional Czech foodstuffs two years after accession of Czech Republic to the EU is presented in the Figure 1.

CR is self-sufficient and has a significantly active balance in cereals. On the other hand, almost 30 % of potatoes consumed have been coming from imports recently. Self-sufficiency in fruit, inclusive of berries declined almost to 75 %. In fresh vegetables of which Czechs have learned eating year round, i.e., during the season, too, when those cannot be grown here, the self-sufficiency has fallen down to 40 %. In the main livestock commodities has the Czech Republic been self-sufficient in milk production (130 %) and beef (140 %). However, the experts have warned that, Czechs are lagging significantly behind the European average in beef consumption. Self-sufficiency in the production of traditional pork has been moving below the 80 % limit since 1992 and since 2012 it has fallen below 60 % perennially, even along the ongoing reduction of consumption.

Figure 1. Self-sufficiency in production of selected traditional foodstuffs in CR over 2006-2016



Source: authors, using Ministry of Agriculture reports

4. Conclusion

Radical changes have occurred in food consumption over the last 25 years. How Mezera and Štiková (2000) have put it, these have been affected in particular by the expansion of supply of food products connected with the arrival of supranational trading companies, by the globalization process, increasing interest in healthy lifestyle, advertisement and promotion, changes in the population income development, or by expansion and structural changes within the distribution networks. At the turn of the millennium then it was the accession to EU and subsequent increasing competition within the common food and farming market of the EU.

Consumption of traditional Czech foodstuffs has decreased significantly and in pork, potatoes and vegetables in particular, self-sufficiency has fallen sharply even in spite of the favourable soil and climate conditions for the production of these in the CR. The differences in livestock production correlate to a large extent with changes in agricultural production, but also volume of the livestock products needed for the domestic consumption satisfaction has of course changed. Outcomes of the analyses done coincide with findings of the studies by Gebelová (2012), Doucha and Foltýn (2008). As compared with the period before quarter of the century Czechs consume approximately 40 % of beef, 88 % of pork but, on the other hand, poultry meat is being consumed at 2.5 times higher level. Drinking milk and potatoes consumption has fallen down to about 80 %. Consumption of lard, eggs, potatoes, rye flour and bread has declined sharply, too. In the consumption of separate vegetable types the change of eating habits has occurred significantly. Popularity of the thermophilous vegetable types, such as tomatoes and red peppers, is growing, cabbage and Brussels sprout, cauliflower and carrots are on decline. The self-sufficiency level has fallen most notably in pork. With roughly 40 kilos per head and year it represents one half of the domestic meat consumption. Still in 2000 the CR was self-sufficient in pork almost at one hundred percent. With the decreasing numbers in domestic breeding and the increasing imports this indicator has so far fallen down to the historical minimum of 53 % in 2015. It can be expected that, the current mild growth of economics and the strengthening households consumption will do good to Czech agriculture over the next years. In addition, also a gradual transition of Czech consumers towards the home production of higher quality could do good to it. The CR Ministry of Agriculture are then going to pay attention to food self-sufficiency as based on their Strategy until 2030, mainly through support of livestock production and vegetables, potatoes and fruit growing.

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ISOLATED AND COMBINED EFFECT OF ALLELOPATHIC PLANTS WATER EXTRACTS FOR WEED MANAGEMENT IN MAIZE

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Annotation: Current study was designed under laboratory condition (Pots trials). The specific objective of the study was to evaluate the most effective, ecofriendly and an economical treatment for weed management in maize through various allelopathic plant aqueous extracts. Selected allelopathic plant species were collected from farmer fields. All the plants were cleaned, dried in oven and grinded. The grinded powders were soaked in distilled water according to treatments in the ratio of 1:10 (w/v) or 100 g/L and kept at room temperature. Atrazine 38 SC (atrazine) @ 100 g/L was used as recommended herbicide. Distilled water treatment was also included for comparison. All the treatments were applied on maize, *T. portulacastrum* and *L. regidum* seeds. Data on Germination (%), Shoot Length (cm) and Dry Biomass (g) was recorded.

Results showed that *S.bicolor*, *H.annuus* and *P.hysterophorus* (WE) @ 33.33+33.33+33.33 (g/L) reduced dry biomass of *T.portulacastrum* and *L.regidum* by 35-41 %, whereas the commercial herbicide ranged from 45-47 %. Maize seeds were found more tolerant as compared to weed species. Furthermore allelopathic plant water extracts applied in combination had more inhibitory effect than their sole application, however the efficacy of commercial herbicide was more pronounced in suppressing the germination and seedling growth of test species. Hence it is concluded from the current study that allelopathy could be a potential source for designing an alternative to synthetic herbicide. Results showed that *S.bicolor*, *H.annuus* and *P.hysterophorus* WE @ 33.33+33.33+33.33 (g/L) reduced the dry biomass of *T.portulacastrum* and *L.regidum* by 54-68 % and 35-41 %, whereas the commercial herbicide

Key words: Allelopathy, Maize, Weeds, Sorghum, Sunflower, Parthenium

JEL Classification: A29 others

1. Introduction

Weed infestation is becoming a major constraint in maize production systems and is reported to reduce its yield by 24-83 % (Dogan et al., 2004 and Usman et al., 2001). Weeds are the most omnipresent class of pests and interfere with crop plants through allelopathy and competition, resulting of direct loss to quantity and quality of the produce (Gupta, 2004). The yield of maize could be reduced up to 32% due to trianthema infestation (Balyan and Bhan, 1989) and up to 80 % due to the competition from *lolium regidum* depending on the season and infestation level (Izquierdo et al., 2003).

Weeds can be controlled effectively using herbicides with a resultant increase in crop yield but non-judicious use of herbicides can create many environmental and health related problems everywhere (Jabran et al., 2008). Hand weeding is labor intensive, time consuming and getting expensive. This is not practical for large areas. Cultural methods are environmental friendly but very slow. Therefore, the scientist realized the need of an alternative to herbicide should be design for sustainable weed management.

Research efforts have made it possible to use these allelopathic plants and weeds for quality production of crops and to reduce the use of synthetic herbicides to contribute for maintaining sustainable agriculture (An et al., 2005).

Sorghum (*Sorghum bicolor* L.) plant contains allelochemicals that possess phytotoxic effect against weeds (Cheema et al., 2004), and against other crops (Correia et al., 2005). This toxicity is mainly due to the production and release of phenolic compounds, including phenolic acids (Ben-Hammouda et al., 1995) and sorgoleone (Einhellig and Souza, 1992). The germination and growth of weed seedlings is inhibited by sorghum seeds and seedlings (Kim et al., 1993).

Sunflower allelopathic effect on crops and weeds are well documented in literature Mahmood (2013) reported that sunflower actively influence the growth of its surrounding plants, and known to have a strong allelopathic effect against other plants. Macias and his team have isolated and identified the natural compounds from various cultivars of sunflower which includes simple phenolics, steroids, triterpenes, sesquiterpenes, flavonoides, heliespirones and helikauranoside (Macias et al., 2002, 2004).

Parthenium is an aggressive and troublesome weed with strong allelopathic potential (Javaid et al., 2011; Amin et al., 2007). Infesting both cultivated and wasteland in Pakistan (Riaz et al., 2010, 2011, 2012). Parthenium weed is known to be allelopathic Adkin and Sowerby (1996). It has allelopathic effect and drastically retards the growth of many species (Tefera, 2002). Phenolic acids identified from Parthenium plant parts with reference to allelochemical interactions include caffeic acid, vanilic acid, ferulic acid, chlorogenic acid, p-coumaric acid and p-hydroxybenzoic acid and among the organic acids, fumaric acid (Kanchan and Jayachandra 1980b; Das and Das 1995)

Several laboratory experiments indicated that mixture solution of allelochemicals have greater effect than the same concentration of the compound applied separately (Blum et al., 1999; Einhellig 1995b), similarly combined use of root exudate of sorghum and fagopyrum tataricum were recorded for higher inhibition of weeds as compare to extracts applied as in isolated. (Uddin et al., 2013).

Keeping in view the importance of these allelopathic plants/weed inhibitory effects on weeds, the present study was designed with the objective to find the allelopathic effects of water extracts applied alone and in mixture for weed control in maize under laboratory (Pot condition).

2. Materials and Methods

Two runs of laboratory based experiments (Pots) were conducted at Weed Research Laboratory, The University of Agriculture Peshawar, Pakistan during June-July (2013) and were repeated in September-October 2013. Sorghum (*Sorghum bicolor* L.), and Sunflower (*Helianthus annuus* L.) were collected from the farmer fields in district Swabi, while Parthenium (*Parthenium histerophorus* L.) plants were collected from the road sides and waste areas. Sorghum and sunflower plants were collected after harvesting crops in the field while Parthenium was collected freshly at maturity stage. All the plants samples were cleaned to remove dust and other particles and then were dried in oven (Kenton; KH-120AS) for 72 hours at 65 °C and were ground with the help of electrical grinder. The final grinded samples of all three species were kept in bags and labeled properly for further use in both runs of experiments. All plants powders were soaked in distilled water as per the treatment combination @ 1:10 (w/v). The extracts were kept at room temp 20 + 22 °C for 48 hours and filtered through muslin cloth and finally through Whatman No.1 filter paper to collect the respective water extract. Synthetic herbicide (atrazine) and distilled water was included for comparison. Fungicide Topsin-M 70 % @ 2 g kg⁻¹ was used in all treatment to avoid fungal attack. Water extracts were bottle individually and tagged for further utilization. Total 81 plastic pots (12 cm Height and 15 cm diameter) filled with 1 kg soil. These pots were replicated thrice. All the seeds of test species were

soaked in their respective treatments for 48 hours, and were sown in in the pots. All pots were irrigated through mini sprayer when needed. All pots were discarded after 45 days of experiment.

Factor A. Treatments (plant water extract types)

Treatment	Water extracts (WEs) Species	WEs Conc. @ (w/v)
T1	Sorghum	100 g/L
T2	Sunflower	100 g/L
T3	Parthenium	100 g/L
T4	Sorghum + Sunflower	50+50 g/L
T5	Sorghum + parthenium	50+50 g/L
T6	Sunflower + Parthenium	50+50 g/L
T7	Sorghum+Sunflower + Parthenium	33.3+33.3+33.3 g/L
T8	Atrazine (herbicide)	100 g/L
T9	Control (distilled water)	1L

Factor B. Test Species

Maize (*Zea mays L.*)

Trianthema partulacastrum (horse purslane)

Lolium regidum. (Regid Rye grass)

Data Recording:

Germination (%) was recorded by counting the number of germinated seeds in each pot and percentage were computed and recorded for each treatment. Seeds having 2mm radicle were consider as germinated. On daily basis germination % were observed. After germination shoot length (cm) was measured with measuring scale for all germinated seeds in each treatment. Dry biomass (g) was taken on an electrical balance after drying the fresh biomass in oven at 65 °C for 48 hours. The data presented for experiment is the mean of two runs conducted during June-July (2013) and September-October (2013).

Statistical Analysis

The data recorded for all the individual parameters were statistically analyzed using the appropriate ANNOVA suitable for Completely Randomized Design (CRD). Means were separated by using LSD test at 0.05 probability, where P-values were less than 0.05 (Steel et al., 1984).

3. Results and Discussion

Germination (%)

The statistical analysis of the data revealed that various plant extract treatments had significant effect on germination (%) of test species (Table-1). Data recorded showed the maximum germination (100 %) of *Z. mays* in control (distilled water) treatment. minimum germination (85 %) was recorded in *H. annuus* + *P. hysterophorus* (WE), similarly for *T. portulacastrum* seeds maximum germination (75 %) was recorded in control (distilled water) treatment while the minimum germination (36.67 %) was recorded in herbicide (atrazine) treatment. Furthermore, data recorded for *L. regidum* showed maximum germination (98.33 %) in control (distilled water) treatment while the minimum (40 %) was recorded in herbicide (atrazine) and *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) treatments. Among the species means highest germination (90.55 %) was recorded in *Z.mays* followed by *L. regidum* (57.59 %) whereas the lowest value (49.81 %) was recorded for *T. portulacastrum*. Among the treatment mean highest value of germination (83.89 %) was recorded in control (distilled water) treatment while the lowest value (55.56 %) was recorded in herbicide (atrazine) treatment followed by *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) with (56.11 %).

Allelopathic plants/weed water extracts and herbicide (atrazine) treatments had significantly influenced the germination (%), shoot length (cm), dry biomass (g) of test species viz. *Z. mays*, *T. portulacastrum* and *L. regidum*. Water extracts in mutual combination had more inhibitory effect than their sole effect on weed germination (%), shoot length (cm), and dry biomass (g) of test species, however efficacy of water extracts in mutual combination was slightly less than synthetic herbicide (atrazine). Higher inhibitory effects of water extracts in mutual combination could be due to synergistic actions off allelopathins present in these allelopathic plants/weed species which enhance the ability of extracts to show better inhibition for recorded parameters. Furthermore, strong inhibitory effect of these extracts on germination (%) of the test species indicating the presence of seed inhibitors in the allelochemicals released by these plants/weed species. Among the test species *Z. mays* seeds showed tolerance against herbicides and other allelopathic plants/weed water extracts. The tolerance of *Z. mays* seeds against allelopathins is a good indicator that could be further explored for selective weed management whereas, *T. portulacastrum* followed by *L. regidum* seeds were found more sensitive to water extracts and herbicide (atrazine) treatments.

Minimum germination (%) of *T. portulacastrum* seeds recorded in herbicide (atrazine) treatment was followed by *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) treatment. *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) inhibited the seed germination of *T. portulacastrum* by 41 % whereas the synthetic herbicide (atrazine) by 46 %. Allelopathic extracts is ecofriendly and economical, yet the inhibition on seed germination of test species is slightly less than synthetic herbicides. Our results are in close similarity with the findings of (Cheema et al., 2000; Cheema et al. 2000b) who observed that the inhibitory effect of allelopathic plant extracts on weeds is less than synthetic herbicides. However minimum germination of *L. regidum* was recorded in *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) followed by herbicide (atrazine). *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) inhibited the seed germination of *L. regidum* by 54 % whereas the synthetic herbicide (atrazine) by 50 %. Higher inhibitory effects of aforesaid extract in mutual combination may be due to synergistic actions of various allelopathins present in these allelopathic plants/weed species which enhanced the efficacy of extracts. Furthermore strong inhibitory effect of *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) on germination (%) of the tested species indicating the presence of seed inhibitors in the allelochemicals released by these plants. Leather (1983) reported that chlorogenic acid and Isochlorogenic acids could reduce the seed germination of many weed species.

Shoot length (cm)

The statistical analysis of the data showed that all extracts had significant effect on shoot length (cm) of test species (Table 2). Data recorded for *Z. mays* showed that maximum shoot length (38.46 cm) was recorded in control (distilled water), while minimum (29.99 cm) was recorded in *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) treatment which was statistically at par with herbicide (atrazine) treatment. Furthermore, maximum shoot length of *T. portulacastrum* (6.20 cm) was recorded in control (distilled water) treatment, while the minimum (3.55 cm) was recorded in herbicide (atrazine) treatment. Data recorded for the *L. regidum* showed the maximum shoot length (16.96 cm) was recorded in control (distilled water) treatment while the minimum (9.45 cm) was recorded in herbicide (atrazine) treatment which was statistically at par with *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) treatment. Among the species means maximum shoot length (32.36 cm) was recorded for *Z. mays* followed by *L. regidum* with (11.76 cm) whereas lowest shoot length (4.5 cm) was recorded for *T. portulacastrum*. Among the treatment means maximum shoot length (20.54 cm) was recorded in control (distilled water) treatment while minimum (14.46 cm) was recorded in herbicide (atrazine) treatment which was statistically at par with *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) treatment. Minimum shoot length (cm) of *T. portulacastrum* and *L. regidum* species in herbicide (atrazine) treatment by (42-44 %), indicated that allelopathic plant water extracts had less inhibitory effect on shoot length (cm) of test species. Furthermore, *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) was the next best treatment in reducing the shoot length (cm) of *T. portulacastrum* and *L. regidum* species by (37-43 %). The presence of p-coumaric, vanillic, syringic, and ferulic acids in allelopathic plants may inhibit the shoot growth of the tested species. Our results are like that of Turk and Tawaha (2002) who stated that allelopathic plants water extracts were more promising on radicle growth inhibition, as radicle emerges earlier and comes in contact with phytochemicals. Based on result of current study it is suggested to developed additional strategies and techniques to increase the efficacy of allelochemicals to reduce our reliance on synthetic herbicide.

Dry biomass (g)

The statistical analysis of the data showed that all extracts had significant effect on dry biomass (g) of test species (Table 3). Data recorded for *Z. mays* showed maximum dry biomass (0.2585 g) in control (distilled water) treatment, whereas the minimum (0.1895 g) was recorded in herbicide (atrazine) treatment. Furthermore, data recorded for *T. portulacastrum* showed maximum dry biomass (0.0707 g) in control (distilled water), while the minimum (0.0163 g) was recorded in herbicide (atrazine) treatment. Similarly, Data recorded for the *L. regidum* dry biomass, the maximum value (3.04 g) was recorded in control (distilled water) treatment, while the minimum (1.66 g) was recorded in herbicide (atrazine) treatment. Among the species means maximum dry biomass (2.14 g) was recorded for *L. regidum* followed by *Z. mays* with (0.2126 g) whereas minimum value (0.038 g) was recorded for *T. portulacastrum*. Among the treatment means maximum dry biomass (1.12 g) was recorded in control (distilled water) treatment, whereas the minimum (1.62 g) was recorded in herbicide (atrazine) treatment.

All allelopathic plant water extracts had significant effect on dry biomass (g) of the tested species. Among the tested species maize showed maximum tolerance to various allelopathic water extracts and herbicide (atrazine) treatment, whereas *T. portulacastrum* and *L. regidum* species were more sensitive to herbicide treatment (atrazine) followed by *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) treatment. Furthermore, herbicide (atrazine) treatment reduced the dry biomass (g) of *T. portulacastrum* and *L. regidum* by (77 and 53 %) whereas the *H. annuus* + *S. bicolor* + *P. hysterophorus* (WE) by (68 and 41 %) respectively. The inhibitory effect of allelopathic plant

extracts on weeds is less than synthetic herbicides (Cheema et al., 2000; Cheema et al. 2000b). Though, the utilization of allelopathic water extracts for weed management was economical and ecofriendly yet the reduction in dry biomass of test species was less than synthetic herbicide (Einhellig, 1996). The presence of sorgoleone, phenolics, p-coumaric, vanillic, syringic, and ferulic acids in allelopathic plants may inhibit dry biomass (g) of the tested species by inhibiting the electron transport in both photosynthesis and respiration, reduction in chlorophyll content, and reduction in chlorophyll accumulation.

Table 1. Allelopathic effect of different plants water extracts applied alone and mixed on germination (%) of *Z. mays*, and its associated weeds under laboratory condition (pots study).

Treatment types	Species tested			Means
	<i>Z. mays</i>	<i>T. partulacastrum</i>	<i>L. rigidum</i>	
Sor W.E @ 1:10 (w/v)	90.00 bc	56.66 b	78.33 b	74.1000
Sun W.E @ 1:10 (w/v)	86.67 bc	56.66 b	73.33 bc	72.2200
Par W.E @ 1:10 (w/v)	91.67 b	58.33 b	71.67 c	73.8900
Sor+ Sun W.E @ 1:10 (w/v)	86.67 bc	45.00 cd	51.67 d	61.1100
Sor+ Par W.E @ 1:10 (w/v)	86.67 bc	48.33 c	51.67 d	62.3300
Sun+ Par W.E @ 1:10 (w/v)	85.00 c	50.00 c	53.33 d	62.7800
Sun + Sor + Par W.E @ 1:10 (w/v)	88.33 bc	40.00 de	40.00 e	56.1100
Atrazine (commercial herbicide)	86.67 bc	36.67 e	40.00 e	54.4500
Control (distilled water)	100.00 a	75.00 a	98.33 a	91.1100
Means	89.07	51.85	62.03	
LSD 5 %	6.37	6.57	6.57	

For each effect, values with same letter (s) in a column do not differ from one another at $P \leq 0.05$ according to LSD test.

Whereas Sor = *Sorghum bicolor* L. Sun = *Helianthus annuus* L. Par = *Parthenium hysterophorus* L.

Table 2. Allelopathic effect of different plants water extracts applied alone and mixed on shoot length (cm) of *Z. mays*, and its associated weeds under laboratory condition (pots study).

Treatment types	Species tested			Means
	<i>Z. mays</i>	<i>T. partulacastrum</i>	<i>L. rigidum</i>	
Sor W.E @ 1:10 (w/v)	35.51 b	5.04 b	12.16 c	17.5700
Sun W.E @ 1:10 (w/v)	31.85 cd	4.95 b	12.94 b	16.5800
Par W.E @ 1:10 (w/v)	32.48 c	4.95 b	12.10 c	16.5100
Sor+ Sun W.E @ 1:10 (w/v)	31.39 de	4.16 c	10.28 e	15.2800
Sor+ Par W.E @ 1:10 (w/v)	30.58 ef	3.99 cd	11.20 d	15.2600
Sun+ Par W.E @ 1:10 (w/v)	30.68 ef	4.00 cd	11.11 d	15.2600
Sun + Sor + Par W.E @ 1:10 (w/v)	29.99 f	3.71 de	9.70 f	14.4700
Atrazine (commercial herbicide)	30.37 f	3.55 e	9.45 f	14.4600
Control (distilled water)	38.46 a	6.20 a	16.96 a	20.5400
Means	32.36	4.5	11.76	
LSD 5 %	0.85	0.37	0.339	

For each effect, values with same letter (s) in a column do not differ from one another at $P \leq 0.05$ according to LSD test.

Whereas Sor = *Sorghum bicolor* L. Sun = *Helianthus .annuus* L Par = *Parthenium .hysterophorus* L.

Table 3. Allelopathic effect of different plants water extracts applied alone and mixed on dry biomass (g) of *Z. mays*, and its associated weeds under laboratory condition (pots study).

Treatment types	Species tested			Means
	<i>Z.mays</i>	<i>T.partulacastrum</i>	<i>L.rigidum</i>	
Sor W.E @ 1:10 (w/v)	0.2175 b	0.0508 b	2.32 b	0.8600
Sun W.E @ 1:10 (w/v)	0.2157 b	0.0482 bc	2.33 b	0.8700
Par W.E @ 1:10 (w/v)	0.2148 b	0.0440 c	2.30 b	0.8500
Sor+ Sun W.E @ 1:10 (w/v)	0.2048 bd	0.0295 d	1.99 c	0.7400
Sor+ Par W.E @ 1:10 (w/v)	0.2063 bc	0.0315 d	1.94 c	0.7300
Sun+ Par W.E @ 1:10 (w/v)	0.2092 bc	0.0283 de	1.94 c	0.7300
Sun + Sor + Par W.E @ 1:10 (w/v)	0.1968 cd	0.0227 e	1.80 d	0.6700
Atrazine (commercial herbicide)	0.1895 d	0.0163 f	1.66 e	0.6200
Control (distilled water)	0.2585 a	0.0707 a	3.04 a	1.1200
Means	0.2126	0.038	2.146	
LSD 5 %	0.016	0.006	0.065	

For each effect, values with same letter (s) in a column do not differ from one another at $P \leq 0.05$ according to LSD test.

Whereas Sor = *Sorghum bicolor* L. Sun = *Helianthus .annuus* L. Par = *Parthenium .hysterophorus* L.

4. Conclusion:

It is concluded from the current study that all tested allelopathic plants species plants viz sorghum, sunflower, and parthenium have allelpathic effect against the weeds of maize. They have water soluble allelochemicals which could inhibit the germination % and growth parameters of weeds. Among all the various treatments Sorghum + Sunflower + Parthenium (WEs) showed significant results which were almost nearby to the effect of synthetic herbicide. A positive indicator during the study has been observed that maize seeds shown more tolerance against these extracts. Furthermore, the combination of these extracts had more inhibitory effect as compared to their sole application; hence the combination extracts of these plants could be utilized for sustainable weed management in maize.

It is recommended that water extract of sorghum + sunflower + parthenium @ 33.3+33.3+33.3 g/L in mutual combination may be recommended for sustainable weed management in maize.

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BRAND OF QUALITY AND ORIGIN REGIONÁLNÍ POTRAVINA ÚSTECKÝ KRAJ BY VIEW OF CUSTOMERS

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Annotation: This paper presents an overview of the results of research carried out in 2017 in the Usti Region, in the Czech Republic. This research is a part of researches realized by the author team in years 2014-2017 in selected regions of the Czech Republic and focused on analyzing consumers' recognition and preferences of the most important Czech food brand of quality and origin – Regionální potravina. The questionnaire of this survey was conducted in the year 2017. A sample of 231 respondents in this region were used. The Pearson's Chi-squared test was utilized to test the independence of the brand recognition of "Regionální potravina Ústecký kraj" on selected socio-demographic factors. The results show that in the Usti Region recognize this brand around 60 % of the respondents – inhabitants of the Usti Region in the Czech Republic. The brand is more known by young and middle-aged consumers. Also, an interesting factor is the fact that the mark is mainly known by middle-income respondents and fewer by respondents with the highest family income.

Key words: Marketing, Food branding, Quality, Origin, Region, Consumer Behavior

JEL classification: Q13, M31

1. Introduction

The establishment of the first regional brand system in the Czech Republic goes back to the year 2000. The trend towards seeking to create regional brands and the certification of regional production came to the Czech Republic from western countries. Its aim is to make small and middle-sized food producers more visible and more easily identifiable by consumers. Kögl and Tietze (2010), among others, state that, market saturation from both global as well as local products, product indistinguishability, the increasing awareness and demands of consumers, as well as new trends in marketing and marketing communication, for example building customer relationship (Balcarová et al., 2016), have all had a particular impact on this trend. Starzyczná and Pellešová (2009), and Frey (2011), only point to these facts in connection with increasing consumer awareness. State institutions and mainly non-profit organizations are the coordinators of the brand systems in the Czech Republic. At present, the most important task of company marketers is to the increase these organizations' visibility (Frey, 2011), which is in the case of small businesses, very difficult area (Pilař and Pokorná, 2016). Developing regional brands and certifying goods is one of the ways regions are seeking to react to new marketing trends. McEntee (2010) states that, the regional branding of food is the result of consumer pressure with regards to food quality and the need to create an alternative for those who prefer to purchase local products to global ones. As Hollis (2008) points out, the regional branding of food can be based on several pillars e.g. local culture, traditions and habits, nostalgia, but on the basis of logistical advantages, etc., too. La Trobe (2001) sees advantages for consumers in terms of freshness by sidelining intermediaries in the supply chain, as well as in the quality of food

production for reasonable prices. Margarisová et al. (2017) says that regional product is representing the place of origin, small-scale production and family company product. Regional food brands therefore provide suitable opportunities for small and medium-sized local or regional producers; they produce high quality food products but lack the appropriate communication instruments (e.g. because of lack of knowledge or high costs) with which to inform customers accordingly. Research by Kalábová and Turčínková (2012), and Horská, Ůrgeiová and Prokeiová (2011), proves the significance of branding for Czech consumers. Vokáčová and Margarisová (2017) describe 3 types of labeling of the regional and local Czech products - European system (PDO, PGI etc.), national system (Regionální potravina etc.) and micro regional level (ARZ etc.). Rojík, Chalupová and Prokop (2016) adds one more level – regional (for example brands Perla Zlínska, Zlatá chuť jižní Moravy etc.).

The aim of the article is to test the recognition of the label Regionální potravina Ústecký kraj among customers in Lower Austria in relation with selected socio-demographic and verify the dependence. Food products labeled by regional food brands are mostly high-quality food products – safer for customers (compare to the “mainstream” food production).

2. Materials and Methods

The regional food of the Ústí Region is part of the Czech national food labeling system with modification for each region in the Czech Republic. The marking was established in 2010, the organizer is the Ministry of Agriculture, and the regional coordinator of the competition is the Regional Agrarian Chamber of Most.

Figure 1. Brand logo of the “Regionální potravina Ústecký kraj”



Source: Ecological Center of Most (Ekologické centrum Most), 2017

The main purpose of the competition is to award the winning products in nine categories the status of a regional brand. The entrants (producers) have to fulfil 3 types of conditions (general conditions, specific conditions, regional conditions) which form the basis for the methodology for granting regional brand status. Those products that meet the given criteria are evaluated by a committee; this committee publishes its assessments and subsequently awards the winning products in each category the status of “Regionální potravina Ústecký kraj” (The Ministry of Agriculture of the Czech Republic, 2017).

Primary data were obtained through a questionnaire survey among the inhabitants of the Ústí Region. The questionnaire was standardized and most of the questions closed due to less dispersion of the answer variants. The questionnaire contained a total of 25 questions. The questionnaire survey was conducted from September 2017 to December 2017 on a sample of 231 respondents. All of these respondents live in the Usti Region. The primary research was realised among consumers aged 18-65 years. The data were analysed due selected socio-demographic characteristics (level of education, net monthly family income and age). The responses of 231 participants who took part in the survey were selected for further analysis.

The data were analyzed using the Pearson's Chi-square test of independence to test the null hypothesis. The null hypothesis was determined as follows: "Recognition of the regional brand "Regionální potravina Ústecký kraj" does not depend on the chosen socio-demographic factor".

H1: Recognition of the brand Regionální potravina Ústecký kraj does not depend on the respondents' level of education.

H2: Recognition of the brand Regionální potravina Ústecký kraj does not depend on the respondents' net family monthly income.

H3: Recognition of the brand Regionální potravina Ústecký kraj does not depend on the respondents' age.

Categorical data were obtained during the analysis of the questionnaire survey. In order to apply the Pearson's Chi-square test, a maximum of 20% of the expected frequencies must be less than five (see Řezanková, 1997; and Agresti, 2013). Where this test could not be applied, Fisher's exact test was used or the simulated p-value of the χ^2 statistic was calculated (see Anděl, 2005):

$$\chi^2 = \sum_i \sum_j \frac{(n_{ij} - e_{ij})^2}{e_{ij}} \quad (1)$$

Alternatively:

$$G^2 = \sum_i \sum_j n_{ij} \ln \frac{n_{ij}}{e_{ij}} \quad (2)$$

e_{ij} is the expected and n_{ij} the observed frequency. Either the test statistic χ^2 of Pearson's chi-square was used to test independence, or G^2 for the likelihood-ratio test. These two statistics are asymptotically $\chi^2_{(r-1)(c-1)}$ distributed. The null hypothesis of the test assumes independence. In order to apply the Pearson's Chi-square test, a maximum of 20% of the expected frequencies must be less than five (Agresti, 2013). Where this test could not be applied, Fisher's exact test was used or the simulated p-value of the χ^2 statistic was calculated (Anděl, 2005).

The p-value for each hypothesis was calculated by means of the Statistica software. Where $p < 0.05$, the null hypothesis was rejected in favor of an alternative hypothesis on the basis of the assumption of the dependence of the variables.

3. Results and Discussion

The results of the research presented in Table 1 show that the brand recognition of "Regionální potravina Ústecký kraj" is the highest (66.04 %) among the consumers with University or Collage level of highest education. The brand is only slightly less well-known by those respondents in the "High school" category (61.16 %) and Elementary school (60 %). The respondents with the lowest level of brand recognition (50.00 %) were the consumers with Apprenticeship.

Table 1. Recognition of the brand Regionální potravina Ústecký kraj according to respondents' level of education

Recognition of brand	Elementary school	Apprenticeship	High school	University and Collage	Row Totals
Yes	9	21	74	35	139
Column %	60	50	61.16	66.04	
No	6	21	47	18	92
Column %	40	40	38.84	33.96	
Total	15	42	121	53	231
Chi-square			df	P-value	
Pearson Chi-square		2.62	df=3	p=0.45	

Source: Own research, 2018

The P-value is 0.45. Therefore the H1 hypothesis was not rejected at a level of significance of 5% - H1 hypothesis "Recognition of the regional label Regionální potravina Ústecký kraj does not depend on the respondent's level of education".

Table 2. Recognition of the brand Regionální potravina Ústecký kraj according to net family monthly income

Recognition of brand	Up to CZK 25000	CZK 25001-50000	CZK 50001 and above	Row Totals
Yes	48	75	16	139
Column %	52.75	66.37	59.26	
No	43	38	11	92
Column %	47.25	33.63	40.74	
Total	91	113	27	231
Chi-square			df	P-value
Pearson Chi-square		3,91	df=2	p=0.14

Source: Own research, 2018

The results presented in Table 2 show that brand recognition is the highest among those respondents with a net monthly income of 25,001-50,000 CZK (66.37 %). Approximately almost of 60 % of those respondents with a net monthly income of CZK 50000 and above recognized the brand too. The poorest level of brand recognition was in the group of respondents with a net monthly income of up to CZK 25,000 (52.75 %). Due the data presented in the Table 2 the hypothesis H2 was not rejected at a level of significance of 5%. Recognition of the brand Regionální potravina Ústecký kraj does not depend on the respondents' net family monthly income.

Table 3. Recognition of the brand Regionální potravina Ústecký kraj according to respondents' age

Recognition of brand	18 to 35 years	36 to 50 years	51 to 65 years	Row Totals
Yes	84	46	9	139
Column %	59.15	70.77	37.50	
No	58	19	15	92
Column %	40.85	29.23	62.50	
Total	142	65	24	231
Chi-square			df	P-value
Pearson Chi-square		8.25	df=2	p=0.02

Source: Own research, 2018

The results of the research presented in Table 4 show that the brand recognition of “Regionální potravina Ústecký kraj” is the highest (70.77 %) among the middle-aged consumers (age category 36-50 years). The brand is also well-known by respondents in the age category 18-35 years (59.15 %). The respondents with the lowest level of brand recognition (37.50 %) were the oldest consumers (age category 51-60 years). When considering the dependence of knowing the brand according to age, the p-value of Pearson’s Chi-square test of independence is significantly lower than the defined level of significance. The H3 hypothesis was therefore rejected at a level of significance of 5 %. For the Usti Region it was statistically proven that *Recognition of the regional brand “Regionální potravina Ústecký kraj” does depend on the respondents’ age.*

The presented results can be compared with results from research other authors or other research results realized by the authors team. Because the data are part of previous authors research focused on the area of brands of origin or quality and on the brand Regionální potravina, is possible to compare the results with results from other regions. I. e. the recognition of the same brand Regionální potravina, but in modification for South Moravian Region shows, that in South Moravian Region also recognize this brand consumers with highest education, youngest and middle-aged customers, but against the Usti Region-in the South Moravian Region mostly recognized this brand respondents with highest monthly income (Rojík et al., 2016a). Also few years ago in the same region authors Zámková and Prokop (2014) shows, that the recognition of the quality and origin food brands was lower by respondents with higher income than with lower income. The interest in local brands is high in the regions with the higher average monthly income as Prague and the Central Bohemian Region (Šánová et al., 2017). It shows how has been changed the strategy of the Regionální potravina Jihomoravský kraj in few years. Also Chavicchi and Santini (2018) confirm the same results in their research in Vysočina Region in the Czech Republic. An interesting conclusion about that is that very similar results by those brands are around regions in the Czech Republic or in neighboring countries (for example in Austria) too (Rojík et al., 2016).

3. Conclusion

The data of this research show too, that even the recognition of the brand is around 60 %, only circa 40 % of the respondents buy products labeled by those brands of quality or origin. Authors believe that the reason is, that in the Czech Republic, regional food branding is still a rather new tool for informing consumers and gaining their interest in locally produced food. Food labeled as a regional brand, in contrast to larger scale food production, does not tend to attract consumers on the basis of, for example, low prices. In addition to fulfilling a consumer’s basic needs, regional brands also try to satisfy consumers’ higher demands for quality, ingredients, etc. Defining this specific added value is one of the objectives of marketing such regional brands. The findings presented in this research show that consumers in the Usti Region are not very aware of the specifics and opportunities of the Czech regional brand system (or its regional brand “Regionální potravina Ústecký kraj”). The brand is mostly known by consumers with the highest education (University or College, 66 %), respondents from the “middle class” with the family net income 25,001-50,000 CZK and middle-aged consumers (36-50 years old) from the Usti Region. Even in those groups in which brand recognition is poor there are opportunities for marketers to increase awareness. However, the most significant group in the Usti Region for marketers is the group of respondents with the highest incomes, simply because branded products usually sell for higher prices. But an interesting result of researches focused on the food branding of origin and quality is, that the respondents with higher income does not prefer those products. The reason could be “low exclusivity” of those products. It is the next task for marketing specialists for changes in communication strategies of the brand Regionální potravina Ústecký kraj. The future way for authors is to collect and compare data from

other regions and countries, especially from countries where the regional food labeling is working well with the aim to find data for benchmarking and to improve the Czech regional labeling systems.

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QUALITY AND REGIONAL BRAND GUTES VOM BAUERNHOF IN AUSTRIA: CUSTOMER'S RECOGNITION

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Annotation: This paper is focused on the test of recognition of one of the oldest food brands in Austria – in the region Lower Austria- the brand Gutes vom Bauernhof. Paper presents the results of research in the Lower Austria region realized in years 2014 and 2015. The brand Gutes vom Bauernhof is well-working food labeling system established in 1998 in the Austrian region - Lower Austria. It is the typical Austrian brand for small farmers which helps to make visible the small farmers and their products. This article brings the results of the recognition by this brand by consumers-inhabitants of the Lower Austria region (Region of origin of the brand Gutes vom Bauernhof). The results are presented according to the selected socio-demographic factors – respondent's age, level of education, net family income and verified by the Pearson Chi-quadrat test of independence. The results show very similar recognition due to respondent's age and higher recognition of the label by customers with middle education. The paper also shows that the lowest level of recognition is by respondents with the highest level of net family income. The paper also compares this brand with analogical brands in the Czech Republic and recommends opportunities for those food labeling systems in the Czech Republic.

Key words: Marketing, Food branding, Quality, Origin, Region, Consumer Behavior

JEL classification: Q13, M31

1. Introduction

Food labeling (in this article it represents labeling of origin or quality) represents too small and medium-sized entities (for example farmers) and regions an opportunity for an effective marketing (Messely et al., 2015). In Austria, there are currently several effective labeling systems focused on the origin or quality of the food from Lower Austria. The labeling system Gutes vom Bauernhof is one of the oldest in Austria. It dates back to 1998 when it was introduced in Lower Austria as a label for regional food producers. To date, this system is presented in almost all of the Austrian regions. The labeling system was established to make small and middle-sized food producers more visible, attract their quality food production and to be more easily identifiable by consumers (Landwirtschaftskammer Österreich, 2017). Kögl and Tietze (2010), among others, state that, market saturation from global as well as local products, produces indistinguishability. Developing regional labels and certifying products is one of the ways how to differentiate the food products how to react to new marketing trends. Emphasis on the regional origin of food products is becoming an increasingly more attractive alternative to the conventional globalizing food system (Van Der Ploeg, 2008; Bryla 2015). Since the beginning of the century an increasing demand for regional products have been observed in EU countries (e.g. Loureiro and Umberger, 2005; McEntee, 2010). Schermer (2015) is mentioning a possibility of the shift of the entire food system from 'food from elsewhere' to 'food from here', defining a food patriotism. Van Ittersum et al. (2007) define a regional product as one whose quality and (or) fame can be attributed to its region of origin, an important attribute is that the product is marketed using the name of the region of origin. Regional

food may also be viewed as a part of regional identity or a manifestation of the cultural and economic heritage (Minta, 2015). As Šánová (2017) says the interest in local brands is high in the regions with the higher income.

The aim of the article is to test the recognition of the label Gutes vom Bauernhof among customers in Lower Austria in relation with selected socio-demographic factors – respondents' age, level of education, net family income and verify the dependence which can help the label coordinator effectively manage the marketing activities.

2. Materials and Methods

The food labeling system Gutes vom Bauernhof is a registered trademark of the Austrian Agrarian Chamber and Agrar Verein Project. The brand was established in 1998 in Lower Austrian Region. (logotype see Fig. 1).

Fig. 1. Gutes vom Bauernhof



Source: Landwirtschaftskammer Österreich. Gutes vom Bauernhof, 2017, <http://www.gutesvombauernhof.at/>

The purpose of the labeling system is to provide certified food producers and their products with selected marketing activities (logotype use, brand promotion, PR - Media Relations and lobbying), provide marketing and sales training to manufacturers, provide expert assistance in legislative areas related to regulations applicable to food production. In Lower Austria, 170 food manufacturers are certified to date (Landwirtschaftskammer Österreich, 2017).

Authors of this paper present the results of the research according to the selected socio-demographic factors. The primary research was realized by authors in years 2014-2015 among consumers aged 18-65 years. The research was realized in all the main provincial towns in Lower Austria – Krems an der Donau, Mistelbach an der Zaya, Sankt Pölten, Weidhofen an der Ybbs a Wiener Neustadt. Respondents were selected by trained interviewers on the basis of quotas for specific socio-demographic characteristics (age, sex, and net monthly family income). The responses of 450 participants who took part in the survey were selected for further analysis. The data were analyzed using the Pearson's Chi-square test of independence to test the null hypothesis. The null hypothesis was determined as follows: "Recognition of the brand Gutes vom Bauernhof does not depend on the chosen socio-demographic factor". The authors work in research with recognition of the brand because regional brands aren't specific product brand. This approach is also applied by other brand researchers - e.g. Kögl and Tietze (2010). This paper presents the results of the Pearson's Chi-square test of independence on the following hypotheses:

- H1: Recognition of the brand Gutes vom Bauernhof does not depend on the respondents' age.
H2: Recognition of the brand Gutes vom Bauernhof does not depend on the respondents' level of education.
H3: Recognition of the brand Gutes vom Bauernhof does not depend on the respondents' net family monthly income.

Categorical data were obtained during the analysis of the questionnaire survey. Contingency tables were subsequently used as an easy way to display the relations between this data. Subject to the character of the data, suitable tests of independence were carried out. According to Řezanková (1997), for the purpose of a contingency table of the $r \times c$ type (r is the number of rows, c is the number of columns), the following test statistic was used the most often:

$$\chi^2 = \sum_i \sum_j \frac{(n_{ij} - e_{ij})^2}{e_{ij}} \quad (1)$$

Alternatively:

$$G^2 = \sum_i \sum_j n_{ij} \ln \frac{n_{ij}}{e_{ij}} \quad (2)$$

e_{ij} is the expected and n_{ij} the observed frequency. Either the test statistic χ^2 of Pearson's chi-square was used to test independence, or G^2 for the likelihood-ratio test. These two statistics are asymptotically $\chi^2_{(r-1)(c-1)}$ distributed. The null hypothesis of the test assumes independence. In order to apply the Pearson's Chi-square test, a maximum of 20% of the expected frequencies must be less than five (Agresti, 2013). Where this test could not be applied, Fisher's exact test was used or the simulated p-value of the χ^2 statistic was calculated (Anděl, 2005). The p-value for each hypothesis was calculated by means of the Statistica software. Where $p < 0.05$, the null hypothesis was rejected in favor of an alternative hypothesis on the basis of the assumption of the dependence of the variables.

3. Results and Discussion

Table 1. Recognition of the brand Gutes vom Buernohof according to respondents' age

Recognition of brand	18 to 35 years	36 to 50 years	51 to 65 years	Row Totals
Yes	100	98	92	290
Column %	66.67	65.33	61.33	
No	50	52	58	160
Column %	33.33	34.67	38.67	
Total	150	150	150	450
Chi-square			df	P-value
Pearson Chi-square	1.01		df=2	p=0.60

Source: Authors

The results of the research presented in Table 1 show that the brand recognition of Gutes vom Bauernhof is the highest (66.67 %) among the youngest consumers (age category 18-35 years). The brand is only slightly less well-known by those respondents in the age category 36-50 years (65.53 %). The respondents with the lowest level of brand recognition (61.33 %) were in the age category 51-65 years). Statistically, Table 1 shows that Recognition of the regional brand Gutes vom

Bauernhof statistically does not depend on the respondent's age (the H1 hypothesis of independence was not rejected at a level of independence of 5%).

Table 2. Recognition of the brand Gutes vom Buernhof according to respondents' level of education

Recognition of brand	Elementary school	Apprenticeship	High school	University and College	Row Totals
Yes	27	118	103	42	290
Column %	60	71.52	60.59	60	
No	18	47	67	28	160
Column %	40	28.48	39.41	40	
Total					450
Chi-square			df	P-value	Chi-square
Pearson Chi-square	5.69		df=2		p=1.13

Source: Authors

Table 2 shows that label recognition is the highest among those respondents with the middle education - Apprenticeship (71.52 % of respondents). The brand recognition levels among respondents with completed elementary school, high school or college education were very similar, ranging from 60 – 60.59 %. The H3 hypothesis was not rejected at a level of significance of 5% - H2 hypothesis "Recognition of the regional label Gutes vom Bauernhof does not depend on the respondent's age".

Table 3. Recognition of the brand Gutes vom Buernhof according to net family monthly income

Recognition of brand	Up to EUR 2000 incl.	EUR 2001-4000	EUR 4000 and above	Row Totals
Yes	124	136	30	290
Column %	66.76	64.45	53.57	
No	59	75	26	160
Column %	32.24	35.55	46.43	
Total	59	75	26	450
Chi-square			df	P-value
Pearson Chi-square	3.76		df=2	p=1.15

Source: Authors

The results presented in Table 3 show that the brand Gutes vom Bauernhof is best known by the respondents with net income over 4,000 EUR (57.14 %). The respondents with income 2,001 – 4,000 EUR and respondents with income up to 2,000 EUR recognize the brand very similar about 52-53%. Table 3 involves the P-value of Pearson's Chi-square test is 1.15. The hypothesis of independence was therefore not rejected at a level of significance 5%. The H3 hypothesis - Recognition of the regional brand Gutes vom Bauernhof' does not depend on the respondent's net family monthly income – was therefore confirmed.

An interesting result is that in Lower Austria is mostly recognized the brand Gutes vom Bauernhof by customers with lower and middle net family income and it confirms the results from Chavicchi and Santini (2018) or Zámková and Prokop (2014), who says, that the recognition of the quality and origin food brands is lower by respondents with higher income than by customers with lower income.

This research data also confirmed that one of the lowest recognition of food brands in Vysočina Region is by the oldest respondents (Loureiro and Umberger, 2005). Even in Lower Austria is quite low the difference between recognition due respondent's age.

This research data also confirmed, that customers with the highest education have known these brands relatively little, especially compared to people with middle education. This corresponds to Teuber (2010), focused on regional EU labeling. Her results indicated that people with higher education may have the lowest interest in certified foods.

Compare the results of this article with results of recognition of the regional brands in the Czech Republic (in the neighboring region - South Moravian Region and tested on the sample of respondents with the same quota and socio-demographic characteristics) - the recognition of the label Gutes vom Bauernhof is much higher than the Czech average is. For example the most famous Czech food label Regionální potravina Jihomoravský kraj was recognized by less than half of all respondents (46.9 %) and the recognition by the smallest labels (Moravský kras Regionální produkt, Zlatá chuť Jižní Moravy and Znojensko Regionální produkt) was only between 9.33 - 14.9 % (Rojík et al., 2016 and 2017).

4. Conclusion

The results show a very high level of knowledge of the brand Gutes vom Bauernhof in Lower Austria – it is the region of origin of this brand and region with the highest number of users (business entities) of this brand. The recognition of the brand Gutes vom Bauernhof is the second highest (compare to other brands of origin and quality) in Lower Austria. The research confirms also that Gutes vom Bauernhof is a "mainstream" brand. It is known to consumers around different sociodemographic characteristics. For example, an interesting fact is that the difference of the recognition among respondents by age only around 5 % for all age groups is. A similar situation was found by respondents according to the level of highest education - the highest level of knowledge was by respondents with Apprenticeship (71.5 %), by the other educational groups of respondents is the knowledge equally about 60 %. According to the net monthly family income, the results show that the highest level of knowledge (recognition) is by consumers with the lowest and middle income of family income and lowest by respondents with highest family net income. It shows that respondents with the highest level of income have been the lowest interest in the products labeled by those brands of origin and quality. To find the way, how ho attractive the brands of origin and quality for the consumers with higher income is one of the future research ways for authors of the article and other researches.

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THE SIMILARITY OF THE STRUCTURE OF FOREIGN TRADE IN DAIRY PRODUCTS IN THE EUROPEAN UNION

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Abstract: The analysis of the commodity structure and geographical system is an important element of foreign trade. The article analyses the structure of foreign trade in dairy products based on the data concerning the European Union (EU) countries. The study aims to assess the similarity of commodity structures of foreign trade in dairy products. The data were obtained from the UN Comtrade database. The similarity of the structure was verified based on a cluster analysis using Ward's method. All calculations were made with the use of the Sas 9.4 software. As a result of the analysis, a grouping of the European Union countries was obtained with respect to the similarity of the structure of goods imported and exported in 2005 and 2016. The examined countries were grouped into three clusters with respect to the structure of goods, separately for import and export. Interestingly, Germany is a separate country as far as the similarity of the dairy trade structure for imports and exports is concerned.

Key words: dairy products, foreign trade, cluster analysis, Ward's method, import, export, the EU

JEL classification: F14, C38, Q13

1. Introduction

The importance of foreign trade to the development of countries' economies is unquestionable. Exchange between countries exerts influence on the pace of their development and brings benefits to highly developed countries as well as those that are still before an economic boom (Sołdaczuk and Misala, 2001; Salamaga, 2013). Milk and dairy products are also commodities. Moreover, their share in agricultural products turnover in the European Union countries is growing year by year (FAO, 2018). However, the trends in dairy products trade are not the same in all the states. The higher the economic development of the country is, the more dairy products it exports. For example, one of the biggest milk producers, India, exports small amounts of milk. It results from high domestic demand as well as relatively small scale of processing (Parzonko, 2009).

Apart from the level of economic development, the membership of organisations, as e.g. the European Union, also has considerable influence on foreign trade. With the 2004 enlargement of the European Union, there was a growth of trade in agricultural products in the new Member States. Their products gained access to the EU markets and farms had to make investment, which resulted in the improvement of competitiveness in agriculture in the new Member States, including their dairy products sector (Marcysiak and Prus, 2017; Roman, 2017). The increase in trade dynamics was caused by the fact that the countries had to adopt the uniform principles of Common Commercial Policy connected with the change of customs rates, unification and conclusion of customs agreements (Pawlak, 2014).

Therefore, the classification of countries into clusters with regard to the structure of foreign trade in dairy products and indication of changes that took place in those clusters after the European Union enlargement may constitute an interesting research problem. One can find examples of countries clusters with regard to issues concerning economics of agriculture in Błażejczyk-Majka and Kala

(2005) – characteristic features of agricultural land in selected countries of the European Union; Poczta (2005) – level and structure of financial support for agriculture in the OECD countries; or Poczta, Średzińska and Pawlak (2008) – analysis of the financial situation of farms in the EU Member States. In addition, Salamaga (2017) carried out the evaluation of similarity of the product structure of foreign trade in the European Union countries. He analysed the directions of products flow and its size for five variables: (1) agricultural products in total; (2) raw materials; (3) mineral fuels and derived products; (4) industrially processed products; and (5) machines, devices and transport equipment. The structure of particular groups of agricultural products was not analysed. That is why the aim of the article is to determine similarities in the structure of foreign trade in dairy products in the European Union countries. In order to present changes, countries are grouped in two periods, which makes it possible to present the influence of the European Union enlargement.

2. Materials and methods

In order to verify the similarity of structure of foreign trade in dairy products, the authors based the analysis on secondary data from the UN Comtrade Database (2018). In order to verify the dynamic of changes, two periods were purposefully chosen: 2005 (the first full year after the 2004 enlargement of the European Union) and 2016 (chosen because of availability of full latest data at the time of writing the article). The analysis covers all the European Union Member States in 2016.

Seven variables were chosen to analyse the structure of foreign trade in dairy products in the European Union. These are dairy products that are most often traded in:

- Butter – commodity code: 040510,
- Cheese and curd – commodity code: 0406,
- Milk and cream concentrated, other than in powder – commodity code: 040299,
- Milk and cream not concentrated – commodity code: 040120,
- SMP (skimmed milk powder) – commodity code: 040210,
- Whey – commodity code: 040410,
- WMP (whole milk powder) – commodity codes: 040221 and 040229.

It should be mentioned that, apart from the substantive criterion, the choice of the variables also resulted from the low mutual correlation of variables (correlation rate below 0.8).

The similarity of the structure of foreign trade was verified based on the analysis of clusters with the use of Ward's method. It is one of the agglomerative hierarchical clustering methods and is based on the classical criterion of the sum of squares (Ward, 1963). The division should be carried out in such a way that objects of one group (class) are as similar as possible and those of different classes as different as possible. The measures of similarities or differences are based on the distance between the units (Murtagh, 2014). The starting point in this method is matrix D of euclidean distance d_{ij} between classified objects. The algorithm procedure is as follows: (1) Each O_i object ($i = 1, 2, \dots, n$) is treated as a one-element group; (2) In the distance matrix finds the minimum value: $d_{pq} = \min\{d_{ij}\}$; (3) O_p and O_q objects are treated as one-element groups, A_p and A_q are combined into one two-element group A_r : $A_r = A_p \cup A_q$; (4) Determination of the distance d_{ir} of the formed A_r group from all other groups A_i ; (5) Repeating steps 2-4 until all objects form one group (Stec, Janas and Kuliński, 2005). To choose the number of classes, Cubic Clustering Criterion (CCC) (Sarle, 1983) and Pseudo F (Calinski and Harabasz, 1974) were used. All the calculations were made with the use of Sas 9.4 software.

3. Results and discussion

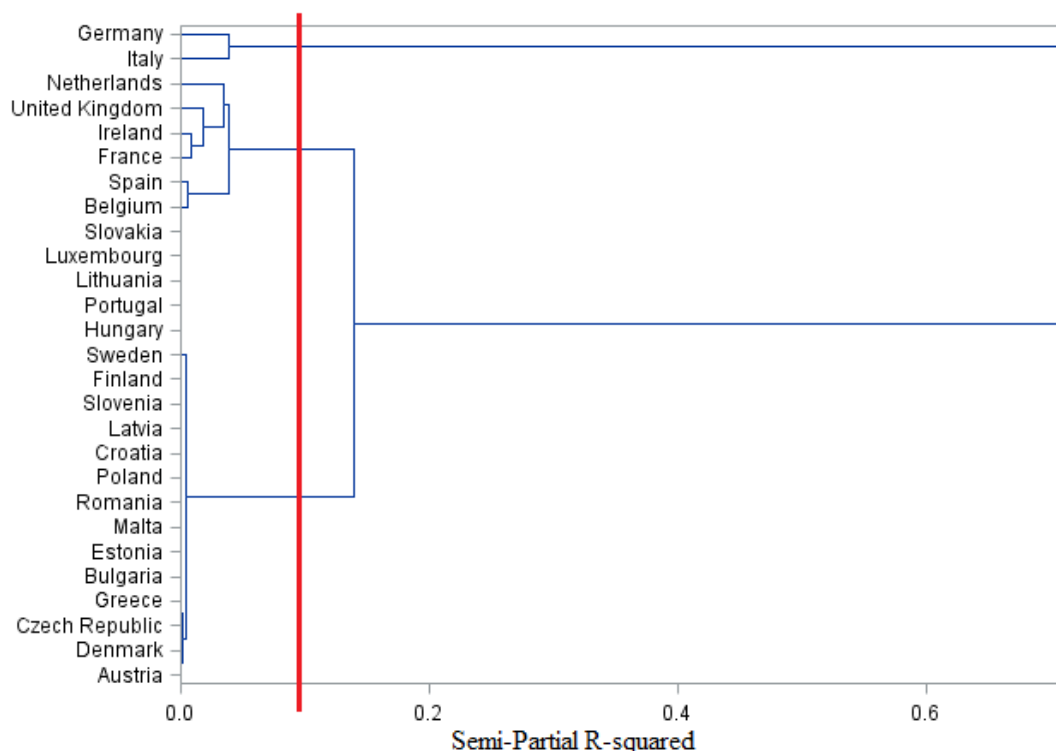
In case of an analysis of clusters, it is usually proposed to make the classification complete, disjunctive and non-empty. Completeness means that every object belongs to a class. Disjunction means that it belongs to only one class. And non-emptiness requires that each class should contain at least one object (Kisielińska, 2009). The problem in cluster analysis may result from ensuring completeness in case there are distinct units, dissimilar to others, in the examined cluster.

The simplest solution is the creation of one-element classes, which can in fact be interpreted as specific exclusion of such objects. However, such a situation may result in erroneous classification of the remaining objects. That is why the article thoroughly analyses the examined objects first, and then, when the distinct objects are recognised, they are eliminated in the course of clustering countries and treated as separate classes.

a. Similarity of dairy products import structure

Figure 1 presents the outcomes of clustering the EU countries with regard to the level of similarity of dairy products import structure in 2005. The use of the CCC criterion and pseudo F resulted in the distinction of three groups of countries that are most similar with respect to commodities import structure. The first one contains Germany and Italy, which imported considerable amounts of milk and cream not concentrated; and import of all dairy products reached 2 bn. kg there. The second group is composed of the Netherlands, the United Kingdom, Ireland, France, Spain and Belgium, where the volume of import varied between 0.3 and 1.3 bn. kg of dairy products, with milk and cream not concentrated as well as cheese and curd also dominating. However the countries imported little milk powder. The third cluster contains the remaining countries, where the volume of import did not exceed 0.2 bn. kg. It is worth noticing that only the so-called “old EU countries” belong to in the first and second clusters.

Figure 1. Outcomes of clustering the EU countries with respect to the similarity of the commodities import structure in 2005

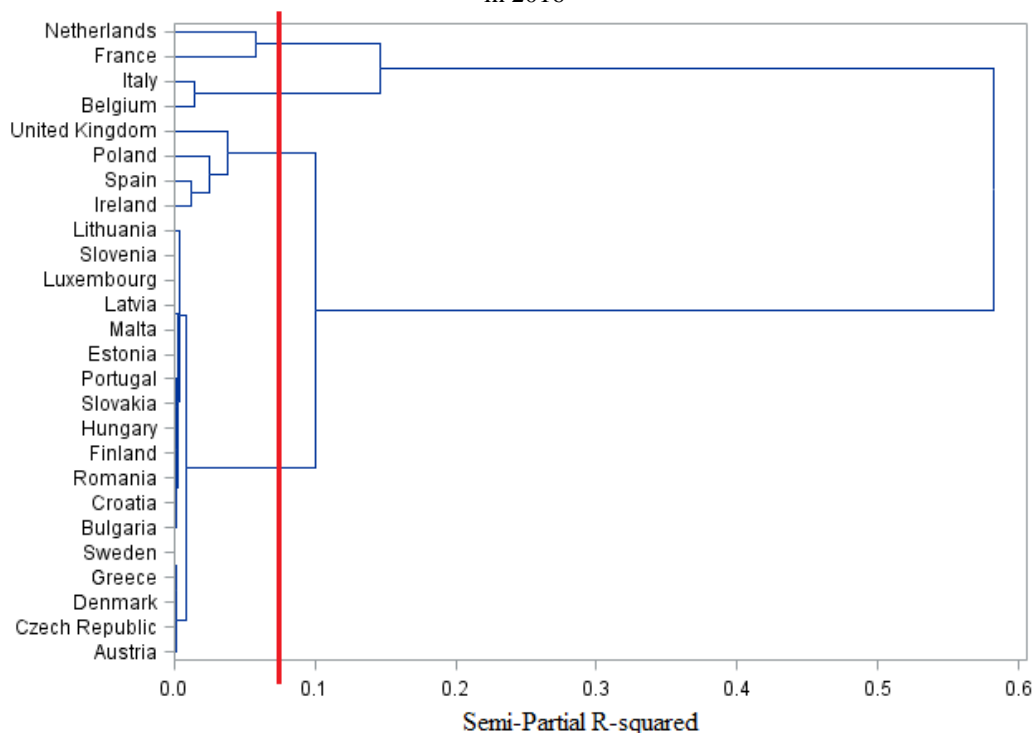


Source: authors' own calculations based on UN Comtrade

Figure 2 presents similar clustering of the EU countries in 2016. As a result of the analysis conducted, four clusters of most similar countries with respect to commodities structure were distinguished. Moreover, in this case, there was one distinct country: Germany, which can be treated as the fifth group. The first cluster contains the Netherlands and France, which imported considerable amounts of whey, milk and cream not concentrated as well as cheese and curd. The countries also imported similar amounts of butter and their import of all dairy products reached between 1.2 and 1.9 bn. kg. The second group was also composed of two countries: Italy and Belgium, where the volume of import varied from 1.7 to 2.0 bn. kg of dairy products, with milk and cream not concentrated

dominating. On the other hand, the countries imported small amounts of milk and cream concentrated. The third cluster gathered four countries: the United Kingdom, Poland, Spain and Ireland, where the value of import varied from 0.4 to 0.8 bn. kg, with milk and cream not concentrated or cheese and curd as the main imported products. Apart from that, the countries also imported comparable amounts of whey and whole and skimmed milk powder. The last cluster was composed of the remaining countries, where the volume of dairy products import did not exceed 0.4 bn. kg.

Figure 2. Outcomes of clustering the EU countries with respect to the similarity of the commodities import structure in 2016



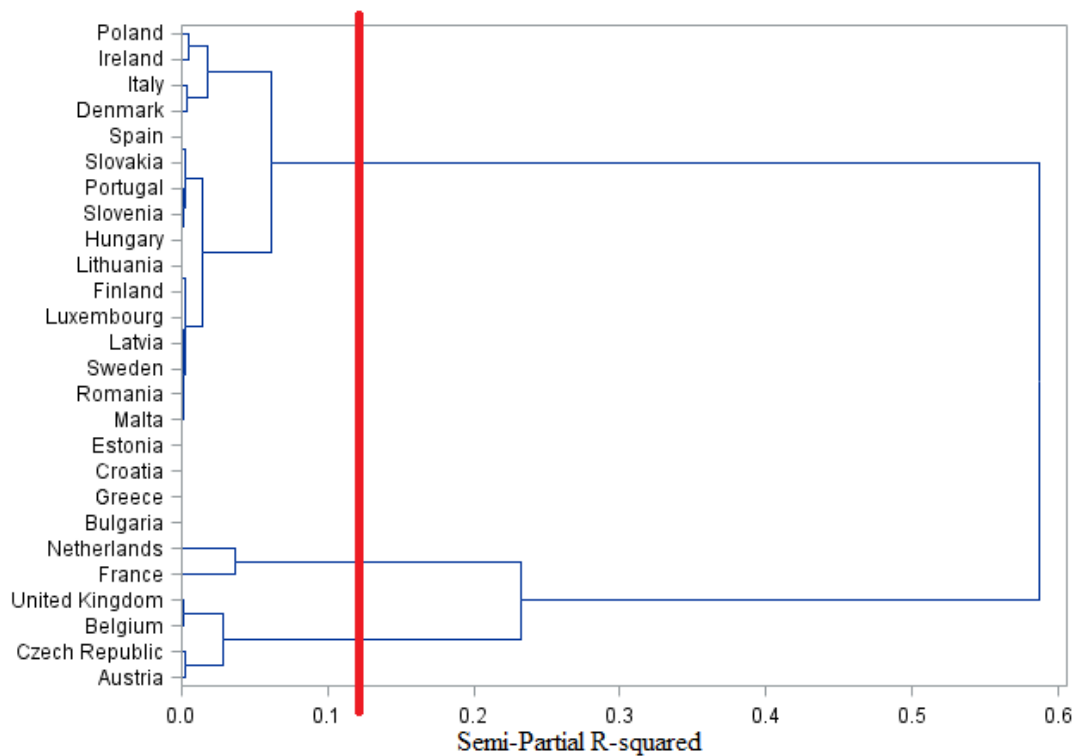
Source: authors' own calculations based on UN Comtrade

The comparison of the clusters makes it possible to notice a considerable change in the role of the following countries: Germany (as a completely distinct one), the Netherlands and France (a new cluster of the countries, where there is big import of whey, milk and cream not concentrated as well as cheese and curd), Poland (inclusion of Poland as the only “new” country in the so-called group of “old EU countries”).

b. Similarity of dairy products export structure

Figure 3 presents the outcomes of clustering the EU countries with respect to the similarity level of the dairy products export structure in 2005. As a result of the analysis conducted, three clusters were distinguished. In this case, also one country, Germany, was found distinct and can be recognised as a separate fourth group. The first cluster is composed of the Netherlands and France, which exported mainly milk and cream not concentrated as well as cheese and curd in that period, and similar amounts of whole and skimmed milk powder. Export of all dairy products in those countries accounted for 1.5 – 1.9 bn. kg. The second group gathers such countries as the United Kingdom, Belgium, the Czech Republic and Austria, where the volume of export varied from 0.4 to 1.0 bn. kg, with only export of milk and cream not concentrated dominating. The third group contained all the remaining countries, where the volume of export did not exceed 0.5 bn. kg. In the last cluster, a sub-group may be distinguished with countries such as Poland, Ireland, Italy and Denmark. The countries, unlike others, exported 0.3 to 0.5 bn. kg of dairy products, mainly cheese and curd, and also considerable amounts of butter and whey. The countries also exported small amounts of milk and cream concentrated.

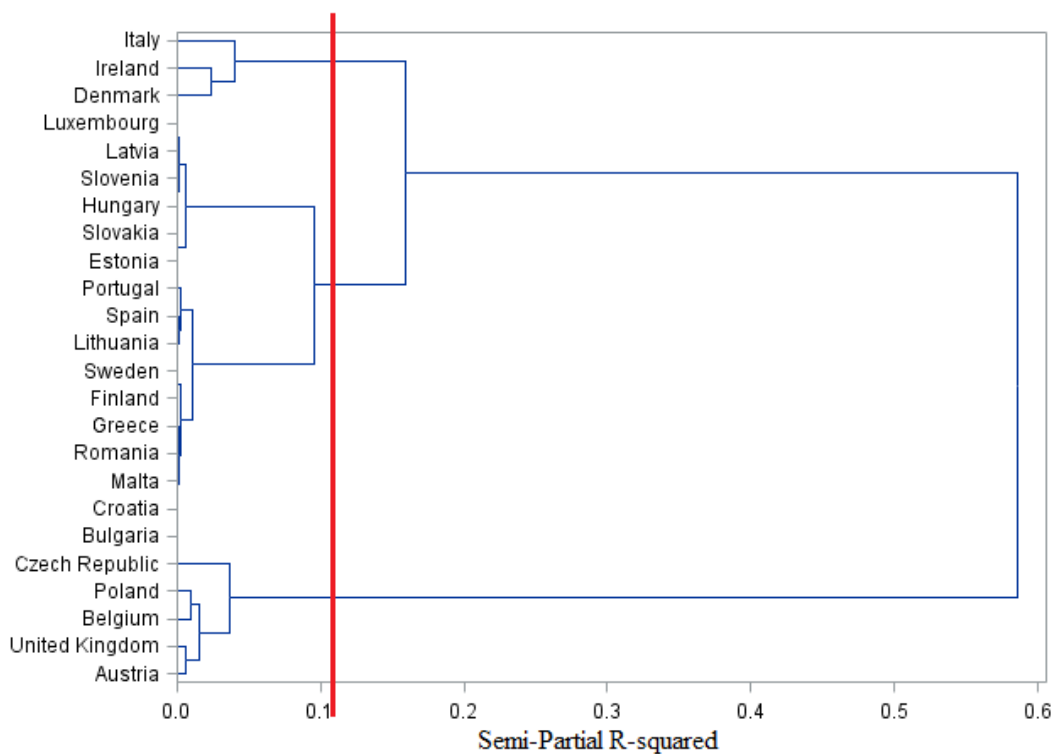
Figure 3. Outcomes of clustering the EU countries with respect to the similarity of the commodities export structure in 2005



Source: authors' own calculations based on UN Cometrade

Figure 4 presents a similar grouping of countries in 2016. As a result of the analysis conducted, also three clusters of countries were distinguished. In this case, a few distinct countries were observed. This time they were: Germany (with dominating export of milk and cream not concentrated), the Netherlands (with dominating export of cheese and curd) and France (with dominating export of milk and cream not concentrated as well as cheese and curd). They may be recognised as additional separate single-country groups. The first cluster is composed of three countries: Italy, Ireland and Denmark, where the main export products were cheese and curd, and milk and cream concentrated constituted the smallest share in export. All dairy products export to those countries reached the level of 0.6 up to 0.8 bn. kg. The second group includes such countries as the Czech Republic, Poland, Belgium, the United Kingdom and Austria, where the volume of export varied from 0.8 to 1.4 bn. kg, with export of milk and cream not concentrated dominating. The third cluster gathered the remaining countries, where the volume of export did not reach 0.35 bn. kg.

Figure 4. Outcomes of clustering the EU countries with respect to the similarity of the commodities export structure in 2016



Source: authors' own calculations based on UN Comtrade

The comparison of the two groupings makes it possible to notice the considerably decreasing role of the following countries: Germany (which even more strongly confirmed its distinction), the Netherlands and France (they created separate objects with regard to similarity of their export structure), Poland (which changed the group), Italy, Ireland and Denmark (which formed a separate group characterised by big export of cheese and curd).

4. Conclusions

The analysis presented in the article makes it possible to draw the following conclusions:

1. It should be recognised that the structure of import and export of dairy products in the European Union countries is quite similar. In case of both export and import, mostly three clusters were distinguished.
2. As a result of the 2004 extension of the European Union, the volume of foreign trade exchange in dairy products in the European Union countries increased.
3. In case of clustering countries in 2005, clear distinction of the so-called “old EU countries” can be noticed.
4. The comparison of the two examined periods make it possible to notice greater product specialisation of selected countries, e.g. the Netherlands, Italy, Ireland and Denmark, which exported mainly cheese and curd in 2016.
5. The position of Poland clearly rose in the trade in dairy products. In 2016, it was found in the group of “old EU countries” in the field of both export and import.

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GLOBAL BUTTER MARKET AND POSSIBILITY OF FORECASTING BUTTER PRICE

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Annotation: The situation at the global market with butter based especially on rapidly rising consumer price in year 2017 has surprised not just consumers all around the world. The aim of the paper is to describe the current situation at the global market with butter and to explain the main reasons of rapidly increasing prices during the last periods. Within the analysis the main attention is paid to the Czech market. However, the tendencies and the main factors are common for the all countries all around the world, just with some regional specifics that are also depicted.

The examination of butter market and possibility of its modelling and forecasting arisen from the current situation in the dairy agri-food chain all around the world. The general overview as well as consecutive analysis is based on the determination of the main factors influencing the butter market. The possibility of forecasting of the consumer price of the butter is strongly affected by rapid increase of the price during the 2nd half of the year 2017. The question is whether any suitable model can be estimated and used for the prognostic purposes of the price of butter.

The structure and the development of the consumer price of butter in the Czech Republic were modelled using the time series analysis. Concretely, SARIMA (1,1,0) (1,0,1)₁₂ model with 2 instrumental variables representing the specifics of the butter market in analyzed period was selected as the most suitable for the description of analyzed time series as well as for the prognostic purposes. Based on this model, the consumer price of butter was forecasted for the period January 2018 – April 2018. The analysis has shown that the consumer price of the butter should decrease in the following periods; however, its level seems to be still higher compared to the level before its increase in year 2017.

Key words: Butter, price, time series, ARIMA, forecast.

JEL classification: C53, Q02, Q11

1. Introduction

The situation at the butter market is alarming all around the world. The prices are rapidly growing, last few periods; the demand is slightly increasing, the production slightly decreasing and stocks have become depleted, currently. What are the main reasons of such changes? Is the situation at the global butter market really critical, do we need to worry what will happen in the future?

Because the problem at the butter agri-food chain has emerged during last few periods, almost none scientific paper focusing on this problem area have not been published, yet. The main comments were published in form of comments in specialized news-papers, journals and websites.

Dudová and Bečvářová (2015) show that agri-food commodity chain analysis is one of the most useful tools especially about informing the influence of specific individual market entities on the development of the agribusiness industry. Onour and Sergi (2011) found that increasing volatility in the agriculture commodity prices creates uncertainties to farmers to meet the rising demand for agricultural food commodities, and to consumers to manage their future spending plans. Matošková (2011) says that significant price volatility has been observed at the world agri-food markets in these latter years. It has been caused by the triggers of the so-called market shocks.

The main aim of the paper is to describe the situation at the global butter market and to explain the main reasons of the current situation. Other objective deals with the possibility to forecast the price of the butter.

2. Materials and Methods

The development of the consumer price is examined using univariate time series analysis. Suitability of utilization of the time series models for analysis and forecasting of the agri-food markets were shown e.g. by Svatošová and Köppelová (2017). Autoregressive Integrated Moving Average Model (ARIMA) is employed to fulfill the aim. Similarly, Nochai and Nochai (2006) employed ARIMA model for forecasting oil palm price, Darekar and Reddy (2017) to predict market price of soybean in major India or Wang, Ye and Huo (2011) proves the quality of ARIMA modelling for forecasting of household food retail prices.

ARIMA model is estimated based on Box-Jenkins methodology that is typically processed in the 3 steps: identification, estimation and diagnostic checking (see Kočenda and Černý 2007).

The whole analysis is processed in the following steps:

- i. Detection of stationarity of the time series using Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF).
- ii. Selection of maximal lag using information criterions. For that purpose Schwarz Information Criterion (SIC) has been employed. Schwarz (1978) defined SIC as following:

$$SIC = T \ln SSR + n \ln T, \quad (1)$$

where SSR represents sum of the squared residuals, n number of explanatory variables and T number of usable observations.

- iii. Detection of the development of the time series using index analysis and Box-plot analysis. In this step base index (BI), chain index (CHI) and Box-plot has been processed and interpreted to discover specific features of analyzed time series.
- iv. Estimation of ARIMA model. Autoregressive Integrated Moving Average Model ARIMA (p,d,q) model is based on generally defined ARMA (p,q) model for stationary time series as following:

$$ARMA = \sum_{i=1}^p \alpha_i y_{t-i} + \sum_{j=1}^q \delta_j \varepsilon_{t-j} \quad (2)$$

- v. Residual analysis is employed to verify the quality of estimated model. Heteroskedasticity, autocorrelation of residuals, normality of distribution and other features of the model are evaluated using appropriate tests.
- vi. Forecasting. The forecasted values has been calculated based on estimated ARIMA model.
- vii. Evaluation of forecast quality using MAPE. Mean Absolute Percentage Error was calculated according to the following formula:

$$MAPE = \frac{100}{h} \sum_{t=n+1}^{n+h} \frac{y_t - \hat{y}_t}{y_t}, \quad (3)$$

where h represents prognostic horizon and n number of observations.

The analysis is based on the time series analysis of consumer price containing monthly data in period January 2006 – December 2017. The data set was provided by Czech Statistical Office. The data set contains consumer price of butter in the Czech Republic in CZK/kg. The calculation were done using IBM SPSS Statistics.

3. Results and Discussion

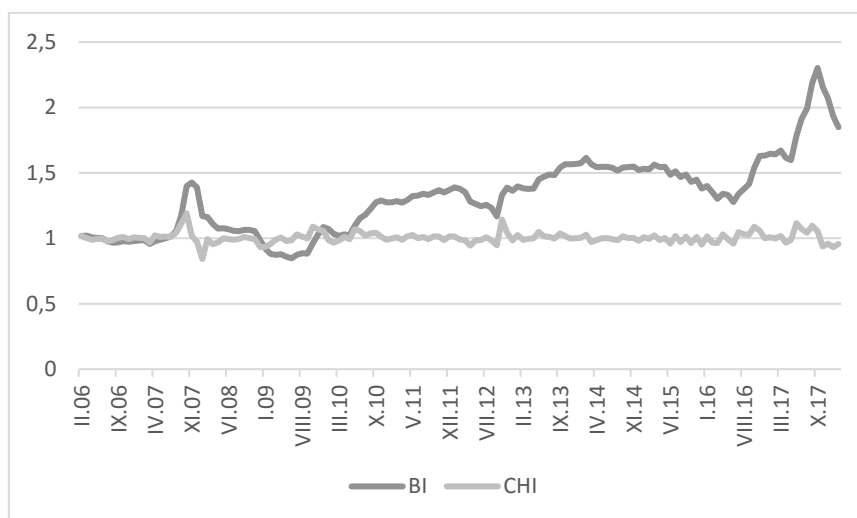
The consumer price of butter has increased during last periods all around the world. Several reasons might be used to explain such unexpected development. The strains in Europe have global origins (FT, 2012). The combination of falling milk output in key producing countries and adverse weather sent the international butter price to a record high.

The main reasons of high level of the consumer price of butter might be seen in:

- increasing price of butter at global market;
- increasing demand for the butter, especially in Asian region (China, Japan, South Korea) (Novinky, 2017);
- EUR currency development during the last periods;
- low-fat cow-milk;
- increase of the demand/consumption of fat milk products;
- increase of the price of cream (Finance, 2017).

The model describing the development of the consumer price of butter in the Czech Republic is based on the time series analysis. The main features of the ARIMA model were detected using index analysis and Box-plot analysis. The development of the time series of the consumer price as well as the development of base and chain index (see Figure 1) has discovered change in the trend in July 2017. Since this period the consumer price of butter has been characterized by steep increase as first and subsequently steep decrease in the last periods of the time series. Thus, an instrumental variable (I1) describing this change has been employed into the model.

Figure 1. Index analysis

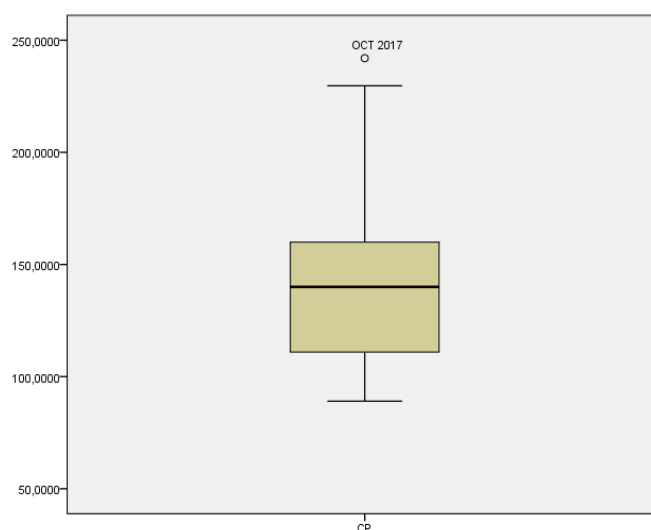


Source: own calculation

Then, Box-plot analysis has detected an extreme value of the time series in October 2017 (see Figure 2). Thus, another instrumental variable (I2) has been included into the model to describe this outlier.

On the other hand, the financial crisis was not detected as a significant break in the time series of consumer price of butter; even, Gebelová (2010) shows that the essential reason for the fluctuations of the price of milk and milk products in period 2008 – 2009 is the impact of the economic crisis.

Figure 2. Box-plot analysis



Source: own processing

Based on Autocorrelation function (ACF) and Partial Autocorrelation Function (PACF) a non-stationary character of analyzed times was detected while the time series of the 1st differences might be considered as stationary. It means that the time series of the consumer price is non-stationary and integrated of order 1, i.e. I(1). The development of the consumer price of butter in the Czech Republic is finally described using ARIMA model, concretely SARIMA (1,1,0) (1,0,1)₁₂. It means that the model is integrated of the 1st order and contains autoregressive process (AR) lagged 1 period, seasonal autoregressive process (SAR) lagged 1 period, seasonal moving average process (SAM) lagged 1 period and 2 instrumental variables I1 and I2. The first one showing the change in the trend (unexpected increase/decrease of consumer price of butter since July 2017) and extreme value of the consumer price of butter discovered by the Box-plot analysis in October 2017. The parameters of estimated ARIMA model and their characteristics are shown in Table 1.

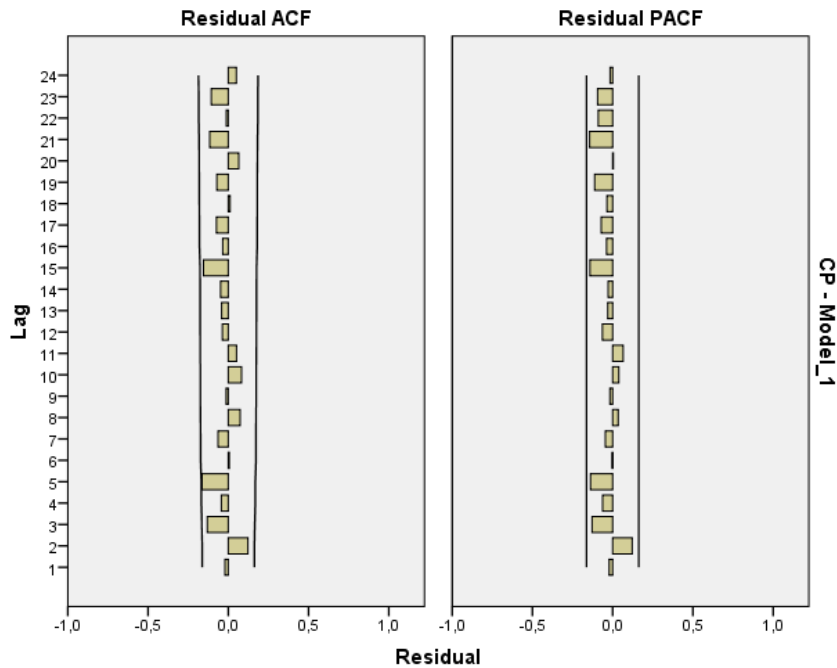
Table 1. ARIMA (1,1,0) (1,0,1)₁₂

ARIMA	Estimate	SE	t	Sig.
AR_lag1	0.34	0.082	4.137	0.000
AR_seasonal_lag1	0.991	0.115	8.609	0.000
MA_seasonal_lag1	0.951	0.327	2.91	0.004
I1	16.669	4.856	3.433	0.001
I2	9.422	3.074	3.065	0.003

Source: own calculation

The residual analysis as well as the main statistical characteristics show that the model is of a good quality and may be employed for prognostic purposes. The significance value of Ljung-Box test 0.256 proves the null hypothesis about the independence in analyzed time series. R-squared equals 0.97 and stationary R-squared value 0.284. Similarly, residual ACF and residual PACF show that the model has white noise residuals (see Figure 3).

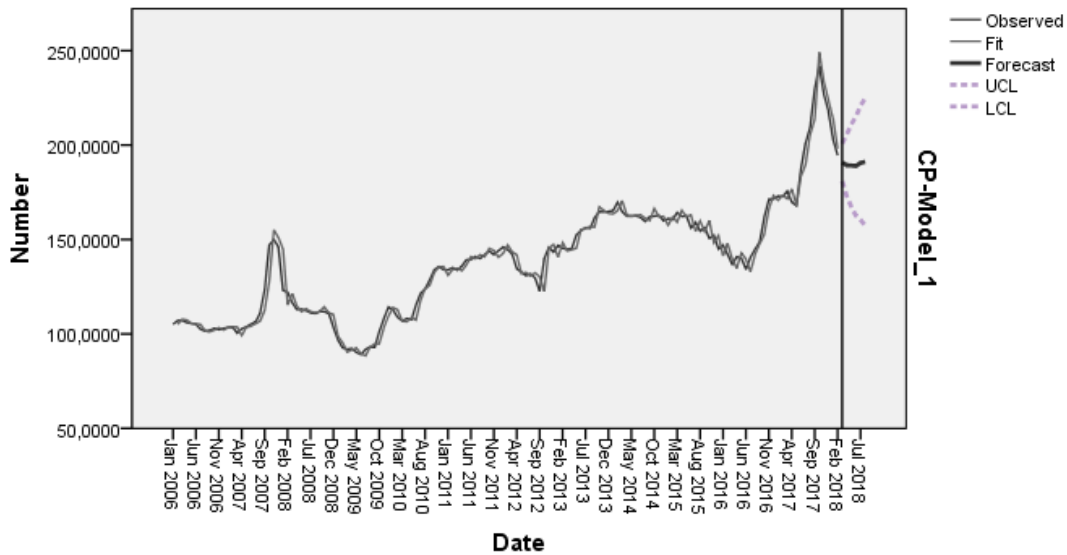
Figure 3. Residual analysis



Source: own calculation

Based on estimated SARIMA (1,1,0) (1,0,1)₁₂ model the consumer price of butter has been forecasted (see Figure 4). According to the model consumer price should decrease in the first periods of prognostic horizon, then, seems to remain almost constant. In conclusion the price of butter should decrease in the future, however, it should remain on higher level compared the level before July 2017.

Figure 4. Consumer price - forecast



Source: own calculation

Finally, the quality of the forecast was evaluated using Mean Absolute Percentage Error (MAPE) calculation. The value of MAPE has been calculated for the forecasted values in period January 2018 – April 2018 (see Table 2). In the short-term period the forecast might be considered as a forecast of a good quality, the forecast error is 5.89 %. However, the longer prognostic horizon, the higher forecast error.

Table 2. Forecast error

Period	CP-real	CP-forecast	MAPE (%)
I.18	203.21	215.1915	5.8961
II.18	194.55	213.93	7.9287
III.18	193.22	213.0632	8.7091
IV.18	184.75	212.2434	10.2521

Source: own calculation

Thus, one may conclude that the consumer price of butter may be successfully forecasted in a short-term period. Due to the global situation at the butter market, the quantification of the forecast is very difficult. Many factors influences current price of butter. As the forecasted values show the consumer price continue with declining tendency. The same tendency may be confirmed based on real values in year 2018.

4. Conclusion

The aim of the paper was to define the main reasons of the high level of the consumer price of butter all around the world and to evaluate the possibility of the price of butter forecasting. Firstly, the main factors were defined. The development of the consumer price of the butter is all around the world affected by increasing ratio of low-fat cow-milk, development of EUR, increasing price of the cream and increasing demand for the butter.

Subsequently, the time series analysis was employed to describe and forecast the consumer price of butter in the Czech Republic. Based on the time series containing monthly data an appropriate SARIMA model (1,1,0) (1,0,1)₁₂ with 2 instrumental variables was estimated.

The estimated ARIMA model describes the development of consumer price of butter in the Czech Republic very well. However, the question is whether the forecast of a good quality can be derived based on this model. Due to the current situation at the butter market, short-term prognosis may be derived, while higher forecast error is connected with the medium and long-term forecasting. Despite increasing value of the error, estimated model might be considered as the model suitable for prognostic purposes.

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ASSESSING FOOD SAFETY STANDARDS COMPLIANCE: A CASE STUDY OF KOSOVO

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Annotation: This paper aims to assess food safety standards compliance on Kosovo. While trade barriers are being steadily reduced, the attention has been shifted on food safety standards, which subsequently have a direct effect on the access of developing countries in global markets. Substantial investments in the field of food safety standards are required to be implemented in developing countries, so that the output is in accordance with the regulatory requirements and Sanitary and Phytosanitary (SPS) measures. In reality, the developed countries set the regulations which apply in trade; hence, the burden falls in the developing countries. As a result, due to the lack of sufficient resources, Kosovo is failing to comply with international practices and regulations. Given the complexity of the topic, the UNIDO cost benefit approach was undertaken. The approach measures three indicators of a country's standard compliance capacity: i) import rejection data; ii) buyers' perceptions on the compliance capacity; and iii) Trade Standards Compliance Capacity Index. As such, a comprehensive picture on Kosovo's compliance with the food safety standards was created. A consensus among researchers has been reached in highlighting that the exports of developing countries are negatively affected from the food safety standards. In accordance, the model shows that SPS measures are highly subjective and allow room for interpretation; therefore, there is room for manipulation. Throughout history, Kosovo has been denied access to export markets under the pretext of failing to meet the food safety standards and regulations. However, findings show that buyers are optimistic on the potential benefits which may derive from imposing food safety standards. Last but not least, the findings show that Kosovo needs more financial and technical support in complying with the safety regulations and standards.

Key words: exports, foreign trade, food safety standards, Kosovo, developing countries

JEL Classification: Q17, F41, F13

1. Introduction

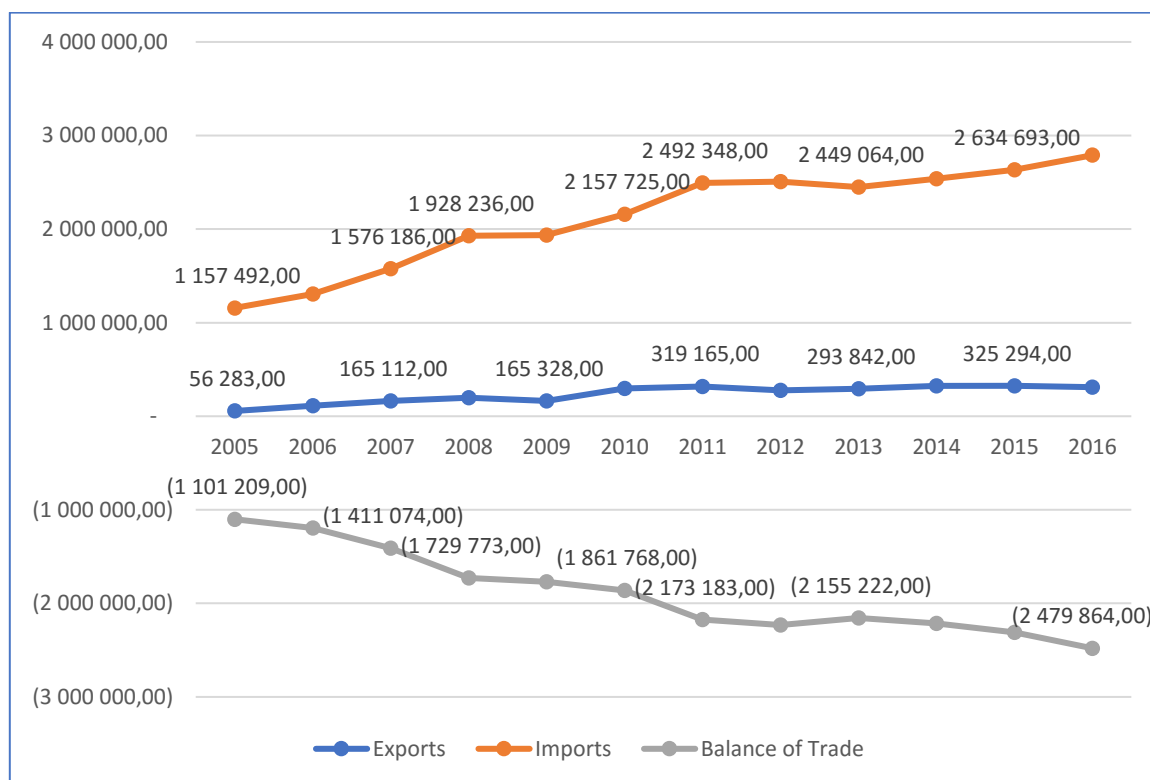
While the most common trade barriers among countries, such as tariff barriers, non-tariff barriers and quotas are being steadily reduced, the attention has been shifted on food safety standards. According to Beghin (2017) food safety standards are important non-tariff barriers which are used as policy measures to regulate international trade. Schuster and Maertens (2015) argue that food safety standards have a direct effect on the access of developing countries in global markets. Research in the field of food safety standards shows that food safety standards and regulations hinder international trade among countries; therefore, affecting the access of in particular developing countries to global markets (Henson and Jaffee, 2007; Schuster and Maertens, 2015). As a result, substantial investments in the field of food safety standards are required to be implemented in developing countries, so that the output is in accordance with the regulatory requirements and Sanitary and Phytosanitary (SPS) measures. Food safety standards include but are not limited to traceability, product certification and environmental standards; therefore, most of the time compliance requires action by the responsible government bodies as well as exporting companies. In practice, the developed countries set the regulations, which apply in trade; hence, the burden falls in the developing countries. As such, developing countries are denied access to global markets because they fail to meet the required criteria (Szczepaniak and Tereszczuk, 2016). Research in the field of food safety standards has shown that outdated laws, lack of the required knowledge among the responsible appointed parties, limited research funding and the lack of awareness on food safety standards may affect compliance and participation of a developing country in international

trade (Henson and Loader, 2001). The aforementioned list of factors, which affects international trade for developing countries holds true for the case of Kosovo as well; therefore, due to the lack of sufficient resources, Kosovo is failing to comply with international practises and regulations.

The ongoing negative trade balance is one of the most serious problems in Kosovo since 1999. After the 1999 conflict, Kosovo’s economy has experienced a downfall, with almost non-existent industries; therefore, the country heavily relied in imported goods. As such, food safety remains a challenge due to the fact that meeting domestic demand overpasses the environmental and health concerns (World Bank Group, 2018). To date, the situation remains the same as Kosovo’s trade deficit has reached the highest level in years at over €2.5 billion, which is equivalent to 40% of its GDP (World Bank Group, 2018).

One should note that the gap is still very high, even though in average, during the period 2005-2016 exports have reached an increase of roughly 21% when compared to imports which have reached an increase of 9% for the same period (Ministry of European Integration, 2018). The total value of Kosovo exports during the period 2005-2016 has reached more than €2.8 billion (Kosovo Agency of Statistics, 2018).

Figure 5. Kosovo Balance of Trade



Source: Kosovo Agency of Statistics, 2018

Extant literature shows that developing countries have a comparative advantage over developed countries in the field of agriculture and food products (Murphy and Shleifer, 1997); therefore, according to Gallopin (2003) the ability of the developing countries to gain access in global markets will depend not only on price but also the quality and safety of the products. In order to soften the trade deficit, Kosovo needs to increase its exports. Due to abundant productive land, which is not optimally used, according to Tosuni and Vokri (2015) Kosovo could reach a competitive advantage; therefore, the agriculture sector is seen as the best prospect industry for exports. Along the same lines, the demand for milk and dairy products is also expected to grow. The livestock and meat processing sector is foreseen as a lucrative opportunity as the domestic production does not yet meet the market demand (Tosuni and Vokri, 2015).

The main objective of this paper is to assess food safety standards compliance on Kosovo; thus placing special emphasis on the underdeveloped quality control mechanisms, which threaten exports and international trade of the country.

2. Materials and Methods

The study focuses on assessing food safety standards compliance on Kosovo. The country was chosen primarily for having a developing or transitioning economy, where the importance of exports has significant implications to the overall economic success of the country. While this is the practical significance in terms of the geographical choice, the implications for academia are also relevant since very little research considers developing countries. Even less research is conducted in the field of food safety standards on Kosovo. Considering the nature of this research paper, the study is heavily based on the data published by the Kosovo Agency of Statistics, reports, analysis as well as publications. It presents a comprehensive analysis covering the period 2005 to 2016.

In search of consistent data sets which funnel the process of exploring the compliance patterns with food safety regulations on Kosovo, three indicators are taken into consideration: i) import rejection data, ii) buyer's perception on the compliance capacity; and iii) Trade Standards Compliance Capacity Index; therefore the UNIDO cost benefit approach is undertaken (UNIDO, 2018). The first indicator, the import rejection data, indirectly measures the compliance performance of Kosovo with food safety and quality requirements in global markets. It serves as an indirect tool of measuring compliance, as non-compliance may result in border rejection of products by government authorities of the importing country. The import rejection sets the path in understanding the scale and root, which has caused non-compliance. Using the European Commission RASFF Portal, the researcher will also be able to identify the measures taken by the authorities of the exporting country. The second indicator, corporate buyer compliance confidence survey, aims to explore the perceptions of the buying companies on the performance of the exporting country. It complements the gaps from the import rejection data in cases when the official measures have not been enforced or trade has not taken place at all. The survey has been taken among buyers within the European Union (n= 74), with respondents from Germany, Netherlands and Austria. The last but not least indicator, trade standards compliance capacity index, includes the assessment of the country in terms of its capacity to meet the Quality Infrastructure (QI). The QI factors include the following: legislative environment, standardization, technical regulations, metrology, accreditation, inspection, testing, certification, food safety, and WTO – related institutions respective to technical regulations/standards. Ideally, this indicator should be overlooked in cooperation with the government representatives, as it is a country's self-assessment; however, due to the lack of response from government representatives, the researcher has taken five out of 10 QI factors and mapped the answers based on secondary data available. As such, this presents a whole new opportunity for further research to be conducted in this specific indicator.

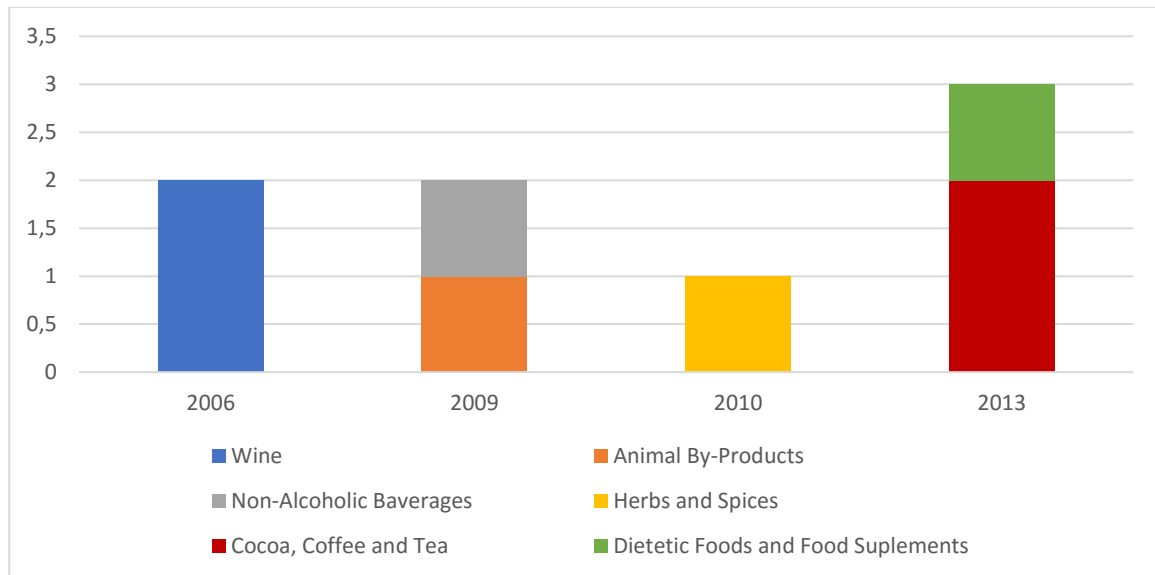
3. Results and Discussion

3.1 Import Rejection Data

In search of data sets which explore patterns of non-compliance, attention has been given to the border rejections of Kosovo food products headings towards European Union. These data show specific cases when products are rejected at the border due to non-conformity. As a result, with border rejection data one is able to identify products which cause persistent rejections, thus, allow room for intervention and improvements. This study examines border rejection data from 2005 until 2016; however, data is available only for the period 2006–2013. Data is available only for border rejection within European Union. Of total rejection of food products, alcoholic and non-alcoholic beverage rejections have repeatedly occurred. Red wine imported to Germany has been found non-compliant twice; both times the wine was contaminated with mineral oils and high levels of alcohol content

(9.97% V/V) was found in a non-alcoholic beer exported from Kosovo to Italy. The products have been rejected at both, the German and the Italian border. The rejection of herbs and spices, occurred for the first time in 2010. Significant increase in rejections was also recorded for the cocoa, coffee and tea products. Most of the non-compliance was found in slimming products that are served in the form of coffee, tea or powder. Unauthorized substance called sibutramine was found. As such the product was rejected at the German border. At all times, one should bear in mind that Kosovo has limited data available at its disposal due to the past political and economic situation of the country. As such, this study sets the framework for future research which offers a more comprehensive analysis of border rejection data, encompassing the European Union but also other markets as well.

Figure 6. Number of EU rejections of food and feed exports from Kosovo, 2006 to 2013



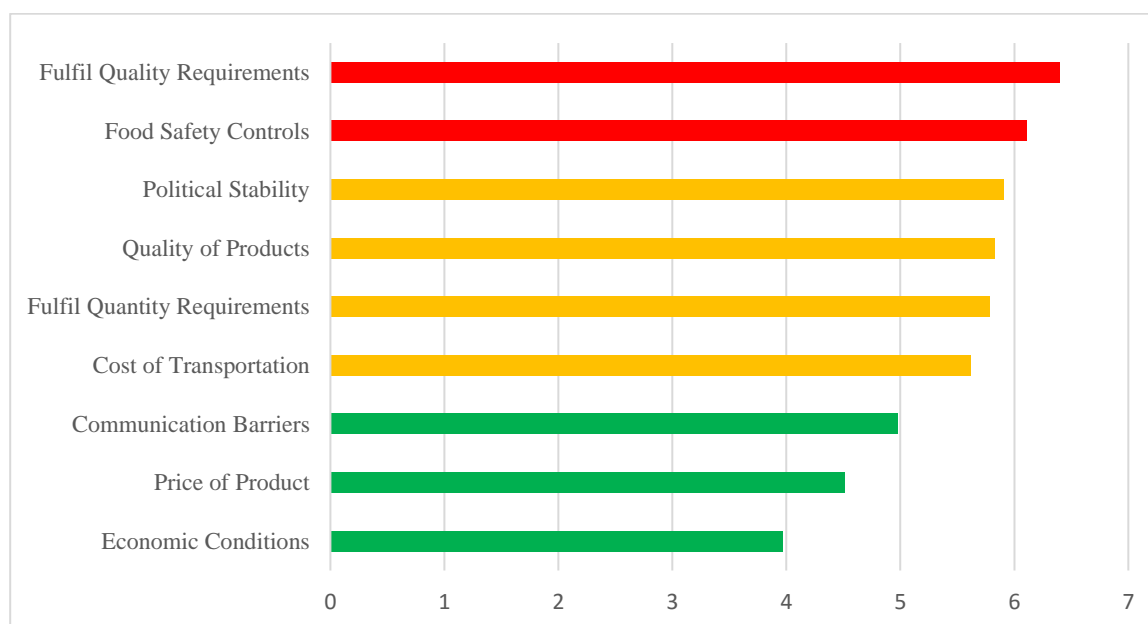
Source: European Commission RASFF, 2018

3.2 Corporate Buyers' Compliance Confidence Survey

The Corporate Buyers' Compliance Confidence Survey is an additional layer of analysis conducted to provide an overview of challenges which developing countries face on daily basis in terms of compliance. It goes one step further than the import rejection data analysis since it takes into consideration the needs of private buyers in export markets. The findings of the survey provide insights on how important are official food safety controls compared to other buyer requirements and investigate how buyers rate local laboratory infrastructure. A total of 300 export market buyers were invited to participate in the survey, of which 74 or roughly 25% provided valid responses. The respondents were mainly from countries with which Kosovo has the highest export rates within the European Union; thus, Germany, Netherlands and Austria.

Survey participants were given a list of nine factors related to quality, food safety, political stability, ability to meet the quantity requirements, transportation, communication and price. For each factor, the respondents were asked to indicate the importance of the factor in decision making based on a seven-point scale from "very unimportant -1" to "very important -7". The average score of each of the listed factors is presented in Figure 3. As Figure 3 shows, the buyers ranked the ability to fulfil the quality requirements as the most important criteria in decision making. Food safety controls is characterized with the same importance in the decision making. These were followed by political stability, quality of products, ability to fulfil the quantity requirements and cost of transportation. The communication barriers, price of product and economic conditions were among the least important factors which influence the decision of the buyer.

Figure 7. Relevance factors of choosing Kosovo



Source: Own Survey

The final issue addressed by the Corporate Buyers' Compliance Confidence Survey is the trust of the buyers towards the local companies. Respondents were asked if: they accept in-country laboratory tests; if buyers undertake in-house laboratory tests and if buyers visit local companies on site. The findings show that 84% of the respondents do accept laboratory tests conducted in Kosovo, only if the laboratories are internationally accredited. Most of the buyers, 63% do not undertake in-house laboratory tests, and last but not least, 68% of buyers carry mostly surprise visits on-site to check on local food safety and quality controls.

3.3 Trade Standards Compliance Capacity Index

Trade Standards Compliance Capacity Index includes the assessment of the country in terms of its capacity to meet the Quality Infrastructure (QI). The QI factors discussed include the following: technical regulations, metrology, accreditation, inspection and food safety.

The technical regulations of Kosovo are partly aligned with *acquis*; therefore, further work need to be carried on market legislation. The responsible institutions for quality assessment have limited staff and financial resources, which hinder full implementation.

In terms of metrology, Kosovo has adopted the legislation designed to align with Measuring Instrument Directive in 2016; however, the legislation is still not aligned with Non-Automatic Weighting Instruments Directive. Data show that there is also a lack of qualified staff and operational laboratories which would enhance the implementation of the directives.

In 2017, Kosovo has adopted the Law on Accreditation, thus officially creating the Accreditation Agency under the administration of the Ministry of Trade and Industry. One should note the Accreditation Directorate has been drafted in 2016; however, limited knowledge and financial resources have put its implementation at risk.

Kosovo has made some progress in meeting the food safety, veterinary and phytosanitary requirements; however, further efforts are required to complete the food legislative framework. Kosovo Food and Veterinary Agency lacks an annual control plan for food and feed safety; therefore, additional financial resources are required in the field.

Last but not least, inspection bodies face financial difficulties in fulfilling their job in regular basis. In 2017, 266 product safety inspections were carried, out of which identified 249 dangerous products which as a result were taken off the market. Due to political reasons, inspections cannot be carried in the North of Kosovo. Inspections in 2017 in the North were followed by a bomb attack.

4. Conclusion

The main objective of this paper is to assess food safety standards compliance on Kosovo. The findings of the study were based on the UNIDO cost benefit approach looking at three specific indicators: i) import rejection data, ii) buyers' perception on the compliance capacity; and iii) Trade Standards Compliance Capacity Index. In terms of import rejection data, findings show that products exported from Kosovo to European Union countries have been rejected at the border due to non-conformity standards. The main rejections have occurred at the German border, with which Kosovo has also the highest export rates. The root of rejection lies on the i.e. contamination of the products with mineral oils as well as significant increase of unauthorized substances in cocoa, coffee and tea products. In order to complement the import rejection data, the buyer's perception on the compliance capacity survey was conducted. Findings derived from the survey show that the market buyers ranked the ability to fulfil the quality requirements and food safety controls as crucial determinants in the process of decision making when choosing the exporting company. The findings of the last indicator, Trade Standards Compliance Index show that Kosovo has made progress in most of the Quality Infrastructure Indicators; however, there is still room for improvement. In order to do so, Kosovo needs to heavily invest in capacity building and legislative framework implementation.

Further study will be devoted in building a comprehensive analysis of border rejection data, as well as conducting buyers' perception on the compliance capacity survey with companies outside the European Union as well.

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SELF-SUFFICIENCY IN SELECTED AGRICULTURAL COMMODITIES IN CENTRAL EUROPEAN COUNTRIES

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Annotation: This article deals with the development of self-sufficiency in selected commodities (sugar, rape, sunflower) for "V4" countries. The data are used for the period 2006-2016 and are drawn from particular statistical offices, or from individual commodity balances, the database F.O. Licht was used for sugar. Self-sufficiency was calculated according to share of domestic production and domestic consumption. The results show that the Czech Republic is self-sufficient in the case of sugar and rape. In the case of sunflower there is a decrease in self-sufficiency in the analysed period due to the decrease of the sown areas and the growth in the domestic consumption. Slovakia is self-sufficient in all monitored commodities – except for small fluctuations in sugar. Hungary is self-sufficient in the case of rape and sunflower. The situation differs in the case of sugar. The rate of self-sufficiency is gradually increasing over the reporting period, but this indicator was only 50% in 2016. Poland is, except for minor fluctuations, fully self-sufficient in sugar and rape. Sunflower is a minor crop in Poland, which is also reflected in the results of the self-sufficiency rate. This rate has a declining tendency over the analysed period, ranging from 21% to 3%. The main reason can be seen in a stagnant production over the growth in the domestic consumption.

Key words: Commodities, Czech Republic, Hungary, Poland, Self-sufficiency, Slovakia, Visegrad countries

JEL classification: Q18, R14

1. Introduction

Food self-sufficiency is currently discussed topic which is related to internal factors of national security; therefore it requires sufficient attention. Multiple authors (Timsina et al., 2018; Prasilova and Prochazkova, 2016; Golebiewska and Stefanczyk, 2017; Sadowski and Baer-Nawrocka, 2016; Kuzminov, et al., 2018) have focused on that problem among various commodities and countries. A rate of self-sufficiency measures the ability of a given country to satisfy all needs of consumers from the country's domestic production. The term self-sufficiency is often confused with the term food security. The whole concept of self-sufficiency, on the contrary to food security, takes in consideration whether the food is imported or produced locally (Clapp, 2014).

Self-sufficiency has recently become a significant factor of the national policy agenda, especially after the price volatility shocks in the years 2007 and 2008. Since then many countries have revealed their interests in improving supply of domestic food consumption. The discussion on food self-sufficiency basically reflects two perspectives. First, defends the national right to insulate national market from world food markets by increasing domestic food production. Secondly, it claims that such a measure increases costs in states which prioritize political considerations in their food policy (Clapp, 2017).

Food self-sufficiency is a serious problem in several regions. Middle East and North Africa are struggling from lack of cereals, and as the biggest importers of cereals pay their attention to reaching self-sufficiency (Woertz, 2017). Same question is asked in China (Ghose, 2014); South East Asia (Ghose et al., 2013; Ritchie, 2018).

The question of self-sufficiency is connected not only with the national or regional production; it is also discussed on the level of individual households. If households can gain some level of self-

sufficiency, this may protect households and even the whole regions from global, regional or local shocks (Fraser, Mabee and Figget, 2005; Pradhan et al. 2014).

Generally there are two different concepts of food self-sufficiency. They range from an extreme form where a government closes the borders completely, to the situation, when a country tries to increase its domestic production (Clapp, 2015) or there are incentives to invest into food production and food processing capacities. Also, within an open market of the EU, the ratio of self-sufficiency has the ability to indicate – to a certain extent – whether a country has a comparative advantage over other countries in production and processing of a certain commodity. Enormous self-sufficiency could indicate that there is an advantage in the production, while in processing a country is dropping behind.

In the Visegrad countries – even though they are members of the EU – the question of the local/national self-sufficiency in food has constantly been discussed. Politicians like paying special attention while addressing national food problems (including the same or double-quality standards, national security, environmental and phytosanitary issues, etc.). Also, they are keen on their own national (regional) food protectionism via multiple “eat-local” campaigns and local food promotion.

Based on above stated information, this contribution aims to measure self-sufficiency of the Visegrad countries (the Czech Republic, Hungary, Poland, Slovakia) in selected (sugar, rape and sunflower) commodities and to characterize its trends. The information is understood to serve well to policy leaders as well as to food processors and investors.

2. Materials and Methods

This article was created within a project focused on the development of self-sufficiency among the Visegrad group in multiple commodities (Kotyza, Slaboch, 2014; Slaboch, Kotyza, 2015, 2016). Methodology might appear similar even though commodities and analysed years are different.

According to Staatz (1991) there are several possibilities how to explain the national self-sufficiency. First, calculations could be based on the complete specification of a commodity (cultivar, class, place of cultivation, manner of cultivation), which is regarded as the most accurate method. Second, a calculation is done only for a specified commodity with respect to species (rice). Third, the self-sufficiency could be calculated for a wide category of goods (cereals) containing several commodities mutually complementing one another. In addition to abovementioned, fourth approach is being used (Sadowski and Baer-Nawrocka, 2016). It uses energetic balance, i.e. domestic production and consumption are expressed in calories.

In this contribution the second approach of Staatz (1991) is applied. Self-sufficiency was calculated using data about production and consumption of specified commodities (sugar, sunflower and rape) in the Czech Republic, Hungary, Slovakia and Poland. Due to the extent of the conference contribution, only self-sufficiency calculations are taken in consideration, no other indicators were calculated.

The aim of this article is to analyse the rate of self-sufficiency development in sugar, sunflower and rape in the Czech Republic, Hungary, Poland and Slovakia. The rate of self-sufficiency is analysed between the years 2006 and 2016, based on the data from national statistical offices (CR – CSU – Czech statistical office; HU – KSH – Hungarian central statistical office; PL – GUS – Statistics Poland; SK - SU SK – Statistical office of the Slovak Republic). The information on production and consumption were gained from national commodity balance sheets. F.O. Licht database was used to gain data about sugar production and consumption (in raw sugar equivalent). If there were not available full data sets of all analysed years for a certain commodity and country, only available data were used.

The calculation of the rate of self-sufficiency is carried out according to the following formula (Lohoar, 1981):

$$\text{Rate of self-sufficiency} = (\text{domestic production} / \text{consumption}) \times 100 (\%) \quad (1)$$

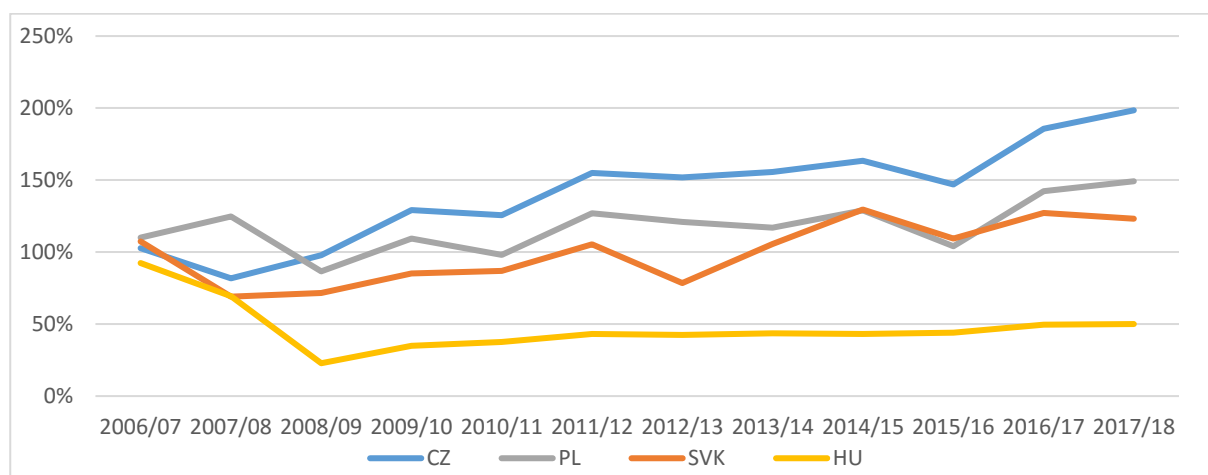
3. Results and Discussion

This chapter presents the results of self-sufficiency in the evaluated commodities in the Visegrad countries. The evaluated commodities include sugar, rape and sunflower, in particular in the period 2006-2016.

SUGAR

Self-sufficiency is a big issue these days; it is being discussed on a national level, regional level (EU) as well on global level. There are many concepts of self-sufficiency. One being used here reflects national production and national consumption of one specific commodity – in our case, self-sufficiency in raw sugar equivalent. As displayed in the Figure 1, the rate of self-sufficiency has an increasing trend in Czech, Polish and Slovakian markets. In Hungary the trend has opposite direction. In all analysed countries we can observe similar factors influencing the self-sufficiency in the sugar sector: (i) EU sugar reform of 2006 and (ii) extreme heat and low rainfalls which negatively influenced production of sugar beet. During the EU sugar reform (2006), production quota in all countries were exchanged for monetary incentives, many sugar production facilities were destroyed. In the Czech Republic and Slovakia Eastern Sugar company renounced quota of 102,478 tonnes in the Czech Republic and 103,717 tonnes in Slovakia. In Poland British Sugar Overseas left operations, by reform Polish quota were down by 366,869 tonnes (European Commission, 2009) and in Hungary the reduction was 301,264 tonnes. Eastern Sugar and Nordzucker renounced all production quotas from Hungary, while Agrana kept only one sugar refinery and the largest European isoglucose production plant. The EU reform that was applied between marketing year 2006/2007 and 2009/2010 significantly influenced a total production in the related countries. Since the reform, the total sugar production has been increasing mainly due to the intensification of the production (Smutka et al., 2018; Benesova, et. al. 2015; Artyszak, et al. 2017) in Poland and the Czech Republic by 5.9%, in Slovakia by 6.1% and in Hungary by 7.4%. On the contrary, the consumption has a slightly decreasing trend (CR -2.9%; PL-0.3%; SK -1.4%; HU -2.8% per annum). Due to the fact that the consumption decrease is slower than the production increase the total rate of self-sufficiency is increasing. From the latest available data we can conclude that the total lowest self-sufficiency is reached in Hungary (50%); than by Slovakia (123%), and Poland (149%). After the reform, the most dynamic increase in the rate of self-sufficiency was observed in the Czech Republic (9.3%) and Hungary (9.1% per annum) while in Slovakia and Poland the annual growth rate reached 6.2%. The highest self-sufficiency is reached by the Czech Republic, which exported about 64% of the national raw sugar production, while Poland exported only 38% of its national production. Strong food industry is able to use domestic sugar and convert it into finalised products with a higher value added. In Slovakia, additionally, Slovakia's production achieved an out-of-scale sugar beet production level within the EU countries in 2004 and 2005. However, farmers of new EU-member-countries benefited from advantages of the EU market rules only for two years (Kovács and Tomkuljaková, 2010). Slovakia's EU entry had a stimulating effect on commodity production of sugar beet (high granted prices and quotes). Due to the market rules reform in 2006 which affected also sugar refinery capacity, sugar beet production declined in Slovakia (Blaas, 2013). As a result of conflicts among sugar refineries and sugar beet farmers at the second stage of sugar refinery restructuralization, a number of sugar beet producers significantly declined after 2008.

Figure 1. Self-sufficiency of sugar (“V4”, %, 2006-2017)

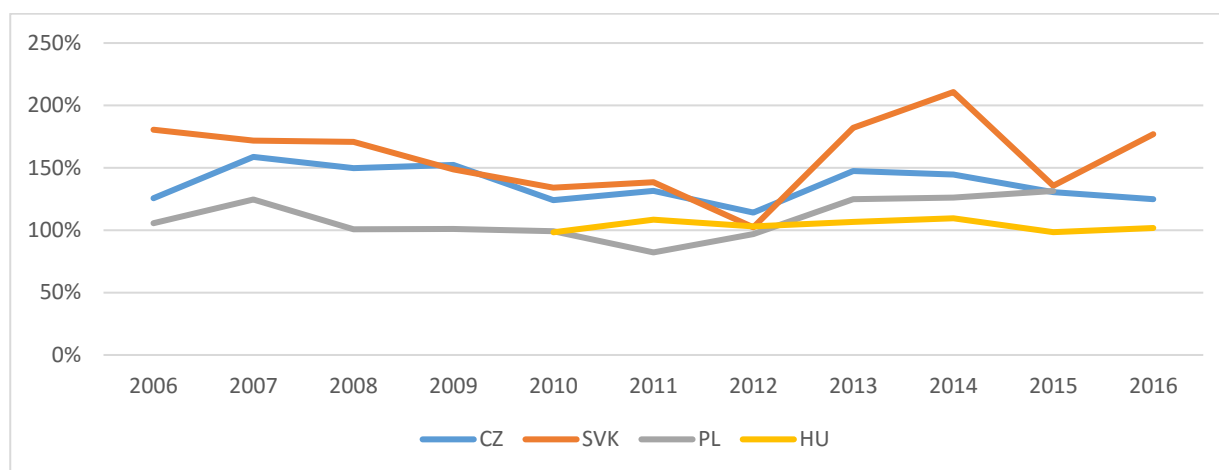


Source: F.O. Licht (2016; 2018)

RAPE

In the case of rape, the Czech Republic is fully self-sufficient. Self-sufficiency ranges from 115 to 160% over the analysed period, with a decreasing tendency since 2013. This decrease is caused by increasing consumption. In 2006, the consumption was 700,000 tonnes, while in 2016 the consumption was already 1,090,000 tonnes (the main reason is the increase in consumption in the area of FAME (Fatty Acid Methyl Esters) – there is a doubling of the consumption for these purposes during the monitored period). The production did not change significantly during the monitored period and ranged from 1,030,000 to 1,360,000 tonnes. In the case of Slovakia, the situation is very similar. Throughout the monitored period the level of self-sufficiency is above 100%, particularly in the range of 133-210%. Significant fluctuations can be seen in the Figure 2 for the years 2012 and 2014. In 2012, the total production of rape was dramatically reduced due to the low yield per hectare (compared with the previous year, total production decreased by 120,000 tonnes, which represents a 30% decrease). In 2014, on the other hand, the yields on hectares increased significantly (compared with 2013, production increased by 75,000 tonnes). Overall, in Slovakia there was an increase in consumption over the monitored period, which increased in the monitored period from 142,000 tonnes in 2006 to the level of 243,000 tonnes in 2016. In the case of the total production, the situation is very similar – during the analysed period it increased from 256,000 tonnes (in 2006) up to the level of 430,000 tonnes (in 2016). In the case of rape, Hungary moves just around the borders of self-sufficiency, without any significant fluctuations. The fluctuations in the level of self-sufficiency are not apparent during the monitored period, but significant volatility can be seen in the case of the production and consumption. The total production during the analysed period ranges from 414,000 to 924,000 tonnes. The total consumption is similar – it copies to some extent the fluctuations in the production. Again, the total consumption is in the range of 401,000 to 909,000 tonnes. In Poland, the level of self-sufficiency falls below the 100% threshold (2006-2011) during the analysed period, and consequently there is an increase over the rest of the period – up to 131% (2012-2016). Over the monitored period, there is a gradual increase both in the total production and the total consumption. Production during the analysed period ranges from 1,652,000 to 3,276,000 tonnes. This increase is not abrupt, but has a gradual character. In the case of consumption, the increase is not so significant, with the total consumption during the analysed period ranging from 1,600,000 to 2,600,000 tonnes. According to Krolczyk et al. (2014) Polish production could be significantly increased, as production could be doubled if investments and know-how provided, yield is still below EU average. In the rest of the countries, average yield is above EU average and comparable to Netherlands, Germany and Belgium (Eurostat, 2018).

Figure 2. Self-sufficiency of rape (“V4”, %, 2006-2017)



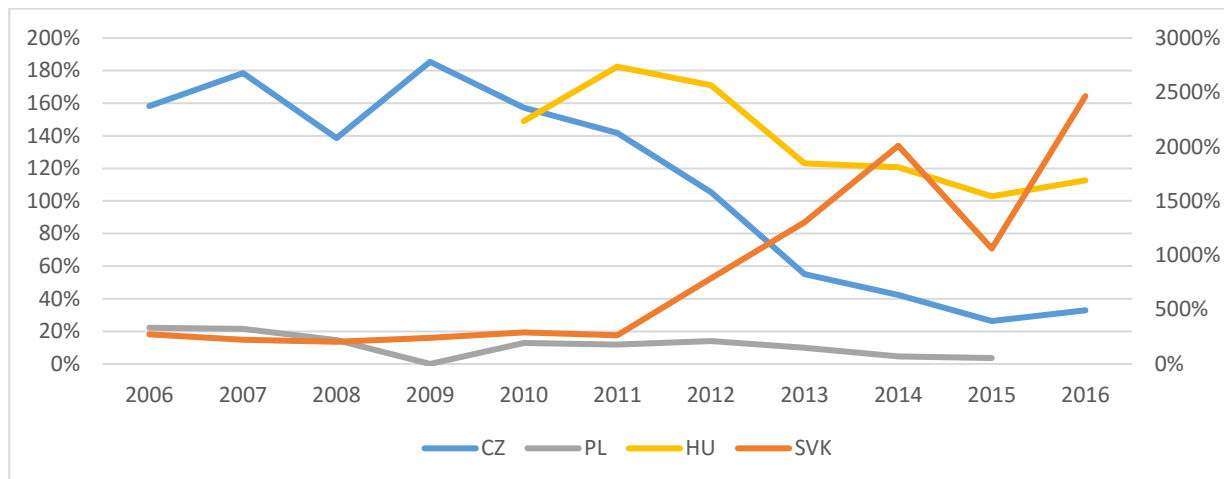
Source: own calculation, statistical office of each country (2006; 2016)

SUNFLOWER

In addition to rape, sunflower is other important oilseed crops with respect to the sown areas. The Czech Republic is in the case of the commodity in decline (see Figure 3). The self-sufficiency rate decreased significantly over the monitored period – from 170% to only 30%. This decrease is caused by a significant decrease of the total production, which decreased during the monitored period from the level of 95,000 to 40,000 tonnes. This decrease is caused by decrease of the sown areas (total drop by 68%). In 2006, the sunflower was seeded at 47,000 hectares, but in 2016 it was only 15,000 hectares. A significant volatility in prices also has negative impact on planting sunflowers; over the monitored period it ranged from 6,000 to 12,000 CZK/t. Another reason is the change in crop rotation, mainly in favour of increasing the sown areas of maize for biogas stations and the introduction of greening. The yield per hectare in the monitored period ranges from 2.15 to 2.60 t/ha. In terms of consumption, during the monitored period a significant increase can be seen. In 2006, the consumption was 60,000 tonnes; in 2016, this is already 124,000 tonnes. The increase in this consumption is covered by a gradual increase in imports. In the case of Slovakia, the situation is quite the opposite. Over the monitored period there is an increase in the total production, which was 195,000 tonnes in 2006, while in 2016 it is already 246,000 tonnes (an increase of 26%). On the other hand, there is a significant fall in the consumption over the monitored period. In 2006, the consumption was 71,000 tonnes, but in 2016 it is only 10,000 tonnes (this decrease is caused by the decrease in the number of mills). Most of the production is exported mainly to the Czech Republic, Germany, and Austria. In the Figure 3 below, therefore, the degree of self-sufficiency is shown on the right (minor axis) due to very high values. The degree of self-sufficiency in this case is in the range of 220 to 2464%. In Hungary, the level of self-sufficiency is 103-180% during the monitored period; a decreasing tendency can be seen in the graph below. The reason for decrease in the resultant self-sufficiency indicator is faster growth rate of the consumption than the production. The total production increased over the monitored period from 969,000 tonnes up to 1,875,000 tonnes (an increase of 93%). However, the total consumption increased more significantly, from 650,000 tonnes in 2006 to the level of 1,664,000 tonnes in 2016 (an increase of 156%). In the case of Poland, it is clear that the level of self-sufficiency is very low and ranges from 4 to 21% over the analysed period. Production does not change over the monitored period, ranging from 4,000 to 6,000 tonnes. The resulting fall in self-sufficiency is in this case caused by increasing consumption. Over the period 2006-2016, the consumption increased from 27,000 tonnes up to the level of 54,000 tonnes. Situation in sunflower and rapeseed oil may be influenced by policy changes in the future. On the level of the EU exist discussions about sustainability

of rapeseed and sunflower usage for bio fuels. According to EU commission, new advanced bio fuels (second-generation) shall be used according to new legislation proposal (RED II). As approved by European Parliament (2018), situation in rapeseed and sunflower usage for FAME shall be capped to 2017 levels and therefore production and consumption shall not be further directly influenced by supply and demand of bio-fuels production.

Figure 3. Self-sufficiency of sunflower (“V4”, %, 2006-2017)



Source: own calculation, statistical office of each country (2006; 2016)

4. Conclusion

From the results the following conclusions are apparent for individual states. For the Czech Republic, a high degree of self-sufficiency can be seen in the case of sugar, where was observed the highest increase in self-sufficiency (CR annual growth of 9.3%). At the same time the Czech Republic shows the highest level of self-sufficiency (200%). In the case of rape, the level of self-sufficiency ranges from 115 to 158%. Since 2013 there has been a decreasing trend caused by increasing consumption. Sunflower, which has a minority representation in the Czech Republic, decreased self-sufficiency from 158% to 30% mainly due to reduction of the sown areas (-68%). In Slovakia, self-sufficiency in sugar beet increased from 70% in 2007 up to 123% in 2017. In the case of rape, Slovakia is self-sufficient and its degree of self-sufficiency varied between 133 and 210%. Therefore self-sufficiency rapidly increased from 220 to 2464%. Hungary achieved the lowest degree of self-sufficiency in the case of sugar. Although it had grown slightly since 2008, in 2017 degree of self-sufficiency was only 50%. In the case of rape, Hungarian self-sufficiency remains close to 100% threshold. Significant fluctuations are, however, evident in both the production and consumption. In the case of sunflower, the self-sufficiency rate was between 103 and 180% with a gradually decreasing trend. In Poland, the degree of self-sufficiency for sugar ranges from 90 to 150% with a growing tendency after 2008. In the case of rape, first we observed decline in self-sufficiency (2006-2011) but after increase up to 130%. Sunflower is a minority crop in Poland. Its degree of self-sufficiency has been declining because of stagnant production.

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ORGANIC MARKET IN POLAND – CONDITION AND DETERMINANTS OF DEVELOPMENT

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Annotation: The objective of the paper is to discuss the state of the organic food market in Poland and indicate the key factors for its further development. Data on organic farming provided by the AFQI and FiBL were analysed in the elaboration. It also presents the results of research conducted in 2012 on retail outlets dealing with organic food, which covered 131 specialist stores, 109 groceries and 179 units of retail chains. Moreover, in 2016 the organic food prices compared to prices for conventional products were observed on a weekly basis in 6 shops offering organic food and 3 with conventional food located in Poznań. As the study results shows, in spite of dynamic growth of the organic agricultural area and number of organic farms, the production volume and the offer in retail remained quite narrow. Considering consumers, quality, taste and health properties of organic food are vital for them. They rather live in cities, have more than average incomes and are mostly interested in purchase of fruit, vegetables or meat. However, only specialist shops have sufficient product range to fulfil the consumers' expectations. Other retailers' offer mostly limits to selected processed products, which mainly results from low level of production and processing. Therefore, large part of the offer must be imported. This reflects in high price of organic food in relation to conventional, which, in terms of relatively small consumers' incomes, lowers the demand quantity.

Key words: organic food market, Poland, demand, distribution, retail, price premiums

JEL classification: D12, D22, M31, Q13

1. Introduction

Currently, the principles of sustainable development are applied in agriculture and therefore, apart from productive function, it fulfils environmental and social functions as well. Organic farming seems to be such production system that enables applying of these principles and simultaneously helps solve economic and social problems (Brožová, 2005). First of all, as a labour consuming production method, it may maintain some workplaces on rural areas as well as contribute to obtaining sufficient farmers' incomes. Not without significance is the fact that it produces high quality food, for which the demand is increasing. Furthermore, there are also favourable conditions for exports of organic products to the EU countries.

The organic farming has been developing in Poland for almost 30 years. A significant growth occurred in 2004, when Poland joined the EU and organic farmers could participate in the agrienvironmental programme and obtain financial support. Since that moment, the organic agricultural area increased by 5.5 times. Despite some decrease since 2014 caused by changes in rules of organic farming support (currently, in order to obtain financial support a farmer has to deliver products to the market), in 2016, 22,435 organic farms ran organic production on the area of almost 537 thousand ha (table 1).

Table 1. Organic agricultural land and number of organic farms in Poland between 2004 and 2016

Year	Number of organic farms	Year-over-year increase (%)	Agricultural land area (in thousand ha)	Year-over-year increase (%)
2004	3,760	64.4	83.7	67.7
2005	7,182	91.0	166.3	98.7
2006	9,187	27.9	228.0	37.1
2007	11,870	29.2	287.5	26.1
2008	14,896	25.5	314.9	9.5
2009	17,091	14.7	416.3	32.2
2010	20,582	20.4	519.1	24.7
2011	23,449	13.9	605.5	16.6
2012	25,944	10.6	661.7	9.3
2013	26,598	2.5	670.0	1.3
2014	24,829	-6.7	657.9	-1.8
2015	22,277	-10.3	580.7	-11.7
2016	22,435	0.7	536.6	-7.6

Source: Zdrojewska I. (2017), "Raport o stanie rolnictwa ekologicznego w Polsce w latach 2015-2016", Warszawa, IJHARS.

The value of organic market in Poland in 2015 was estimated at 167 million euro and was supposed to reach 250 million euro in 2017. Moreover, it comprises only 0.5% of the entire food market in Poland (IMAS International, 2017). Despite the fact that it is relatively small, it indicates high potential for growth. However, there is a number of barriers to the market development, both on its demand and supply side. In the production sphere it results from the fact that high growth dynamics of organic agricultural area in Poland has not resulted in high dynamics of supply volume increase. Although, currently the support system relates the payments with an obligation to sell the products, still part of the converted farms does not deliver goods on the market. Therefore, the supply of organic food is small. It contributes to the low level of domestic processing. In 2016, only 547 companies actually processed organic food, whereas almost 1/3 dealt with fruit and vegetable processing, every sixth with cereals and only a few percent with meat and dairy products. Therefore, very often there are shortages on the market and consequently imported processed products have great share in the retail offer.

Direct selling to individual consumers was formerly the most important distribution channel on the Polish organic food market. However, a disadvantage of this form of selling is the fact that it occurs only on rural areas, while the highest demand for organic food – in cities. Moreover, consumer studies indicate that specialist shops and supermarkets are the basic supply sources of organic food in cities and other forms are of little importance (Łuczka-Bakula, 2007; Pilarczyk and Nestorowicz, 2010). Supermarkets are currently the main distribution channel of organic food in most European countries. The market share of retail networks in total sale of organic food is in the interval between 60% and 90% in Austria, Belgium, Croatia, Czech Republic, Luxembourg (Meredith and Willer, 2016). Recently in Poland this retail form, as well as grocery stores, have been becoming more and more active participants of the organic food market, which, considering the experiences of the mature organic food markets, may be recognised as a positive occurrence.

Large retail chains may become efficient market players on the markets of organic food, however they require supplies of homogenous quality and large quantities. In Poland this may be a problem, because organic food is produced in small volumes, therefore the resources of supply are limited and unstable. Consequently, supermarkets very often import organic food, which results in relatively higher prices (Wier and Calverley, 2002).

In countries like Poland with immature organic food markets, large share of organic food is still sold thorough specialist shops (Atănăsoaie, 2011). Specialist shops struggle for consumers, who need contact with salesperson. In order to compete with large retail chains, specialist retailers have to be innovative, develop new concepts, improve their offer and have full information on the sold products (Santucci et al., 1999). Therefore, in some countries, like Germany, France or the Netherlands, they were considered as a driver for organic market development.

The number of specialist shops in Poland is estimated at over 1,000. Currently in big cities, one may observe an amount growth of outlets dealing with organic food only. They have a wide product range, but they sell at higher prices than supermarkets. Some specialist shops also run internet sale, which will gain in importance in the nearest years (Hermaniuk, 2016).

The prices for organic food are much higher than the prices for the conventional ones. The price premiums are different for diverse product groups – in years 2005 and 2006, they ranged from a dozen in vegetable and cereal products to a few hundred in case of highly processed products (Łuczka-Bakuła and Smoluk-Sikorska 2010). It hinders the organic food market development, because according to a world literature review done by Aschemann-Witzel and Zielke (2014), high price is the main obstacle in purchasing decision of organic food consumers. As shown by the study on acceptance of organic food prices, consumers are not willing to accept such high price levels (Koreleska, 2009; Żakowska-Biemans et al., 2012; Zámková and Blaškova, 2013) and consider the price premiums between 10% and 20% to be adequate (Łuczka-Bakuła, 2007).

Relatively low incomes of Polish consumers and high prices of organic food contribute to the fact that in 2016, the average expenditure on organic food amounted to almost 4.5 euro only, while in other countries it is much higher, e.g. in Denmark 227 euro, Sweden 197 euro, Austria 177 euro and Germany 116 euro (Willer and Lernoud, 2018). The most important motives of organic food purchase are healthiness, lack of harmful substances higher quality of food followed by taste, and naturalness (Żakowska-Biemans, 2011; Bryła, 2016). In Western European countries, more important are environmental issues, however lately they started to gain in significance among Polish consumers (Średnicka-Tober, Kazimierczak and Hallmann, 2016).

Considering the obstacles of organic food purchase, it is worth to emphasise that the knowledge on environmental issues is rather general and incomplete, especially among elder people, who very often see organic food as a “sale trick”. Therefore, identification of organic food is difficult, which additionally undermines its credibility (Witek, 2017; Frostling-Henningsson, Hedbom and Wilandh, 2014).

2. Materials and Methods

The main objective of the paper is to discuss the state of the organic food market in Poland. The elaboration also aims at indicating key factors for further development of the market. The paper discusses the issues concerning demand side of the market (features and behaviour of organic food consumers), main distribution channels and prices of organic food.

The review of literature on organic food market in Poland was carried out in the paper. Data on organic farming provided by the Agricultural and Food Quality Inspection and Forschungsinstitut für biologischen Landbau were analysed as well.

The paper also presents the results of research conducted in 2012 on retail outlets dealing with organic food, which covered 131 specialist stores, 109 groceries and 179 units of retail networks located in eight agglomerations in Poland. The outlets were chosen using purposive selection and inquired in form of in-depth interview. The study concerned organic food product range, supply sources, marketing tools and strategies as well as pricing policy.

Moreover, in 2016 (between February and July) the organic food prices compared to prices of conventional products were observed on a weekly basis. The research was carried out in Poznań in 6 shops offering organic food and 3 with conventional food. The investigation covered 26 products. The results were shown and discussed with the use of descriptive statistics tools.

3. Results and Discussion

According to the research conducted in the retail of organic food, only specialist shops have sufficient product range to fulfil the consumers' expectations. Over 57% of them offered more than 200 different organic products and in 2/3 of the specialist outlets, organic offer constituted at least 80% of the all available products (table 2). As it comes to general groceries, the stores offering up to 100 articles (over ¾) had the highest share. None of the groceries had over 200 organic products in the assortment. In the retail networks, the most units offered between 200 and 300 organic articles, however it was only a small part of their whole assortment.

Table 2. The organic product range in the investigated outlets

Number of the offered organic products	Groceries (%)	Specialist outlets (%)	Retail chains (%)	Share of the organic products in the total product range	Groceries (%)	Specialist outlets (%)
0-50	28.4	3.1	7.5	11-20%	32.2	1.5
51-100	47.7	11.3	14.5	21-40%	33.4	10.7
101-200	23.9	28.5	17.3	41-60%	34.4	22.3
201-300	-	19.0	43.6	61-80%		38.1
over 300	-	38.1	17.1	81-100%		27.4

Source: authors' own research.

Considering the width of the product range, the most specialist outlets offered cereal, fruit and vegetable products, dairy and spices. In turn, in grocery units, cereal fruit and vegetable product as well as spices mostly occurred in the assortment. In retail networks processed products dominated and hardly any supermarket had fresh products, i.e. vegetables, fruit and sausages or meat. The deepest assortment occurred in case of spices, cereal, fruit and vegetable products and the shallowest – in meat and sausages, wherein the offer of the specialist shops was much deeper than in the other types of retail units. Such assortment structure is determined by the above mentioned underdeveloped processing of organic food. Insufficient number of e.g. meat processors reflects in market lacks. On the other hand, according to the consumer study, the quality of conventional meat is worsening and therefore consumers are more and more interested in purchase of organic meat (Łuczka-Bakuła, 2007).

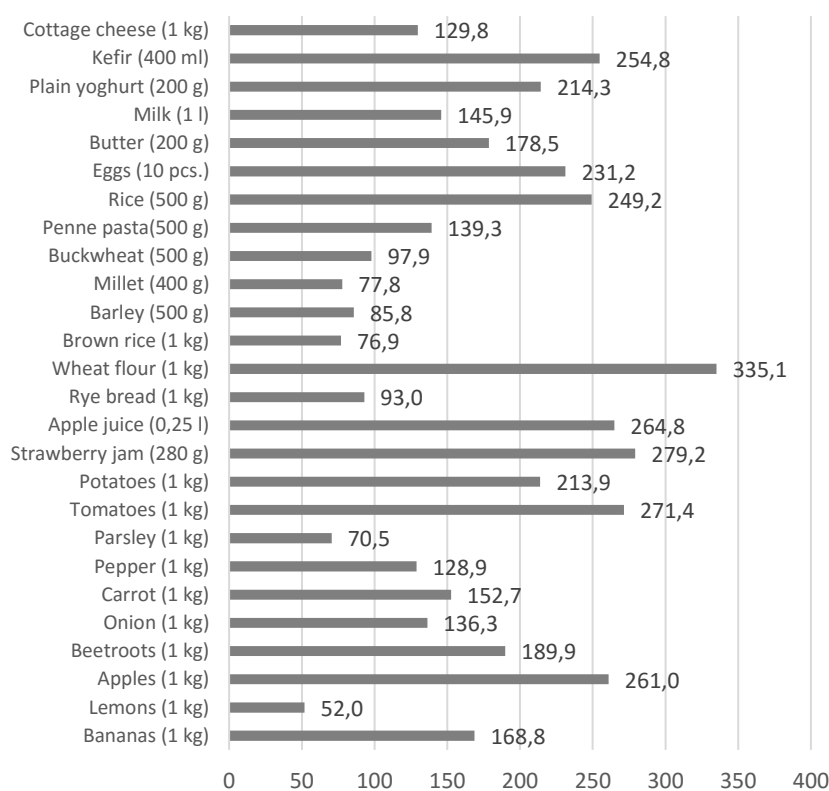
The most important source of supply for the outlets offering organic food is wholesale, especially in dry processed products and in smaller degree in dairy, fruit and vegetable and eggs. Specialist stores and groceries also purchase fresh products, directly from farmers. Processing companies and brokers have some significance as providers of organic food as well, particularly when they deliver products to the outlets.

One of the most essential obstacles of effective distribution of organic food is dispersion of providers. The conducted research proved that average distance from the investigated specialist shops to wholesalers amounted to nearly 146 km and to groceries nearly 160 km. Noticeable differences were observed in case of distance to processors – almost 170 km to specialist outlets and 52 km to groceries. Groceries are provided by processors generally when they are placed in the neighbourhood. As it comes to deliveries from farms – they were located 101 km away in case of specialist shops and 76 km away from grocery outlets.

Longer distance between specialist shops and suppliers, compared to groceries, generally result from the necessity to assure wider product range and therefore they have to look for providers offering varied assortment. Considering retail chains, the purchase is usually made for the entire chain at wholesalers' distant mostly from 20 to 70 km and processors distant up to 300 km.

This reflects in high price of organic food, which, in terms of relatively small incomes of the population, lowers the demand quantity. The study proves that most of the investigated specialist and general grocery shops apply margins in the interval between 21 and 40%, which means that they use high price strategy as they consider organic food as goods of higher order. It is justified to some extent, because they provide specialised service and therefore have higher operational costs. In turn, retail networks declared margin up to 20%, which is in line with their declared low price strategy for the entire assortment. Only the supermarkets offering delicatessen indicated higher margin and high price strategy addressed to the purchasers with high incomes.

Figure 1. Price premiums for selected organic food (in %)



Source: authors' own research.

The conducted research prove that the average prices of organic food are high, which is confirmed by the level of so-called price premium (difference between organic and conventional food), which ranged between 50% and 335% (fig. 1). From the 26 products, which prices were observed, in case of 10 the price premium exceeded the level of 200%, i.e. wheat flour, strawberry jam, tomatoes, apple juice, apples, kefir, rice, eggs, yoghurt, potatoes. For 9 it was in the interval between 100 and 200% (cottage cheese, milk, butter, pasta, red pepper, carrots, onions, beetroots and bananas) and for 7 – mostly processed cereals – below 100% (buckwheat, millet, brown rice, rye bread, parsley and lemon). Lower price premiums for cereal products probably results from the fact that organic cereal processing is the most developed and one can notice some competitive behaviours between processing companies.

4. Conclusion

Although organic farming in Poland has been developing dynamically, the market of organic food still shows the features of the emerging market. The main barriers hampering its development are on one hand insufficient supply, underdeveloped processing of organic food, ineffective distribution channels, which contributes to the high level of price premiums. On the other hand, organic food market development is hampered by low acceptance of organic food price level and small environmental awareness of the consumers. This reflects in irregular purchase and low expenditures on organic food.

To minimize this barriers, the market participants should closely cooperate, both horizontally and vertically. Cooperating farmers may have stronger market bargaining power and they will be able to meet the processors and distributors requirements towards product quality, quantity and regularity of deliveries. On the demand side, the state and large market players should support promotional campaigns delivering complete information on benefits of organic food, its indication, places of purchase etc. The promotion should be also aimed at creating a positive image of organic food.

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BASIC CHARACTERISTICS OF THE CZECH AGRARIAN FOREIGN TRADE DEVELOPMENT: COMPARATIVE ADVANTAGE ISSUES

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Annotation: Czech agrarian trade has undergone a substantial transformation over the last few decades. Its turnover value increased from 118 bil. CZK to 426 bil. CZK. The goal of this article is to identify significant changes that occurred in its territorial and commodity structure in relation to the EU and “third countries”. In addition, the analysis also includes an element that is related to the development and condition of unit prices (CZK/kg) and the physical volume (in kg) of agrarian trade. This paper is based on the application of standard comparative advantage instruments such as the LFI, RCA and TBI indices. The basic source of data for the analyses is the CZSO foreign trade database. The most noteworthy partners of the Czech agrarian trade are the developed countries, particularly the member countries of the OECD (more than 90% of trade value) and more specifically the EU28 (trade turnover is about 376 bil. CZK/year). Based on the overview of the results, which originate from the analysis of the relationship between exports and imports, it is possible to detect the deterioration of the coverage of unit prices of import by the unit prices of export (from 70% to 42%). The basic pillars of Czech agrarian trade comparative advantages and competitiveness in relation to EU countries, respectively “third countries” are the following aggregations (positive values of LFI a TBI index): cereals, tobacco products, living animals, dairy, beverages, oil seeds, animal and vegetable fats, sweeteners, oleaginous fruits, seeds and fruit industrial plants and fodder, cereal preparations, starch or milk pastry cooks' products. In period 2001-2016 the export value of above mentioned aggregations increased from 23 bil. CZK up to 124 bil. CZK (more than five times), while the value of total agri-food exports increased from 49 bil. CZK up to 201.6 bil. CZK (four times).

Key words: Agri-food trade, comparative advantages, value, unit price, territory, commodity.

JEL classification: Q13, Q17

1. Introduction

The Czech agrarian trade has in the last two decades undergone a very substantial transformation (Svatoš, 2008). It was primarily affected in the pre-EU accession period and again in the period following the Czech EU accession. The state of Czech agrarian trade was also affected by applied EU Common Agricultural and Common Trade policies (Smutka, Steininger and Maitah, 2017). Significant transformation processes affected not only its territorial structure but also the commodity structure of the Czech agrarian trade (Burianová and Belová, 2012). In addition, another critical process affecting the state of Czech agrarian trade was the globalization of the world economy, including the agrarian and food markets and also renewable resources policy (Hönig et al., 2018; Hönig, Linhart and Procházka, 2017; Kontsevaya et al., 2015). In this regard, it is necessary to emphasize the impact of multinational capital and foreign investments on shaping the current state of the Czech agrarian sector, especially the food industry (Pohlová and Mezera, 2014). Czech agrarian trade performance is still not completely developed. Its main comparative advantages are based on bulk production, limited added value and low kilogram prices. The majority of comparative advantages are realized particularly in relation to the EU. While in relation to the third countries, comparative advantages are rather limited (Smutka, Steininger and Maitah, 2017). The limited performance in relation to “third countries” is primarily due to the Czech Republic being a “land locked country” and having limited access to non-European regions. A specific contradiction of the Czech agrarian trade is its growth through trend, which is primarily built, not on the growth of the

export of products with a higher degree of processing and higher unit prices, but rather on the continuous growth of the volume of the exported mass. This creates a contradictory set of circumstances in the area of the balance of final trade. Another problem for the Czech agrarian trade becomes the extreme differences concerning the per kilogram prices of realized exports and imports (Burianová and Belová 2012; Smutka, Steininger and Maitah, 2017).

2. Materials and Methods

This article is focused on the issues of transformation of the commodity structure of Czech agrarian trade from 2001 until 2016. The objective of the article is to identify the most significant changes, which occurred in relation to the selected territories. The changes are interpreted by not only utilizing the traditional values concept, but also by the analysis that includes an element related to the development and states of unit prices and the physical volume of agrarian trade. The commodity structure (we applied the HS system of dividing agrarian trade into 24 commodity groups) is analyzed primarily in relation to added value development and distribution. The data sources for individual analyses are the following: The Czech Statistical Office. Collected data covers the following categories: export and import value and volume, and the unit value of realized exports and imports. The paper analyzes, through the use of basic statistical indicators and the general development trends of export and import value and volume. An important part of the analysis is related to the problem of comparative advantages distribution. The basic indicator applied to discover the real state of Czech agrarian trade comparative advantages distribution (at general level) is the standard RCA index (Balassa, 1965).

$$RCA_j^i = \frac{x_j^i - m_j^i}{\sum_{l=1}^N x_j^i + m_j^i} \bigg/ \frac{\sum_{j=1}^N x_j^i - \sum_{j=1}^N m_j^i}{\sum_{l=1}^N x_j^i + \sum_{j=1}^N m_j^i} \quad (1)$$

Where X_{ij} and M_{ij} represent country i 's export and import of product j . $RCA_{ij} > 1$ indicates that country i has a comparative advantage in production of j ; so the greater the index, the stronger the advantage. $RCA_{ij} < 1$ indicates that country i has a comparative disadvantage in the production of j ; so the smaller the index, the greater the disadvantage. For bilateral advantages analysis Lafay index (Lafay, 1992) is applied. The Lafay index helps us to understand the comparative advantages over time. For a given country, i , and for any given product j , the Lafay index is defined as:

$$LFI_j^i = 100 \left(\frac{x_j^i - m_j^i}{x_j^i + m_j^i} - \frac{\sum_{j=1}^N (x_j^i - m_j^i)}{\sum_{j=1}^N x_j^i + m_j^i} \right) \frac{x_j^i + m_j^i}{\sum_{l=1}^N x_j^i + m_j^i} \quad (2)$$

Where x_{ij} and m_{ij} are exports and imports of product j of country i , towards and from the particular region or the rest of the world, respectively, and N is the number of items. Positive values of the Lafay index indicate the existence of comparative advantages in a given item; the larger the value the higher the degree of specialization (Zaghini, 2003). The next part of the analysis presented in this paper was conducted using the analytical tool, called "Products Mapping" (Widodo, 2009). The Product Mapping approach is based on the application of two different indices: The LFI index and The TBI index. Trade Balance Index (TBI) is employed to analyze whether a country has a specialization in exporting (as net-exporter) or in importing (as net-importer) for a specific group of products. TBI is simply formulated as follows:

$$TBI_{ij} = (x_{ij} - m_{ij}) / (x_{ij} + m_{ij}) \quad (3)$$

A country is referred to as “net-importer” in a specific group of products if the value of TBI is negative, and as “net-exporter” if the value of TBI is positive (Table 1) (Widodo, 2009).

Table 1. Product mapping scheme (proposed by Widodo, 2009 and later modified by Smutka, Steininger and Maitah (2017)

Lafay index	LFI>0	Group B: Comparative Advantage Net-importer	Group A: Comparative Advantage Net-exporter
	LFI<0	Group D: Comparative disadvantage Net-importer	Group C: Comparative disadvantage Net-exporter
Czech Agrarian Foreign Trade Commodity Structure		TBI<0	TBI>0
Trade Balance Index			

Source: own modification and processing, 2017

3. Results and Discussion

Commodity structure changes in AZO Czech Republic

Czech agrarian trade has in recent years undergone a dynamic transformation. From 2001 to 2016, the turnover value of realized transactions increased from approximately 118 bil. CZK to approximately 426 bil. CZK. Even though, the values of both exports and imports increased dramatically, the share of negative balance in relation to the turnover of the Czech agrarian trade had been significantly converging as a result of a higher growth rate of the agrarian exports value in comparison with the agrarian imports value. In the selected period the share of negative balance on turnover had been reduced from approx. 17% to approx. 5%. A specific characteristic of the Czech agrarian trade during the monitored period was the significantly higher growth rate of agrarian trade volume in comparison with the agrarian trade value. In the selected period, the volume of agrarian exports increased from about 3.1 mil. tons to more than 16.1 mil. tons, while the value increased from 49 bil. CZK to 201.6 bil. CZK. In the case of agrarian imports, it was the opposite. Significantly, higher dynamics showed import value growth from 69 bil. CZK to 224 bil. CZK, while the volume of realized imports increased from only 3.1 mil. tons to 7.54 mil. tons. The result of the above-mentioned development is an interesting point concerning the relationship between the volume and value of the Czech agrarian trade. The value of the Czech agrarian trade is in a long-term deficit, but volume of Czech agrarian trade is in a permanent surplus. This finding was confirmed already by Tuček (2004) and later by Pohlová and Mezera (2014), Burianová and Belová (2012) or Bielik et al. (2013). During the years 2001 to 2016, the Czech Republic exported around 191 mil. tons of agrarian and food products, while at the same time imported only 86 mil. tons. The specific feature of Czech agrarian trade is much higher dynamic of import price development when compared to export prices. The mentioned negative development trend is typical not only for the Czech Republic, but also for other central European countries as it was confirmed by e.g. Burianová (2011) or Vošta (2012), Bojnec and Fertó (2018). While the unit price of imports grew by an average of 2% per year in the selected period, the unit price of exports declined by less than two percent. The resulting inequity created a situation where, in 2001, the average kilogram price of exports and imports was CZK 16 and CZK 22.25, and in 2016 it was already CZK 12.5 and CZK 29.8. From the perspective of unit price development, the Czech export price decreased by about 25% per kilogram, while the import price increased by about 30%. This evidence suggests that the main driving force of Czech agrarian exports is primarily the continuously growing volume of exported mass and the consistently falling unit price of exports. Limited ability to generate added value and high unit price of exports is long-term weakness of the Czech Republic, but also other post-socialistic countries within the region as it was proved by e.g. Bojnec and Fertó (2015; 2017). In the monitored period, the negative growth rate of unit prices was recorded primarily for the following commodity aggregates: live animals, meat and edible offal, milk, dairy products

and eggs, animal products, cereals, vegetable knitting materials and non-alcoholic beverages. These are in general the aggregates that represent the main foundations of Czech agrarian exports, within which approximately 73% of the volume of annual agrarian exports is realized. In 2016 it was approximately 11 mil. tons out of a total of more than 16 mil. tons of Czech agrarian exports. The analyses (LFI, RCA, TBI) proved that the Czech agrarian export strategy is based on its low unit price character and high volume performance.

EU28 vs. Third Countries

While EU28 countries play the key role as the driver of the Czech agrarian trade, the non-member countries only make up a territorial complement. This trend could be considered as rather negative because of limited heterogeneity and long-term stability of trade performance, but on the other hand it is not only problem of the Czech Republic, but also other central and eastern European countries has been suffering as it was already proven by e.g. Pohlová and Mezera (2014), Fertő (2008), Bojnc and Fertő (2018). The cause of this phenomenon is the geographical location of the Czech Republic, which is “trapped” in the middle of Europe as a so called “land locked country”; moreover, without any maritime access. Regarding the comparison of characteristics of Czech agrarian trade realized in relation to countries of the EU28 and with third countries, it is possible to identify the following differences and facts which are typical in relation to the analyzed groups of countries: The value of the Czech agrarian exports and imports in relation to the EU28 has increased in the years 2001 to 2016 from 42 bil. CZK to almost 185 bil. CZK and from 51 bil CZK to approx. 191 bil. CZK. The negative balance of mutual agro-trade had then significantly approached the values of “balanced” trade, where the negative balance of mutual trade during the period had decreased from approx. 11% to 0.9%. Applying the approach described in the methodology of “product mapping”, it can be stated that in the case of the EU28 countries, as the export partner of the Czech Republic, most of the value of exports is due to transactions with comparative advantages. In 2001, comparative advantages had the following aggregations: HS12, HS22, HS24, HS04, HS11, HS01, HS17, HS03. In 2016, then the aggregations: HS10, HS24, HS01, HS12, HS15, HS04, HS22, HS11, HS17, HS03, HS16, HS09, HS13, HS14. Conversely, the following aggregates were without comparative advantages in 2001 and 2016: HS10, HS14, HS09, HS05, HS16, HS18, HS20, HS15, HS21, HS06, HS19, HS23, HS05, HS23, HS18, HS06, HS20, HS08, HS07 and HS02. From the point of view of the competitiveness of Czech agrarian trade, it is suggested that there has been an improvement in the competitive position of several aggregates in relation to EU28 countries over the monitored period and in addition to the strengthening of the role of Group A (see methodology) in Czech agrarian trade. Within the aggregate segment showing positive LFI and TBI index, it can be observed that the value of exports and imports increased from CZK 23 bil. to CZK 124 bil. and from CZK 12.6 bil. to CZK 82 bil.. The weakness of Czech trade within this segment of goods, is primarily its export structure that is built on high volume items with low added value. Limited added value represents the significant problem and the Czech Republic’s ability to improve the current state is rather limited. One of the reasons affecting our ability to generate higher added value is the specific determination of applied CAP as it was already criticized by several authors e.g. Svatoš and Smutka (2009), Bakucs et al. (2018). While in 2001, Czech exports and imports within this aggregate group were realized at 12.8 CZK / kg and 18.24 CZK / kg, by 2015 the difference in the per kilogram prices of exports and imports had worsened to the detriment of Czech agrarian trade. The price of one kilogram of export was at 7.32 CZK, which was significantly lower compared to the import price of 24.76 CZK / kg. The following data regarding the development of the mass of the realized exports and imports within the above specified group of goods can be mentioned only for reflection. While in 2001, in the monitored group of products with comparative advantages, export and import volumes amounted to approximately 1.79 mil. tons and 0.693 bil. tons, and in 2015 it was approximately 17 mil. tons and 3.3 mil. tons. It can be suggested from the above information that the mass of exports

had almost doubled, and therefore the comparative advantages of Czech agro-trade with the EU-28 countries are built primarily on mass at a consistently decreasing price per kilogram. This is generally a long-term weakness of the entire Czech agrarian trade market, which as a whole, in 2001, recorded unit price of exports cc 20.5 CZK/kg and in 2016 it was only for 9.7 CZK/kg. On the other hand, kilogram import prices in the long run grew from 14.5 CZK in 2001 to approximately 27 CZK in 2016. In the case of third countries – i.e. non-EU countries - the restructuring represents even more significant shifts, leading to an even higher level of weakening of the share of these countries in the Czech agrarian trade. Volume, value and the price of closed contracts experienced substantial changes. While in 2001, the value of exports and imports was roughly CZK 8.3 bil. and CZK 18 bil.. With both export and import per kilogram prices, it was 32.3 CZK and 29.2 CZK. In 2016, the value of exports and imports amounted to approximately CZK 17 bil. and CZK 31.5 bil.. The average per kilogram export and import prices then fluctuated between approximately 38 CZK to 46.24 CZK. The volume of closed contracts increased from 247,678 to 447,368 tons in the case of exports; and in the case of imports, the increase in transaction volume was only slight, from 616,438 tons to 692,041 tons. It is therefore apparent from the above values, that the values characterizing trade with third countries, are significantly lower and different in comparison with the EU28 countries. What is more interesting is the commodity structure. Within Group A, in 2001 and 2016 the value of agricultural exports and imports increased from CZK 6.4 bil. to CZK 11 bil. and from CZK 0.831 bil. CZK to 3.65 bil.. Conversely, in the case of aggregations without a comparative advantage (Group D), export and import values grew from CZK 1 bil. to CZK 2.2 bil. and from CZK 16 bil. to CZK 24.45 billion. It is evident from the above mentioned point, that group A aggregates have experienced more turbulent developments over the monitored years compared to that of Group D aggregates. This can be explained more specifically by the fact that within Group A transactions, in terms of the territorial structure of trade, there was dominance by the OECD and CIS countries. However, for Group D it was primarily long-term non-competitive products being imported from developing countries. In 2001 and 2016, comparative advantages were shown by the following aggregations: HS04, HS17, HS22, HS11, HS01, HS13, HS11, HS01, HS13, HS19, HS04, HS17, HS01, HS24, HS12, HS11, HS13 and HS18. The imbalance between export and import prices within this group of countries is not as significant as that of the EU28. Within the group of products included in group A, export and import prices were on average at CZK 28.8/kg and CZK 41/kg and in 2016 it was CZK 40.9/kg and 66.40 CZK/kg. It is a contradiction that comparative advantages are again realized primarily through low prices and high volumes of goods, where the physical volume of exports increased from 221,703 tons to 286,786, i.e. the volume is significantly higher compared to the volume of imports, which increased from 20,270 tons to 54,952 tons. In the case of segment D, the differences between the export and import prices are not that significant within the monitored years, where the prices increased from 41.84 CZK/kg to 62.66 CZK/kg and from 29.26 CZK/kg to 48 CZK/kg.

4. Conclusion

The Czech agrarian trade has experienced some very significant changes in the past years. However, the process of transformation of its territorial and commodity structure has still not finished. The primary weakness of the Czech agrarian trade is its extreme focus on a limited number of trade partners. This is caused by a number of reasons. First, the Czech Republic is a member of the EU and its agrarian trade is therefore realized under the conditions of the Common trade policy of the EU countries and is under the condition of the Single market. In addition, the Czech Republic is a typical so called ‘land locked country’. Another reason is that Czech agrarian trade suffers from its focus on the export of a relatively limited amount of high-volume items, which can only be exported abroad due to its lower per unit price, limited values added and also high transaction costs connected with its possible export over long distances. In the monitored period, Czech agrarian exports recorded

a significant increase in its value and volume in both export and import, where the dynamics of growth in value and volume of export exceeded the dynamics in growth of import. The weakness, but also at the same time, a comparative advantage of the Czech agrarian export is its significantly low per kilogram prices. This situation, although positive on one hand, cannot be perceived as very complimentary, due to the inability of the Czech Republic to focus on the export of products with higher degrees of processing and therefore higher value added. To understand the aspects of the Czech agrarian trade and its comparative advantages in more detail, it is necessary to separately analyze trade comparative advantages performance in relation to “third countries” and EU countries. In relation to the EU28, the main aspects of comparative advantages are usually semi-finalized agricultural and foodstuff products. In relation to “third countries”, the pillars of comparative advantages are specifically finalized agricultural and foodstuff products.

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UNDERSTANDING THE CONCEPTS OF CORPORATE SOCIAL RESPONSIBILITY AND SOCIALLY RESPONSIBLE MARKETING BY COMPANIES IN FOOD MARKET OF UKRAINE

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Annotation: For most Ukrainian companies, the concept of Corporate Social Responsibility and Corporate Social Marketing is practically new. These approaches are implemented mostly in the big international companies and for smaller local units are not just unfamiliar as a terms, but also their practical implementation is not widespread. Situation is similar in every sector of Ukraine economy, while one of the most visible is food sector. Article describes the level of development of the food market in Ukraine and identifies interconnection between Corporate Social Responsibility and Socially Responsible Marketing on this special market segment. The next part of research will show the different levels of understanding the importance of implementing measures related to CSR and SRM by Ukrainian food market enterprises. Last but not least the reason of not establishing of CSR principles into praxis in Ukraine food industry and their barriers will be identified. Research based on the questioner structured survey among 97 Ukrainian food producers and shows that CSR activities in this sample are partly lagging which is related to the imperfection of the regulatory framework in this area. It also indicate the lack of knowledge and resources as one of the most weight barriers, which do not allow to implement this principles into the activities of enterprises. A positive factor is, that only 9.3 % of the tested companies believe that knowledge about CSR is not important for the enterprise. However, we can conclude, that companies need to improve their skills in implementation of CSR and SRM which can increase not just the level of enterprise competitiveness but also the quality of life of Ukrainian society as a whole.

Key words: market, Corporate Social Responsibility, Corporate Social Marketing, Ukraine, implementation, questionnaire, barriers

JEL classification: M31, L10, L66

1. Introduction

Nowadays the condition of the state food market and its development is one of the crucial indicators of the maturity of country and its position in the international community. Very important is the food security of domestic market as well as its self- sufficiency (Clapp, 2017). Food sector in Ukraine is on the rise and number of involved enterprises are increasing every year. During the period 2004-2007, Ukraine experienced a credit boom fueled by rapid inflows of foreign capital that was intermediated locally through predominantly foreign-owned banks. Foreign-currency denominated consumer lending and household consumption expanded rapidly (De Haas, Djourelova and Nikolova, 2016). The situation has slowed down after global crisis in 2008, but even after signing of the Association Agreement between Ukraine and the EU food market became even more attractive for Ukrainian enterprises. The number of investors increasing not just on the local level, but more and more foreign direct investments are coming (Tarassevych, 2009). The effort of both domestic and foreign producers is not only to secure a strong position on the Ukrainian market but also to use the relatively cheap labor force in Ukraine and offer price-competitive products on foreign markets. Interesting in this respect is primarily the EU market. On the other side, this internationalization

attempt often successes the problems in the advanced markets of Western Europe. Ukrainian companies on these markets must keep pace with the tendencies of intellectual development. One of the biggest gaps between Ukrainian and EU companies is visible in the level of knowledge about Corporate Social Responsibility (CSR) and Corporate Social Marketing (CSM) which can be considered as strong components of the success on the advanced world markets. In addition, Ukrainian food industry still has to face several problems. According to Poperechnyi and Kleban (2009), one of the biggest is, that enterprises have insufficient of means of production and financial resources. The value of capital assets, which are used in agricultural production, have reduced more rapidly than in other activities, which are carried out by agricultural enterprises. This results in difficult financial situations of entities, unfavorable investment environment in agriculture and attempts of diversification of activities of agricultural enterprises by looking for profitable types of economic activities.

Implementation of “responsible” business activities requires managers to understand the concept and principles of building Corporate Social Responsibility (CSR) and in connection Socially Responsible Marketing (SRM), since this is built on the concept of CSR. Commission of the European Communities (2001) defined CSR “as a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on the voluntary basis”. According to Preston and O'bannon (1997), CSR reduces firm costs, create value for stakeholders and craft internal capabilities, such as being first mover in an industry, while all these contribute to the competitive advantage of a firm. Since marketing is a key business discipline that is perhaps one of the most heavily concerned with the link between companies and environments in which they are embedded (Vaaland, Heide and Gronhaug, 2008), the Socially Responsible Marketing (SRM) as a term was created. Title generally describe an approach for integrating social responsibility and ethics into the marketing planning process (Robin and Reidenbach, 1987). This type of marketing is operating as one of the components of CSR that provides interaction between the enterprise with the environment through a system of relations with distribution channels and consumers, in determining pricing policies and the promotion of the products on the market, build relationships with suppliers and etc. Understanding the peculiarities of ensuring the interaction of the enterprise with the market on the basis of SRM allows achieving the strategic goals of the enterprise and introducing the concept of sustainable development in the enterprise activities and responding to the challenges of society by solving the most urgent socially significant problems.

For many entrepreneurs, CSR of business and SRM are the same (or at least similar) concepts. However, most of those companies do not even realize that the evolution of marketing has reached the point where new models begin to develop. These ideas aim at raising the development level of business and achievement of combining the preferences of consumers, producers and society as a whole (Shtal and Tyshchenko, 2012). Thus, CSR is a free choice of the company towards a commitment to improving the well-being of the society, implementing appropriate approaches to doing business and appointment corporate resources (Andrusko, 2013). According to Carroll (1979), in order to determine social responsibility to the fullest extent, an enterprise should take into consideration the economic, legal, ethical and discretionary categories of business activity. These four lines more precisely classify the social obligations of the business. While Ubrežiová and Horská (2011) also believe that social responsibility is based on the expectations of society at a certain time in the economic, legal, ethical and philanthropic spheres. Socially responsible marketing follows this principles at promoting point of view and it can be described as simple combination of terms: marketing, social science and ethics, which work in sum and do not give a result if one of the factors in missed. Thus, we can consider it (Kozyn, 2016) as a concept that involves building a system

of market activities of the company (including its internal and external elements) on the basis of balancing and harmonizing factors such as achieving the company's economic goals, meeting the needs of consumers, and ensuring the long-term interests of society. The analysis of theoretical approaches allows us to conclude that SRM can act as a component of CSR, as well as implement the principles of CSR in interaction with consumers, without being an element of it (Mostenska, 2016).

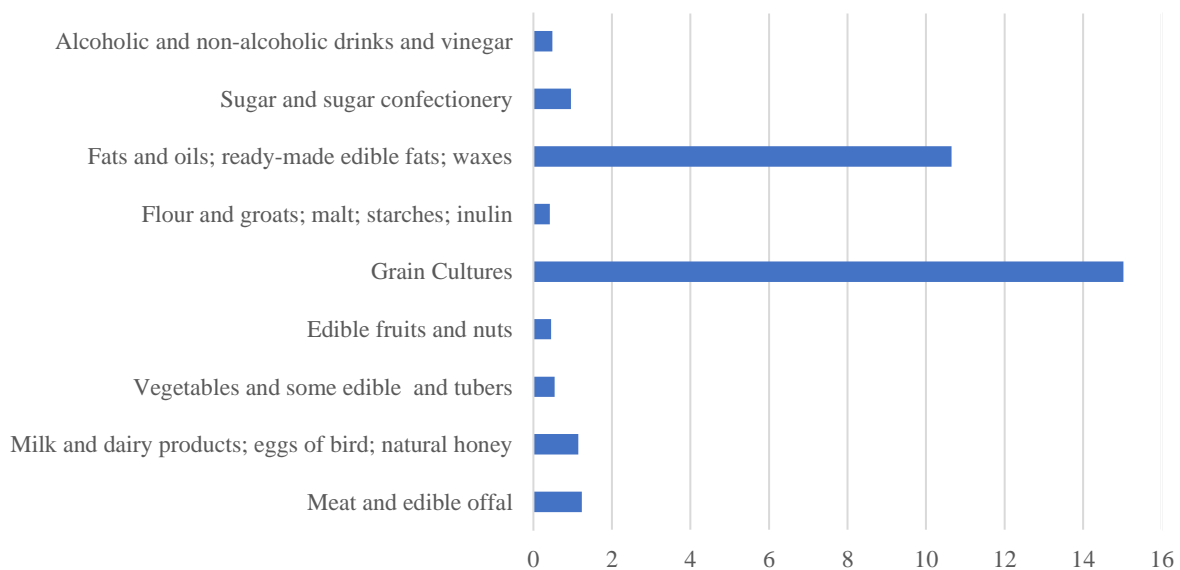
2. Materials and Methods

Paper based on the questioner survive conducted on the sample of 97 Ukrainian companies which are involved in the food industry. The main objective of the survey was to describe the level of understanding concept of “Corporate Social Responsibility” and “Socially Responsible Marketing” in Ukrainian food industry and to recognize main barriers for firms during the implementing these concepts.

3. Results and Discussion

In recent years, the Ukrainian food market shows only affirmative changes that have a positive impact on the economy as a whole. For example, exports of goods from Ukraine are approaching record levels throughout its history, despite numerous predictions about catastrophic consequences for our economy, because of the curtailment of trade relations with Russia, and now from the blockade of the occupied regions of Donetsk and Luhansk regions. Figure 1 shows export of separate groups of food products in Ukraine.

Figure 1. Export of separate groups of food products in Ukraine, % from all capacity of export



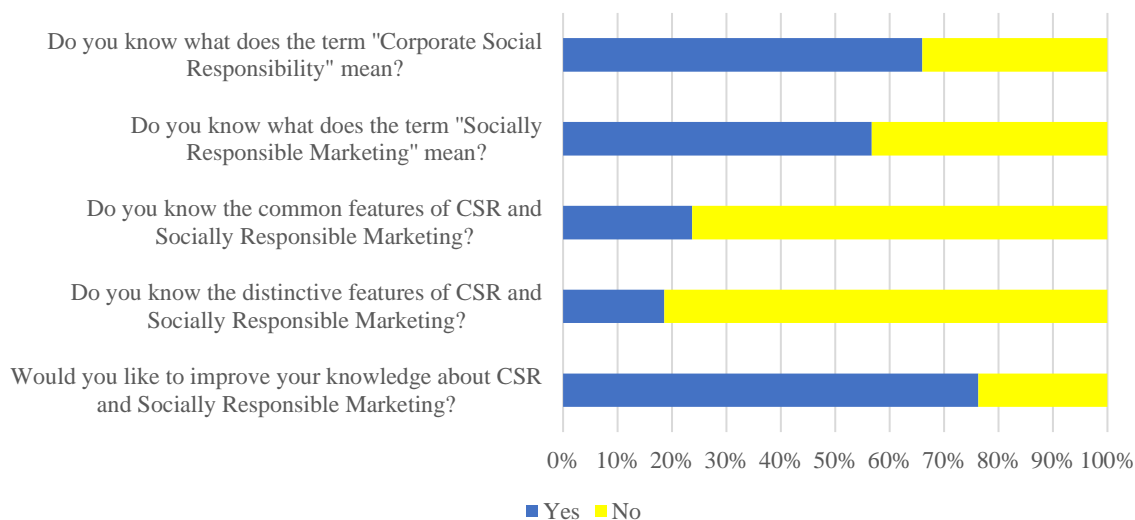
Source: State Fiscal Service of Ukraine, 2017

According to Table 1, it can be seen that grains cultures and oils are the export leaders in the food market. Nevertheless, into consideration has to be take that, domestic food market of Ukraine expressed regional differences. According to Kleban and Poperechnyi (2011), each region has its own conditions for its functioning, which are stipulated by resource potential of enterprises, level of development of market infrastructure, natural conditions, regional specialization etc.

During the survey, an investigation of 97 small and medium-size companies in Ukraine was made. The survey did not take into account the business sphere of the company and the legal form

of business. Figure 2 shows us the level of understanding by the surveyed companies the concepts of CSR and corporate social responsibility and socially responsible marketing.

Figure 2. Level of understanding concept of “Corporate Social Responsibility” and “Socially Responsible Marketing”, %



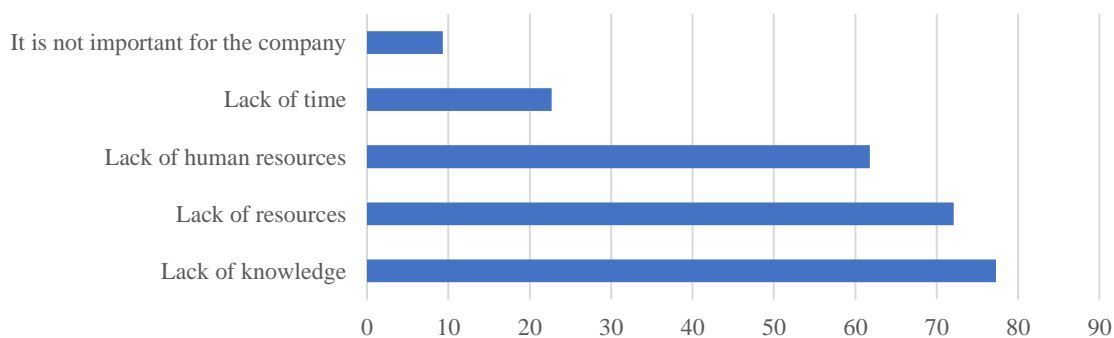
Source: Own research

According to the results of the survey, we can say that most of the surveyed enterprises understand the meaning of those concepts. However, it should be noted that only 23% of firms know the common features of CSR and marketing, and 12% of companies know the distinctive features of these two terms. The positive thing is that 76% of the tested companies want to improve their knowledge in this area.

As you can see, corporate social responsibility and Socially Responsible Marketing have a close relationship since both are aimed at making profits, as well as increasing the competitiveness of the company and its products (Didkyvska, 2009).

Figure 3 indicates which factors companies consider as main barriers to further/begin CSR and socially responsible marketing activities.

Figure 3. Factors, which companies consider as main barriers to further/begin Corporate Social Responsibility and Socially Responsible Marketing activities, %



Source: Own research

The research has shown that lack of knowledge and lack of resources are one of the most weighty barriers, which do not allow to implement CSR and socially responsible marketing into the activities

of enterprises. A positive factor is that only 9.3 % of the tested companies believe that knowledge about CSR is not important for the enterprise.

Socially responsible marketing takes place before corporate social responsibility comes into play, but it also operates rather long-term, in contrast to social marketing; funding. Getting funds goes directly from the company's profit, but other types of financing are possible for social marketing (Mostenska, 2016).

4. Conclusion

Summing up the above, we can conclude that corporate social responsibility and socially responsible marketing have obvious structural relationships that affect the company both externally and internally. Strong and invincible competitive advantages of the company are created by forming the right attitude to these two categories, since corporate social responsibility and socially responsible marketing act in the field of society and consumers of goods and services for which the company works and without which it will cease to exist. However, one should not forget that, despite the common features, there are a number of differences between these two terms.

Moreover, these two categories should both be present in the strategic plan of the company. Also, we should notice that corporate social responsibility and socially responsible marketing are using different methods and types of analysis to predict various changes and the dynamics of enterprise development and quality of life of society (Andrusko, 2013).

It is also worth noting that during the questioning at enterprises of Ukraine, the author determined that most enterprises are familiar with the terms of “Corporate Social Responsibility” and “Socially Responsible Marketing”. However, we can consider that small and medium-size companies firms need to improve their skills in these areas, as the implementation of CSR and socially responsible marketing will increase not only the level of enterprise competitiveness but also the social quality of life of society as a whole.

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CAPITAL STRUCTURE OF FARMS VS. PUBLIC POLICIES. A SYSTEMATIC REVIEW

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Annotation: Shaping capital structure of farms is important for managers, financial institutions and policy makers, taken the issue of economic and financial viability of farm households that ensure food security. Our main paper objective is to identify interdependencies between capital structure of farms and public policies. Our particular attention has been paid to family-owned farm households taken their importance in the agricultural sectors in the majority of EU countries. In the five-procedure systemic review academic and practitioner-oriented literature were explored. We identified three key research streams that may be derived from a systematic review of literature oriented to a nexus between capital structure of farm households and public policies: (1) the impact of governmental support programme, (2) participation of farmers in risk management programmes (inter alia, crop and livestock insurance), (3) the effect of tools of monetary/fiscal policies. A nexus between capital structure and public policies seem to be an important challenge, taken potential changes in agricultural policy tools (for example, so called "financial instruments" in CAP). Further analyses should include research perspectives interdisciplinary angles (i.e. economic psychology, neuroeconomics).

Key words: capital structure, debt, agricultural finance, agricultural credit, public policies.

JEL classification: G32, Q14, Q18.

1. Introduction

Shaping capital structure (inter alia, debt level) of farms is important for managers, financial institutions and policy makers, taken the issue of economic and financial viability of farm households that ensure food security (see: Collins, 1985; Turvey and Baker, 1990; Featherstone et al., 2005, Aulová and Frýdlová, 2012). There is a growing body of papers related to determinants of capital structure as a response to the strong development of theoretical models of the capital structure. Nevertheless, a particular focus has been paid to listed companies that are strongly related to financial markets. The so-called "industry effect" is important in explaining the capital structure of economic entities and, consequently, there are some strong variations in capital structure across sectors (Udell and Berger, 1995; Abor, 2007).

Nowadays the development of agricultural sector significantly depends on access to borrowed capital, mainly in the form of agricultural credit. At the micro-level farm households are characterised by "high proportion of capital assets" and "high proportion of equity capital investment" (Barry and Ellinger, 2012, pp. 7-8). Not only managerial features but also capital structure management are considered as significant determinants of farm growth (Patrick and Eisgruber, 1968). The role of financial institutions in providing agricultural credit is determined by a set of various external and internal determinants (Kata, 2011; Kulawik and Wieliczko, 2013).

As Kulawik and Wieliczko (2013, p. 40) rightly explored, "the relations of agricultural credit, monetary policy and the national economy are complex". Moreover, the agricultural credit (including forms of preferential credits as tools of financial interventionism) is affected by the monetary policy, economic growth and socio-economic development. On the other hand, the preferential credits can lead to a slight imbalance of public finances (Kulawik and Wieliczko, 2013; Gao and Leatham, 2017).

Our main paper objective is to identify interdependencies between capital structure of farms and public policies. Our particular attention has been paid to family-owned farm households taken their importance in the agricultural sectors in the majority of EU countries.

2. Materials and Methods

We followed a methodological approach of Denyer and Tranfield (2009) who presented a five-step procedure for a systematic review: *Question formulation; Locating studies; Study selection/evaluation; Analysis/synthesis; and Reporting/using results*. In order to identify interdependencies between capital structure and we explored both academic and practitioner-oriented literature (FAO, World Bank, OECD, EU institutions). In search engines Scopus and Web of Science (WoS) we used two strings TITLE-ABS-KEY: (1) ("capital structure" AND farm* AND polic*) OR ("capital structure" AND agricultur* AND polic*) and (2) ("capital structure" AND farm*) OR ("capital structure" AND agriculture). Furthermore, we employed additionally *Agecon* search engine in order to find some related proceedings papers. We did not use any constraints to timespan and location of studies in order to study an evolution of research approaches. Additionally, quantitative bibliometric analysis was also employed.

3. Results and Discussion

Table 1 presents search results in Scopus and Web of Science (WoS). It should be indicated that Web of Science generated very similar number of results. A set of results from a broad search related to a nexus between capital structure and agriculture/farming shows a strong variety in research approaches related to determinants and effect of debt of farm households. There was a limited number of articles and reviews (<20) referring to interdependencies between capital structure and issues related to public policy.

Table 1. Search results according to strings used related in the systematic review

String used in search engine	Total number of research papers*	The share of papers related to EU MS [%]
("capital structure" AND farm*) OR ("capital structure" AND agricultur*)	56/54	25
("capital structure" AND farm* AND polic*) OR ("capital structure" AND agricultur* AND polic*)	10/10	20

Note: *Scopus/Web of Science
Source: own studies (date: 5.05.2018).

As shown in Table 2, frequently used key words (only in two narrowest search range in Scopus) included categories related to profitability. Moreover, key words describe the connection of farms with EU Common Agricultural Policy.

There are three key research streams that may be derived from a systematic review of literature oriented to a nexus between capital structure of farm households and public policies: (1) the impact of governmental support programme (for example, Atwood, Watts and Baquet, 1996), (2) participation of farmers in risk management programmes (inter alia, crop and livestock insurance, Turvey and Baker, 1990; Enjolras and Sentis, 2011; Enjolras, Capitano and Adinolfi, 2012); (3) the effect of tools of monetary/fiscal policies (for example, interest rates in Eurozone, see: Myyrä, Pietola and Heikkilä, 2011a; Myyrä, Pietola and Heikkilä, 2011b; Wu, Guan and Myers, 2014).

Although several empirical papers focus on determinants of capital structure of farm households or agricultural enterprises (for example, Aulová and Hlavsa, 2013; Stekla and Grycova, 2016; Wang, 2016), a very limited number of empirical studies tackle with the impact of public policies (including interest rate, macro-prudential regulations, on capital structure of farm households. A critical reading of previous literature related to capital structure in agriculture (both at sectoral and farm level) indicate that “risk balancing” concepts relates to the role of public policies (for example, De Mey et al., 2014; Wauters et al., 2015). The issue of ‘risk balancing’ (RB) is of great importance in American literature in agricultural finance. However, in our opinion the significance of this issue will be increasing in EU agriculture that deals with a growing riskiness. As Uzea et al. (2014) stated, the risk balancing literature indicates that governmental support programs may influence risk behaviour of farmers, and, consequently, increase farm risk. As a result, shocks that affect farm households and the level of their business risk may change the level of financial risk (so-called "offsetting adjustments"). Uzea et al. (2014) referred to empirical findings of Featherstone et al. from 1988 and Cheng and Gloy from 2008 who proved that farm policies oriented to business risk reduction may result in increased financial leverage and total risk (the so-called "paradox of risk balancing"). Furthermore, Yan, Katchova and Barry (2004) proposed an econometric modelling approach to investigate into the RB hypothesis using farm level data. They included a constraint on expected utility maximization, given a farm financial structure, and use cluster method to selected "farms on the efficient frontier under expected utility maximization given risk attitude and actual interest rate". To conclude, we may assume that implications of RB result in a more complex and eclectic methodological approach at farm level.

Table 2. Ranks of frequently used keywords and countries of studies referred to analysed papers

Categories	String: ("capital structure" AND farm* AND polic*) OR ("capital structure" AND agricultur* AND polic*)	String: ("capital structure" AND farm*) OR ("capital structure" AND agricultur*)
Main Keywords	Capital Structure (3) Agricultural Finance (2) Academic Research (1) Agricultural Economics (1) Agricultural Production (1) Business Risk (1) Catastrophe Risk (1) Catastrophic Event (1) Conservation Need (1) Cost Of External Capital (1)	Capital Structure (17) Profitability (6) Agricultural Economics (5) Agriculture (4) Capital (4) Czech Republic (4) Agricultural Finance (3) Agricultural Production (3) Debt (3) Europe (3)
Country/Territory	United States (5) Belgium (1) Canada (1) China (1) France (1) Ukraine (1) Undefined (2)	United States (12) Czech Republic (9) Brazil (3) China (3) Canada (2) Greece (2) United Kingdom (2) Argentina (1) Belgium (1) France (1)

Source: own studies computed by Scopus (date: 5.05.2018).

Table 3 presents main research problems with methodological approaches (methods and data used) referring to a nexus between capital structure and public policies. It should be indicated that most papers focus on farm-level analysis. Most papers are based on econometric modelling, nevertheless some of empirical studies employ mathematical programming (for example, Zhao, Barry and Schnitkey, 2008).

Most papers come from US or Canada and they base on relatively detailed farm level. This may be explained by the fact that a relatively long history of farm credit system in the U.S. (origin from 1916). It should be noted that most empirical studies from European countries are based on farm-level data from the Farm Accountancy Data Network (FADN), mainly from national liason agencies. The FADN data may be described as verified and harmonised (at EU level) microeconomic data on 'agricultural holdings' (European Commission, 2014).

Table 3. Methodological approaches of selected empirical studies on the nexus between capital structure of farms and public policies

Research objective	Research method	Data used	Examples of studies
To "present empirical evidence of risk balancing behaviour" farmers in Europe	A correlation relationship analysis and linear fixed (FE) effects regression models	EU-15 FADN panel dataset, 1995-2008	De Mey <i>et al.</i> , 2014
To "identify" determinants of demand for crop insurance, incl. financial variables	Crosssectional and longitudinal analysis	FADN data (farm-level) for France, 2003-2006	Enjolras and Sentis, 2011
To explore relationships of farm programs and farm financial situation on farmers' decisions to hedge with futures or options.	A two-period discrete sequential stochastic programming model of the farm firm	US farm level data	Turvey and Baker, 1990
To test if whether farmers who purchased agricultural insurance will result in higher demand for credit among farmers.	A natural experiment related to Risk Balancing Hypothesis (RBH).	Sample of hog farmers in China (farm level data)	Du <i>et al.</i> , 2016
To apply sustainable growth challenge (SGC) model as 'a conceptual paradigm' and use this model to SG rates at farm level	A seemingly unrelated regression (SUR), a analysis flows from aggregate US farm data.	Farm-level panel data of Illinois grain and livestock farmers, aggregated US farm data (timespan: 1981-2001)	Escalante, Turvey and Barry, 2009
To provide "a unified theoretical framework that explains farm capital structure choice".	Mathematical modelling (analytical approach);	Panel data at farm level (Dutch farms), 1990-1999	Wu and Guan, 2009

Source: own studies.

An in-depth critical analysis of concluding remarks from selected research papers may lead to formulating proposals for further research on the aforesaid problem, inter alia:

- How to include behavioural/psychological determinants in an in-depth analysis of demand on preferential agricultural credit? Still, most models (mainly based on neo-classical assumptions) neglect the role of psychological factors.
- To what extent does an interchangeability between governmental income support programme and various repayable instruments, even partially subsidised by governments, exist?

Nevertheless, the above subjective list of proposals is not closed. The first proposal is consistent with findings that are presented by Escalante, Turvey and Barry (2009) and Wu and Guan (2009). RB hypothesis may be regarded as a milestone in agricultural finance. A growing interest in risk management tools and their analyses results in more detailed research on an interchangeability between income support programme that may stabilise the level of income and repayable (so-called

'financial') instruments. It should be noted that only a limited number of proposals for further research on the role of public policies on capital structure of family farm households (to, a lesser extent agricultural enterprises) refer to contemporary trends in methodology of economics and finance, for example behavioural approach. Still, a nexus between capital structure and public policies seem to be an important challenge (as indicated in the list of articles in Table 3). Thus, further analyses should include various interdisciplinary angles (i.e. economic psychology, neuroeconomics). A holistic approach to farm risk management (not only financial, yield, revenue or income) will involve an in-depth analysis of interchangeability between various risks and proposals to manage them (see: Enjolras and Sentis, 2011).

4. Conclusion

In-depth systemic review of empirical studies indicates that an enhanced analysis of capital structure of farm households should consider the impact of income-augmenting/risk-reducing policies. Furthermore, exploring risk balancing behaviour indicates that "off-set adjustments" relate to trade-off between business and financial risk. A financial sustainability (based on 'sustainable growth' paradigm) of farm households may be treated as one of significant research challenges because current studies may be too narrowly focused on the income level as a proxy of economic sustainability.

Further detailed empirical studies that will be based on farm-level, survey, experimental data, are necessary to explore role of public policies on capital structure of family farm households. Still, a nexus between capital structure and public policies seem to be an important challenge, taken potential changes in agricultural policy tools (for example, so called "financial instruments" in CAP). Although the share of agriculture is relatively low in contemporary economies, further analyses should include research perspectives interdisciplinary angles (i.e. economic psychology, neuroeconomics).

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PROCESSING OF BIG DATA IN INTERNET OF THINGS AND PRECISION AGRICULTURE

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Annotation: The main focus of the paper is the analysis of various types of agriculture data and open source operational databases and platforms for data collection and data warehousing suitable for storing data obtained from the Internet of Things and Precision Agriculture. The methodical approach consists of primary analysis of current state of operational databases, data warehouse and tools for data transformation usable for Precision Agriculture. Internet of Things is not a new technology in agriculture. Sensors collect data not only from operation of agricultural machinery, but they are already monitoring the operation process of entire farms. Often, solutions are provided to farmers in the form of cloud services. In general, IoT is constantly growing in terms of data volumes, which needs to be effectively stored, processed, and analysed. The Big Data and IoT area is still hindered by lack of standardization. Specifically, in agriculture, there is still a great potential in the efficient usage of these new concepts.

Key words: big data, smart agriculture, precision agriculture, data storing, data analysis, middleware

JEL classification: L86, C8

1. Introduction

Since the early 1990s, precision farming approaches have been progressively enforced. In the years to come, research began to focus primarily on sensors (Birrell et al., 1996; Godwin, 1999). With the gradual development of precision farming technologies, sensors, the Internet, and telecommunication networks, it is no longer a problem to collect data on agricultural production. Agricultural and sensory technology is at a high level nowadays. A number of authors are currently tackling the challenges of data processing in terms of large volumes of data (Big Data) (Coble et al., 2018; Leone, 2017; Xie et al., 2015).

It is no longer a problem to distribute sensors on agricultural plots, in greenhouses, or in areas with animals. Agricultural technology provides additional data not only about its activities but also about its own sensors. Hardware technologies are highly developed in this area, since researchers have been focusing on this field for many years.

As the number of used technologies used increases, the amount of data grows and there is a problem with the efficient processing and especially the use of data. Current research in this area is usually quite specialized (Gexin, Bing and Wei, 2018; White et al., 2018; Tan, 2016). A number of authors see great research potential in the processing and utilization of large data volumes (Big Data) in agriculture.

There are a number of commercial solutions for data warehouses and large data processing. However, they are very costly and they are not adapted to the specific needs of the agrarian sector. These solutions are usually missing metadata models, data processing from remote sensing, etc. For SMEs (Small and Medium-Sized Enterprises), too, they are too costly and therefore not profitable (due to the lack of features offered).

Currently, approximately 27 billion devices is connected to the Internet (Internet of Things IoT) (Seery, 2017) and it is expected to increase to 125 billion by 2030. Although different forecasts are slightly different, they all assume an increase by dozens of billions. In agrarian sector, the situation

is the same. The concept of precision agriculture is based on observation, measurement and the corresponding response. Precision agriculture technology allows farmers to recognize situations and apply solutions with far greater accuracy than without using those (Lindblom et al., 2017). The current concept of IoT can only help to modernize these technologies and increase their usability (Tzounis et al., 2017).

IoT is no new technology in agriculture. Sensors collect data not only while operating agricultural technology, but they are already monitoring the operation of whole farms (Amandeep et al., 2017). Often, solutions are provided to farmers in the form of cloud services. In general, IoT is constantly growing in data volumes, which needs to be effectively stored, processed, and analysed (Marjani et al., 2017). As present (Suciu, 2016), the area of Big Data and IoT is still hindered by lack standardization. There is still a great potential in the efficient usage of these concepts in agriculture.

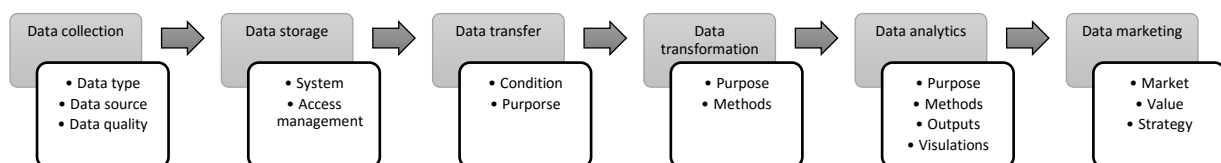
2. Materials and Methods

The main focus of the paper is analysis of various types of agriculture data and open source operational databases and platforms for data collection and data warehousing suitable for storing data obtained from the Internet of Things and Precision Agriculture. The methodical approach consists of primary analysis of current state of operational databases, data warehouse and tools for data transformation usable for Precision Agriculture. The research questions addressed are such as: “How to effective store and analyse Big Data generated by Smart Agriculture? “ This contribution is partly based on studies of open data and metadata formats. (Stočes, Šimek and Pavlík, 2017; Stočes et al., 2018; Šimek et al., 2013)

In agriculture, the collected data needs to be continuously analysed and worked with. Data processing procedures, especially with regard to Big Data, are not yet properly addressed in agriculture. As the volume of data collected grows, the demands for efficient storage grows as well. It is necessary to deal with this issue. One of the tasks is the accurate selection of appropriate databases for primary storage. Especially for IoT, the so-called benchmarks are not yet solved (Patel, 2016). Data from different sources is then stored in data warehouses where one of the problems is a description of these data - semantics (di Martino, Cretella and Esposito, 2017). In agriculture, only data from sensors are not stored, but within precision agriculture, for example, maps of agricultural machinery, yield maps, satellite imagery as part of remote sensing, etc. are generated. In IoT, it is often necessary to link data from different non-coherent sources that were not meant to work together (Razzaque et al., 2016). With precision farming technologies that have been in use for a long time, the incompatibility of individual technologies is even more significant.

The data chain refers to the sequence of activities from data collection to decision making and data marketing. It includes all the activities that are needed to manage agriculture data in farm Figure 1 representing the core steps in this data chain (Xie et al., 2015).

Figure 1. Precision agriculture data chain



Source: Own processing based on (Xie et al., 2015)

3. Results and Discussion

The farmer's data sources can be divided between the data acquired by the farm from its own internal, private data source and data obtained externally. External data can be used from public open data databases or purchased.

Internal (private) data

- Data from sensors (precision agriculture devices) e.g. soil data, animal data, data from machinery, local weather, water data etc.
- Administrative data e.g. input prices, machine and labour availability.

External data (public data sources)

- Research data e.g. national soil databases.
- Education data e.g. new methods and procedures.
- Statistic data (yield).
- Weather information e.g. weather forecast, long term statics.
- Remote sensing.
- Financial data e.g. commodity prices on stock exchanges.

The data can be divided into structured, unstructured and unstructured extended by structured descriptive data (metadata). These data types differ significantly. For further work with the data, it is important to have them in open formats and not in proprietary formats.

Five most used open source platforms for storing large data collections (big data) from Internet of Things and smart agriculture were selected for following analyses (Table 1). The operating system on which the systems are running, the data analysis tools, the data visualization platform and the database systems supported by the platforms were analysed. All selected platforms are open source and allow data retrieval using extended REST API (Representational state transfer Application Programming Interface). All platforms analysed except *SiteWhere* are capable of running on open source operating systems (various Linux distributions). Most support various structured (SQL) and non-structured database systems. An important and all-supported analytics tool is real time analytics.

While the term real-time analytics implies practically instant access and use of analytical data, some experts provide a more concrete time frame for what constitutes real-time analytics, such as suggesting that real-time analytics involves data used within one minute of it being entered into the system. A common example of real-time analytics is a system where managers or others can remotely view order information that is updated as soon as an order is made or processed. By staying connected to an IT architecture, these users will be able to see the orders represented as they happen, therefore tracking orders in almost real time.

Other examples of real-time analytics would be any continually updated or refreshed results about user events by customer, such as page views, website navigation, shopping cart use, or any other kind of online or digital activity. These kinds of data can be extremely important to businesses that want to conduct dynamic analysis and reporting in order to quickly respond to trends in user behaviour. (Marjani et al. 2017)

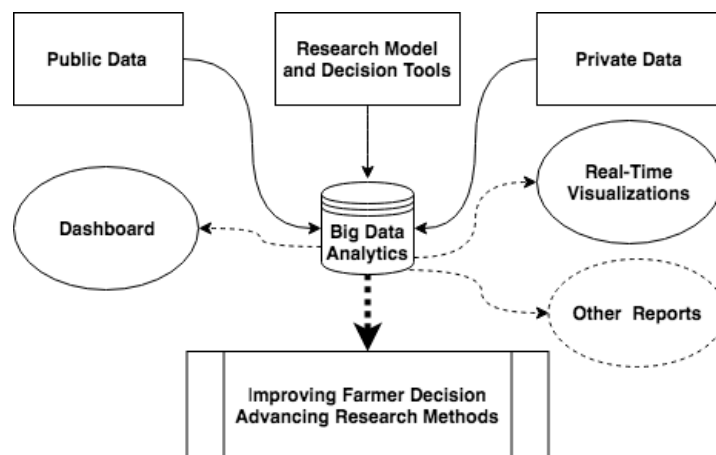
Table 1. Open source IoT platforms

Platform Name	Operation System	Analytics Tools	Visualization Options	Supported Database Systems
Kaa Platform	Linux	Real Time IoT Data Analysis with Apache, Cassandra and Apache Zappelin	Yes	Mongo DB, Cassandra, Hadoop, Oracle, NoSQL
SiteWhere	Unix, Windows	Real time analysis Apache Spark	No	Mongo DB, HBase, Influx DB
Thinger.io	Linux	Real time analysis	No	Mongo DB
Thingsboard.io	Windows, Linux	Real time analysis	No	Cassandra
WSO2 IoT	Linux	WSO2 server for Data Analysis	Yes	Oracle, PostgreSQL, MySQL, MS SQL

Source: own processing

4. Conclusion

Figure 2. Precision agriculture big data analytics



Source: Own processing

Big Data in agricultural sector can be divided into two data groups internal (private) data and external data. Source of internal data can be sensors (smart agriculture, IoT devices). Furthermore, the precision agriculture data can be divided into structured and non-structured data. It is possible to improve farmers' decision-making by using the appropriate Big Data analytic tools. Data source of such analysis are public data sources, private farmer data (data from precision agriculture devices

and IoT) and other inputs such as research models and decision tools (see Figure 2). There are many open source platforms suited for analysis of data from Precision Agriculture and IoT.

Another issue to be explored in the following studies is the analysis of visualization tools and dashboards suitable for agriculture Big Data (as shown also in Figure 2).

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ANALYSIS OF BREAD CONSUMPTION

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Annotation: Every year, the World Bread Day is held; it is a feast of basic human food and a celebration of the bakery profession. However, according to the Czech Statistical Office, Czechs prefer pastry to bread. While the average person consumed more than 80 kg of bread a year after World War II, its consumption was only half (39.72 kg) in 2016. On the other hand, consumption of wheat pastry increased from 16 kg in 1949 more than three times to 48.3 kg. It is, therefore, undisputed that the consumption of bread is constantly decreasing. The aim of this paper is to evaluate the development of bread consumption in the past few decades and to identify the possible causes of this development.

The analysis uses data from the Czech Statistical Office, from the Association of Bakers, and information obtained by qualitative research. Statistical analysis of the data was complemented by a pilot survey of consumer behaviour on the bread market. The results of the survey include the identification of basic breakpoints in the development of bread consumption and the analysis of their causes. Quantitative analysis was compared with qualitative research focusing on changes in production technology, production management, and changes in consumer behaviour.

The conclusions of the paper include the identification of basic breakpoints in the development of bread consumption and the analysis of their causes. Important factors influencing the consumption of bread are changes in eating habits, a significant increase in the range of wheat pastry products, the entry of whole grain products on the market etc. The price analysis of both bakery products (bread and wheat pastry) showed that the price had a negligible impact on consumption. E.g. since 1995, the price of bread has grown by about 75%, while for the price of ordinary pastry by 115%. Still, the sales of pastry were steadily rising, while the sales of bread fell.

Key words: bakery, consumption of bread and pastry, analysis of causes of bread consumption

JEL classification: JEL classification Q180

1. Introduction

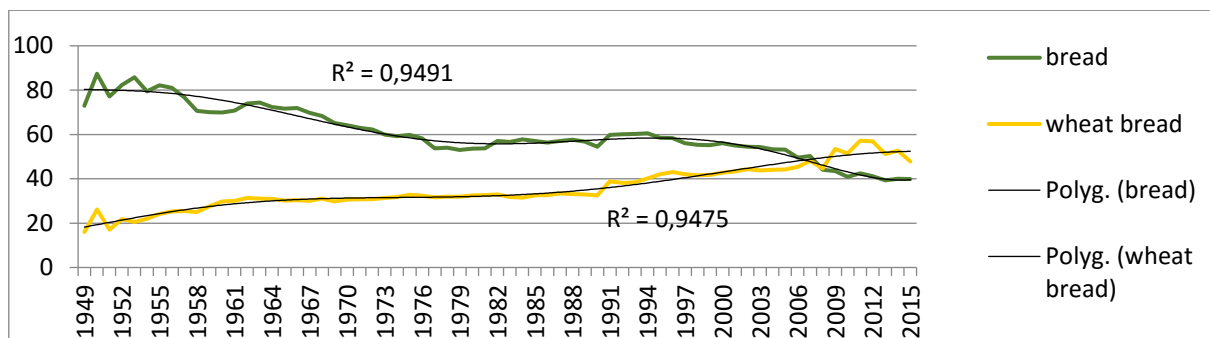
Since the second half of the 19th century, production of rye bread prevailed in the Czech lands (Broncová, 2001). In the First Czechoslovak Republic, i.e. in the interwar period, a limited number of types of bread were made. Between the wars a large number of small bakeries were established. After war, particularly due to the regime change, bakeries were nationalized, and production was centralized. From 1952 on, various technological processes were introduced. The effort to maintain constant quality of the leaven led to the introduction of control measuring of leaven acidity and its temperature at different stages (Příhoda, 2012). Mid-20th century brought about big changes in the types of bread made. After the regime change, bakeries were gradually privatized and market mechanisms were introduced. This, together with the fact that agriculture was no longer subsidized, led to an increase in prices (Fintineru, 2015). The current trend has been described in annotation, there is still a decline in bread consumption. Research based on sensitive analysis of profit (Dyntar, Strachotová, 2017) has shown that the profitability of bakery production depends mainly on the selling price and the quantity sold. The drop-in sales of bakery bread threaten. This concerns mainly medium-sized companies. Analysing the development of bread consumption was also their concern.

2. Materials and Methods

The pivotal point of the research was collection and processing of data from the Czech Statistical Office (the CSO, data on consumption) and from the Association of Bakers (data on prices). The basis for all the following analyses was the long-term consumption of bread and pastry (Fig. 1) that clearly shows the opposing trends in the consumption of both items. Monitoring trends in bread consumption

as well as its direct substitute in the market is a logical step, as similar influences were to have impact on both items. The trend apparently for further analysis it will be necessary to monitor price development of both items.

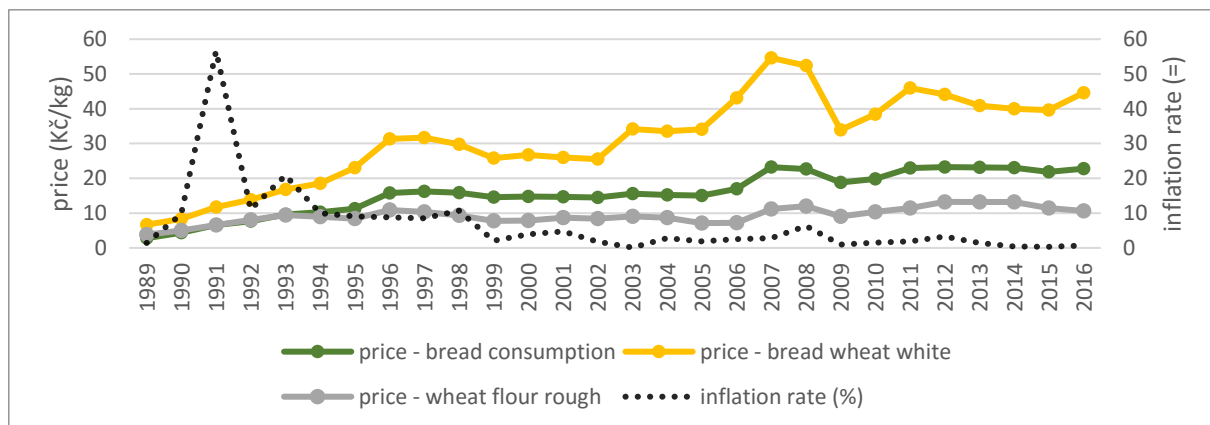
Figure 1. Consumption in kg per capita 1949-2015



Source: Authors using data from the CSO

Methods of data collection by the CSO were compatible throughout the entire period. Nevertheless, the authors of this paper decided to analyse in a greater detail the period 1989–2015. The reason is the need to compare consumption data with prices. However, relevant data on price development date only back to 1989. Data were collected II/2018, unfortunately, data on consumption in 2017 were not available. The graph below (Fig. 2) compares prices of both items also with the development of consumer prices of flour, the main ingredient in bread production, and development of inflation. Figure 2 is two extremes. The rate of inflation in 1991 is related to the transition to a market economy. In 2006-2008, all prices responded to the crisis period.

Figure 2. Prices in CZK per kg and inflation rate in 1989-2016



Source: Authors using data from the Association of Bakers and CSO

Two types of indexes were used for the analysis of development: basic index (BI) where 2010 was used as a basis (in accordance with the CSO methodology) and moving index (MI) for monitoring year-on-year changes (equation 1). These indexes were also adjusted with sixth grade polynomial (equation 2). This polynomial was used because it exhibited the greatest leakage with the time series. There were the highest correlation coefficient values R^2 (Hindels et al., 2007). From the course of this polynomial, it was clear that there is no need to do a deeper analysis (Arlt, Arltová, 2007) and look for cycles or trends.

$$BI = \frac{x_i}{x_{2010}} \quad MI = \frac{x_{i+1}}{x_i} \quad (1)$$

$$p(x) = \sum_{i=0}^n (a_i \cdot x^i) = a_0 + a_1 \cdot x + a_2 \cdot x^2 \dots + a_n \cdot x^n \quad (2)$$

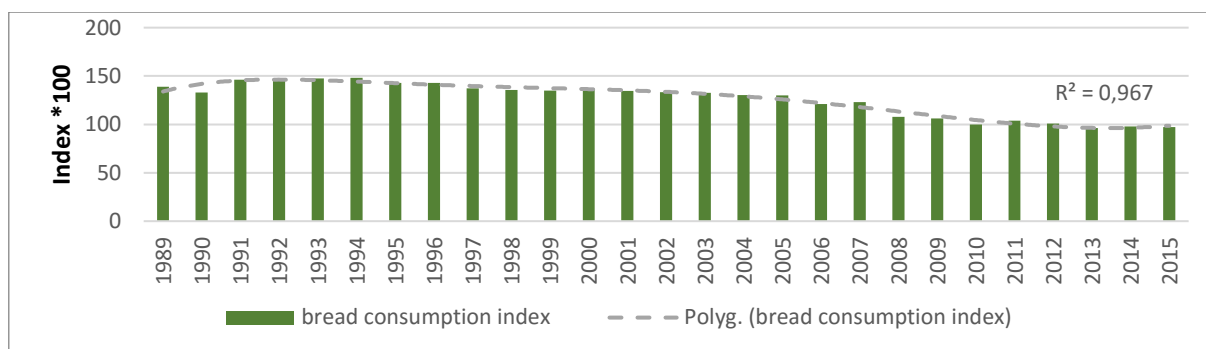
- x_i ... consumption / price value
- a_i ... coefficient of polynomial (regression constant)
- i ... the coefficient of the year concerned

Quantitative research was complemented with qualitative research which consisted in conducting many personal interviews with bakery managers, representatives of the Association of Bakers as well as with customers. The purpose of the interviews was to identify the main causes of the monitored development in consumption. Conclusions of this research are included in the Discussion.

3. Results

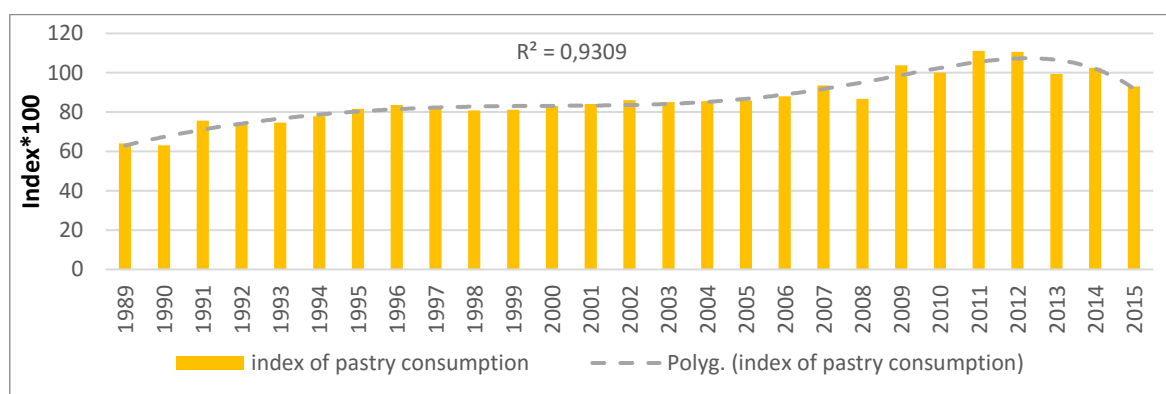
A more detailed analysis of bread consumption shows an S-shaped development of decrease in bread consumption (Fig. 3) with the exemption of “post-revolution” period. While we can see a continuous growth in pastry consumption that was only disrupted in 2008/2009 (increased consumption during the crisis, Fig. 4), the evolution of prices (Fig. 5, 6) fluctuates more and it apparently does not correlate with consumption development. Polynomials always show periods of the most significant changes that occur in both items in the same period.

Figure 3. Indexes of bread consumption 2010=100



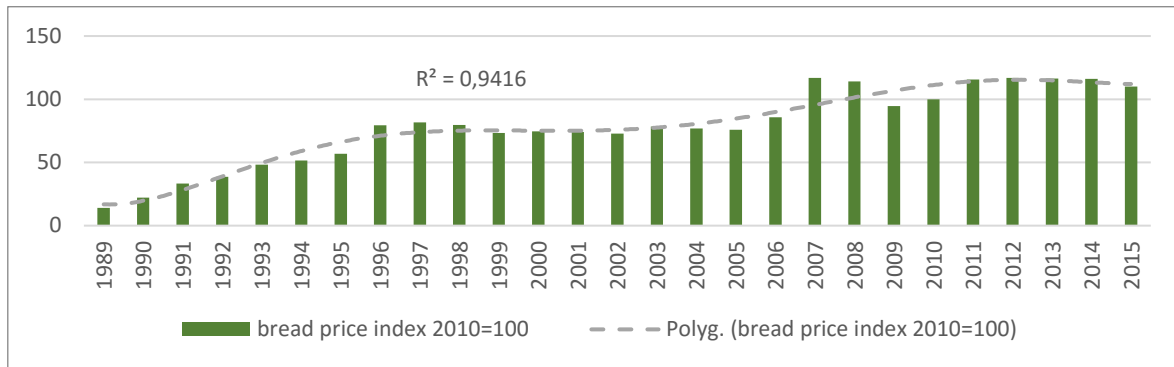
Source: Authors using data from the CSO

Figure 4. Indexes of pastry consumption 2010=100



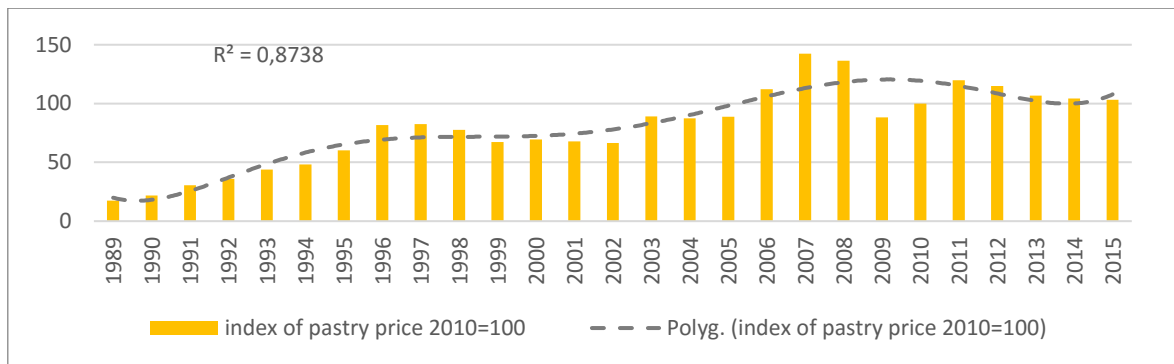
Source: Authors using data from the CSO

Figure 5. Indexes of bread price 2010=100



Source: Authors using data from the Association of Bakers

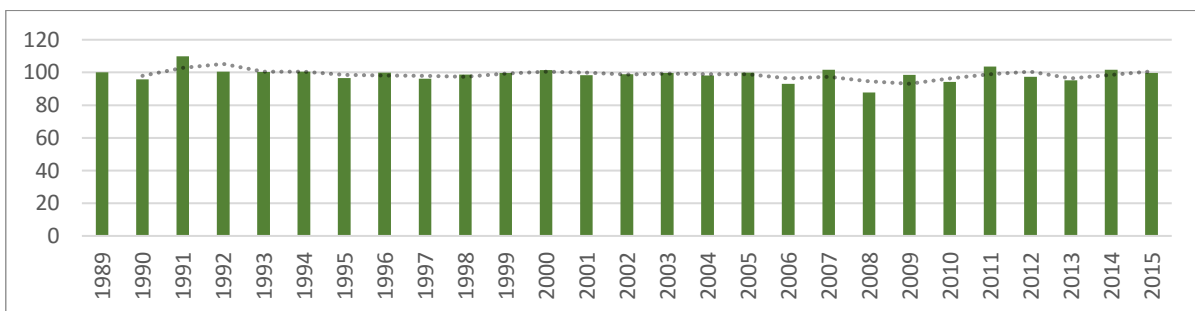
Figure 6. Indexes of pastry price 2010=100



Source: Authors using data from the Association of Bakers

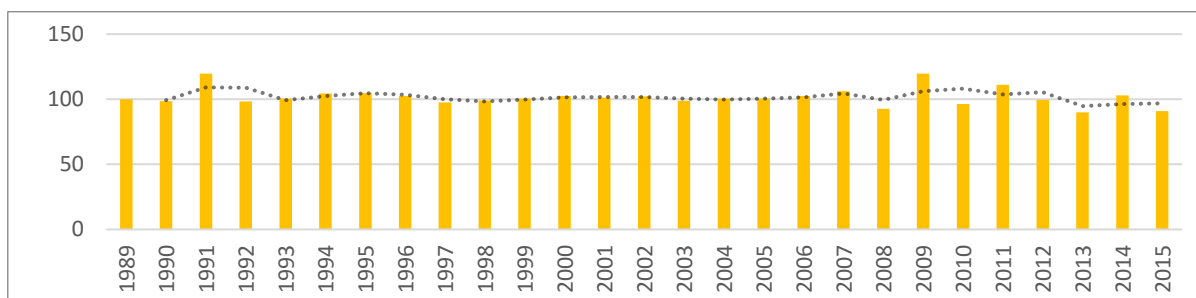
Basic indexes are not ideal for tracking development in the timeline. For a more detailed analysis of year-on-year changes we used moving indexes. In graphs (Fig. 7, 8) we can identify more significant changes that occurred in 1990/1991, 2008/2009, 2010/2011, always in both items. In pastry, there were changes also in 2012/2013 and 2014/2015, while in bread they were not so distinct. Source data show that in the case of bread there are usually year-on-year changes in consumption ranging between 3 and 5 kilos. In some cases, the change was even 8.8 kilos (2008/2009). However, the average year-on-year change for the monitored period was a little short of 0.5 kg.

Figure 7. Moving index of bread consumption



Source: Authors using data from the CSO

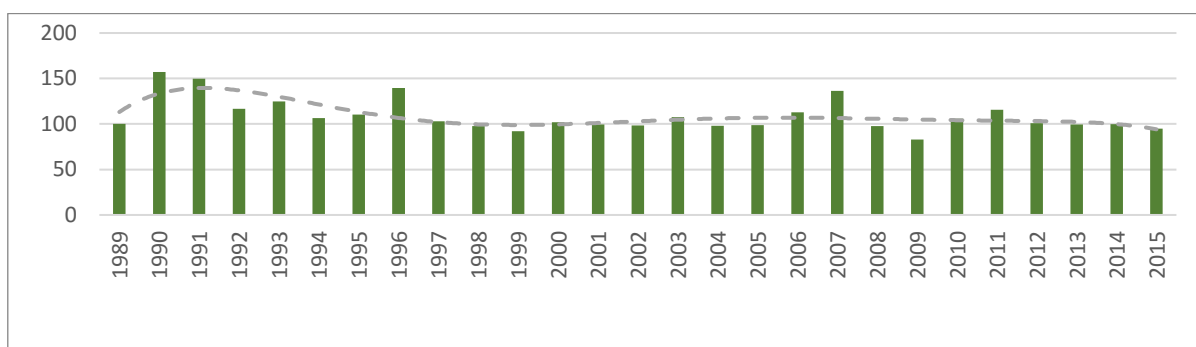
Figure 8. Moving index of pastry consumption



Source: Authors using data from the CSO

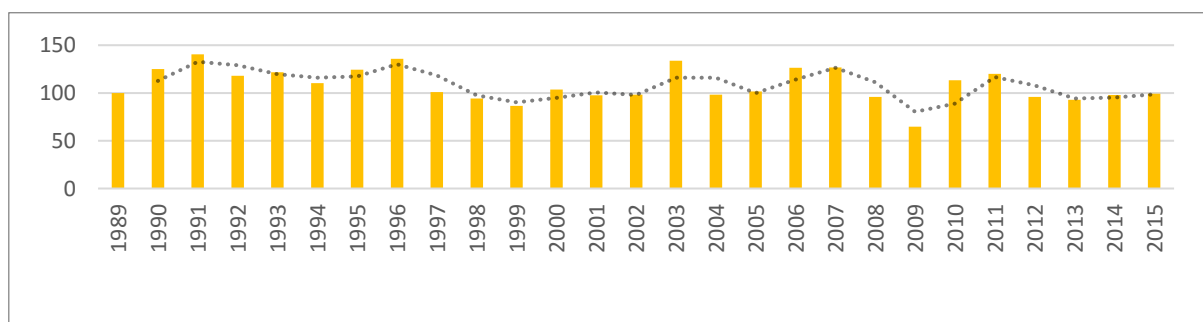
These fluctuations in prices of bakery products may be related by small bakeries fighting with big supermarket chains that push their suppliers to decrease their prices as much as possible until it becomes intolerable for them and then there is a short-term increase in prices (Fig. 9,10). Then the entire cycle repeats. We can identify several dramatic changes in the development of prices. The biggest change was when the price of pastry dropped by 18.52 CZK/kg in 2008/2009. In the case of bread, significant changes occurred in 1995/1996 and 2006/2007 when the price increase was steep compared with the rest of the period. The development in 1989-1992 was influenced by transition to market-oriented economy.

Figure 9. Moving index of bread price



Source: Authors using data from the Association of Bakers

Figure 10. Moving index of pastry price



Source: Authors using data from the Association of Bakers

4. Discussion

When assessing all four moving indexes (bread/pastry consumption and bread/pastry price) we found out that in the monitored 26 years the same direction (growth/decrease) was in all indexes in only 8 years. When comparing the moving indexes of bread price and consumption, the trends correspond in 65.4%, while in the case of bread they only corresponded in 61.5% of the cases. Pastry and bread trends corresponded in moving indexes in 61.5% of the cases, and in the case of prices it is even 73.1%.

The authors tried to sum up the causes of all changes on the basis of the personal interviews and knowledge from literature. Conclusions made on the basis of the interviews are presented in the following paragraphs.

From the perspective of long-term historic development, it is necessary to state that it is an undeniable fact that bread was also used as cheap feed for animals on the farm last century, which is not the case today. However, the falling demand for bread is a long-standing indisputable fact (Chládková and Kudová, 2008), with significant changes in consumer preferences being the most significant causes of the recent drop in consumption (Rodonaia, Sredl, 2015) or a decrease in bread consumption may be diversion of consumers because they consider bakery products “unhealthy”. At present, when the modern world faces problems such as surplus of food, overeating and lack of movement, this simple source of energy seems unnecessary (Ratinger, 2016). Surplus of this energetic balance leads to development of lifestyle diseases, obesity, diabetes and others. Gluten is also problematic as it is becoming toxic for more and more people (Forsapi, 2015). Sluková (2016) state that 0.5-1% of the Czech population has celiac disease. These facts led to certain demonization of wheat and later corns as such on the part of the general public, which got the milling, bakery and dough industry in a very unpleasant situation. Possible answers from bakeries are efforts for new recipes that will improve the quality or nutritional value of bread (Devani et al., 2016; Hrušková, 2000).

The negative trend in consumption may also be due to the options of keeping bakery products fresh, while for consumers their freshness is a critical aspect (Ratinger et al., 2016). The quality of the bread is perceived as a lasting value (Eglite, Kunkulberga, 2015) at the same time, the buyers put considerable emphasis on their price. People often complain that today’s bread becomes mouldy sooner than before. In the past, bread lasted longer, since a loaf weighing 2-3 kilos gets older slower than a 400-gram one. Molding is a frequent problem when crust is not properly baked, which makes the bread softer and it can be pressed, which is something that people often consider to be a feature of freshness. Also, the way how people keep bread in their households is closely linked with molding. In the past, people wrapped bread in a cloth and put it in the coldest place in the households: those conditions were ideal for bread. These days, bread is often kept in households in a plastic bag, or in a breadbox at the best.

Another reason is easier availability of food as such. Nowadays one can consume so many different types of food, which means that bread is not eaten so often. Bread also used to be a “side dish” people had with meals that are not very popular at present. Also, families were bigger, and they bought bigger loaves, now rather small packets are sold. Bread was also partly substituted with white pastry. It turns out that in foreign markets, despite the higher price, the demand for all roses of whole grain bread grows (Mancino and Kuchler, 2012). Until recently, there was a boom of submarine brioche and baguettes, but there are only a limited number of them when compared with bread. The way how to stop the decreasing consumption could be “bread finalization”: selling submarine sandwich. The range of the assortment products makes the position of bread complicated as there are a large number of adequate substitutes.

The phenomenon of globalization related to the food industry is not avoided even by the bakery industry (Oanzea, Brinzea, 2009). In future, it is expected there will be fewer bakeries, especially those run by sole-owners as the society will not be capable of appreciating manual work. What may seem absurd is the fact that while the capacities of bakeries in the Czech Republic are sufficient or even produce surplus, bakery products are still imported. That is due to strategy of big supermarkets. The Czech Republic is the country with most supermarkets in Central Europe. They exert huge pressure on price, since they do not need to buy bakery products from Czech producers. It is no problem for them to import frozen semi-finished loaves for instance from Belgium where they are cheaper. Moreover, a large part of consumers does not care about quality, but they only search

for low prices in a situation when bread is cheaper in the Czech Republic than in any other neighbouring countries.

5. Conclusion

The research confirmed a decreasing trend in bread consumption per capita. Gradual decrease in the recent years has sometimes been changed by periods of mild growth which, however, is not strong enough to overcome the decreasing trend that is prevalent. A long-term graph shows that bread consumption is approximately half when compared with 1950s. There are many possible causes that have led to this. In addition to the negative trends that were discussed above, bakery industry faces problems with employment. Bakery is an unattractive field for many people and they do not find the non-stop operation and working night shifts unappealing. Wages in bakeries are generally low, an increase in the price of bakery products would be necessary so that wages can grow at least partially. A certain solution could be influencing consumers with advertising targeted at supporting bakery products made in the Czech Republic that would be supported by the government. A certain complication is marking products as “regional food” etc. The authors of this study decided to carry on with this issue with a more extensive research of consumer behaviour.

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TRENDS IN CONSUMPTION OF SELECTED TYPES OF FOODSTUFFS AS RELATED TO NUTRITION RECOMMENDATIONS AND SELF-SUFFICIENCY

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Abstract: The food consumption problem has been dealt with by many authors all over the world in their published works. It is a very topical theme discussed and analysed all over the world. Food consumption analysis can be approached from the viewpoint of quantity, quality, but from the viewpoint of nutrition standards or food security, too. Recently, the consumption of various food types can be also affected by the latest trends in the views concerning healthy nutrition. The gravity centre of the paper is an assessment of the basic development trends in selected food types consumption. Its aim is to assess whether consumption has been affected by food security and healthy nutrition information. The factual findings are then confronted subsequently with data on self-sufficiency in production of the selected foodstuffs separate types. From the methodology viewpoint the assessment of development trends in food consumption and subsequent determination of consumption forecasts for the nearest future have been based on time series analysis, especially the application of adaptive models taking into account data aging and usually supplying higher quality forecasts. By means of the SAS system selection criteria all the time series have been identified automatically and diagnosed, and adequate forecasting models constructed subsequently. The forecasts quality has been evaluated using the testing part of the time series under study (hold of sample evaluation) by means of the *MAPE* (Mean Absolute Percent Error) metric or the relative forecast error.

Key words: foodstuffs consumption, nutrition trends, time series analysis, short-term forecasts, self-sufficiency

JEL classification: C32

1. Introduction

The food consumption problem has been a very topical one all the time. Consumption of various food types is affected among other factors, by latest trends in the views concerning healthy nutrition. Delaney and McCarthy (2014) focused in their study at eating habits of adults aged 50 to 70 years. A specimen was chosen of people differing in nutrition quality and health condition. Chandron et al. (2010) dealt in their study with impact assessment of the HEI-2005 (Healthy Eating Index-2005) and of each of its component separately upon the incidence of cancer.

Within food consumption problem exploration the fact can never become forgotten that, farmland is the irreplaceable foodstuffs production source (Pletichová and Gebeltoová, 2013). Reduction of land area currently taking place in the Czech Republic (Procházková et al., 2016) is raising concerns about securing self-sufficiency in the basic foodstuffs. Food self-sufficiency in the CR has been lagging behind the needs especially in case of livestock production. Meat industry as one of the food industry key sectors has been the object of study of Náglová and Horáková (2016). Clapp (2017) has dealt with a closer look at the food self-sufficiency problem in his paper. He has shown that, in practice food self-sufficiency is defined and measured many different ways and a wider understanding of the whole concept can open a space for the food self-sufficiency assessment. Zasada et al. (2017) have dealt with food consumption analysis and the food self-sufficiency problem in the EU metropolitan regions as concerns the separate food systems scenarios.

Smutka et al. (2009) have dealt with the global food consumption together with the global food supply and demand development and the global farm production, too. Olsen and Tuu (2017) have focused in their work at a comparison of the values of healthy nutrition and of epicureanism while analysing food consumption. Healthy eating is very fashionable. It is a life style the target of which is stronger health, vitality and psychic serenity. A common part of today's hurried life, however, is fast food which is a comparatively unhealthy way of eating. De Vogli et al. (2014) have dealt in their paper with fast food consumption, respectively with influence of fast food consumption on BMI in 25 member countries of the Organisation for Economic Co-operation and Development. For estimates of the expected food consumption development that represent a very important information various model procedures have been prepared. The complex econometric models consider effect of more factors upon the final consumption and have a good causal reasoning. However, construction of these is not simple. Currently, therefore, time series models start taking over. These techniques are based on the time series models extrapolation and they are only based on the course of values in time. An examination of properties of the economic indicators time series was the object of work by Kába (1997), for example. Analyses have shown that use of the time series adaptive models in particular, that add more weight to the newest data, can supply forecasts of better quality.

2. Materials and Methods

For the empirical analysis proper, data were used from time series gathered by the Czech Statistical Office surveys. All in all, 27 time series of foodstuffs consumption data with annual frequency were subject to analysis. The reference period covered 1989-2015 years. At the first stage the development trends were assessed and forecasts for the basic foodstuff types established – the total consumption of cereals, meat, milk and milk products, fats, non-alcoholic drinks, vegetables and fruit. Further analyses were aimed subsequently at the development trends of selected foodstuffs considering the basic recommendations of healthy eating (Společnost pro výživu, ©2018) and changes occurring in the period concerned. A detailed list of perishable foodstuffs contains the Table 1.

For an effective implementation of the analysis the SAS programme system, specifically the TSFS module (Time Series Forecasting Systems) has been applied. The SAS system has a really wide choice of models available (Hindls et al., 2000). In the area of time series analysis methods it permits to specify the most appropriate forecasting models exploiting diagnostic tests for the time series' properties exploration (Arlt and Arltová, 2009). By means of the chosen selection criteria all the time series have been identified automatically and diagnosed, and adequate forecasting models constructed subsequently. The forecasts quality has been evaluated using the testing part of the time series under study (hold of sample evaluation) by means of the *MAPE* (Mean Absolute Percent Error) metric or the relative forecast error, *rp*, and subsequently the mean relative forecast error, defined by the following relationships:

$$M.A.P.E. = \frac{100}{n} \sum_{t=1}^n \left| \frac{y_t - y'_t}{y_t} \right| \quad (1)$$

$$rp = \frac{|y'_t - y_t|}{y_t} \cdot 100 \quad (2)$$

where y_t or y'_t ($t = 1, 2, \dots, n$) are the actual or even smoothed values of the given time series and n is the number of the time series observations. The pseudoforecast has been established for three years always. The relative forecast error has been evaluated for each year of the forecast and the mean relative error for the three-year period obtained subsequently for a total forecast quality assessment. *MAPE* is one of the most often applied metrics when assessing the constructed models quality. Its value usually is expressed in percent what brings the popularity of its use. The *MAPE* criterion

in model quality assessment has been applied by, e.g., Mamat et al. (2016), Reboiro-Jato et al. (2011) or Svatošová and Köppelová (2017) in their works.

3. Results and Discussion

3.1 Trends in the consumption of basic foodstuffs

The Table 1 is clearly presenting time series models for the separate indicators inclusive of the values of selected assessment criteria, the actual 1989 consumption and the 2018 forecast.

Table 1. Consumption development models of the selected foodstuffs

Type of food	Model	MAPE in %	rp in %	Consumption in 1989	Forecast for 2018
Cereals - total	Linear Holt ES	3.11	1.59	156	141 kg
Long Pastry	Log Linear Trend	5.07	8.7	6.5	10.1 kg
Pasta	Log Linear Holt ES	6.65	4.14	3.1	8.0 kg
Rice	Log Linear Trend	5.65	8.35	3.96	5.7 kg
Bread	Linear Holt ES	2.7	2.8	56.8	37.2 kg
Bread of wheat	Damped Trend ES	4.01	8.05	33	45.3 kg
Meat, total	Log Simple ES	2.17	2.63	97	79.3 kg
Beef	Log Linear Holt ES	5.89	6.74	30	7.01 kg
Porc	Damped Trend ES	2.18	3.06	49.9	41.0 kg
Poultrymeat	Damped Trend ES	3.56	4.25	13	27.7 kg
Fish	Linear Holt ES	6	0.19	6	5.8 kg
Milk and milk products	Damped Trend ES	3.12	0.96	259.6	247.2 kg
Cow's milk	Log Simple ES	4.6	2.88	94.3	64 kg
Cheese	Damped Trend ES	4.36	3.11	7.8	13.2 kg
Fats and oils	Log Simple ES	1.25	0.74	28.8	27 kg
Butter	Log Simple ES	5.94	3.73	9.4	5.50 kg
Lard	Log Linear Holt ES	3.14	1.48	6.8	4.2 kg
Edible vegetable fats and oils	Damped Trend ES	1.32	1.76	12.5	17.2 kg
Sugar, total	Linear Holt ES	4.57	4.55	39.8	32.6kg
Sweets	Damped Trend ES	2.75	1.93	5.1	7.14 kg
Chocolate	Linear Holt ES	6.1	5.03	0.9	2.81 kg
Mineral water	Linear Holt ES	3.96	4.85	14.1	60.6
Soda water	Log Damped Trend ES	4.86	8.16	10.9	30.2
Lemonade	Damped Trend ES	2.13	2.55	45	85.2
Vegetables	Linear Holt ES	3.1	2.38	68.7	86.4
Tomatoes	Linear Holt ES	9.7	6.73	5.1	12.5 kg
Potatoes	Linear Trend	2.14	2.15	82.8	64 kg
Lettuces	Log Damped Trend ES	16.2	14.3	1.2	2.4 kg
Spinach	Damped Trend ES	17.9	14.6	0.1	1.25 kg
Pulses	Damped Trend ES	4.6	7.9	1.3	3.20 kg
Fruit, total	Linear Holt ES	4.41	2.11	70.5	83.9 kg
Fruits of the mild belt	Log Damped Trend ES	3.7	5.16	53.6	48.1 kg
Subtropical and tropical fruits	Simple ES	6.8	2.28	16.9	33.5

Source: Own processing based on data from CZSO

Note: ES – Exponential Smoothing

The exponential smoothing models have presented themselves as the most appropriate ones, taking data aging into account. The mean absolute percent error was less than 5 % with most of the models which represents a model of high quality. Models with *MAPE* up to 10 % can be taken as comparatively good quality ones, too. *MAPE* higher than 10 % was found with models of spinach and lettuces consumption only. As it concerns the forecast quality assessed based on the mean relative forecast error (3 years), again it is really possible (except the two items mentioned) to rate the forecast quality in case of the mean relative forecast error lower than 5 % as excellent (66.7 % foodstuffs), in case of the mean relative forecast error within 5-10 % as very good (27 % foodstuffs).

Based on the findings it is then possible to assume the consumption forecasts for 2018, that follow the models mentioned, as very likely ones. Consumption development of the separate food types will be confronted subsequently with healthy eating requirements.

All in all, there was a rather significant decline in the **consumption of cereals** over 1996-1999, since then it has maintained the level of about 140 kgs per head per year, with alternating fluctuations. Forecast for the next year assumes consumption of 142 kgs per head per year. Considering the right nutrition assumptions, it can be recommended to replace the white flour meals by wholemeal products, to prefer food with low glycaemic index, such as pasta and rice. If we do a closer look at the trends in these food types consumption, we can see an increase in rice and pasta consumption. Pasta meals show a mean annual increase by 3.4 %, in rice it makes 2 %. As it concerns the consumption forecast for these two, we can presume pasta consumption at 8 kgs per head per year, what means 155 grams per week, in rice then 109 grs per week. In pastry consumption a reduction of bread consumption has been found over the same period and an increase of wheat pastry consumption, what does not correspond slightly to healthy eating recommendations. If we assume weight of one slice of bread and one bread or roll at 43 grs (usual weight) then the daily consumption makes it 2.4 slices of bread and 3 rolls, which is not little.

In **meat consumption** total there was a significant drop over 1989-1993, from 97.4 kgs per head per year down to 81.2 kgs per head per year and for the years following the data have kept to a very similar level. The model having been chosen as the most appropriate (Log Simple Exponential Smoothing with *MAPE* 2.17 %) is presuming a very similar level of meat consumption for future, too. If we follow consumption of separate meat types, apparent differences in the trends can be detected. The nutrition recommendations are encouraging reduction of meat and meat products consumption, especially food containing a high content of fat (pork flank, sausages etc.) and consumption increase of fish and fish products rich in the omega-3 fatty acids. However, the findings obtained do not agree with the recommendations any too much. In pork a slight decrease has been detected over that period, a significant fall of consumption happened in beef – from 30 kgs per head per year in 1989 down to 8.1 kgs per head per year in 2015. A contradictory development of consumption has been observed in poultry meat. There is a virtually continuous increase in consumption here. Rather than the nutrition trends or fear of the BSE diseases which could explain the beef consumption decrease, the price could support the decision here. This can be seen in the poultry meat case in particular, where even over the period of the bird flu occurrence and possible fear of infection from poultry meat, any consumption decrease has not been recorded thanks to steadily very low price of poultry meat. On the other hand, in the fish meat consumption there was virtually no change, even in spite of the eating recommendations to eat fish and fish products twice weekly, at least. The fish consumption in 2015 was 5.5 kgs per head per year, what would mean a weekly consumption about 0.1 kg per head.

In **milk and milk products** there was a steep decline in consumption over 1989-1997, about 65 kgs per head per year, but through 1998-2010 consumption returned to growth up to 249 kgs per head per year and recently it has rather stabilized itself about 240 kgs with alternating fluctuations. The forecast (Damped Trend Exponential Smoothing, *MAPE* 3.12 %) presumes a slight increase. Nutrition advices recommend inclusion of milk and milk products into the menu on daily basis, especially those sour, semi-fat and low-fat ones. However, cow milk consumption has had decreasing trend over this period. A more pronounced decline of cow milk consumption was over 1989-1997. On the average there was an annual decline of milk consumption by 5.67 %. Over the following period has the consumption kept itself, except the decline in 2005-2007, at about the same level of 60 kgs per head per year, what represents daily personal consumption at 0.16 kg. Total consumption

of cheeses increased by 5.3 kgs per head per year and it currently represents daily consumption of 0.036 kg per head.

The largest changes in the period given appeared in the **consumption of oils and fats**. After the initial decline (1989-1996) the consumption kept itself at the level of 25.5 kgs per head per year, since 2009 there has been an increase again. The Log Simple Exponential Smoothing model with 1.25 % *MAPE* presumes a very slightly increasing trend for the following period. From the healthy eating viewpoint it has been recommended to raise the intake of vegetable oils, especially the rapeseed oil and olive oil and to possibly reduce the intake of animal fats. Consumption of edible vegetable oils represented 44 % of the total consumption of oils and fats in 1989, in 2015 then even 63 %. Currently however, views have been appearing again that, animal fats are beneficial, too, and especially in butter there has a slight consumption increase been recorded, while the consumption of lard still has been showing a slight decline.

Decline of the total **consumption of sugars** represents one of the most prominent claims for healthy eating. During the reporting period a very slight decline has been recorded only. The recommended consumption is about 60 gr daily what makes it 22 kgs consumption per head per year, 65 % of the actual consumption in practice.

In the **non-alcoholic drinks** there is a predominance of sweet lemonades consumption, even though there has been a decline here (0.23 litre per head daily). In the alcoholic drinks consumption there is a comparatively high consumption of beer – 146.9 litres per head per year – over the recent twelve years we have been recording a decline of beer consumption anyway, a decline by 0.8 % yearly is on the way, on the average. On the other hand, consumption of wine is increasing – from 16 litres per head in 2004 to 19.8 litres in 2016, which makes the mean annual increment of 1.5 %. Healthy eating recommendation admits daily consumption up to 20 grams of alcohol, what means 0.2 litre of wine or 0.5 litre of beer, hence, if we consider adults only drinking alcohol, then this limit is strongly exceeded.

Total **consumption of fruit** has been recording growth over the reporting period predominantly. This is caused by the increase of consumption of southern fruit (consumption grew twice in practice, while in the moderate zone fruit consumption a decline appeared by about 10 %). By the healthy eating recommendation the daily fruit consumption should make 165 grams at least what means annual consumption at 60.2 kgs and this standard is richly exceeded (83 kg). Total **consumption of vegetables** has recorded growth by 25 % over the reporting period. A positive trend (growth) is evident in the consumption of tomatoes, lettuces, spinach and legumes. On the other hand there has been a decline in potatoes consumption – from 82.5 kgs in 1989 down to 66.3 kgs in 2015. Within the standards of healthy eating a daily consumption of vegetables at about 350 grams is recommendable, what means annual consumption of 128 kgs per head. This means that, the recent consumption of 85 kgs per head per year is insufficient, as seen from the healthy eating viewpoint.

3.2 Self-sufficiency in basic food types

When assessing food self-sufficiency in the Czech Republic, we can see that, this cannot be hundred percent sufficient. There are foodstuffs, belonging daily in our menu that cannot be grown here due to the climate. As it concerns the basic foodstuffs, however, this is a strategic question, too, and a safety fuse in case of natural disasters, military or commercial conflicts, epidemics etc. A low food self-sufficiency not only can negatively affect price stability and food safety but restrictions on agricultural production have negative impacts from the ecological and environmental aspects and, all in all, on the countryside development, too. When the level of self-sufficiency in the basic foodstuffs is to be considered (data for 2015 and 2016), we can conclude that, we are fully self-sufficient in cereals, milk, beef and sugar commodities. The low level of self-sufficiency in pork is warning since it was 55.2 % only, in 2016. A low self-sufficiency is in poultry - 74.4 %, eggs –

85 %, surprisingly in potatoes, too, where in spite of the potatoes consumption level reduction the production has not reached this reduced level. In the moderate zone fruit the self-sufficiency level is 79 %. The biggest problem requiring attention has been the insufficient self-sufficiency in vegetables. Here the self-sufficiency level has been 40 % only.

4. Conclusion

Based on the analyses done it is obvious that, the application of time series adaptive models in future food consumption estimation can bring comparatively high quality results. The model quality has been assessed (*MAPE*) as well as the forecast quality (relative forecast error). In both cases virtually in 67 % of the foodstuffs monitored the errors obtained were less than 5 % and in 27 % then less than 10 %. In both cases this is an evidence of models and estimates of comparatively high quality. We can then conclude that, the prognostic procedures in the future food consumption development estimation can offer good alternatives or supplements of those complex econometric models. Especially the forecasts for shorter periods have shown themselves mostly as relatively good quality ones.

The assessment whether the food consumption development inclusive of forecasts really corresponds to the principles of healthy eating is not unambiguous. In the consumption of cereals there has been a general decline, bread consumption has been decreasing, too, on the other hand, however, there has been a disproportionate growth of consumption of wheat bread and durable pastry, what acts rather to the detriment of healthy eating. In pasta and rice consumption an increase has appeared which is in line with the nutrition recommendations. Total meat consumption has fallen, poultry meat consumption is growing, fish consumption is stagnating in spite of all the recommendations. Consumption of milk and milk products has corresponded to the healthy eating principles thanks to the 0.65 kg volume daily per head. Total consumption of sugar has had a moderately decreasing tendency, but on the other hand, consumption of confectionery and chocolates has been rising markedly. In the consumption of drinks, after a high consumption increase of mineral waters, soda water and lemonades over 2006-2008, a decrease has been recorded recently, but the high consumption level of sweet lemonades is warning. Fruit and vegetables consumption has been rising over the reporting period, the recommended daily consumption has been exceeded in fruit, but in vegetables it has been by 30 % lower than recommended.

All in all, it is obvious that, the healthy eating recommendations are taken into account on one side, but for a large body of consumers the established traditional ways of eating are decisive and food prices particularly, too. Detection of preferences in the choice of foodstuffs among the consumers by age groups, education levels, living in town or in the countryside etc., could bring other interesting information.

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ATTITUDES OF FOOD CONSUMERS TOWARDS FARM ANIMAL WELFARE ON THE EXAMPLE OF THE MAŁOPOLSKIE PROVINCE

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Annotation: The paper objective is identification the attitudes of Polish food consumers towards farm animal welfare but also an identification of selected socio-demographic factors determining these attitudes. The main source of the data used for the analyses and applications was the primary information obtained from personal research (PAPI method, 350 people). The spatial range of the studies covered the Malopolska province. The statistical analysis of the studied material encompassed aggregate statistical indicators, the non-parametric test „chi square” (χ^2), as well as non-hierarchical method – k-means cluster analysis. Apart from the primary sources they also used secondary sources which encompassed both domestic as well as foreign literature. As results from the conducted investigations, the issue of farm animal welfare is important for the consumers (71%) or very important (29%). A vast majority of them think, that animal welfare should be better protected in Poland than it has been done so far. These attitudes are determined by the respondent gender, age, education and place of dwelling. Protecting animal welfare is a significant problem for a majority of women, persons with tertiary education and city dwellers. Regarding food consumer attitudes towards farm animal welfare, three types of attitudes were identified: active consumer, consumer cautiously adjusting to new trends on the food market and consumer who does not follow new trends.

Key words: animal welfare, farm animal, food consumer

JEL classification: D12, P46, Q13

1. Introduction

Farm animal welfare is an established subject matter in veterinary sciences (Naylor et al., 2018), legal science (Góral, 2016; Urbánová and Kozáková, 2017), as well as production practice (Boháčiková et al., 2017; Frisk et al., 2018; Robichaud et al., 2018). Production methods complying with the rules of welfare emphasise the animals' well-being in their farming environment. Over 80 legal acts (directives and regulations) regarding animal welfare are currently in effect in the European Union member states. Nevertheless, the law protects only 65% animals in the EU. The remaining 35%, i.e. 300 million animals, include: farmed trout, salmon, ducks, turkeys, or sheep (Herbut and Walczak, 2017).

The ways of manufacturing animal products affect not only health and welfare of animals, but also the environment, eco-development, and food safety (Krause and Machek, 2018). Multiple studies show that introducing stricter animal welfare standards increases the costs of animal production by 5-30%, which surely translates to higher animal product prices (Čerkasov et al., 2016; Czubak and Konieczny, 2016). Pechrová (2017) is convinced that food consumers have to be aware of their responsibility for animal welfare and ready to incur the costs related with breeders' compliance with standards.

Chen, Nie and Yang (2017) state that animal welfare is important for contemporary food consumers in Europe. However, the interest in these problems varies across countries (Grunert et al., 2018). Malak-Rewlikowska, Gębska and Spaltabaka (2010) indicate that in Spain and Italy, the interest is low in comparison with Sweden, the Netherlands, Denmark, or United Kingdom characterized

by high activity of non-governmental organizations advising and promoting the use of products manufactured in compliance with high animal welfare standards.

The attitude of Polish food consumers towards animal welfare has not been studied sufficiently. The deliberations on this subject adopt mostly the perspective of new trends on the food market and are presented by Żakowska-Biemans (2011); Gutkowska et al. (2014); Matysik-Pejas, Szafrńska and Horská (2017).

Therefore, the aim of the paper is to determine the attitude of Polish food consumers towards the welfare of farmed animals and to identify selected socio-demographic factors determining it. The knowledge of these problems may serve as a basis for the actions of different entities, which will contribute to the increase of animal welfare awareness of food buyers.

2. Materials and Methods

The main source of data used was primary information from author's own study. Personal interview technique was used during research, which was conducted in 2017 on a sample of 350 people in the Małopolskie province. Proportional stratified sampling was used to select the respondents. The strata (groups) were sub-regions of the Małopolskie province according to the Central Statistical Office (CSO, 2013). The gender structure of the sample corresponded with the general population.

54% of the respondents were women and 46% were men. Only adult persons (over 18 years of age) participated in the study. Almost 35% of the respondents were between 40 and 54 years old. Respondents between 18 and 24 years old constituted 27% of the sample. Every fourth respondent was over 55 years old. The smallest group were persons between 25 and 39 years old. In the studied group, half of the respondents had a secondary education. Persons with a higher education constituted 27% of the studied group. The remaining respondents declared a basic vocational education. Working persons were the dominant group (2/3 of the respondents). Every fourth respondent was a pensioner. Farmers also participated in the study (14%).

To fulfil the research objective, structure indicators, non-parametric chi square test (statistical significance $p=0.05$) and non-hierarchical clustering method (k-mean clustering) were used. The aim of this method is to distinguish homogeneous groups of consumers while minimising the variability inside clusters and maximising the variability between particular clusters (Stanisz, 2007). The population was divided in three clusters in the study.

3. Results and Discussion

The respondents were asked to express their opinion on the importance of securing the welfare of farm animals. Over 70% of the respondents stated that this is an important problem. The remaining group considered it very important. The respondents could choose from 5 answers. The remaining alternatives ("Not very important", "Not at all important", and "I do not know") were not marked. The obtained results are consistent with the results obtained in other studies that show that this issue is very important for 34% of the Polish society (Special Eurobarometer, 2015).

Socio-demographic factors determining the respondents' opinions include gender ($\chi^2=18.9$; $df=1$) and age ($\chi^2=105.9$; $df=3$). The results of the statistical analysis show that women are more likely than men to consider animal welfare a very important problem (50% vs. 20%). People between 40 and 54 years old also declared it. 75% of this group expressed this opinion. The share of the youngest respondents who marked this response was 3%. The obtained results concerning the importance of animal welfare were consistent with the results obtained by other authors (Małażewska and Gajos, 2017). The determinants that did not differentiate the attitudes of the consumers were education

($\chi^2=4.9$; $df=2$), place of residence ($\chi^2=0.4$; $df=1$) and a subjective assessment of the respondent's financial situation ($\chi^2=4.3$; $df=3$).

For about a dozen years, numerous information campaigns carried out by ecological organizations and movements for animal rights protection with the objective of changing the consumer's attitude towards animal welfare have been observed. The respondents were asked what they thought about it. The vast majority of research participants (86%) think that information campaigns are a good way of changing consumers' behaviors (29% answered "Definitely" and 57% "Most probably"). The remaining group answered "Probably not" (7%) or "Definitely not" (7%). The obtained results are consistent with the results obtained in the studies conducted by the EU (Special Eurobarometer, 2015).

The improvement of farm animal welfare is an important field of discussion held by consumer movements, media, and the political class (Johansson-Stenman, 2018). Therefore, the respondents were asked whether animal welfare in Poland should be better protected than now. The majority (65%) thinks that better protection is needed. Almost every third respondent marked "Definitely" and 36% "Most probably". The remaining group had an opposite opinion. Every fifth respondent answered "No", the remainder "Rather not". Comparing the obtained results with the results of other studies, a higher share of negative answers (19 percentage points) was noticed (Special Eurobarometer, 2015). In this case, the respondents' opinion depended on gender ($\chi^2=41.0$; $df=3$), age ($\chi^2=136.7$; $df=9$), level of education ($\chi^2=65.5$; $df=6$) and place of residence ($\chi^2=29.1$; $df=3$). Women, people over 39 years old, respondents with a higher education, and city residents were more likely to express positive declarations. The factor that did not affect respondents' opinions was the main source of income ($\chi^2=16.6$; $df=12$).

Study participants were also asked if they would be willing to pay more for products from the animal welfare-friendly production system. Every second respondent would pay more for such products. Almost 30% could pay up to 10% more and 21% declared that they could pay up to 5% more. For a large part of respondents (35%), this would depend on the product price. Almost 15% would not pay more. Marian et al. (2014) also obtained corresponding results. Comparing the obtained results with the results for an average European Union resident, a smaller share of consumers willing to pay more for products from animal welfare-friendly production system was noted (10 p.p. difference). (Special Eurobarometer, 2015). This discrepancy is a result of the difference of income per person in a family in particular European Union member states and the share of food expenses in the total amount of expenses of a household.

The groups more willing to pay higher prices for such products were women ($\chi^2=87.5$; $df=3$), persons between 25 and 54 years old ($\chi^2=95.4$; $df=9$), respondents with a secondary education ($\chi^2=53.9$; $df=6$) and persons from urbanised areas. Men, the youngest and the oldest respondents, respondents with a higher education, and inhabitants of rural areas had an opposite opinion. Šálková and Tóth (2013) obtained corresponding results in terms of gender for Czech consumers.

To make the decision easier for the consumers, products from animal welfare-friendly production systems have special markings (Krause and Machek, 2018). Over 35% of the respondents never pay attention to such information. Almost 10% did not know that such labels existed. The remaining persons check information on product labels: 30% sometimes, 26% rarely. No one marked the answer "I always check for such information".

The analysis of socio-demographic factors indicates that women ($\chi^2=22.6$; $df=3$), people between 18 and 24 years old and between 40 and 54 years old ($\chi^2=166.6$; $df=9$), respondents with a secondary education ($\chi^2=155.8$; $df=6$) and city residents ($\chi^2=40.4$; $df=3$) looked for such information the most

often The largest number of persons unaware of such markings was noticed among men (every tenth man), the oldest group (every third respondent from his group), and respondents with the lowest level of education (50%). Moreover, people who consider animal welfare protection important ($\chi^2=420$; $df=9$) and those who are willing to pay more for such products ($\chi^2=137.0$ $df=9$) look for products with such a marking more often.

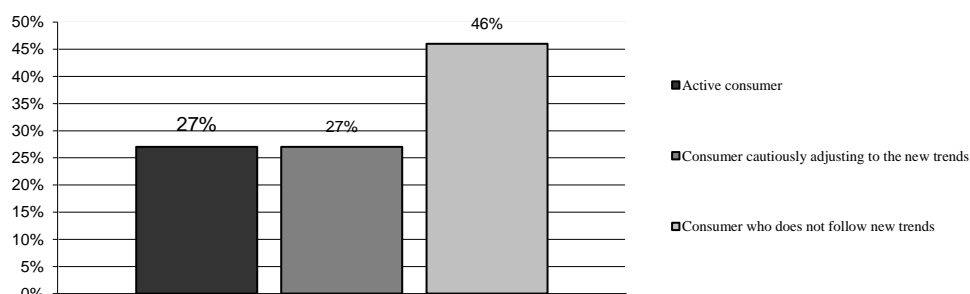
Another question concerned the accessibility of food products from animal welfare-friendly production systems in commercial establishments. Almost every third respondent thinks that the assortment of products is sufficient. Over 20% responded “Most probably” and only 7% “Definitely”. 51% expressed an opposite opinion, stating that the choice of products was insufficient (30% marked “No” and 21% “Rather not”). The remaining persons did not have an opinion on the subject. The obtained results are consistent with the results obtained in other studies (Special Eurobarometer, 2015).

The analysis showed statistical differences of consumers’ opinions depending on gender ($\chi^2=87.5$; $df=4$), age ($\chi^2=167.4$; $df=12$), and education ($\chi^2=155.8$; $df=3$). Women, people between 40 and 54 years old, and respondents with a secondary education believed that the assortment of products from animal welfare-friendly production systems in commercial establishments was unsatisfactory. It was also noticed that the respondents willing to pay more for such products consider their assortment insufficient (67% answers vs. 20% declarations of respondents unable to pay more).

Polish consumers adapt to changes on the food market and change their behaviours to a varying degree. In order to identify this variation, a consumer typology was established. The basic criterion of classification carried out using cluster analysis were respondents’ opinions on animal welfare and food products from farms respecting animal rights. Based on the adopted segmentation criteria, three types of strategies were distinguished: Type 1 - active consumers, Type 2 - consumers with a cautious approach to changes, and Type 3 - conservative consumers.

The first type are active consumers. They constituted 27% of the entire sample. The majority of this group considers animal welfare very important and believe it should be better protected in Poland. They are willing to pay even 20% more for products from farms respecting animal rights and look for such products when shopping. Moreover, they consider the assortment of such products insufficient. Active consumers are mostly women, people between 25 and 54 years old, with a secondary or a tertiary education, living in cities. Such behaviours prevail among respondents with a high income.

Fig. 1. Typological groups of consumers’ attitudes towards farm animals’ welfare



Source: own research, n=350

Other types of consumers are people approaching changes cautiously. They also constitute 27% of the sample. They believe that animal welfare is important and probably needs better protection in Poland. They declare a willingness to buy products from production systems taking animal rights

into account, but are not able to pay more than 10% more for them. These persons look for such products occasionally and consider their assortment sufficient. They are both women and men, are between 18 and 24 years old or over 40 have a basic vocational and a secondary education. They live both in urban and rural areas and consider their material situation good.

The last type of consumers are people who do not follow new trends on the food market. This group included the largest number of people who did not think that animal welfare in Poland required better protection. Every tenth person from this group would not pay more for products from farms respecting animal rights and every fifth never buys them. Additionally, they believe that the assortment of products from animal welfare-friendly production systems is definitely sufficient. Such behaviours are typical for men, the oldest group, people with a secondary education, residents of rural areas and small towns, and respondents assessing their financial situation negatively.

4. Conclusion

The conducted research revealed the attitudes of food consumers towards farm animals' welfare, as well as the factors determining them. According to the conducted research, animal welfare is important (71%) or very important (29%) for consumers. The majority believes that animal welfare in Poland should be better protected than it is now. Such attitudes are determined by gender, age, education, and the place of residence of the respondents. Welfare protection is very important for most women, people with a higher education, and city residents.

Despite the fact that the food from animal welfare-friendly farms is more expensive than food from traditional production, every second respondent declares a willingness to pay more for it. Women, people between 25 and 54 years old, with a secondary education, living in cities are more inclined to pay higher prices.

Almost every second food consumer looks for products from animal welfare-friendly production systems with appropriate markings. The remaining people never check packages for such information and almost 10% did not know about the existence of such markings. Therefore, entities responsible for consumer education should establish special programmes or information campaigns to increase consumers' awareness. These initiatives should be dedicated mostly to the youngest and the oldest consumers, as these two groups know the least on the subject.

Three types of consumers' attitudes towards farm animals' welfare were identified: active consumers, consumers approaching changes cautiously, and consumers not following new trends. These types are differentiated mostly by consumers' attitude towards farm animals' welfare and the level of willingness to buy products from animal welfare-friendly farms.

In relation with the fact that consumers' behaviours on the market keep changing, conducting research aiming at determining the dynamics and direction of changes.

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THE ASSESSMENT OF MARKET DEMAND FOR PRODUCTS OBTAINED FROM PRIMARY WHEAT FORMS WITH INCREASED NUTRITIONAL VALUE

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Annotation: Maintaining food security means producing foods which are both high-quality and in sufficient quantities. As far as farming production is concerned, maintaining biodiversity is essential for the protection of the natural environment, while allowing for the production of a more diverse high-quality cereal product offer at the same time. The aim of the study was to determine market demand for primary wheat highly-nutritious products such as Spring Indian Dwarf Wheat and Spring Persian Wheat. The empirical data for the study was provided by a survey, which was performed in 2017 on a group of 283 respondents, out of which 143 were customers of traditional grocery shops, and the remaining 140 were customers of organic food fairs. The authors deliberately chose different types of consumers because they tried to compare different product preferences among them. The study revealed that when buying food products, the majority of consumers carefully examined attached labels with nutritional information. What is more, they were willing to buy products obtained from primary wheat forms. Certain differences were observed in feedback provided by members of both groups. Customers who regularly bought organic products were more concerned with the quality of the cereals and they were more willing to buy products with increased nutritional value. Thus, it can be argued that promoting primary wheat types through scientific and introductory studies, as well as the production of high-quality cereal products is beneficial.

Key words: consumer preferences, nutritional value, cereal products, Spring Indian Dwarf Wheat (*Triticum sphaerococcum* Percival), Spring Persian Wheat (*Triticum persicum* Vavilov)

JEL classification: M31, Q11, Q13, Q18

1. Introduction

Food security in the European Union and in contemporary global economy development is of paramount importance (Candel and Biesbroek, 2018; Pawlak, 2016; Pawlak, 2017; Puślecki, 2016). Ensuring food security, which means producing high-quality nutritious food, is one of the key goals in the EU policy (Bojar, Sikora and Dzieża, 2017). As far as farming production is concerned, maintaining biodiversity is essential for the conservation of the natural environment (Altieri, 1991; Barthel, Crumley and Svedin, 2013; Kiełbasa et al., 2018; Menta et al., 2011; Moonen and Barberi, 2008). This can be accomplished by searching for new genetic variations, which can guarantee obtaining desired qualitative features. Unfortunately, by relying heavily on industrial means of production and breaking the holistic bonds upon which farming should be based, the industrial farming system not only poses a threat to farming and wellbeing of humans and animals, but it does not guarantee food security (Donald, Green and Heath, 2001; Hole et al., 2005; Krasowicz, 2009). In order to satisfy the world's growing need for food security and sustainable development, food production should increase, while the impact on the natural environment should decrease considerably at the same time (Carvalho, 2006; Foley et al., 2011; Godfray et al., 2010; Roman, Roman and Roman, 2018). Biodiversity of agriecosystems can be increased by i.e. introducing genetically diversified species and varieties of plants (Chateil et al., 2013; Gotsch and Rieder, 1995; Jana, 1999), or by reinstating the production of former genotypes, which in turn requires revitalization

of the unused potential of certain primary species (Borders et al., 2011; Hammer, 2003). Growing primary wheat species and varieties creates a good opportunity to reinstate and maintain biodiversity in the natural environment. It also allows to extend the high-quality cereal product range. The aim of the research was to assess market demand for products based on primary wheat types with increased nutritional value of the Spring Indian Dwarf Wheat (*Triticum sphaerococcum* Percival) and the Spring Persian Wheat (*Triticum persicum* Vavilov). Therefore, consumers were asked if they paid attention to the nutritional value information included on cereal products, and whether they would consider buying primary wheat products with increased nutritional value. The survey was performed in order to determine whether a scientific project focusing on technology of growing primary pure wheat forms in bio-ecological and traditional systems should be launched.

2. Materials and Methods

The diagnostic survey method including questionnaires was employed in order to collect the empirical data. The survey was performed in the spring of 2017 and involved 283 respondents in total, out of which 143 were customers of traditional grocery shops and the remaining 140 were customers of organic food fairs. The choice was intentional as the authors tried to compare product preferences between these groups. The obtained empirical data was calculated using the methods for verification of statistical hypotheses. The aim was to find the relationships between the answers given by respondents, and the variable which distinguished the two groups. The chi-squared test [χ^2] was used to test the hypothesis of relationship between the variables. After the hypothesis was verified, the scientists proceeded to define its character (direction) and force using the *C* Pearson's contingency coefficient and the *g* convergence coefficient methods (Dziekański, 2016; Gruszczyński, 1986). The analysis proved that the differences in the respondents' answers were statistically relevant. Members of the two groups revealed different opinions regarding paying attention to products' nutritional information as well as interest in buying primary wheat products such as bread, biscuits, pasta, finely ground wheat, cereals and flour. No relevant differences were recorded between the two groups as far as the respondents' willingness to buy rolls or other products obtained from primary wheat (Table 1).

Table 1. The significance of differences between answers provided by the traditional grocery shop customers and those buying food at organic food fairs - the chi-squared test (χ^2), the *C* Pearson's contingency coefficient and the *g* convergence coefficient results

Wyszczególnienie	χ^2 $\alpha=0,01$	χ^2	<i>C</i>	<i>g_{rc}</i>	<i>g_{er}</i>
Checking nutritional value of cereal products (cereals, finely ground wheat, pasta, biscuits, bread, rolls, flour)	13.277	22.670*	0.272	0.000	0.257
Interested in buying flour produced with primary wheat	13.277	24.005*	0.280	0.000	0.243
Interested in buying cereals produced with primary wheat	13.277	28.020*	0.300	0.000	0.300
Interested in buying finely ground wheat produced with primary wheat	13.277	26.665*	0.293	0.000	0.271
Interested in buying pasta produced with primary wheat	13.277	13.650*	0.215	0.000	0.186
Interested in buying biscuits produced with primary wheat	13.277	14.591*	0.221	0.000	0.207
Interested in buying bread produced with primary wheat	13.277	15.669*	0.229	0.000	0.186
Interested in buying rolls produced with primary wheat	13.277	6.317	-	-	-
Interested in buying other products produced with primary wheat	13.277	7.407	-	-	-

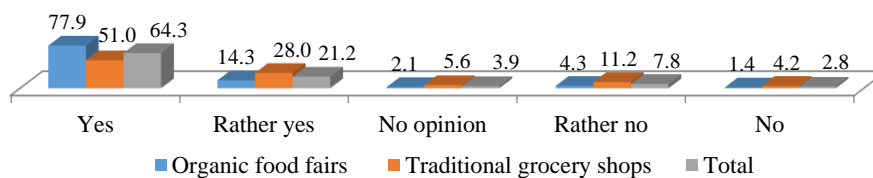
*Result relevant for $\alpha=0,01$

Source: own research, 2017

3. Results and Discussion

On the increasingly competitive food market, consumer preferences play a key role when making decisions about buying particular products. Product quality – not merely its price – is one of several factors that customers consider when they decide to buy something (Matysik-Pejas, Krasnodębski and Satoła, 2015; Navratilova et al., 2017; Paraffin, Zindove and Chimonyo, 2017; Regnerová et al., 2017; Yiridoe, Bonti-Ankomah and Martin, 2005). In Europe more and more people look for healthy foods with sophisticated taste. It is mainly the high-quality foods, which help to maintain healthy diet, and are characterized by their sophisticated taste that drive conscious and demanding consumers to buy them (Kalinowski, 2015; Krupa and Mantaj, 2016; Rodrigues et al., 2018; Silvestri et al., 2018; Wandel and Bugge, 1997). Such consumer behaviour can be ascribed to the growing trend of “eco-consumption” and living a healthy lifestyle, which is based upon healthy nutrition (Kuźniar, Kawa and Kuźniar, 2016; Smoluk-Sikorska, Łuczka and Kalinowski, 2017). The study results indicated (Figure 1) that the vast majority of the respondents (85.5%) paid attention to the nutritional information included on cereal product labels. The statistical analysis confirmed (Table 1) that there were statistically relevant discrepancies between the two groups of consumers. The customers of organic food fairs were more concerned with nutritional information attached to products (92.2%), while those shopping in traditional grocery shops were less interested in such content (79.0%).

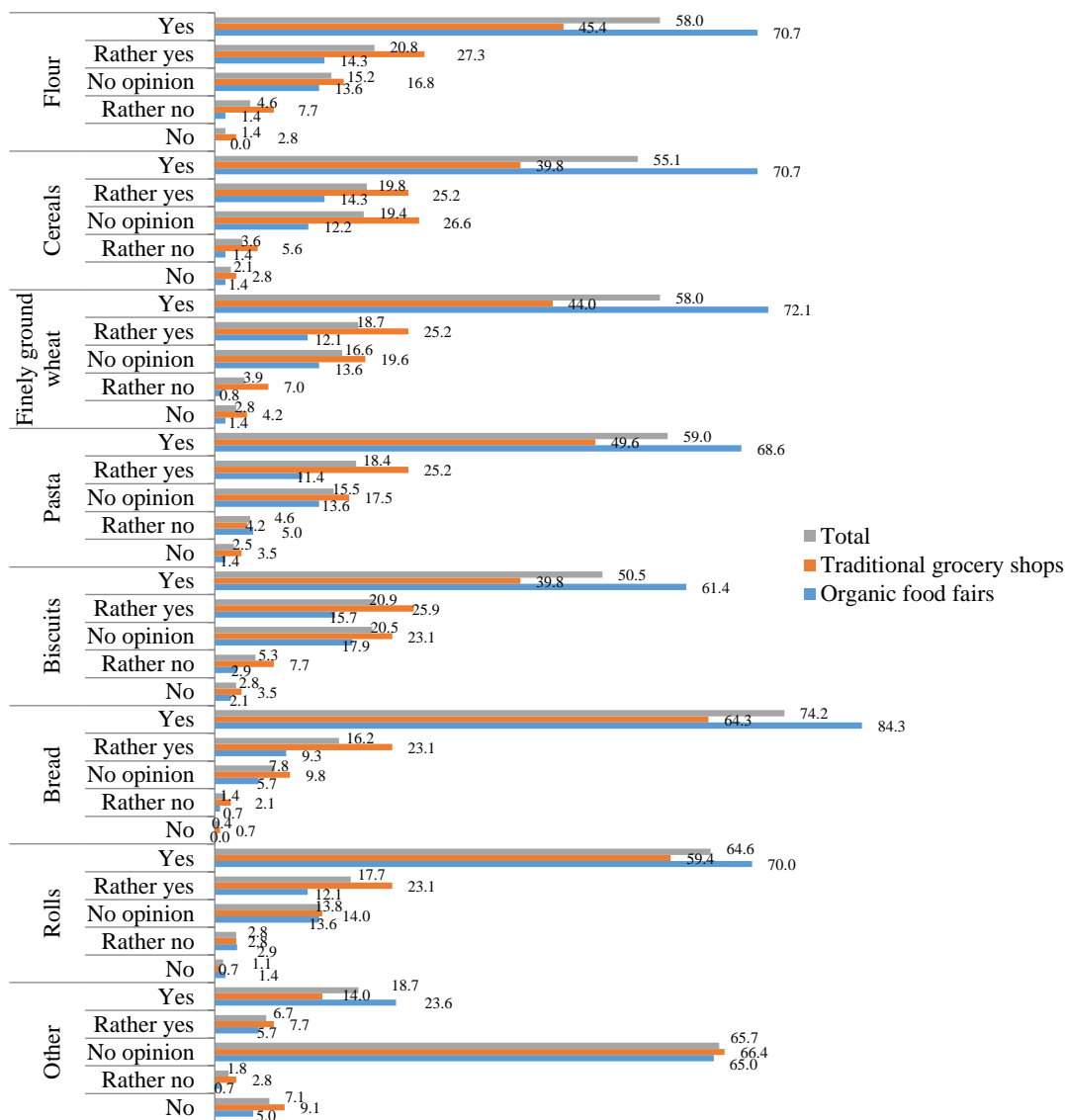
Figure 1. Consumers checking nutritional value of cereal products (flour, cereals, finely ground wheat, pasta, biscuits, bread, rolls and others) [%]



Source: own research, 2017

The majority of all respondents declared willingness to buy products made with primary wheat (Figure 2). The most popular item in this group was bread (90.4%), followed by other products such as rolls (82,3%), flour (78.8%), pasta (77.4%), finely ground wheat (76.7%), cereals (74.9%) and biscuits (71.4%). What is more, 25.4% of the respondents were interested in buying other primary wheat products such as chicory coffee, homemade bread baking mixes, pies and birthday cakes. The statistical analysis confirmed (Table 1) there were relevant discrepancies between answers provided by the respondents from the two group. The consumers buying grocery products at organic food fairs more often declared willingness to buy the following primary wheat products (as opposed to consumers buying traditional foods): flour (85.0% versus 72.7%), cereals (85.0% versus 65.0%), finely ground wheat (84.2% versus 69.2%), pasta (80.0% versus 74.8%), biscuits (77.1% versus 65.7%), bread (93.6% versus 87.4%).

Figure 2. Consumers interested in buying cereal products (flour, cereals, finely ground wheat, pasta, biscuits, bread, rolls, etc.) produced using primary wheat forms [%]



Source: own research, 2017

4. Conclusions

The concern about own and family welfare is the main reason why conscious consumers choose to buy highly nutritious foods. This awareness is inversely proportional to the growing number of people suffering from different ailments and illnesses. More and more people realize that buying high-quality bio food products is a kind of investment in one's own wellbeing and a sort of insurance policy for the future (Yiridoe, Bonti-Ankomah and Martin, 2005). The study confirms that there is a considerable number of consumers who carefully check the nutritional value information attached to cereal products. The same group is interested in buying primary wheat products with increased nutritional value. However, this feedback was obtained mainly from those buying food in organic food fairs rather than traditional consumers, supplying themselves in typical grocery shops. To sum up, the study established that there is a need for a scientific project aimed at designing the technology to grow primary and pure wheat types. What is more, the research will encompass quality assessment of the collected grains and their nutritional and technological values. Eventually, this will allow for new types of foods such as bread, biscuits, pasta cereals, finely ground wheat etc. based on the primary wheat forms to be produced.

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EVALUATION OF ASPECTS THAT INFLUENCE SYSTEM EFFECTIVENESS TO ENSURE FOOD SAFETY IN FOOD OPERATIONS USING MAXAGR SOFTWARE

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Annotation: Ensuring food safety in food operations in the Czech Republic is currently regulated by an extensive range of European and national legal regulations. Nevertheless, there are also customers' demands beyond this framework for independent declaration of compliance not only with these legal requirements, but also with some of the preferred standards. These are frequently essential prerequisites in order to establish or maintain a customer-supplier relationship. The HACCP system is fundamental (essentially stipulated by the legal framework) and generally forms only the basis for other required standards, such as the GFSI, BRC, IFS, FSSC2200, and ISO 22000 norms or the GLOBAL.G.A.P. standard for primary production. The aim of this paper is to evaluate the key aspects which might influence the success rate and effectiveness of implemented systems to ensure food safety in food operations in the Czech Republic. The research methodology is based on using a modified version of the Delphi method as an experimental method for group problem solving. The panel comprises twelve experts specializing in food operations who are responsible for effective setting of the food safety system, expert consultants on correct implementation of the food safety system, university experts in this area as well as representatives from inspection and certification authorities. A questionnaire with closed-ended questions and the Likert scale, designed to measure attitudes and opinions, was the tool used in the research. The MaxAgr. software developed at the CULS Prague was used for evaluation. The research questions are as follows: Which aspects influence effectiveness of the implemented food safety system the most? Which aspect is considered key in terms of a potential negative consequence? Are certified solutions to these systems the key to increasing sales on the domestic and international market?

Key words: food processing, modified Delphi environment, certification, HACCP, standard

JEL classification: M10, Q18, P46

1. Introduction

Debates on the future of the agri-food system have been accompanied by an increasing focus on ethical concerns which in the recent period have centred around the concept and the political goal of food security (Wilkinson, 2015). According to King et al. (2017), the global food sector operates in an environment where policies, standards, regulations, guidelines, education, and advice related to food, including those related to the safety of food, are continuously being either developed or updated.

Ensuring food safety in food operations in the Czech Republic is currently regulated by an extensive range of European and national legal regulations. Nevertheless, there are also customers' demands beyond this framework for an independent declaration of compliance not only with these legal requirements but also with some of the preferred standards regarding e.g. of the food quality or origin (Rojík et al., 2016), or B2B standards. The HACCP (Hazard Analysis Critical Control Point) system is always the base for B2B standards such as ISO 22000, BRC, IFS, and other.

The HACCP system provides several magnitudes of food safety assurance over that offered by traditional inspections for the food market and foodservice operations (Bryan, 1990). The EU legislation requires implementation of the Food Safety Management system based on the HACCP

principles by food businesses in all member states. Some research shows that the maximum improvement was achieved when implementing the pre-requisite programmes and a bespoke HACCP plan; however, deterioration in standards could be identified when using more complex systems such as ISO 22000 (Charalambous et al., 2015).

The aim of this paper is to evaluate the key aspects which might influence the success rate and effectiveness of implemented systems to ensure food safety in food operations in the Czech Republic. The research questions are established as follows: (1) Which aspects influence effectiveness of the implemented food safety system the most? (2) Which aspect is considered key in terms of a potential negative consequence? (3) Are certified solutions to these systems the key to increasing sales on the domestic and international market?

2. Materials and Methods

MaxAgr, a modified version of a Delphi method based on Shannon entropy, was selected as a methodological tool (Vrana et al., 2012). This method removes some imperfections of the Delphi method, for instance, its laboriousness and time-consumption which make it expensive (Fitzsimmons and Fitzsimmons, 2006), or possible distortion due to inappropriate primary interpretation or decrease in experts' concentration in the process (Gupta and Clarke, 1996). The MaxAgr method enables to determine the parameter value which is examined by the experts. This value corresponds with the best consensus on the opinions of the experts participating in the evaluation. The consensus might be perceived as a probability value of the statement that "The experts have reached consensus on their opinions". It reaches the value from interval [0, 1]. The consensus equals 1 provided that the experts' opinions reach consensus and 0 if half of the experts hold a different viewpoint.

A basic framework for an in-group analysis is used as a solution (Rowe et al., 1994). In this case, the in-group comprises experts on application of the food safety system specializing in food sector (that is agriculture, retail and gastronomy has been excluded). The survey was conducted in April 2018. Twenty experts from the Czech Republic were asked to respond to 26 key questions in a structure review process firstly. This process has been designed in order for the panel to be concerned with a given problem as a whole (Linstone and Turoff, 2011). The panel comprised experts specializing in food operations who are responsible for effective implementation of the food safety system (5 experts), expert consultants for correct implementation of the food safety system (5 experts), university experts in this area (5 experts) as well as representatives from inspection and certification authorities (5 experts) from the Czech Republic. Only twelve experts completed the entire questioning process. 22 statements were formulated on a record sheet. These were related to the impact of individual aspects on effectiveness and efficiency of implemented systems to ensure food safety (hereafter only "system"). These statements consist of 3 thematic subjects. The first could be referred to as "business attributes" which significantly influence overall effectiveness (efficiency) of the system. It comprises the business form, its configuration in terms of food safety and human resources. The second subject refers to "insufficiently considered factors" which influence the entire system negatively. The third area includes "the key aspects" which, unless fulfilled or when they fail, have a considerable negative consequence (for example, a consumer's death).

The panellists were asked to express their agreement / disagreement using the Lickert scale between 1 (strong disagreement) and 5 (strong agreement). 4 questions were supplementary, providing the experts with an opportunity to expand, clarify or adjust the above-mentioned statements. Should there have been evident differences in the responses to these questions against the formulated statements, there would have been another round of questioning adjusted based on the new findings. Only twelve experts completed the entire questioning process.

MaxAgr software was used to process the responses. It was developed along with MaxAgr method. For clarity, the results are summarized in tables (Table 1-4). The highest calculated value of the MaxAgr indicator refers to the most prevailing degree of consensus of the experts' estimate for the given value on the Lickert scale. Subsequently, based on the outcomes, responses to research questions are formulated and recommendations are suggested in order to increase effectiveness of the system to ensure food safety.

3. Results and Discussion

As has been mentioned above, the aim of this paper is to evaluate the key aspects which might influence the success rate and effectiveness of implemented systems for ensuring food safety in food operations in the Czech Republic. *The first research question is (1) Which aspects influence effectiveness of the implemented food safety system the most?*

In order to identify these aspects, it was firstly necessary to focus on overall attributes of the company related to the system. These contain the attribute of the company's form, the company's arrangement and human resources. Table 1 shows the results of evaluation of the attributes that influence effectiveness of the system using the MaxAgr method.

Table 1. Evaluation of the attributes that influence effectiveness of the system

No. of question	Attribute	Value on Lickert scale	Value in MaxAgr
1.	Attribute of the company's form	3	0.7282662244
2.	Attribute of the company's arrangement	5	0.9333060287
3.	Attribute of human resources	5	0.9518387305

Sources: own research, 2017

The attribute of the company's form can influence overall perception and effectiveness of the food safety system, for instance, depending on the type of the enterprise (natural person x legal entity), ownership (family business x joint-stock company) or on related organizational structure, delegation of responsibility and authority and so on. All these elements can influence the engagement of the management and owners of the companies in the entire system. This concerns willingness to invest in the system or strict insistence on performing the duties to maintain an efficient system. It might be assumed that the closer the relationship between the owner and the entity, the greater the interest in the system and its effectiveness might be expected. This attribute is not considered very important by the experts.

The attribute of the company's arrangement has a more considerable impact. It involves, for example, configuration of prerequisite programmes, the standard of the company's equipment, configuration of verification methods. This involves setting partial procedures while taking into consideration spatial disposition and the given technical equipment standards.

According to the experts, however, the human resources attribute has the most considerable influence on the final effectiveness and efficiency of the system. This attribute consists of availability of suitable employees (in terms of required qualification, experience), their turnover, engagement in the process, acceptance of system requirements and in this regard performance of the duties including administration, participation in seminars, and so on.

Based on the analysis of Greek companies, Fotopoulos, Kafetzopoulos and Psomas (2009) have also discovered that these latent constructs also have a significant impact on the achievement of the system's aims regarding identification, assessment and control of food- borne safety hazards.

Bryan (1990) states that there are several hazardous operations associated with preparation of foods. Risks vary depending on (a) the food source, (b) methods used to prepare foods, (c) conditions during storage. Therefore, the second view targeted at the aspects which, unless considered sufficiently, can influence effectiveness and efficiency of the system negatively. This concerns mainly inadequate consideration of the type of foods and their composition, food processing methods, food storage conditions, semi-finished and finished products including handling as well as of all types of risks (physical and chemical hazards are most frequently neglected) and the risk analysis alone. In practice, an incorrectly selected or conducted method, so-called business blindness, or absence of a microbiologist in the HACCP team is a rather frequent problem. For this reason, Table 2 illustrates evaluation of these aspects based on the experts' opinions.

Table 2. Evaluation of aspects which negatively influence effectiveness and efficiency of the system

No. of question	Aspect	Value on Lickert scale	Value in MaxAgr
4.	Inadequate consideration of food type and its source	4	0.8530372463
5.	Inadequate consideration of food processing methods	4	0.8876237045
6.	Inadequate consideration of storage conditions and handling foods	4	0.8876237045
7.	Inadequate consideration of all types of hazards	5	0.9839462435
8.	Inadequate risk analysis	5	1

Sources: own research, 2017

All the aspects have been evaluated by the panellists as important on the second half of the Lickert scale.

Nevertheless, the absolute consensus between the experts prevails in their perception of an inadequate risk analysis as an aspect which negatively influences effectiveness and efficiency of the system. Furthermore, inadequate consideration of all types of hazards is another significant aspect which negatively influences effectiveness and efficiency of the system. However, establishment of hazards could also be perceived as an input step for the risk analysis alone. FMEA (Failure Mode and Effect Analysis) has been identified as the most suitable method. FMEA is a powerful systematic preventive method for risk management, which aims to eliminate potential failures associated with each stage of the process before they enter the next stage. It has been widely used by manufacturing companies for quality and safety assurance, addressing customer and governmental requirements, quality control and safety (Kurt and Ozilgen, 2013; Ozilgen, Bucak and Ozilgen, 2011; Scipioni, Saccarola and Centazzo, 2002).

The response to the *research question (1) is that*, based on the analysis of the in-groups' viewpoints, the attribute of the company's human resources and the attribute of the company's arrangement, upon simultaneous correctly-conducted risk analysis, have the most considerable impact on effectiveness and efficiency of the system.

The second research question is *(2) which aspect is considered key in terms of a potential negative consequence?* In other words, which aspects, if not complied with or when they fail, result in a significant negative consequence. For example, there is a breach of food safety which will cause a consumer's death. The results based on the experts' evaluation are summarized in Table 3.

Table 3. Evaluation of key aspects, the non-compliance with or failure of which has a significant negative consequence

No. of question	Aspect	Value of Lickert scale	Value of MaxAgr
9.	Company management style	5	0.8456004104
10.	prerequisite programme	4	0.8690910028
11.	Company equipment	4	0.9011985157
12.	Configuration and methodology for verification procedures	4	0.871569948
13.	Availability of qualified staff	5	0.8607462801
14.	Involvement and engagement of staff in the process of ensuring food safety	5	0.9011985157
15.	Frequency and quality of staff training	4	0.8369834898
16.	Accepted responsibility for the system and its functionality by the company's management	5	0.9333060287
17.	Involvement of an independent competent person in the HACCP team	3	0.7492778714
18.	correctly-conducted risk analysis	5	0.9006129102
19.	Checking compliance with the directives by staff	4	0.8311177124

Sources: own research, 2017

Involvement of an independent and competent person in the HACCP team has been considered the least significant.

According to the experts, the most important key attribute of the system, the non-compliance with or failure of which has a considerable negative consequence, is accepted responsibility for the system and its functionality by the company's management. However, according to them, this responsibility is not connected with the attribute of the company's form. Van Kleef et al. (2006) also regard responsibility for prevention and management of food risks as a key factor in ensuring food safety,

Involvement and engagement of members of staff in the food safety system, correctly-conducted risk analysis, availability of qualified employees as well as the company's management style have also been considered as key attributes in the area.

The final part focused on seeking a response to the research question (3) *Are certified solutions to these systems the key to increasing sales on the domestic and international market?* Third-party certification has emerged as a significant regulatory mechanism in the global agri-food system (Hatanaka, Bain and Busch, 2005).

Table 4. Evaluation of importance of certified systems to ensure food safety

No. of question	Attribute	Value on Lickert scale	Value in MaxAgr
21.	Certified HACCP always means greater effectiveness and efficiency of the system.	4	0.850558301
21.	Certification of the system always means greater effectiveness and efficiency of the system	4	0.850558301
22.	Certified systems are the key to increasing sales on domestic and international markets	4	0.850558301

Sources: own research, 2017

The experts' responses (see Table 4) are balanced in all of the aspects. System certification to ensure safety of produced foods by the third party is considered a rather significant aspect by the majority of the respondents. Psomas and Kafetzopoulos (2015) also endorse the position of certified systems on the example of certified and non-certified ISO 22000 and HACCP systems.

4. Conclusion

The aim of this paper was to evaluate the key aspects which might influence the success rate and effectiveness of implemented systems for ensuring food safety in food operations in the Czech Republic. Based on the experts' opinions analysis, using a modified MaxAgr method, the responses to the research questions are as follows. (1) According to the in-groups' opinions, the effectiveness and efficiency of the system is mostly influenced by the attribute of the company's human resources, the company's arrangement upon simultaneous correctly-conducted risk analysis. (2) The most important key aspect of the system, the non-compliance with or failure of which has a significant negative impact, represents responsibility for the system and its functionality accepted by the company's management. This aspect directly influences other important aspects, such as involvement and engagement of the staff or conducting risk analysis. (3) The certification solution to the system is not a key aspect, but rather important in order to increase sales on the domestic and international markets, according to the experts.

The recommendation for a company's management is as follows: accepting the management's responsibility is a prerequisite to increasing the efficiency of the food safety system. In the frame of this responsibility, the company's management needs to focus on human resources and their disposition in terms of ensuring the food safety system. The management should also remember that HACCP teams must be competent to use the risk analysis correctly.

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ANALYSIS OF EARTH REMOTE SENSING DATA SETS AND THEIR USABILITY IN THE AGRICULTURAL SECTOR

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Annotation: The main objective of this article is to analyze the Earth remote sensing data sets and identify shortcomings limiting the efficient processing and use of these datasets in the agricultural sector and related industries. The Copernicus remote sensing data is distributed internationally via the Copernicus Open Access Hub. The data is in the form of packages covering a defined area and, if available, also in the form of single images, which is the basic unit. Color syntheses and selected spectral bands provide a view of the state of vegetation in other spectral bands than the human eye permits. E.g. The Sentinel-2A MultiSpectral Instrument (MSI) records data in three wavelengths of visible light and also in the infrared band, which is particularly useful in agriculture in monitoring vegetation, soil, food safety, but also for monitoring of the environment in general. Properly chosen color synthesis can point to plant stress or soil erosion with a different color shade than is common for healthy and prosperous growth. Usable spectral indices in plant production include NDVI, EVI, RENDVI (or NDRE) GNDVI, MSI (or NDWI) and LAI.

Key words: Spatial data, Earth, Earth observatory, agriculture, precision farming, analysis

JEL classification: C8/C80 General Data Collection and Data Estimation Methodology • Computer Programs, Q16 R&D • Agricultural Technology • Biofuels • Agricultural Extension Services

1. Introduction

Aerial or satellite imagery facilitates non-destructive Earth observation and monitoring in agriculture and related fields such as monitoring of agricultural and forest growth status, water in the countryside, rural development and offers the possibility of operational use for modeling agro-technical interventions (Fülöp et al., 2015). Remote sensing of optical and radar data can help map out crop types and estimate biophysical parameters, particularly with the availability of the unprecedented amount of free Sentinel data from Copernicus (Veloso et al., 2017). For planning activities, comparing the current situation with the past, predicting weather behavior, or influencing human civilization, it is necessary to have a high-quality data base that can analyze the evolution of the monitored issue over time.

Color synthesis and selected spectral bands provide a view of the state of vegetation in other spectral bands than the human eye permits. E.g. The Sentinel-2A MultiSpectral Instrument (MSI) records the data in three wavelengths of visible light and also in the infrared band, which is particularly useful in agriculture in monitoring vegetation, soil (Congedo et al., 2017), food safety (Lacaze et al., 2015), but also for the monitoring of the environment in general (Fernández-Manso et al., 2016). Properly chosen color synthesis can point to plant stress or soil erosion with a different color shade than is common for healthy and prosperous growth. Usable spectral indices in plant production include NDVI, EVI, RENDVI (or NDRE) GNDVI, MSI (or NDWI) and LAI.

In order to work efficiently with remote sensing data, there are often some limitations that arise from the properties of the acquired data, e.g. data requirements (Clauss et al., 2018) - especially in case of mobile use, resolution (Barton et al., 2017; Clark et al., 2017), cloudiness (Buongiorno Nardelli et al., 2015; Surek et al., 2016), sun reflections (Harmel et al., 2018) and so on.

2. Materials and Methods

The basic scientific methods of analysis and synthesis were used to solve the studied subject. The European Commission and its agencies ensure the implementation of Copernicus services. The Commission is the owner and source of funding for Copernicus. Technical implementation is provided by specialized bodies - ESA, EUMETSAT, EEA, ECMWF (European Center for Medium-Range Weather Forecasting) and others (Copernicus, 2016a). The Copernicus data policy is also based on the European INSPIRE (European spatial data infrastructure), which harmonises policy and electronic access to geographic information in Europe (Copernicus 2016b; Center National Detudes Spatiales, 2016).

Sentinel line of satellites consists of several types of satellites, usually discharged in pairs to provide faster data recovery. Currently, the satellites of the first two missions are active, and there are two further missions in the test run.

- Sentinel-1 for very accurate land and sea monitoring
- Sentinel-2 for high-resolution multispectral surface monitoring
- Sentinel-3 for multi-sensor surface monitoring
- Sentinel-4 for monitoring the atmosphere, especially gases over Europe (planned for 2020)
- Sentinel-5P for monitoring of selected gases in the atmosphere
- Sentinel-5 for accurate high-resolution atmosphere monitoring (planned as Sentinel-5P successor)
- Sentinel-6 for the continuation of the Earth's radar monitoring program (planned for 2020)

LandSat missions also consist of several satellites:

- LandSat7 for surface scanning and satellite nap recovery (scheduled termination in 2017)
- LandSat 8 / LDCM for surface imaging and satellite map recovery
- LandSat 9 to continue the program with a new generation of sensors (planned for 2020)

The analysis of individual data sets of the remote sensing was performed using available sources. The problem was also consulted with experts in the field.

3. Results and Discussion

The Sentinel and LandSat missions monitor not only marine ice, water areas and coasts, polar regions or snow cover, but especially forests, agricultural land use, soil deformation, climate change, vegetation, etc. Each mission produces a large amount of data that needs to be processed into a usable form. Typically, data is being cleaned and calibrated. The raw signal is corrected by spectrum corrections. Each dataset represents image data of a particular sub-surface area of the Earth. Data sets are downloadable and available for free. However, it is necessary to count on large data production, especially when they are constantly restored.

Data accessibility

The data is available via web presentations of organizations that provide both Sentinel and Landsat programs. The basic idea is slightly different, given by local habits and the concept of open data, but the data is available in the form that allows automatic downloading and subsequent machine processing. Everything is a question of the resourcefulness and the ability of the subject who wants to explore and exploit the data.

OpenHub (program Copernicus)

OpenHub is an online interface available through a browser that requires registration for access to data (of course, respecting conditions and rules). The graphical interface is very simple and clear and supports easy use of data sets.

API Hub (program Copernicus)

The API Hub is designed for automated download of data sets. It has no graphical interface and it is based on standardized reports. API Hub Access is currently available for all Sci Hub users. The only limitation is in slow login credentials write-through. Upon registration with Sci Hub, the user will gain instant access through a web interface. Access through the API Hub is activated within a week. Likewise, any changes to logins are updated within 1 week for the API Hub.

Sentinel-3 Pre-operational Hub

Mission Sentinel-3 is still in the trial phase. Selected samples can be viewed either within Sci Hub or inside a special version of Sci Hub with a unified user name - so there is no need to register for these samples.

GNSS Hub

The GNSS Hub is a pre-access point for all users of all GNSS L1b products in Rinex format for all Sentinel platforms.

LandSat

To access the data, can be used one of several options offered on the NASA website:

- LandsatLook Viewer,
- USGS GloVis: The Global Visualization Viewer,
- USGS Earth Explorer,
- Free Web Enabled Landsat Data (WELD),
- Free Orthorectified Landsat Data.

It is a web application that allows access to data acquired by individual Landsat satellites. Access is completely free and is not subject to registration.

Data sets

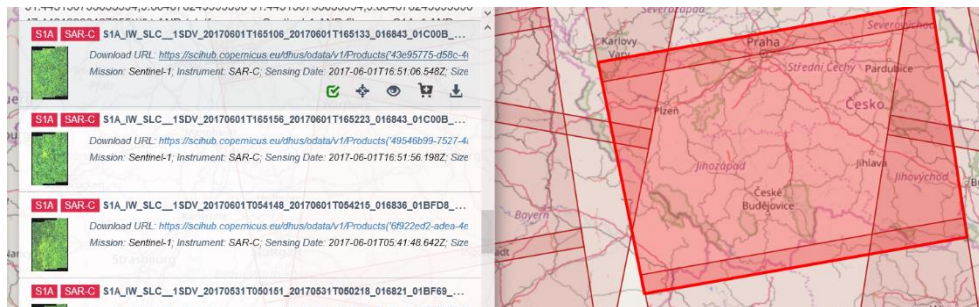
The Sentinel-1, Sentinel-2, and Sentinel-3 mission data products consist of the following datasets:

Table 1. Sentinel data sets products and their size

Sentinel-1	Sentinel-2	Sentinel-3
Satellite (Platform) <ul style="list-style-type: none">- S1A- S1B Product type <ul style="list-style-type: none">- SLC- GRD- OCN Polarization <ul style="list-style-type: none">- HH- VV- HV- VH- HH+HV- VV+VH Sensor mode <ul style="list-style-type: none">- SM (Strip map) – Level 0 and 1- IW (Interferometric wide swath) – Level 0, 1 and 2- (Extra wide swath) – Level 0, 1 and 2	Product type <ul style="list-style-type: none">- S2MSI1C- S2MSI2Ap Cloud cover <ul style="list-style-type: none">- Choice between 0 to 9,4	The data of the Sentinel-3 program are specific because of availability of outputs from several sensors. <ul style="list-style-type: none">- OLCI- SLSTR- SRAL

- WV (Wave) – Level 2 Relative orbit number - From 1 to 175 Collection - Only 1		
Data size		
Usually 7,65 GB After compression, around 4,4 GB	Usually 790 MB (zip)	SLSTR: 575 MB per area OLCI: 650 MB per area SRAL: 104 MB per area

Figure 1. Example of data set selection from a map (Sentinel-1)



Source: <https://scihub.copernicus.eu/dhus/#/home> - request needed

Figure 2. Data set detail (Sentinel-1)



Source: <https://scihub.copernicus.eu/dhus/#/home> - request needed

The processing of image data from Earth remote sensing and the interpretation of image information includes several follow-up digital image analysis techniques. Lillesand et al. (2008) describes several basic steps of digital image processing, the most important being image pre-processing, image enhancement, and image classification. Recently, in addition to official remote sensing data sources, various cloud platforms and repositories for providing and sharing data from various sources (O'Flaherty, 2015; Kliment et al., 2016) also appeared.

Limitations for effective work with datasets

The following limitations and barriers for efficient work with data were identified based on the analysis of datasets from Sentinel and LandSat:

- too large data file (especially for work on mobile devices)
- too large area covered by a single image
- possible cloudiness and other atmospheric distortions of data

4. Conclusion

Aerial or satellite imagery allows for non-destructive Earth exploration. The Copernicus remote sensing data is distributed internationally via the Copernicus Open Access Hub. The data is in the form of packages covering a defined area and, if available, in the form of single images, which is the basic unit. Color syntheses and selected spectral bands provide a view of the state

of vegetation in other spectral bands than the human eye permits. E.g. The Sentinel-2A MultiSpectral Instrument (MSI) records data in three wavelengths of visible light and also in the infrared band, which is particularly useful in agriculture for monitoring vegetation, soil, food safety, but also for monitoring of the environment in general. Properly chosen color synthesis can point to plant stress or soil erosion with a different color shade than what is common for healthy and prosperous growth. Usable spectral indices in plant production include NDVI, EVI, RENDVI (or NDRE) GNDVI, MSI (or NDWI) and LAI. There are often some limitations for the efficient work with the remote sensing data, which is a result of the specificity of the acquired data, such as data intensity - especially in the case of mobile use, resolution, cloudiness, reflections of sunshine, etc. Identification of the main shortcomings is that there is no general methodology for work with remote sensing datasets for the needs of the agricultural sector, since remote sensing data typically cover a large area, or have a resolution that is often limited to certain use cases.

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FOOD AVAILABILITY AND THE DEVELOPMENT OF THE CONSUMER PRICES OF MEAT

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Annotation: The share of households' expenditures on food and beverages in the Czech Republic is on acceptable level, but it is still important to observe consumer prices, because this share depends also on the type of the household (especially unemployed and retired people can experience some constrains). The structure of the consumption has not changed much, but beef meat (BM) consumption decreased. Consumers started to prefer poultry meat (DM) due to health reasons and high increase of BM price. Knowledge about future consumer' prices is desirable to ensure that meat is available also to low-income households.

The aim of the paper is to model consumer prices of BM, PM and DM and predict them from 03/2018 to 02/2019. Methodological objective is to find suitable method for modelling of consumers price of meat: Box-Jenkins methodology (ARIMA) or VAR model. Monthly data were taken from Czech Statistical Office for 01/2006–02/2018.

First, the time series were explored in terms of their stationarity and seasonality. Time series were non-stationary and only PM price was seasonal, but insignificantly. The consumer prices depended mainly only on the lag of price one month ago: BM – ARIMA(1,1,0)_c, PM – ARIMA(1,1,0) with unit impulse in 06/2008, DM – ARIMA(1,1,0) with unit impulse in 07/2008. However, the projections of price were unsatisfying. VAR(2) model showed weak relations between consumers' prices. Only BM statistically significantly depends on PM two months ago, PM on its second lag and DM on its first and second lag. According to the projections, the prices might increase next year. This may cause certain problem to low-income households that might not be able to afford enough meat for balanced nutrition.

However, our projection has limitation as the final prices are influenced also by the politics of the retail and it is difficult to construct regression model with more explanatory variables.

Key words: ARIMA, consumer price, meat, VAR

JEL classification: E64, C22, E27

1. Introduction

Despite that the share of expenditures on food and beverages of the households in the Czech Republic is on acceptable level (decreased on 20% level in 2015 after slightly increasing trend in years 2010–2014) and in spite of low share of expenditures only on food (18.3%), it is still important to observe consumer prices, because the share of expenditures on food depends also on the type of the household. Households where the main person is unemployed spend almost 22.7% of their income on food, beverages and tobacco and in households of retired people even 23.9%. Those types of households can experience some budgetary constraints.

While the structure of the consumption has not changed much in general, significant changes happen especially in the structure of consumed meat. Particularly, beef meat (BM) consumption steeply decreased and consumers started to prefer (for healthy and price reasons) poultry meat (DM) which consumption doubled. This change was also caused by the increase of price of BM from average 167 CZK/kg in 2006 to 218 CZK/kg in 2017 (by 31%), while the price of PM increased from 105 to 118 CZK/kg – i.e. by 24% only. Increase of DM price was the highest (by 43%) from 48 to 68 CZK/kg, but it remains the cheapest type of meat in absolute terms. Besides, consumers started to prefer poultry meat (DM) due to health reasons. “Health conscious consumers have driven upwards

the demand for low fat and low cholesterol meat, in turn sparking a new interest in suitable alternatives to traditionally sourced farm meat products,” (Tomasevica et al., 2018) Besides, there is certain saturation level, or more precisely intervals, where the meat consumption is moving between 80 to 110 kg. (Ingr, 2004) The scope of decrease of consumption is proportional to the price elasticity of particular meat. “Price elasticity is generally negative; when a brand’s price increases, sales decrease, and vice versa” (Huang et al., 2017), but with different intensity that depends on lifestyle of the consumer. “The average consumption frequency of different types of meat was examined for example by Escriba Perez et al. (2015) in Spain according to two methodologies: consumer segmentation using the food-related lifestyle (FRL) framework, giving rise to 4 segments, and analysis of socio-demographic profiles.

Consumer prices are not modelled that often as agricultural producers’ prices, despite that knowing the probable future development of them is also desirable to ensure that meat will be available despite budget restrictions of households. The prices for which consumers buy food are the highest in the whole commodity vertical due to the highest added value. Price transmission in pork agri-food chain concerned for example Čechura and Šobrová (2008). They found out that this chain is demand-driven. “The type of market structure implies that the agricultural support is in this case shared within the vertically related markets and thus is less efficient”, (Čechura and Šobrová, 2008). Špička, Náglová and Gürtler (2017) evaluated the effects of investment subsidies in the Czech meat processing industry and found out that “subsidies from the national program increased the profitability of family-owned and medium-sized companies and changed the capital structure of the supported companies which used more bank loans for upgrading the technology”, (Špička, Náglová and Gürtler, 2017).

Myers et al. (2018) examined the price transmission in oil market and found important long-run relationship between oil prices, producer prices, and consumer prices using permanent-transitory decomposition method. Price transmission between world food prices and different consumer food price indices for the case study of Thailand was examined by Barahona and Chulaphan (2017). Their findings showed that all world prices were co-integrated with domestic ones, and that the speed of adjustment was similar in all models regardless of the type of consumer price used (average consumer, low-income consumer or consumers located in rural areas (Barahona and Chulaphan, 2017). The volatility of wheat and agricultural commodity prices was examined by Čermák, Malec and Maitah (2017). They recommended to use general auto-regressive conditional heteroscedasticity model GARCH(1,1) that “has the ability to capture the main characteristics of the commodity market, specifically leptokurtic distribution and volatility clustering”, (Čermák, Malec and Maitah, 2017).

In our article we compare Autoregressive Integrated Moving Average (ARIMA) and Vector Autoregressive (VAR) models in terms of their ability to predict the future consumers meat prices the most accurately measured by the mean square forecast error. “A forecasting method with small forecasting error is generally accepted as good and the forecasting error is calculated based on the difference between forecast and actual values,” (Ha, Seok and Ok, 2018).

2. Materials and Methods

The aim of the paper is to model consumer prices of BM, PM and DM and predict them from 03/2018 to 02/2019. Methodological side-objective is to find suitable method for consumers’ meat price modelling. Box-Jenkins methodology (ARIMA) and Vector Autoregressive (VAR) models are used and compared by mean square forecast error. Monthly data prices of beef back without bone, pork roast with bone and whole chickens were taken from Czech Statistical Office for 01/2006–02/2018 (146 observations). Calculations were done in EViews 8.

First, the time series were explored by Augmented Dickey-Fuller (ADF) test, model with constant c for BM (1a), and without constant and without deterministic trend for PM and DM (1b) to assess whether there are stationary or non-stationary as the analysis of the relationship between time series by VAR model can be done only if they are integrated of the same order.

$$\Delta Y_t = c + \Phi Y_{t-1} + \sum_{i=1}^m \alpha_i Y_{t-i} + \varepsilon_t \quad (1a) \quad \Delta Y_t = \Phi Y_{t-1} + \sum_{i=1}^m \alpha_i Y_{t-i} + \varepsilon_t \quad (1b)$$

where ΔY_t is the first difference of the examined variable (time series Y_t), t is time, m is the maximum length of the lagged dependent variable, α , Φ are parameters, and ε_t is a pure white noise error term. Consequently, F-test for seasonality is applied on each time series. Only PM price was seasonal, but statistically insignificantly and seasonality could not be modelled.

Identification of the type of ARIMA model is done by Autocorrelation function (ACF) and Partial Autocorrelation function (PACF) that are plotted in order to determine the order p of Autoregressive (AR) process and order q of Moving Average (MA) process. The autoregressive model of order p AR(p) is defined as (2)

$$Y_t = \beta + \sum_{i=1}^p \Phi_i Y_{t-i} + \varepsilon_t, \quad (2)$$

where α_i ($i = 1, \dots, p$) are the parameters, β represents the constant, and ε_t is a pure white noise error term. Moving average model of order q is formulated as (3).

$$Y_t = \varepsilon_t - \sum_{j=1}^q \delta_j \varepsilon_{t-j}, \quad (3)$$

where δ_j ($j = 1, \dots, q$) are the parameters and ε_t is white noise. Sample ACF is calculated as (4)

$$ACF(k) = \frac{\sum_{t=k+1}^n (Y_t - \bar{Y})(Y_{t-k} - \bar{Y})}{\sum_{t=1}^n (Y_t - \bar{Y})^2}, \quad (4)$$

ACF and PACF can be expressed graphically in correlograms. PACF is defined for $k > 2$ as (5).

$$\begin{aligned} PACF(1) &= cor(Y_{t+1}, Y_t) \\ PACF(k) &= cor(Y_{t+k} - P_{t,k}(Y_{t+k}), Y_t - P_{t,k}(Y_t)) \end{aligned} \quad (5)$$

where $P_{i,k}(Y)$ denotes the projection of Y onto the space spanned by $Y_{t+1}, \dots, Y_{t+k-1}$. In case of agricultural prices some seasonality in the prices can be expected as the supply and demand of exhibit volatility during the year (due to natural character of the agricultural production), but it was statistically insignificant. Impulses in certain years were included to catch the price shocks.

Before VAR model construction, the time series are tested by ADF test (after and before seasonal adjustment) and consequently by Granger test for spurious regression. Possible correlation between the time series of the consumer price of three types of meat is examined by VAR(2) model for three time series (in natural logarithms) (6).

$$\mathbf{Y}_t = \Phi_1 \mathbf{Y}_{t-1} + \Phi_2 \mathbf{Y}_{t-2} + \varepsilon_t, \quad (6)$$

where Φ_i , $i = 1, 2, \dots, m$ are $l \times l$ dimensional non-random matrices of AR parameters and ε_t is l -dimensional process of white noise. The middle projection and projection with 95% confidence intervals are done for 12-month period.

Models were verified in terms of autocorrelation, heteroscedasticity and normality of residues. The autocorrelation is tested using Breusch-Godfrey serial autocorrelation LM test with H_0 : There is no serial autocorrelation. If the calculated value exceeds the tabled test criterion from Fisher and χ^2 distribution H_0 is rejected and there is autocorrelation. Heteroscedasticity is tested by Autoregressive Conditional Heteroscedasticity (ARCH) test with H_0 : There is no heteroscedasticity. The test uses Fisher and χ^2 critical values. Normality is tested by Jarque-Bera test with H_0 : The residues are normally distributed and calculated value is compared to critical value of Jarque-Bera distribution. Tests are done at 0.05% significance level.

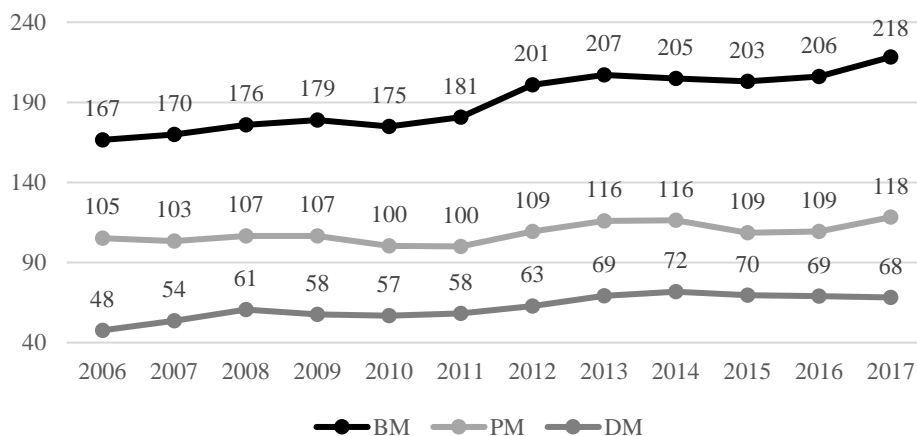
The most typical measures of accuracy of forecasting methods are Mean Absolute Deviation (MAD), Mean Square Error (MSE), Mean Absolute Percent Error (MAPE), Cumulated Forecast Error (CFE), Number of Shortages (NOS), and Period in Stock (PIS). (Ha, Seok and Ok, 2018). We used MSE that is squared differences between predicted \hat{Y} and real Y value divided by the number of observations n (7).

$$MSE = \sum_{i=1}^n (Y_i - \hat{Y}_i)^2 / n \quad (7)$$

3. Results and Discussion

As it can be seen from Figure 1, average year prices of the meat have been increasing since 2006 and were the highest in 2017 with exception of DM which average price was the highest in 2014. While BM was approximately 3.5 times more expensive than DM and 1.6 times more expensive than PM in 2006, it was only 3.2 times more expensive than DM in 2017, but the gap between BM and PM deepened slightly to 1.7. BM price increased from 167 CZK/kg in 2006 to 218 CZK/kg in 2017 that is 1.3 times more. The average growth rate was 31% with the highest between years 2011 and 2012. Average growth rate of PM was milder, only 12% with the biggest change between years 2016 and 2017. The price is almost the same, in 2017 it is only 1.1% times higher than it was in 2006 that indicates relative stability. The highest average growth rate was in case of DM, 43%. Between 2006 and 2007 and 2007 and 2008 the average growth rate accounted to 13%. The price is 1.4 times higher in 2017 than it was in 2006.

Figure 1. Development of BM, PM and DM prices in period 01/2006–12/2017



Source: own elaboration, 2018

The time series were tested for their stationarity (Augmented Dickey-Fuller test and seasonality (F-test)). They were not stationary (had unit root) and were integrated of order 1. Only PM price time series was seasonal, but this seasonality was statistically insignificant at 5% significance level and could not be modelled. Also, the process that generated the time series was weak – the consumer prices depend mainly only on the lag of price one month ago. ARIMA(1,1,0)c was optimal for BM price, ARIMA(1,1,0) with unit impulse in 06/2008 (IMP1) for PM price and ARIMA(1,1,0) with unit

impulse in 07/2008 (IMP2) for DM. The residues were normally distributed and uncorrelated. Their variance was constant and finite. However, the projections were unsatisfying (linear function close to the average value of the price in time series).

Hence, VAR model was also constructed to examine linear inter-dependencies of 3 time series. First, Granger test revealed that there is not spurious regression, because residues of this static regression are stationary at 5% significance level. Stationarity was proved by Augmented Dickey-Fuller test statistic (model with constant and deterministic trend) with p-value 0.04. Optimal type of model – VAR(2) was used for prediction of consumer prices. There was no serial correlation. The residuals were homoscedastic (constant and finite variance in time) and normally distributed.

The results (see Table 1) show that relations between consumers' prices are weak. BM statistically significantly depends (α level = 0.05) on itself one and two months ago (BM_{t-1} , BM_{t-2}), and PM two months ago (PM_{t-2}). PM (seasonally adjusted) depends on its first and second lag (PM_{t-1} , PM_{t-2}) and DM on its first (DM_{t-1}) and second lag (DM_{t-2}). Nevertheless, VAR show only short time interdependences between 2 or more time series. Granger causality shows long-term relations. If 1 time series affects the other in Granger sense, than the final prediction of both time series is more quality in terms of lower mean square forecast error.

Table 1. VAR(2) model estimates

	BM (-1)	BM (-2)	PM D11(-1)	PM D11(-2)	DM (-1)	DM (-2)	IMP1	IMP2	Model character.
BM	<i>0.6090</i>	<i>0.3939</i>	<i>0.2716</i>	<i>-0.2675</i>	<i>-0.1747</i>	<i>0.1680</i>	<i>0.1958</i>	<i>-2.2944</i>	$R^2 = 0.9800$
	(0.0775)	(0.080)	(0.1166)	(0.1140)	(0.1214)	(0.1206)	(2.5653)	(2.5454)	$\underline{R}^2 = 0.9790$
	[7.8599]	[4.9306]	[2.3292]	[-2.3475]	[-1.4387]	[1.3928]	[0.0763]	[-0.9014]	F = 951.4611
PM D11	<i>0.0632</i>	<i>-0.0116</i>	<i>0.7068</i>	<i>0.21775</i>	<i>0.0256</i>	<i>-0.0523</i>	<i>4.3746</i>	<i>6.4852</i>	$R^2 = 0.9310$
	(0.0517)	(0.0533)	(0.0778)	(0.0760)	(0.0810)	(0.0805)	(1.7118)	(1.6985)	$\underline{R}^2 = 0.9275$
	[1.2223]	[-0.2178]	[9.0829]	[2.8635]	[0.3164]	[-0.6500]	[2.5555]	[3.8181]	F = 262.2329
DM	<i>-0.0493</i>	<i>0.1013</i>	<i>0.0758</i>	<i>-0.1055</i>	<i>0.6754</i>	<i>0.2189</i>	<i>5.0893</i>	<i>0.1230</i>	$R^2 = 0.9523$
	(0.0526)	(0.0543)	(0.0792)	(0.0774)	(0.0825)	(0.0819)	(1.7423)	(1.7287)	$\underline{R}^2 = 0.9499$
	[-0.9361]	[1.8678]	[0.9568]	[-1.3635]	[8.1905]	[2.6730]	[2.9211]	[0.0711]	F = 388.2461

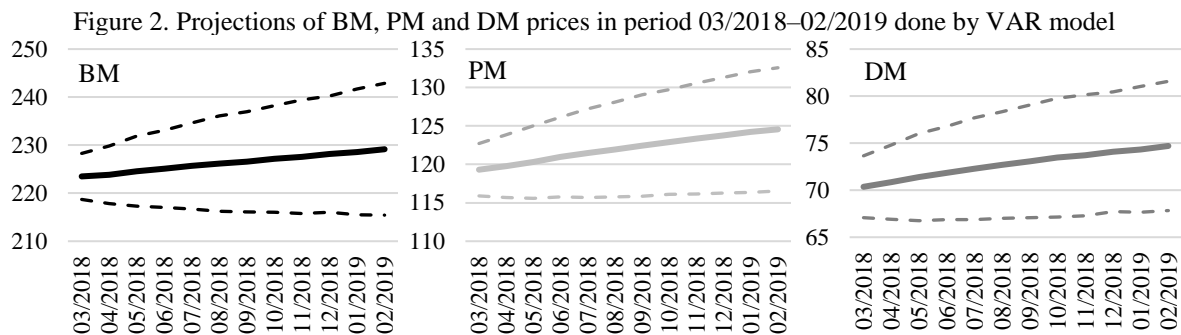
Source: own elaboration, 2018

Note: parameter (standard error) [*t*-statistic], *PMD11* – pig meat price seasonally adjusted; significant coefficients at 5% level of significance marked in italics

The results of projections are displayed at Figure 2. Average projected price of BM will be 226 CZK/kg, 122 CZK/kg for PM and 73 CZK/kg in case of DM for 03/2018–02/2019. Slight increase of prices is expected in case of all prices of meat. Average growth rate is expected the lowest in case of BM (only 3% between 02/2018 and 02/2019), the highest in case of DM (7%), then PM can increase only by 5% on average). This may cause certain problem to low-income households that might not be able to afford enough meat for balanced nutrition. It can be seen that the 95% confidence interval in absolute terms is the widest in case of BM. Nevertheless, the relation between prices shall not change much, DM still will be the cheapest.

Regarding the quality of the projection, as ARIMA model did not provide any reasonable results, VAR model and its methodology can be recommended to be used to predict prices of agricultural

commodities. MSE was the lowest in case of DM price, only 13.8, then in case of PM price (28.2) and the highest for BM (39.4). While in financial sphere, the time series exhibit generally certain “well-known statistical features such as heavy tails and volatility clustering” (Chavez-Demoulin, Embrechts and Sardy, 2014), time series of prices of agricultural commodities are less examined and predictable. While Rumánková (2016) uses different types of ARIMA models to predict agricultural producers prices, and also Pechrová and Šimpach (2017a) recommended for consumer prices of sugar using ARIMA(1,1,1) model and Pechrová and Šimpach (2017b) use ARIMA(1,0,0) for projection of eggs prices, our suggestion is to rather use VAR model for projection of consumer prices of meat.



Source: own elaboration, 2018

4. Conclusion

The aim of the paper was to model consumer prices of beef, pork and poultry meat and to predict them for next 12 months. Monthly data of prices of beef back without bone, pork roast with bone and whole chickens were taken from Czech Statistical Office for 01/2006–02/2018. Projections with 95% confidence interval were done for period 03/2018–02/2019. Methodological objective was to find suitable method for modelling of consumers price of meat – either Box-Jenkins methodology (ARIMA) or VAR model.

Optimal model for BM was ARIMA(1,1,0)c, for PM an ARIMA(1,1,0) with unit impulse in 06/2008 and for DM an ARIMA(1,1,0) with unit impulse in 07/2008. However, the projections to the future were not feasible. Hence, VAR model was constructed. Despite that it shows only weak linear interdependencies between consumers’ prices, but the projections were relatively feasible. The prices of all types of meat might slightly increase in the future. We may expect that average price of BM will be 226 CZK/kg, 122 CZK/kg for PM and 73 CZK/kg in case of DM for 03/2018–02/2019. MSE was used to assess the quality of prediction which was the best in case of DM. BM prices were projected with high MSE and also 95% confidence intervals were the highest. Possible increase of price may cause certain problem to low-income households that might not be able to afford enough meat for balanced nutrition. On the other hand, it might be positive for farmers if agricultural producers’ prices also increase.

We can also conclude that the most suitable way how to predict consumer prices of meat is VAR model. However, our projection has also limitation. The final prices that are paid by the consumer are influenced also by the politics of the store chains. The decision of the retail part of the agri-food chain is hard to be modelled, hence, it is difficult to construct regression model with more explanatory variables. This remains a challenge for future research.

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PHYSICAL AND ECONOMIC SIZE OF FARMS IN THE EU 28 – FOCUS ON SLOVAKIA

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Annotation: The area on which the farmers work is the national wealth of any country. It is very important to utilize the land efficiently (mainly nowadays) when the competition increase in EU. The structure of farms differs significantly across Member States, and the physical size of farms is one of the indicators by which we can see these differences. For example, Slovakia is EU 28 leader in the average size of farm. But, determining the size of farms in terms of their agricultural area is just one of the approaches. In many cases more significant is to measure the economic size, which based on the indicator of standard output. Slovakia is also the leader in the amount of per hectare standard output. But, deeper analysis shows unexpected negative moderate relationship between these two variables, which can be defined as inverse. The main goal of this paper is to identify, whether the remuneration of subsidies is more suitable in connection to physical or to the economical size of farm (agricultural unit). Analysis is based on the FADN data from 2004-2015 period and includes 28 EU members. In this period total subsidies in EUR average per farm and the two indicators of farm size were analyzed: standard output (SO) in EUR.ha⁻¹ and utilized agricultural area (UAA) in ha.farm⁻¹. The research shows that the remuneration of subsidy by the number of hectares of UAA results in big negative correlation for Slovakia, but when put into the correlation with standard output this resulted in moderate positive relationship. The simple no intercept regression analysis also showed better relationship of TS with SO than UAA. In conclusion it would be therefore more efficient to remunerate subsidies according to SO than UAA.

Key words: European Union, Slovakia, utilized agricultural area, standard output, economic farm size, physical farm size, inverse relationship

JEL classification: Q12, Q15, G19, M21

1. Introduction

The size of farms varies from one country to another and it is primarily determined by noneconomic variables, such as laws of inheritance, social conditions, historical consequences, nature of the land, or government policies (Dillon and Hardaker, 1980). According to the reasons of changes in size of farm units are complex and include long social and economic changes on the country level as term government policies, technological change, and changes in farm and nonfarm markets (Bachman and Christensen, 1967; Ahearn and Yee, 2004).

As well as determining the size of farms in terms of their agricultural area, economic size can be determined by reference to the standard output, in other words, the value of agricultural output at farm-gate prices (EC, 2018). According to microeconomic theory, the larger the size of the plant or farm, the more the average cost of production; and when the unit size is smaller, the average cost will decrease to some extent and then it will increase (Roland, 1988). Neoclassical theorists argue that the segmentation of land, credit, and labor markets results in the inverse relationship. Large landowners have access to land and credit that small farmers do not. However, this segmentation implies that larger farms are more capital intensive, which should theoretically decrease the inverse relationship (Dyer, 1996). Regarding this, the typical size of the farm in the country should determine used approach of the state support system. On agricultural subsidies almost every EU country spending a large proportion of its income; still the agricultural farmers of many countries are unable

to compete globally, which expressing in increase dependence on food imports, and a decline in food self-reliance (Swain, 2009).

2. Materials and Methods

The main goal of this paper is to identify, whether the remuneration of subsidies is more suitable in connection to physical or to the economical size of farm (agricultural unit). Analysis is based on the EUROSTAT data of EU 28 member states within the period of 2004-2015. There are two main criteria that have been used to describe farm size: classification of farms in economic terms based on their standard output, and an alternative measure, based on the utilized agricultural area (EC, 2016). The economic size is calculated on the basis of the coefficient of Standard output (EC No 1242/2008). The standard output of an agricultural product (crop or livestock), known as SO, means the average monetary value of the agricultural output at farm-gate price. SO can be expressed in EUR per hectare or per head of livestock. Total SO of the holding is found by multiplying the number of animals and hectares by corresponding standard output coefficients per unit and summing standard output obtained for all types of farming. SO of the holding does not include the kitchen garden and permanent grassland not used for production purposes but maintained in good agricultural and environmental conditions. (FADN, 2017). Utilized agricultural area (UAA) is the area used for farming and is measured by the average amount of agricultural land per holding (EC, 2018).

Nowadays, the subsidies in EU are remunerated on the basis of physical size of farm (UAA), which does not have to be suitable for all the EU members (Urbánová and Kozáková, 2017). Therefore, examining the possibility of more effective compensating of subsidies on the basis of standard output (SO) would be essential. In such process several authors used correlation analysis (Siebert, 2004; Kravčakova Vozarova and Kotulič, 2016), which can be used also for examination of relationship between UAA and (TS) total subsidies and SO and subsidies as well. In this paper, the standard output (SO) in EUR per hectare and utilized agricultural area (UAA) in ha per holding among the EU 28 is compared and the relationship between them is examined. In addition this physical and economic size of farm is placed into the correlation with total subsidies by which it can be reflected to the current system of remuneration of subsidies by Common Agricultural Policy (CAP). Found link between them leads to the setting of three assumptions on the basis of similar research by (Ladvenicová and Miklovičová, 2015) where they investigate the relationship between farm size and productivity on chosen sample of companies in Slovakia and (Cianan, 2012) who stated that the relationship between farm size and output is one of the basic questions in development economics:

- Assumption 1: There is a positive relationship between SO and UAA.
- Assumption 2: There is a positive relationship between UAA and (TS) total subsidies.
- Assumption 3: There is a positive relationship between SO and TS.

Realized quantitative research is based on the Excel correlation analysis build on examination of the variables X and Y. If there is a reversible dependency the, the correlation dependency was found (Obtulovič, 2001). Outcomes can displayed positive, negative or none correlation between two variables. Calculated correlation coefficients can be interpreted in certain ranges (Munk, 2011): The correlation rate is trivial (0.0 – 0.1), The correlation rate is small (0.1 – 0.3), The rate of correlation is moderate (0.3 - 0.5), The correlation rate is strong (0.5 – 0.7), The correlation rate is very strong (0.7 – 0.9), The correlation rate is almost perfect (0.9 – 1.0).

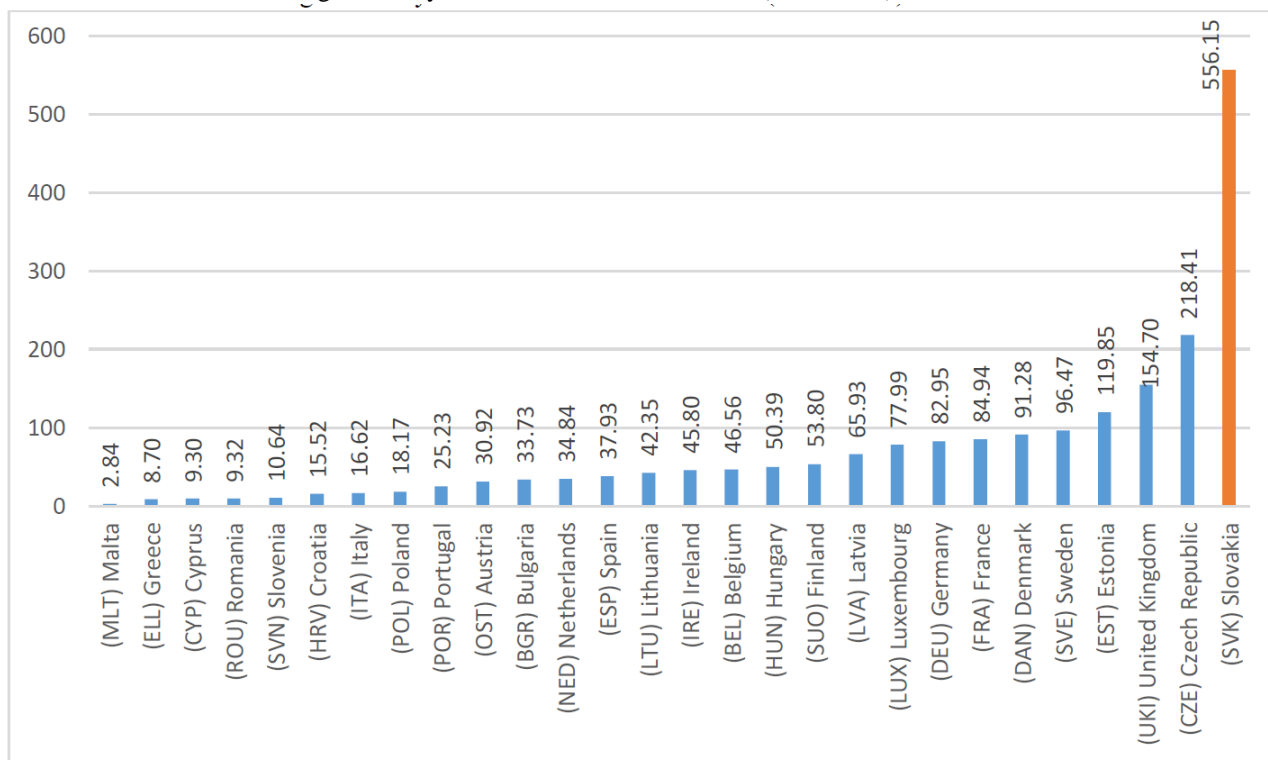
Simple regression analysis model, which describes the linear relationship between a pair of numeric variables and this dependency (Kravčakova Vozarova and Kotulič, 2016), was used to show the significance of UAA and SO as independent variables. Total subsidies were set as a dependent variable. Based on the expected theory that with zero UAA and SO simultaneously the TS will be

zero, the simple linear regression was used to show the relationship between the dependent and independent variables. The estimation of regression coefficients (the slope in the case of a simple linear regression) is carried out by setting the intercept to zero following the description by Kozak and Kozak (1995), where the physical constraints of the modulus of rupture and specific gravity relationship suggest the use of a simple linear no-intercept model. Letting $(x_1, y_1), (x_2, y_2) \dots, (x_n, y_n)$ represent n data points (a sample from a population, N), the simple linear relationship between the dependent and independent variables can be described by the no intercept model: $y_i = \alpha_1 x_i + \varepsilon_i$. Regression through the origin is also known as a zero intercept model. Example is the well-known capital asset pricing model (CAPM) of portfolio theory (Gujarati, 2014).

3. Results and Discussion

Slovakia has among all the EU 28 member states the biggest average physical size during the selected time period of 2004-2015 with the number of 556.15 hectares. It is more than twice as much as the second rated country (CZE). These two countries are historically connected, which can be seen also on their similar social and economic development even after their separation in 1993. Most of the EU countries farm size range between 25 - 100 hectares. The countries with the lowest physical size are those among mediterranean area as Cyprus, Greece and Malta as the last one (Fig.1).

Figure 1. Physical size of farm in ha.farm^{-1} (2004-2015) in EU 28



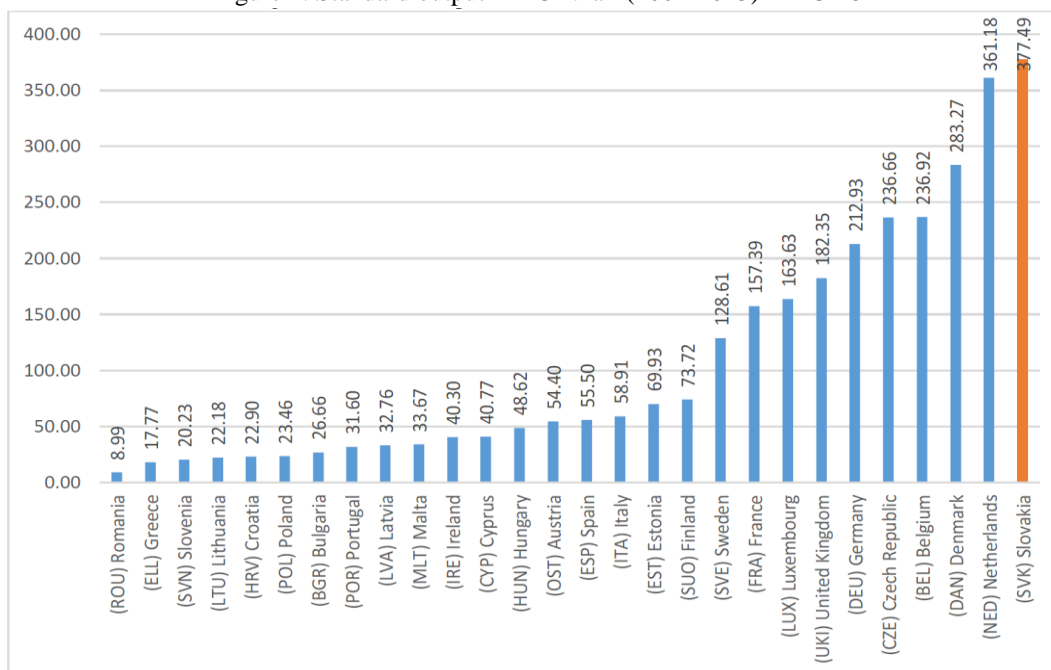
Source: authors own calculations based on FADN 2018

The other approach in defining the size of farm is the economic approach. The economic size of an agricultural holding is measured as the total Standard Output (SO) of the holding expressed in euro. The standard output of an agricultural product (crop or livestock) is the average value of agricultural output at farm-gate prices, in euro per hectare or per head of livestock (EC, 2018). It is expected that reaching high UAA will lead to also high SO. Slovakia is in this indicator also the top one, but not so far before other EU countries which despite their much lower UAA have high SO as can be seen in the Netherlands (Fig.2).

In spite of expectation of assumption 1, that there is a direct proportion between standard output (SO) and utilized agricultural area (UAA), it was not proved (Fig. 3) in three countries including Slovakia.

Mutual relationship between these two variables in Slovakia reached -0.46, what means negative moderate relationship which can be defined as inverse. Similar results have been seen in other researches, e.g. Thapa (2007) stated that relationship between farm size and productivity in developing countries is one of the oldest issues in the academic arena for analyzing the agrarian structure. He even stated, that it is ‘stylized fact’ of inverse relationship (IR) between farm size and output per hectare.

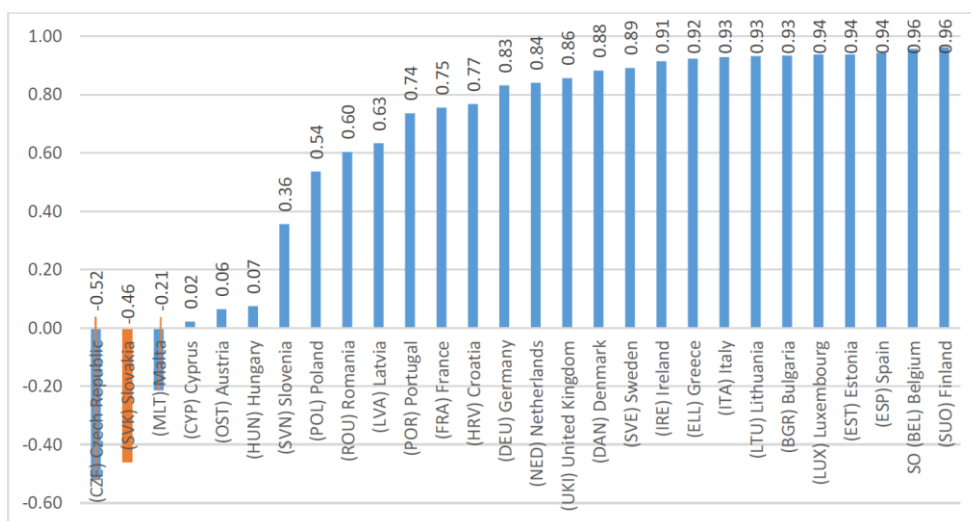
Figure 2. Standard output in EUR.ha⁻¹ (2004-2015) in EU 28



Source: authors own calculations based on FADN 2018

This phenomenon of inverse relationship between farm size and productivity is well known and in developing countries it is one of the longest standing and most contentious empirical issues in agriculture and development economics and it assumed the existence of an inverse relationship (Savastano et al., 2011).

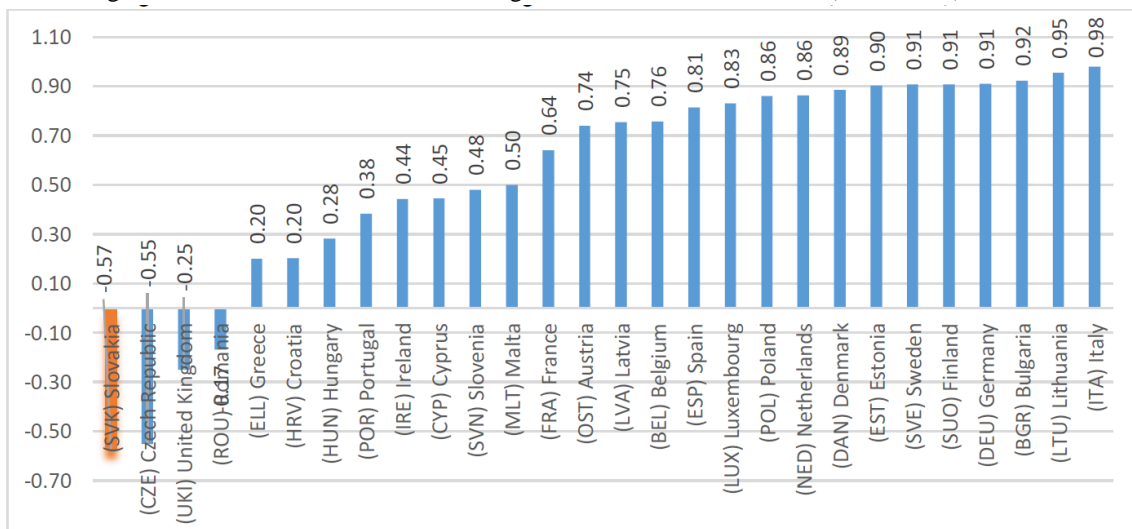
Figure 3. Correlation between utilized agricultural area and standard output (2004-2015) in EU 28



Source: authors own calculations based on FADN 2018

Such research is of particular importance for countries which are major in agriculture because the approval of this hypothesis may give a stimulus to land redistribution among farmers in order to maximize country's productivity (Teryomenko, 2008). Most of the EU 28 countries (18) proved our assumption and indicated very large or almost perfect positive relationship, which means that the more UAA in hectares per farm the more SO in EUR per hectare. This is seen in the most examined countries, for example in the Netherlands (NED) which has second highest standard output (after Slovakia) but average physical farm size of 34.84 hectares, compared to Slovakia's 556.46 hectares. This result of (NED)s very big correlation can be connected with its high efficiency and on the other hand the moderate negative correlation can be related with Slovakia's efficiency/productivity where Slovakia is on the lowest place from EU 28. (Urbánová and Kozáková, 2017).

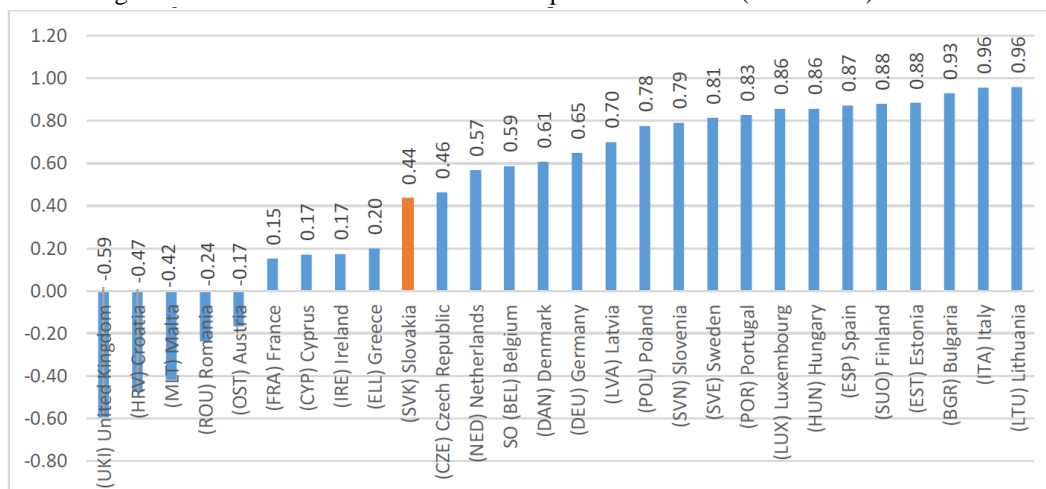
Figure 4. Correlation between utilized agricultural area and subsidies (2004-2015) in EU 28



Source: authors own calculations based on FADN 2018

The remuneration of subsidies in EU are done according to CAP by the hectares of utilized land. Therefore the assumption 2 was made and the expectation of positive relationship was proved in all of the selected countries except four (ROU, UKI, CZE) and SVK with the highest negative relationship of -0.57 (Fig. 4), which can be described as a big correlation. In more than half of countries this correlation coefficient is big ranged from 0.5 to almost perfect 0.98.

Figure 5. Correlation between standard output and subsidies (2004-2015) in EU 28



Source: authors own calculations based on FADN 2018

The assumption 3 was the only one to be proved for Slovakia with the positive moderate correlation of 0.44. There were few countries with negative relationship (UKI, HRV, MLT, ROU), which means that the more subsidies these farms receive, the less standard output they produce (Fig. 5). This situation indicates, that these farms are not forced to achieve bigger output, what can be connected to the fact, that subsidy is received per hectare.

Caley & Schluter (1997) did linear and nonlinear regressions of local species richness on the richness of the regions in which the localities were embedded using null model. The simple no intercept regression analysis model (Fig. 6), where total subsidies were set as a dependent variable and UAA and SO as the independent variable showed high significance of this model. Significance F was lower than 0.05 (1.71532E-15).

Figure 6. Outcomes of regression analysis

<i>Regression Statistics</i>		
Multiple R	0.99970926	
R Square	0.9994186	
Adjusted R Square	0.89936046	
Standard Error	0.31158386	
Observations	12	
	<i>Coefficients</i>	<i>P-value</i>
SO (SVK)	1.28993491	0.020049
UAA (SVK)	0.65719338	0.164242

Source: authors own calculations

P value lower than 0.05 was only seen in the SO variable which can be interpreted as significant, but on the other hand UAA resulted as not significant, which shows that SO indicates better relationship with TS than UAA.

4. Conclusion

Average physical farm size measured by UAA among the EU 28 member states during the period of 2004-2015 changes from 2.84 ha.farm⁻¹ in Malta to 556.15 ha.farm⁻¹ in Slovakia, with the huge gap between second highest of 218.41 in Czech republic. This extreme physical farm size in Slovakia was previously examined by several authors (Tóth, et al., 2016) and can be connected with the system of farm financing. The other indicator of measuring farm size is standard output (SO), where we can see similar results, with the highest measure of 377.49 EUR.ha⁻¹ in Slovakia, but not so much ahead of the others. The second highest value is achieved by Netherlands (361.18 EUR.ha⁻¹), however 19 countries out of examined 28 countries resulted with the value lower than 100 EUR.ha⁻¹, with the lowest value of Romania (8.99 EUR.ha⁻¹). In spite of general expectation that bigger physical size should results in bigger output, there are three countries including Slovakia where the negative correlation was observed. Similar outcomes noticed Thapa (2007) who even stated, that it is ‘stylized fact’ of inverse relationship (IR) between farm size and output per hectare. This result also supports the statement of Nowak, et al. (2015) who consider Slovak agriculture as one of the least technically efficient in EU 27. In most all of the EU 28 countries the relationship between UAA and subsidies is positive, but there are few exceptions, including Slovakia, where this relationship is found negative. Simultaneously, subsidies correlated with the economic size farm confirm positive relationship in CZE, SVK and other 21 EU members. Surprisingly two countries had negative relationship in both examined indicators put in correlation with the subsidies (ROU, UKI). From the above research it can be seen that remuneration of subsidy by the number of hectares of UAA results in big negative

correlation for Slovakia, but when put into the correlation with standard output this resulted in moderate positive relationship. Here the differences among EU member states can be seen and that the same approach for remuneration doesn't bring same results in these countries. Thus, the possibility of more effective remuneration of subsidies on the basis of standard output occurs. This possibility was tested on the basis of the simple no intercept regression analysis which indicated standard output (SO) as significant, unlike the utilized agricultural area (UAA) which resulted as not significant. Analysis indicates that unit increase of total subsidies raise up farm total output by 1.28 EUR.farm⁻¹, but just 0.66 ha.farm⁻¹ of utilized agricultural area. This fact points out that standard output can be (at least in the theoretical manner) better indication for remuneration of subsidies for Slovak farms than utilized agricultural area. Presented change in CAP policy would possibly make system at Slovakia more effective, fairer and motivating.

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TIME SERIES ANALYSIS OF CHICKEN MEAT PRICE IN EUROPEAN UNION IN YEARS 2006-2017

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Annotation: The aim of this article is analysis of price level and influence of particular kind of fluctuation on variability range of chicken meat price in European Union as a whole market and chosen particular countries of EU. Research material consist of monthly time series of chicken meat price in whole European Union and particular countries for the years 2006 -2017.

Data come from Integrated System of Agricultural Information supervised by Ministry of Agriculture in Poland. Information about level of chicken livestock production was taken from FAOSTAT database. Time series of price were described by multiplicative model and seasonal decomposition was performed using Census X-11 method.

Price of broiler chicken meat in European Union average in year 2006 was on the level of 147 EURO per 100kg. During twelfth years period meat prices were subject different fluctuations and finally increased to the level of 182 EURO in year 2017. Prices of chicken meat in EU were influenced by seasonal fluctuation: generally higher prices are in summer (103% in June) and lower in winter (98% in January). In the one year time horizon variability of prices was shaped in 12% by irregular changes, 31% by seasonal and 57% by cyclical fluctuation. The highest prices of chicken meat were in Germany (245 Euro/100kg as average in analyzed period), followed by: Finland (239 €), Cyprus (236 €), Denmark (219 €) and Sweden (213 €). The lowest prices were in Poland (129€), Great Britain (146 €), Bulgaria (149€) and Latvia (154 €). The most stable prices were in: Malta, Austria and Germany (yearly variability coefficient below 3%) and the biggest fluctuations of prices were observed in: Portugal, Italy, Poland and Spain (variability coefficient above or equal 7%).

Key words: seasonal decomposition, time series, price fluctuation, broiler chicken

JEL classification: Q11, Q13

1. Introduction

Business management and decision making in the free market economy requires having adequate data on the ambient conditions. A reliable source of such information may be the analysis of product prices in earlier periods. Time series methods, based on the theory of a thorough scientific basis, are particularly useful in this area.

In the work, the time series of prices was understood as the implementation of the stochastic process, in which the dependent variable is the price level, while the independent variable is the time. The analysis of such a defined time series is aimed at learning and describing mechanisms shaping the level of prices and affecting its changes.

The methodology of time series analysis is relatively rich. For the pioneers in this field. From which the names of some methods come, you can accept: Box and Jenkins (1983), Winters and Holt (from Cieślak 2005).

The price variability is a key aspect of price risk for all market members: producers, processors, as well as consumers (Figiel et al., 2012). The price levels of agricultural raw materials are mainly influenced by: the biological-technical character of agricultural production, low short-term elasticity of supply, inter-market relations and relations to world prices (Hamulczuk and Stańko, 2011). Price variability is inevitable, however, it is crucial to know the causes lying behind the variability, which may allow foreseeing or preventing sudden changes in price levels. Characteristic elements

of the price variability in agriculture include annual seasonal fluctuations or longer, periodically repetitive cyclic fluctuations (Utnik-Banaś, 2012, 2017b).

Price volatility of agricultural products is of great importance both for agricultural producers in the context of the optimization of the function of the production target, as well as consumers who choose the purchase of specific products. The analysis of the price level is at the same time an indirect way of assessing the effectiveness of the market (Figiel, 2002). Often the one price law is assumed to be the theoretical foundation of the price assessment of the efficiency of commodity markets in agribusiness. The right applies to the free flow of goods and information and the related development of prices in time and space. In the classical approach, the right of a single price indicates that when certain conditions are met, all prices within a given market are uniform after taking into account the costs of increasing the usability of the place, time and form of the product (Kohls and Uhl, 1985).

The aim of this article is analysis of price level and influence of particular kind of fluctuation on variability range of chicken meat price in European Union as a whole market and chosen particular countries of EU.

2. Materials and Methods

The research material was monthly time series for prices of chicken broilers meat (carcasses 65%) in 2006-2017. The monthly prices are mean of weekly of prices taken from the Integrated System of Agricultural Market Information (2018). The price variability was analyzed on two ways: (1) using and (2) by decomposition of price time series. In the first method the following descriptive statistics of price variability in a year was calculated: variability coefficient, minimal value and maximal value (interval), maximal monthly change in price (increase or decrease) and the change in price indicator (in %). In the second method a time series decomposition of meat price was performed. A time series includes the following elements (Dittmann, 2008; Utnik-Banaś, 2017a):

- Developmental tendency – trend (T) – it shows the long-term tendency for one-way changes (increase or decrease) of the price. It is understood as the effect of the influence of a constant set of factors,
- Cyclic fluctuations (C) – they are formed as long-term, rhythmically repetitive price fluctuations around the developmental tendency in time intervals longer than one year,
- Seasonal fluctuations (S) – are price fluctuations of the observed variable (price) around the developmental tendency and repeat in a time interval not longer than one year.
- Random fluctuations – random element – (I).

Given the mutual relation between the long-term trend (T) and cyclic fluctuations (C) formed by similar factors, the elements of the time series are treated in the paper as a whole trend-cycle element ($T_t C_t$). To describe the time series for chicken meat prices, a multiplicative model was used in the form of the following formula [Stańko 2013] :

$$Y_t = T_t C_t S_t I_t \quad (1)$$

where:

Y_t – meat price in the period t,

$T_t C_t$ – long-term trend and cyclic fluctuations in the period t,

S_t – seasonal fluctuations in the period t,

I_t –irregular fluctuations – random component in the period t. Particular components of formula 1 were described before using the same symbols.

The Census II/X11 method was used to determine the seasonality of indicators. The advantage of Census II/X11 is, among others, the ability to calculate seasonal fluctuations for each year separately, which allows for an analysis of possible changes in seasonality models in longer periods of time. In order to check the relevance of the seasonality indicators, a variance analysis was carried out for indicator values in particular months using the F test.

The influence of particular components of the time series, such as: seasonality (S), random fluctuation (I) and developmental tendency (TC) on the general variability of broiler livestock prices was determined in relation to the duration of changes. The share of variances for particular components of the series in the total price variance was analyzed. The calculations were carried out with a forecasting and time series analysis packet included in the computer program Statistica 12.0.

3. Results

Over twelfth years, the average price of chicken meat in whole European Union increased from 147.10 Euro/100kg in 2006 to 182,01 in year 2017 (tab. 1, fig. 1). The biggest monthly drop (-18%) took place in 2006, in which the price decreased from 131,75 Euro/100kg in March to 107.44 Euro/100kg in April. The biggest monthly increase (23.9%) also took place in 2006, in which the price rose from 107.44 Euro/100kg in April to 133.15 Euro/100kg in May. Such extreme changes were caused by bird influenza and lack of demand for poultry meat caused a drop in prices and a significant reduction in production, which then affected the limited supply of meat and rapid price increase. In the remaining years, maximum drops and price increases did not exceed 3% in the month. A significant fall of prices in 2010 was a result of cyclical changes of chicken meat price occurred regular in mostly agricultural products. The reasons of such fluctuations are complex connected mostly with prices fluctuations of others agricultural products.

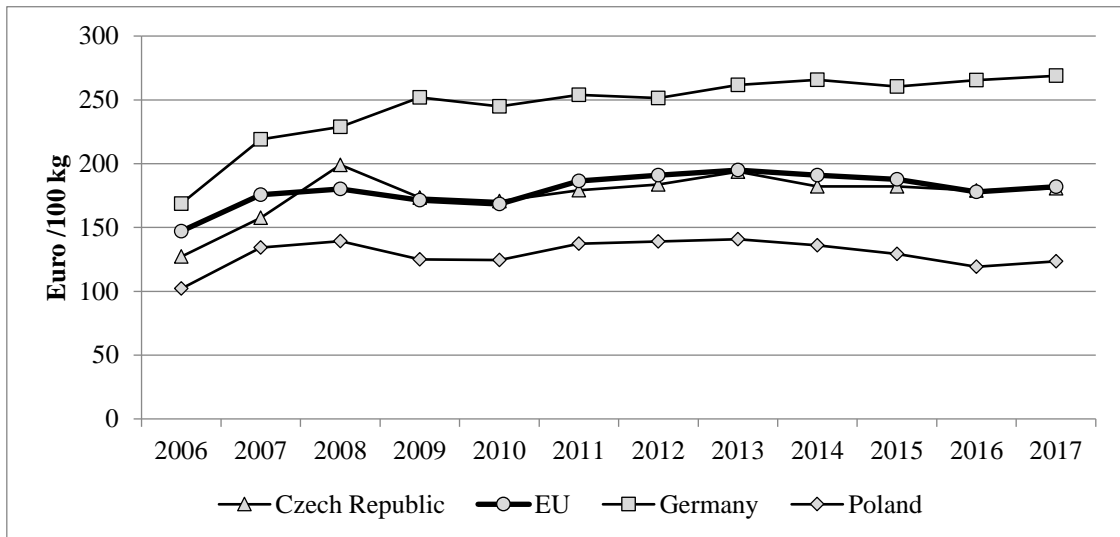
The price variability coefficient in UE decreased from 11.6% in year 2006 to 1.2% in year 2017. Generally prices after year 2010 were subjected to lower fluctuations, and the variability coefficient was under 3% (tab. 1).

Table 1. Variability of broiler chicken meat prices in European Union in years 2006-2017

Year	Price			Variability coefficient %	Max monthly %		Index of change 2006=1
	average	min	max		increase	decrease	
	EURO /100 kg						
2006	147.10	107.44	164.03	11.6	23.9	-18.5	1.00
2007	175.67	160.82	185.57	5.3	3.4	-1.8	1.19
2008	180.18	174.49	185.61	2.2	2.5	-2.4	1.22
2009	171.47	157.48	176.73	3.8	2.0	-5.0	1.17
2010	168.28	155.92	178.38	4.7	3.4	-1.8	1.14
2011	186.49	176.24	193.39	2.8	2.3	-1.6	1.27
2012	190.95	183.37	198.06	2.8	1.8	-1.5	1.30
2013	194.94	187.96	200.57	2.2	1.6	-2.9	1.33
2014	191.00	183.33	196.20	2.6	1.0	-2.7	1.30
2015	187.68	179.85	192.57	2.1	1.2	-2.8	1.28
2016	178.03	174.10	182.82	1.5	2.9	-1.5	1.21
2017	182.01	177.41	184.92	1.2	1.8	-1.1	1.24

Source: own study based on: Integrated System of Agricultural Market Information, 2018

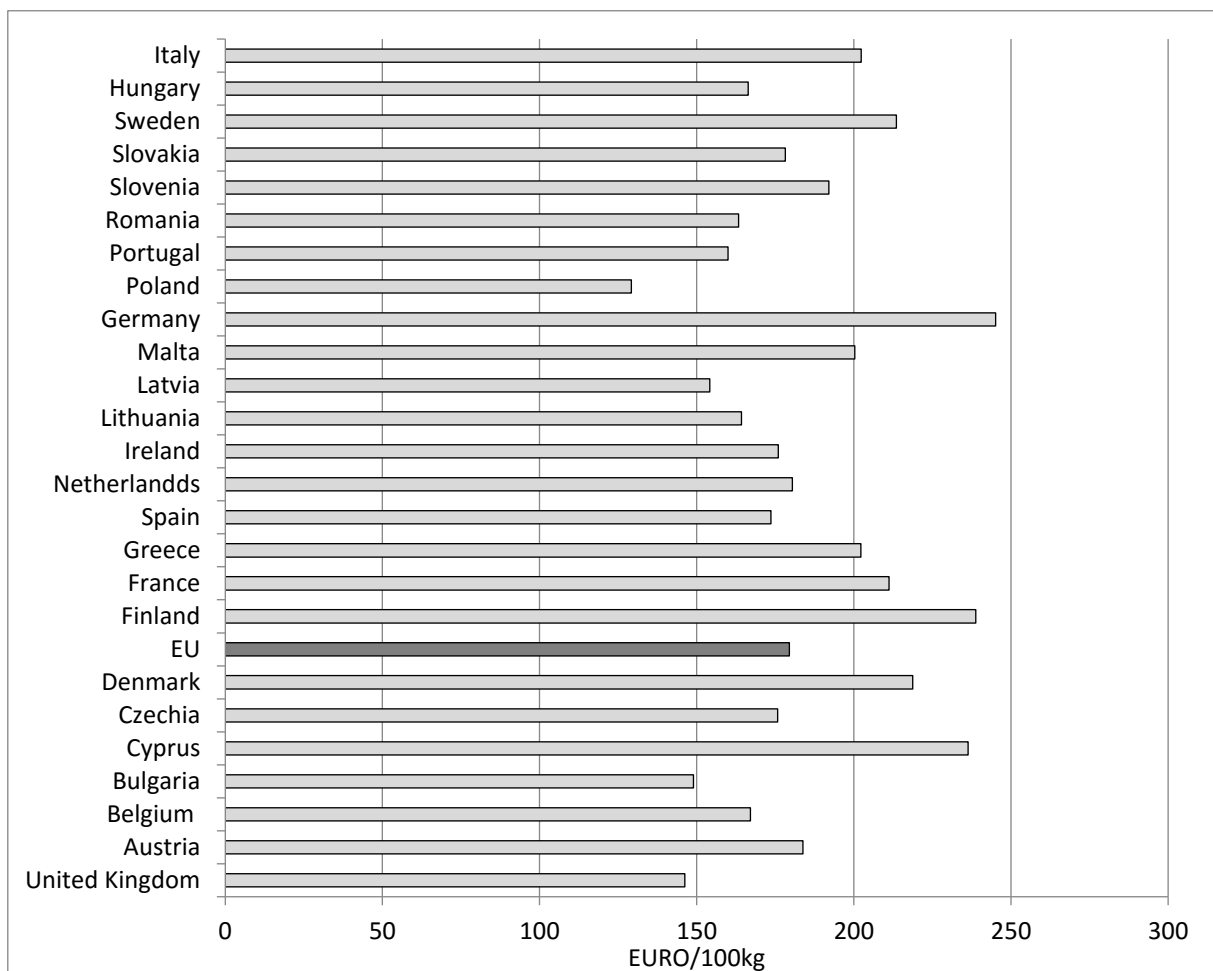
Figure 1. Prices of broiler chicken meat in chosen country of European Union in years 2006-2017



Source: own study based on: Integrated System of Agricultural Market Information, 2018

In particular countries the highest prices of chicken meat were in Germany (245 Euro/100kg as average in analyzed period), followed by: Finland (239), Cyprus (236 €), Denmark (219 €) and Sweden (213 €) (fig. 2).

Figure 2. Prices of broiler chicken meat in European Union countries - average in years 2006-2017

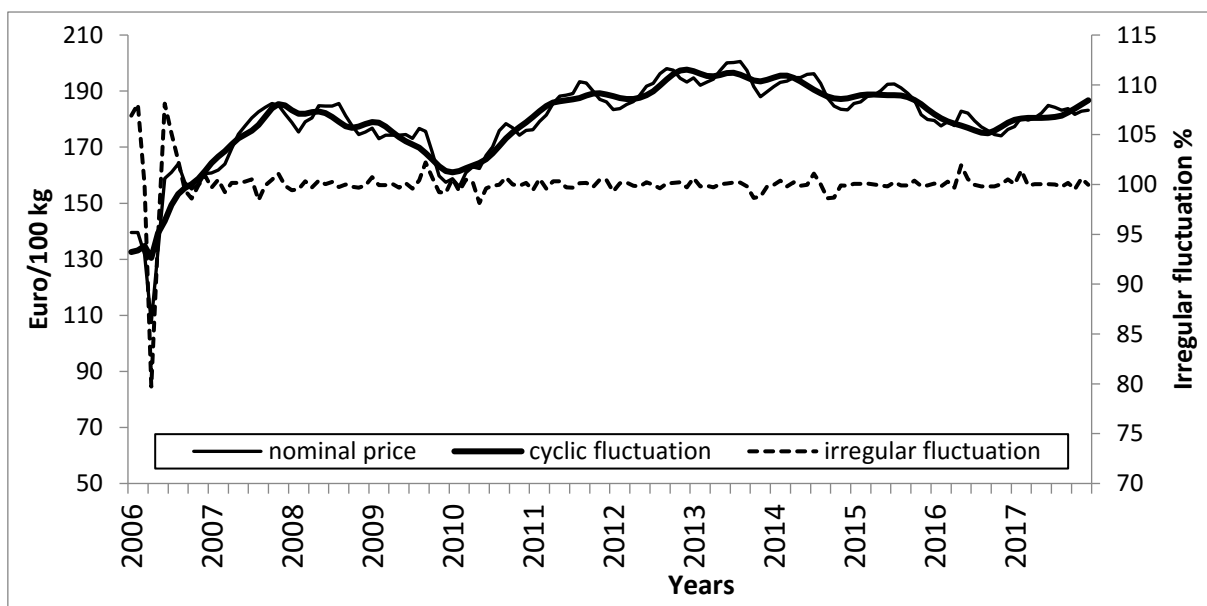


Source: own study based on: Integrated System of Agricultural Market Information, 2018

The lowest prices were in Poland (129€), United Kingdom (146 €), Bulgaria (149€) and Latvia (154 €). The most stable prices were in: Malta, Austria and Germany (yearly variability coefficient below 3%) and the biggest fluctuations of prices were observed in: Portugal, Italy, Poland and Spain (variability coefficient above or equal 7%).

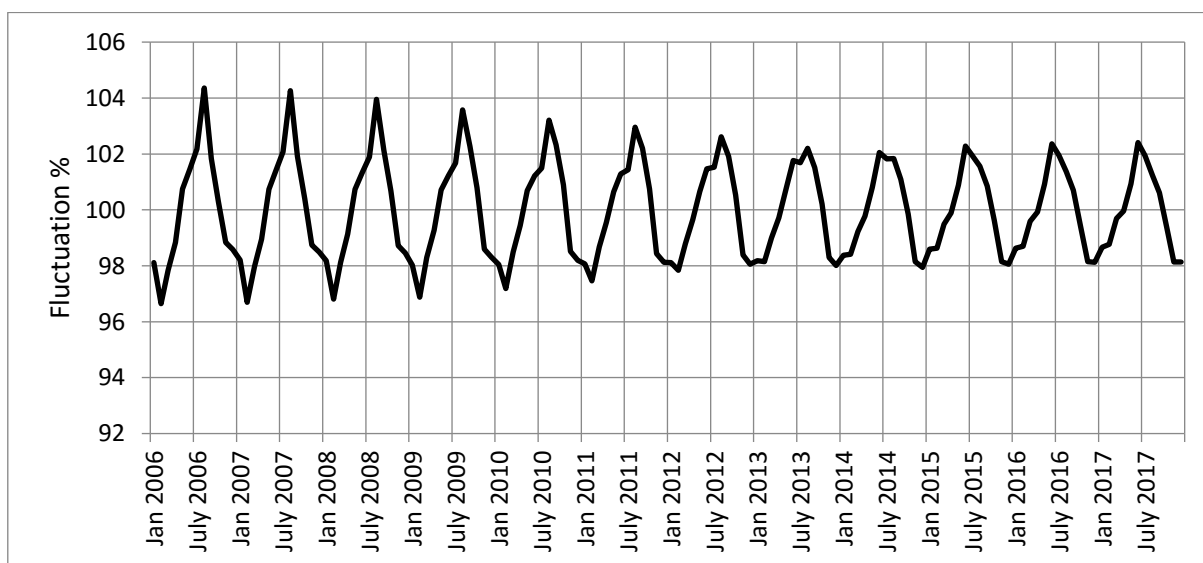
The decomposition of the time series for prices of chicken meat indicates regular seasonal and cyclic fluctuations as well as irregular random fluctuations (fig. 3). The steady seasonality test results proved that the seasonal variability of prices of broiler chicken meat is statistically significant ($p < 0.001$, statistics value $F = 7.61$). In the analyzed period there was a noticeable change in the model seasonality and a decrease in the amplitude of seasonal fluctuations. In 2006 the level of chicken meat price was lowest (96.6%) in March and highest in August (104.4%). (fig. 4). The amplitude of seasonal fluctuations amounted to 7.7%.

Figure. 3. Results of the decomposition of the time series of broiler chicken meat price in EU



Source: own study based on: *Integrated System of Agricultural Market Information, 2018*

Figure. 4. Seasonal fluctuation of broiler chicken meat prices in EU in years 2006-2017



Source: own study based on: *Integrated System of Agricultural Market Information, 2018*.

In the following years, there was a gradual decrease in the fluctuation amplitude and change of seasonal pattern: the summer peak of increase removed from August to June and the winter decrease from March to December. In year 2017, the seasonal fluctuation amplitude decreased to 4.3%. The share of seasonal fluctuations in a monthly horizon amounted to 36.7% of the total price variability, in four-month horizon it was 48% (tab. 2).

Table 2. Share of seasonal, cyclic and irregular changes in the total price variability of in 2006-2017

Horizon of changes (months)	Changes %		
	irregular	cyclic	seasonal
1	43.72	19.62	36.66
2	26.33	30.60	43.07
3	16.41	37.81	45.78
4	7.49	44.40	48.11
5	4.31	49.55	46.14
6	3.58	54.55	41.87
7	3.70	62.56	33.74
9	3.56	81.12	15.32
11	2.58	95.09	2.33
12	2.82	97.12	0.05
Mean	11.45	57.24	31.31

Source: own study based on: *Integrated System of Agricultural Market Information, 2018.*

Cyclic fluctuations constituted the major share in the total price variability of chicken meat: in a month horizon of changes they amounted to 19.6% and in a 5 month period their share constituted almost half (49.5%) of the total variability (tab. 2). Irregular fluctuations in a month horizon of changes amounted to 43.7% of the total variability, whereas in a four-month horizon their share was under 8%. The biggest irregular changes took place between March and May in 2006 and were connected with appearance of bird influenza in EU countries (fig. 2). Annually, on average, cyclic fluctuations amounted to 57.2%, seasonal fluctuations 31.3% and random 11.5% of the total price variability for chicken meat in whole EU. Seasonality of chicken meat prices is connected with consumer preferences and partial substitution of poultry and pork meat. Poultry meat contain less fat in comparison to pork meat and that why some of consumers prefers poultry meat in summer and pork meat in winter (Utnik-Banaś, 2016).

4. Conclusions

1. Despite the common market in the European Union, there is a significant spatial differentiation of meat prices for broiler chickens between member countries. In the period 2006-2017, the highest prices occurred in Germany, Finland and Sweden, while the lowest occurred in Poland, Great Britain and Bulgaria.
2. According to the law of one price on a functioning common poultry market in the EU, it can be expected that the future prices between individual countries will be offset by.
3. Prices of meat for broiler chickens in the EU are characterized by seasonality. Higher prices occur in the summer (culminating in June – August), and lower in the winter (December – March). The amplitude of seasonal changes decreased from 7.6% in 2006 to 4.3% in 2017.
4. The separated components of the time series can be used to prepare a forecast of prices of broiler livestock.

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THE ROLE OF SKILLS DEVELOPMENT IN SUPPORTING ENTERPRISE PERFORMANCE IN THE FIELD OF AGRICULTURE

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Annotation: The main aim of this research is to evaluate the attitude and activity of enterprise management as regards the impact of skills development of employees on their performance in the field of agriculture. An important issue is to ensure that subsidiary administrative processes are in compliance with the key processes – this is one factor supporting process management and the need to ensure enterprise performance. A subsidiary aim of the research is to identify and define a competence model for administrative employees in the field of agriculture. The design of documentation for the competence model is important for providing efficient support for key processes. The research for this article was developed using quantitative research methods. Data were obtained by means of an electronic questionnaire (N=980). For data evaluation a mixture of statistical methods was used. Firstly, categorical variables were analysed by means of frequencies. Secondly, the Pearson Chi-Square test in contingency tables was used for testing hypotheses and correlation analysis was used for measuring the strength of relationship. Employees in the field of agriculture mainly need professional skills and specific knowledge, rather than general skills, to be able to design documentation effectively. Ensuring that employees have the appropriate level of professional skills is one of the main requirements for the effective design of documentation. This is one of the key requirements for providing effective support for organizational processes, to ensure high performance in an enterprise.

Key words: process management, documentation, development, competence model, agriculture

JEL classification: Q10, J24

1. Introduction

According to Řepa et al. (2016) business processes became a regular part of organization management practice. Business owners, sponsors, stakeholders, SMEs, analysts and architects all play a pivotal role in working together to understand and map each process (Iovan and Ivanus, 2016). Porter's model divides activities into primary (inbound logistics, outbound logistics, marketing, sales, service, operations) and secondary (human resources, technology, firm's infrastructure, procurement) (Porter in Kannegiesser, 2008; Porter in Whiteley, 2013). Whiteley (2013) adds that secondary processes (support functions) present the additional activities of an organization that facilitate its operations. In order to understand the business process, this needs to be documented (Pelawi, 2012).

Documentation is an area of project work that is frequently overlooked (Brooks in Note, 2015). In addition, documentation is seen as bureaucratic and tedious. On the other hand, system documentation plays an important part in an organization. In addition, administration is one of the most important business functions (Pelawi, 2012). According to Simon (1997) administration is a widely discussed topic. Emphasis is placed upon process, methods as well as on employees. Employees are a key factor of the success of an enterprise (Price, 2011; Muger, 2012; Armstrong and Taylor, 2014; Kozel et al. in Fejfarová and Urbancová, 2015; Koubek, 2015) and a valuable resource to achieve a competitive advantage (Alo in Obisi, 2011).

It is necessary for enterprises to identify, evaluate and develop key employees' competencies (Cardy and Selvarajan in Fejfarová and Urbancová, 2015). Competency has been defined with terms including traits, motives, personality, personal character, values, attitudes, behaviours, skills,

and knowledge (Caligiuri and Jokinen in Kim and McLean, 2015). According to the National System of Occupations (NSP) competencies have been divided into three groups – soft skills, knowledge and general skills (National System of Occupations, 2018). With regard to this approach, it is crucial to know which key competencies are required to achieve effective job performance (Wickramasinghe and de Zoyza in Yamazaki, 2014).

Agriculture plays an important role in the development of the economy and in the provision of a wide range of public goods, such as the agricultural landscape, farmland biodiversity, climate stability, social, economic and cultural viability of the rural society (Hálová et al., 2015). Currently, Czech Agricultural enterprises face a new challenge. Almost every Czech agricultural enterprise tries to ensure enough qualified employees for a successful business (Spěšná et al., 2014). Nowadays, employees working in the field of agriculture are considered as a strategic asset to ensure enterprise performance (Venclová, 2017).

The main aim of this research is therefore to evaluate the attitude and activity of enterprise management as regards the impact of skills development of employees on their performance in the field of agriculture. A subsidiary aim of the research is to identify and define a competence model for administrative employees in the field of agriculture.

2. Materials and Methods

A quantitative survey was conducted from February 2018 to March 2018 in the Czech Republic to identify and define a competence model for employees in the field of agriculture to ensure that subsidiary administrative processes are in compliance with the key processes. It was carried out on the basis of a questionnaire survey comprising of 25 questions, six of which were qualitative in nature. 19 questions were based on the degree of agreement about the added value as perceived by employers. This was measured using a Likert scale from 1 (not at all) to 5 (complete agreement). The competence methodology used in the questionnaire was according to the National System of Occupations (professional skills, specific knowledge, general skills).

The sample group consisted of 980 agricultural organizations. The questionnaire return rate was 12.5% (123), of which small organizations (up to 50 employees) amounted to 69.9%, medium-sized organizations (from 51 to 249 employees) accounted for 29.3% and large organizations (over 250 employees) represented 0.8 % of the sample. The classification of organizational size was according to the recommendation of the European Commission (No. 2003/361/ES). In terms of their legal basis, the most frequent types of organization were limited liability companies (35.8%), followed by cooperatives (32.5%), while 23.6% were joint-stock companies.

The data obtained were processed by means of absolute and relative frequencies. Testing was carried out using the Pearson Chi-Square test in contingency tables. To interpret the strength of relationship coefficients (Cramer's coefficient), a scale according to Řezanková (2011) was used. For testing statistical hypotheses and the subsequent analysis the significance level $\alpha = 0.05$ was used. The conditions for testing by means of Pearson Chi-Square test in contingency tables were confirmed (no more than 80% of cells had an expected count less than 5, other cells had an expected value count lower than 1). It was necessary, for the purpose of statistical testing of the predefined hypotheses, to merge the categories of variables to create only three categories (disagreement, neutral, agreement). In addition, it was necessary to merge the groups of enterprises to create only two groups – one with up to 50 employees and a second with 51 or more employees. The practical calculations were made with MS Excel and the statistical software SPSS version 24.

3. Results and Discussion

3.1 General skills

The survey conducted has shown that 95.1% of agricultural employees need PC skills to ensure the effective use of administrative processes. Subsequently, testing of hypotheses (H01 – H03) was carried out to carry out deep analysis. The results of testing have confirmed that the need to have PC skills competence for ensuring the effective use of administrative processes is not dependent on the gender of employees. In addition, it was confirmed that the need for PC skills competence for supporting administrative processes is independent of the job position and the size of an enterprise (Table 1). Kunstová (2009) supports the observation that today’s needs for PC skills are attributable to the digitisation of enterprise processes, development of automation and workflow applications.

Table 1. The results of the qualitative characteristics test for hypotheses 1, 2 and 3

Number of hypothesis	Null hypothesis (H ₀)	P-value	Rejection of H ₀	Value of Pearson Chi-Square	Degrees of freedom
1	The need for PC skills competence to support administrative processes does not depend on the gender of employees	0.305	No	2.376	2
2	The need for PC skills competence to support administrative processes does not depend on the size of an enterprise	0.807	No	0.428	2
3	The need for PC skills competence to support administrative processes does not depend on the job profession	0.338	No	4.541	4

Source: Author’s survey, 2018

The survey revealed that agricultural employees need to know basic economic terms and basic financial products and services (86.2%). The result is confirmed also by Koubek (2004), who also points out that partnership between an enterprise and an employee depends on the development of the skills and knowledge needed for management in any enterprise.

The survey also revealed that agricultural employees do not need to have language skills (51.2%). As stated by Armstrong (2011), system factors and personal factors both influence individual performance.

If an employee needs language skills for the performance of administrative processes, then they need to know English language very well (47.2%). As regards the results of testing for the need to have language skills for the performance of administrative processes and its dependence on gender, the null hypothesis (H04) has been rejected (Table 2). In addition, the survey has shown that there is no difference between agricultural job professions or the age of agricultural employees, as regards the need to have language skills for supporting administrative processes. The null hypotheses H05 and H06 have been confirmed, as the p-value 0.075 and 0.782 are lower than the selected level (Table 2).

Table 2. The results of the qualitative characteristics test for hypotheses 4, 5 and 6

Number of hypothesis	Null hypothesis (H ₀)	P-value	Rejection of H ₀	Value of Pearson Chi-Square	Value of Cramer's coefficient	Degrees of freedom
4	The need for competence in language skills to support administrative processes does not depend on gender.	0.000	Yes	13.804	0.335	1
5	The need for competence in language skills to support administrative processes does not depend on the job profession	0.535	No	1.251	-	2
6	The need for competence in language skills to support administrative processes does not depend on age.	0.369	No	3.147	-	3

Source: Author's survey, 2018

3.2 Specific knowledge

The survey has shown that agricultural employees need to know about articles of incorporation and basic organizational regulations (81.3%). They also need to know rules for evidence of contract correspondence and other documents (85.4%). Therefore, they need to know internal organizational regulations (78.1%). As Petřík (2009) states, employees need to know about the real conditions for managing an enterprise to be able solve operational problems. This condition is necessary for high quality decisions.

The survey has also revealed that agricultural employees need to know the requirements for business and bureaucratic correspondence (78.9%). However, agriculture employees of small enterprises have a greater need to know the requirements for business and bureaucratic correspondence (81.4%) than agricultural employees working for medium and large-scale enterprises (Table 3).

Table 3. The need for specific knowledge (requirements for business and bureaucratic correspondence) according to the size of an enterprise

Requirements for business and bureaucratic correspondence		Enterprise size	
		Small-scale enterprises	Medium and large-scale enterprises
Disagreement	Relative Frequency	8.1%	0%
Neutral	Relative Frequency	10.5%	27%
Agreement	Relative Frequency	81.4%	73%

Source: Author's survey, 2018

In addition, employees need to have specific knowledge about payroll documentation, and how to proceed and evidence this documentation. On the other hand, agricultural employees do not need to know the requirements for business and bureaucratic correspondence in English (81.3%). This is related to the issue of documentation for business trips abroad. Agricultural employees do not need to know about documentation of business trips abroad in order to support administrative processes (82.9%).

The survey revealed that employees do not need to know about the principles of document record management system (26.8%). 30.9 % of respondents are not sure whether they need to know about the document record management system for their job. By contrast, 42.3% of employees consider it necessary to know about the document record management system for their job. However, only 17.1% of employees state that they use an e-document record management system for their work.

3.2 Professional skills

The survey revealed that employees need to work with office equipment to carry out administrative processes (95.1%). In general all employees regardless of their positions or age need to work with office equipment (Tables 4 and 5).

Table 4. The need for professional skills - working with office equipment according to job profession

Skill - working with office equipment		Profession		
		Administrative clerks	Specialists	Manual workers
Disagreement	Relative Frequency	0%	0%	1.9%
Neutral	Relative Frequency	3.1%	0%	5.7%
Agreement	Relative Frequency	96.9%	100%	92.5%

Source: Author's survey, 2018

Table 5. The need of professional skill - working with office equipment according to age category

Skill - working with office equipment		Age category			
		Up to 35	36 - 45	46 - 55	Over 56
Disagreement	Relative Frequency	0%	0%	0%	3.4%
Neutral	Relative Frequency	4.3%	7.7%	0%	3.4%
Agreement	Relative Frequency	95.7%	92.3%	100%	93.1%

Source: Author's survey, 2018

According to Truneček (2004) knowledge is a factor affecting productivity, which determines more and more about economic success and economic performance. Knowledge (information) is transferred in printed form in most small-sized enterprises.

Agricultural employees need to work with a data box (87%). However, employees of small-scale enterprises (91.9%) have a greater need to work with a data box than employees of large enterprises (75.7%). In addition, employees need to follow a specific agenda (attendance, incoming documents, evidence of documentation, vouchers) (76.5%).

4. Conclusion

Employees in the field of agriculture mainly need professional skills (working with office equipment – 95.1%, working with a data box – 87%, administer papers – 83.7%) and specific knowledge (knowledge about articles of incorporation and basic organizational regulations - 81.3%). They also need rules for evidence of contract correspondence and other documents - 85.4%, as well as knowledge about internal organizational regulations – 78.1%, and knowledge about requirements for business and bureaucratic correspondence – 78.9%. They need these skills in order to design documentation effectively, rather than general skills (language skills - 51.2%). On the other hand, currently all employees need to have PC skills (95.1%).

Employees present the most important resource for the field of agriculture (Duft, 2011). Therefore, ensuring that employees have the appropriate level of professional skills is one of the main requirements for the effective design of documentation. This is one of the key requirements for providing effective support for organizational processes, to ensure high performance in an enterprise.

The identified competencies will be further examined by means of semi-structured interviews with managers, with the aim of gaining a deeper insight into these issues. Based on the findings from the present survey and semi-structured interviews, a competency model of employees in agribusiness

will be designed to ensure that subsidiary administrative processes are in compliance with the key processes of an enterprise.

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IOT TECHNOLOGIES COMPATIBILITY AND IN-HOUSE SOLUTIONS

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Annotation: IoT technologies are currently the most developing area of telemetry transmissions in both industrial and agricultural environments. It does not mean there is just one technology for data transmission on physical and link layers, but lot more more-or-less compatible technologies for such purpose. Also, there were (and still are) different non-IoT technologies used for the same purpose, thus lot of different tools can be used to obtain same services. Purpose of this paper is to highlight currently available technologies, pick their compatibility issues and compare IoT based on non-IoT solutions.

Key words: IoT, networking, IoT compatibility, telemetry, spread spectrum

JEL classification: D80 General

1. Introduction

To gain access to field-measured data there are a lot of techniques. Old-fashioned was is always to physically attend the location and measure required values. This approach limits usability of such acquiring data due to random character of measurement intervals, location on points within the area, physical capabilities of an explorer.

Typical data obtained in the industry and smart city environments are focused on energy, parking (Chatziannakis, Vitaletti and Pyrgelis, 2016), lighting etc. (Zanella et al., 2014) On contrary, in agricultural environment a different type of data and frequency of their acquiring is required (Playán et al., 2018). According to (Koprda et al., 2017) mainly weather, humidity (Jeong et al., 2018), wind direction and strength values are needed in such conditions.

New technologies in 20th and 21st century allowed us to retrieve such data using automatical remote-controlled devices. Currently, we can use two main groups of technologies – one-use units usually build on a case-by-case basis and so-called IoT (Internet of Things) devices (Atzori, Iera and Morabito, 2017) which tend to be more universal, mass produced and this usually cheaper in terms of purchase. But is a low price regular reason to use such technology in agriculture?

Those commercially available technologies span through wide variety of prices and capabilities, so far no structured comparison of them was made for agricultural use. This paper will partially use results from (Stočes et al., 2016) and extend them by previously mentioned in-house solutions that were used in previous years, and are still competitors to them.

Most of actual IoT studies are focused on city-wide (Centenaro et al., 2016) or industrial use (Shete and Agrawal, 2016), while rural areas are not a mainstream of interest. Not only IoT but multiple-layers telemetry technologies are introduced in this area – usually when a mobile phone is used as concentrator (Granulo et al., 2016) or GSM module (Sarri, Martelloni and Vieri, 2017). But those areas are quite different from previously mentioned in terms of distances, power availability, hostile environment on a fields (Parada et al., 2017) - so different approaches and technologies may or should be used. The purpose of this paper is also to determine whether IoT as a suitable technology for rural areas in general and to prepare a theoretical basis for a future experimental research.

2. Materials and Methods

In the paper, the author will create an overview of technologies – frequency bands - used for acquiring field measurements and transmitting them for a future processing in information systems. Technologies are to be compared according to their compatibility and usability. IEEE standards will be used to describe technologies and publicly available and comparison to alternative telemetry devices using special frequencies is to be made a special part of the evaluation when several bands will be selected and described. For high frequency measurements a spectral analyzer equipped with general purpose scanner antenna will be used. Both rural and city environment will be used as reference. Measured values will be used to determine usability of different technologies in large-distance rural area.

3. Results and Discussion

Although Internet of Things is well name for a technology most of users is not aware if it's exact purpose. IoT is a typical telemetry technology jus using some internet principles. Those principles includes separation of carrier infrastructure, data acquiring devices and their processing. (Stočes et al., 2016). Different approach for similar objective is to use specialized devices where hardware platform is closely bonded to transmission technology. Such devices are more independent while transmission infrastructure is managed entirely by the owner of the devices or user of gathered data. Telemetry is usually describes as on-way communication which occurs only occasionally and amount of data transmitted is extremely limited (Mikhaylyuk et al., 2018).

While only small quantities of data are needed, low bandwidth is suitable to be used as well. This relation is described by the Shannon–Hartley theorem (1):

$$C = B \log_2 \left(1 + \frac{S}{N} \right)$$

Where B stands for bandwidth needed for successful data transmission of desired speed (C) in current noise conditions (S/N ratio). Typical environment measurement data consists of a few bytes including headers and checksums, not exceeds 32 bytes of data transmitted in 1-2 second windows. It generates of channel speed of 128 bps (bits per second). Such extremely low speeds can be achieved using tiny bandwidth on low frequencies.

While S/N ratio (signal to noise ratio) influences available real bandwidth typical measurements of noise in telemetry frequency bands were made:

Table 1. Typical background noise on telemetry bands

Band	City	Rural area
160 MHz	-87 dBm	-96 dBm
430 MHz	-81 dBm	-99 dBm
860 MHz	-83 dBm	-89 dBm
1200 MHz	-92 dBm	-102 dBm

Source: author's original measurements

In table there are arithmetic means of three measurements performed during the first three weeks of April 2018. Location “city” is city of Kladno (Central Bohemia, CZ) on the roof of 13 story house which is used by many telco operators as POP. Site was accessed with cooperation of University Centre for Energy Efficient Buildings of Technical University in Prague. Rural location is a field 2 km east of Bratronice village (Central Bohemia, CZ) at height of 3 meters above ground. Premises is a private property of the author. Spectrum analyzer Advantest R3131A was used to measure 1 kHz band on all the frequencies. General purpose SRH 536 SMA antenna was connected to the analyzer.

Although not enough data are available for a statistical analysis, it is clear that in rural areas less noise on all the bands it is clear that in country-side areas less noise creates a disturbance over data transmissions.

Using given noise levels and already known required bandwidth and channel capacity, minimal signal levels for successful transmission can be calculated (2):

$$S = N \left(2^{\frac{C}{B}} - 1 \right)$$

If typical rf bandwidth 14 kHz for telemetry devices is used, minimal acceptable RF levels in country area are:

Table 2. Minimal acceptable RF levels in country area

Band	Minimal RF
160 MHz	-82 dBm
430 MHz	-84 dBm
860 MHz	-78 dBm
1200 MHz	-86 dBm

Source: author's original calculations

According to the regulations in Czech Republic, General license VO-R/10/05.2014-3 defines maximal output power of telemetry transmitters to 10 mW (+10 dBm) in 160 and 430 MHz band and 25 mW (+13,9 dBm) in 860 MHz band. For 1200 MHz band, there is no specific regulation thus equal 25 mW will be used as well. Typical antennas used for telemetry purposes have gain of 0 dBi and we can roughly calculate coverage area for a typical in-house telemetry solutions:

Table 3. Coverage area for telemetry solutions

Band	Maximal distance
160 MHz	5950 m
430 MHz	2790 m
860 MHz	690 m
1200 MHz	1260 m

Source: author's original calculations

For calculations, the tool (<http://www.l-com.com/content/Wireless-Calculators.html>) was used.

Results shows that traditional telemetry solutions are able to cover areas in a rural environment with exception of 860 MHz band. This exact band is used for many IoT solutions and thus those frequencies are quite busy even out of the city.

Although presented results indicate that 860 MHz band is the worst option, other influences must be taken into the account – in 160 and 430 MHz bands a lot of services are currently used and lack of unlicensed frequencies are available. On contrary, 1200 MHz band suffers from LOS (line-of sight) requirement while such high frequencies almost can't penetrate any living masses (plants, trees, etc.).

Link lengths can be improved heavily by using directional antennas on end-devices gaining up to 10x larger coverage. But such devices will require stationary mounting, will be more vulnerable to weather and of course thieves and other sources disturbance.

Typical IoT technologies offer transport infrastructure managed by the third party and user is responsible only for sensors settings and data processing. Another use for IoT is a private-type solution where a user is also a provider of RF (radio-frequency) layer. While (Akpakwu et al., 2018)

divides IoT technologies into several groups according to an application domain, agriculture and in general rural area usage is usually omitted. This branch of telemetry data gathering can be described by the following parameters (based on Table 1 in (Akpakwu et al., 2018)): Application domain: Agriculture, Tolerable delay: 30mins, Update frequency: 1 hour, Data rate Low.

Table 4. Available IoT solutions for agricultural use

Technology	Band used	Suitability
LoRa	860 MHz (commercial)	suitable city areas, rural use can be questioned
LoRa	160 MHz (self-managed)	perfect for rural use; lack of devices available
SigFox	900 MHz	suitable city areas, rural use can be questioned
WiFi/Bluetooth	2,4 GHz / 5,4 GHz	not suitable in rural areas

Source: author's extension of (Akpakwu et al., 2018)

The same authors clearly divided available IoT technologies into two main groups: long-range and short-range. Our results confirm the results in Table 2 in the mentioned paper where long-range technologies operate at bands 800-900 MHz and short-range ones at much higher frequencies. When comparing author's experimental results to commercially introduced parameters, a significant difference is visible in distance covered values in 800-900 MHz bands technologies. This difference should be studied more deeply in the following research.

4. Conclusion

Results obtained during the research indicates, that in an agricultural environment both traditional telemetry systems based on VHF/UHF and IoT can be used. Sufficient coverage can be better achieved using lower frequencies but still either private or third-party IoT technology benefits from separation of transmission infrastructure from an actual data-gathering and processing devices.

For a rural environment, a VHF telemetry seems to be the best solution but those devices are not commercially available and will not fit into specifications (small, long battery life, cheap, durable). A UHF telemetry can be used as well and will benefit especially from less noise and higher reliability. Still, almost daily on-site maintenance of devices and network infrastructure is needed and for the agricultural industry, this solution is not suitable.

Our research confirms, that some IoT solutions (regardless commercial or self-managed) are currently the best choice for telemetry data gathering in rural areas for agriculture purposes. So far LoRa in (860 MHz band) and Sigfox (also in 860 MHz band). Probably the best solution would be the LoRa in 160 MHz band but those networks are not commercially used in Europe and also no devices are there on the market to build a self-managed solution.

For a future research more experiments should be performed in real field-environment focused on exact coverage measuring. Research question can be – to compare commercial and self-managed IoT solution in large rural areas.

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PROMOTION OF LOCAL PRODUCTS IN REGIONAL DEVELOPMENT

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Annotation: The aim of this work was to determine the relationship between the promotion of local products and regional development. An attempt was made to compare the opinions of inhabitants of the Podlasie, Lublin and Podkarpacki regions regarding the forms of promotion, accessibility and the related frequency and motives for purchasing regional products. The study used the diagnostic survey method with an original questionnaire, by means of which 1128 respondents from three regions of eastern Poland were eventually examined. The methodological procedures allowed to calculate the sample, where the confidence interval was set at 0.95, the fraction size was 0.50, and the maximum error was 0.05. The Student t test, ANOVA statistics and the Pearson correlation test were used in statistical analysis. The analyses have shown that inhabitants of eastern regions emphasize the importance of regional products – 44.48% of respondents buy local products several times a month. According to respondents, it is best to promote regional events, such as fairs and markets using TV and radio advertising. Statistical analysis demonstrated that respondents' gender influenced the perception of various forms of advertising. It was shown that “curiosity and uncommonness” of local products is one of the main reasons for purchasing them at regional fairs. The authorities should continue to focus on promotions not only at national but also international level.

Key words: Consumer behavior, local markets, regional promotion, sustainable development

JEL classification: A11, D12

1. Introduction

The idea of multi-functional development implemented in rural areas in Poland requires a specific approach to the economic development of these regions. It enforces the activation of rural areas and diversification of economic activity, according to which the future of the rural population is associated not only with agriculture, but also with other economic sectors. Multifunctional development is associated with introduction into the rural space of an increasing number of new non-agricultural functions: production, trade and service (Adamowicz and Zwolińska-Ligaj, 2009).

There is an increasing interest of consumers in local products or products manufactured using traditional methods in Poland and other European Union countries. These are products distinguished by signs and certificates confirming the high quality of the food product, unique character, origin from specific regions, or manufacture by traditional methods in accordance with the culinary heritage (recipes passed down from generation to generation). Their registrations are regulated by a number of regulations and ordinances that are intended to protect food against falsification and unfounded appropriation. In Europe, the economic approach to rural development is emphasized by the need for heterogeneous regional food markets. In this context, the European Commission has introduced an ambiguous definition of regional food: “the foods involved are identified by, and traceable to a farmer. The number of intermediaries between farmer and consumer should be minimal or ideally nil” (Niemi and Pekkanen, 2016).

Local products are popular not only on the American and European markets (Autio et al., 2013; Smoluk-Sikorska et al., 2017) but also on the Australian market (Caskey, 2014). Regional food festivals organized by local producers also gain popularity. Producers perceive this activity as improving the economic conditions of their region. Local products for many consumers are

associated with “natural”, “healthy” products and “supporting local producers” (Peters et al., 2008). According to Birch (2018), the purchase of local products is associated with the support of the consumption of local products” movement, which brings social benefits. The purpose of the promotion is both informing and convincing about the attractiveness and benefits of purchasing and then using. The promotion consists in using selected information, tools and methods to present products and subsequently maximize sales (Lombart et al., 2018).

The purpose of the work was to examine the opinions of eastern Poland residents on the promotion of regional products and their significance for the development of rural tourism. Attempts were made to indicate the reasons for purchase and to identify sources of information about local products, regional events (most often these are places where local producers can advertise their productions and convince potential buyers). The availability of retail outlets for local products and forms of promotion that are used in promotional activities were assessed. The criterion used was the division of respondents according to the education, age and gender and the place of residence.

2. Materials and Methods

The diagnostic survey method was used in the study. The author’s questionnaire containing 15 questions regarding the analysis of the regional product market in Poland was the research tool. Six questions were used in the current study. The research was carried out in May and June 2017. A five-point Likert scale was used to measure attitudes, which was preceded by the construction and validation procedure. The index of scale reliability was calculated, where Cronbach’s alpha was 0.87.

Random stratification was applied in the selection of the study sample. In the next stage, the respondents were divided proportionally, taking into account their gender and place of residence. The methodological procedures allowed to calculate the sample size, in which the confidence interval was set at 0.95, the estimated fraction size was 0.50, and the maximum error was set at 0.05.

After taking into account gender and place of residence, a quota sampling was chosen, in which the respondents were selected on the basis of availability. The research sample was calculated from 3,456,183 adult inhabitants of eastern Poland¹⁵. The questionnaire was used to examine 1128 respondents from the following regions: Podlasie, Lublin and Podkarpackie. 1200 respondents were subject to the survey, some of them were excluded after questionnaire verifications due to the lack of reliability and errors in filling out the form.

The proportion of women was 51.3% and 48.7% of men. City inhabitants constituted 47.5% of the respondents. Of the respondents: 7.8% had primary and vocational education, 42.4% with secondary education and 49.8% had higher education. There were 21.6% respondents in the age from 18 to 25 from eastern Poland, 31.3% from 26 to 40 years old, 20.9% aged from 41 to 55 and 26.2% of 56.2 and more years of age. The survey was conducted by telephone (using the CATI technique - computer-assisted telephone interviewing) and included all the criteria applied.

Statistica 13 was used for statistical analyses, and the Student t test and ANOVA (Lant, 2013) implemented within this software. Slight deviations were not that significant due to the large number of respondents in particular groups. Statistically significant were the differences in the means, whose probability of randomness was lower than $p < 0.05$. The Pearson correlation test was also used in the analyses where

weak correlation - $0 < [r] < 0.30$, at $p < 0.050$, - moderate correlation $0.30 < [r] < 0.70$, at $p < 0.050$

¹⁵ www.demografia.stat.gov.pl 2017

The research hypotheses were as follows:

H1: According to the respondents of the studied population, all tested sources of promotion of local products have the same influence on regional development.

H2: The age and gender of respondents are variables that differentiate the motives and frequency of purchase of local products.

3. Results and Discussion

Table 1 indicates that consumers most often declared consumption of local products several times a month. Almost half of respondents (44.48%) made such a statement. This group more frequently included respondents aged 18-25 and people over 56. Consumers aged 26-40 declared to a greater extent that their contact with local food was more frequent than consumers from other groups. Declaration of local food consumption several times a week was 40.24%, of which 17.11% were people aged 26-40. The response rate was on a comparable level in other cases studied. A significant correlation was found between the type of statements related to the frequency of eating local food and respondents from different age groups. The test-T value was 6.97 (at $p = 0.000$, $p < \alpha$), which indicates that the differences between means in the studied groups are significant (Table 1).

Table 1. Frequency of consumption of local products by inhabitants of selected age groups

Type of answer	18-25 y.o.	26-40 y.o.	41-55 y.o.	56 y.o. and more	Total
Every day	1.29%	2.58%	1.27%	1.02%	6.16%
Several times a week	6.25%	17.11%	9.09%	7.79%	40.24%
Several times a month	12.78%	10.02%	8.26%	13.42%	44.48%
Several times a year	1.15%	1.59%	2.28%	3.97%	8.99%
Not buying	0.13%	0.0%	0.0%	0.0%	0.13%
Overall	21.6%	31.3%	20.9%	26.2%	100.0%
Test-T value				6.97	$p=0.000$

Source: own research

The Pearson correlation test was used in order to verify the most popular places of buying local products, depending on the main purchase motives (Table 2). A correlation was demonstrated between the motives of purchasing local products and the site of purchase. In most cases, there was a moderate and weak correlation power between different places where local products can be purchased and individual purchase motives. It should be emphasized that “regional fairs and markets” were correlated with all purchase motives that were considered during the study. The reason “high quality products” was a motif correlated with every point where such products can be bought (the exception was “online sales”, where this motif was not very important for the respondents). Similar results were obtained in the UK in the study conducted by Connor et al. (2010). According to British respondents, the high quality of local products is identified with its safety.

Table 2. Correlation between the main motives of purchasing local products and site of purchase

	original taste and smell	health benefits of the product	curiosity, uncommon food	traditional natural production method	high quality of the product	friend recommendation
internet/mail sale	0.12*	0.15*	0.03	0.08	0.09	-0.02
in specialized stores with regional food	0.25*	0.24*	0.23*	0.23*	0.42**	0.12*
in supermarkets and hypermarkets	0.02	0.10*	0.01	0.05	0.14*	-0.03
at regional markets and fairs	0.34**	0.15*	0.31**	0.22*	0.23*	0.16*
in general grocery stores	-0.06	0.10*	0.01	0.06	0.16*	-0.03
only in the region where they are produced	0.08	0.03	0.06	0.07	0.15*	0.12*

Source: own research

Note: *weak correlation $-0 < [r] < 0.30$, at $p < 0.050$; ** moderate correlation $0.30 < [r] < 0.70$, at $p < 0.050$

The correlation between places of purchase and the availability of local products at retail outlets where local products can traditionally be purchased was calculated to validate research hypotheses (Table 3). In most cases, there was a weak correlation; “on the occasion of regional events” respondents believe that the availability of local products decreases to a limited number of retail outlets. However, there are fears of respondents that non-genuine products can be purchased “directly from the producer” and at “regional stands” (i.e., made according to traditional recipes). According to Barska (2015), promotion in local product retail sites is one of the most important elements in the purchase decision process for people over 25 years of age. The analysis shows that regional products of eastern Poland are promoted and recognized (Table 2 and 3).

Table 3. Correlation between the availability of local products and places of their purchase in the region

	on the occasion of regional events	directly from the producer	at regional stands	on occasional regional markets and fairs
these are hardly available products	0.23*	-0.01	0.09	0.14*
they are available, but in a limited number of retail outlets	0.38**	0.15*	0.21*	0.20*
their availability is not the problem, but the uncertainty if the product is genuine (sometimes there are imitations)	0.16*	0.13*	0.11*	0.08

Source: own research

Note: *weak correlation $-0 < [r] < 0.30$, at $p < 0.050$; ** moderate correlation $0.30 < [r] < 0.70$, at $p < 0.050$

Information obtained from television and radio advertising was the most important source of knowledge about local food products in the opinion of eastern Poland residents. Such opinions were declared significantly more frequently by women than men (assessment of men and women Table 4).

This was the source of information that obtained the highest value – F (this value shows what is the individual contribution of the variable in predicting belonging to a group). The respondents also more often considered folders and leaflets as the proper promotion of local products. At present, the Internet is gaining as a source of promotion. In the study population, men were more interested

in the source of advertising than women (value of “Constans” after calculation in the group of men was higher than in the group of women surveyed -17.443, therefore the significance of individual variables for this sample is of greater importance). ANOVA confirmed the significant impact of such promotion sources as the Internet, knowledge derived from travel around the region, as well as the recommendation of friends or family members (Table 4).

Table 4. The importance of local product promotion sources, taking into account respondents’ gender

Source of promotion	F value	p value	Women assessment	Men assessment
From friends / family	42.198	0.001*	1.856	1.344
From organized regional events	11.987	0.001*	0.866	1.090
From travels	39.159	0.001*	0.576	1.037
From folders, leaflets	1.434	0.236	1.797	1.866
From the Internet	30.778	0.001*	1.738	2.889
From TV / radio	2.787	0.096	2.301	2.196
Constans			15.238	17.443

Source: own research

Note: *-level of significant difference at $p < 0.050$

Many promotional campaigns, events where one can buy regional products are conducive to visiting the rural areas where they are usually organized. However, a group of respondents aged 56 and over assigns higher importance of regional products in the rural tourism promotion (Table 5). The “culinary route of eastern Poland” has been functioning since 2016 (which includes the Podlasie, Lublin and Podkarpackie voivodeships); its task is to organize cultural events aimed at promoting regional products as well as attracting tourists to organized events not only from neighboring regions but also from abroad. The results obtained in the United States (Brown, 2003) on the consumption of local products are consistent with the results obtained by the author. Values related to regional support, promotion of healthy food, with which local products are identified, remain the same despite cultural differences and wealth.

Table 5. Evaluation of the use of local products in the promotion of region

Evaluation of the use of local products in the promotion of region	Age of respondents			
	18-25 y.o.	26-40 y.o.	41-55 y.o.	56 y.o. and more
positive	55.45%	63.04%	65.12%	78.57%
negative	44.55%	36.96%	34.88%	21.43%
Total	100%	100%	100%	100%

Source: own research

The Chi-square test was additionally applied to verify the hypotheses. The statistical test showed that the assessment of regional product utilization to promote region depended on the age of the participants. The value of the calculated chi-square statistics (15.98) significantly exceeded the tabular value (7.8), and the V-Cramer coefficient of 0.21 indicated the weak relationship between the traits considered. The majority of respondents in all age groups noticed the chances of promoting rural tourism with the help of local products in the regions of their production. The applied statistical

tests allowed to verify research hypotheses. The results allowed to reject hypothesis H1 and accept hypothesis H2.

4. Conclusion

The region of eastern Poland is one of the poorest regions not only of Poland, but also of the European Union (Eurostat, 2017). According to socio-economic development analyses, Podkarpackie, Lublin and Podlasie voivodeships are at the end of the regional development list (Wojciechowska-Solis, 2018). The conducted research leads to the conclusion that regional products that eastern Poland can be proud of may be an element of a given region promotion. Residents see opportunities to improve the economic situation of the eastern areas through greater promotion of their products, which can be purchased not only from the manufacturer but also at fairs and local marketplaces. Research conducted by Tjärnemo (2015) in Sweden indicated that the purchase of products from the manufacturer or in specialized local and traditional food stores allowed consumers to contribute to the sustainable development of a region, support the environmental policy of the state, increase wealth of a local population and purchase high quality products.

It should be emphasized that promotion is an important element in regional development, it leads to region recognition, preservation of tradition, and also investment in the region by the authorities that want to attract foreign investments to the region. Advertising programs on regional TV and radio are the most effective form of promotion for fairs and culinary events of the region. Health benefits of the products made by traditional methods, as well as the originality of taste and smell should be emphasized by companies that have mail order sales of local products in their offer. According to respondents, high quality of local products, manufactured by traditional methods is their best advertisement.

In summary, there is a need to take decisive promotional measures for regional products and regional events, at which they are presented, because acquiring knowledge from family and friends is an insufficient method. Television and the Internet have enormous promotional potential to educate young generations of consumers interested in purchasing local products, thereby investing in regional development. High awareness of the importance of local products among consumers of the surveyed regions should lead to an increase in the number of retail outlets.

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CZECH GOODS IN THE RUSSIAN AGRICULTURAL AND FOOD MARKET: ADDITIONAL ANALYSIS CAPABILITIES USING FOREIGN TRADE INDICES

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Abstract: Foreign trade indices (FTI) are one of the known tools for analyzing foreign trade and are calculated by statistics using the well-known Laspeyres and Paasche formulas by aggregating statistical data on the main goods and presenting them as average price indices and physical volumes indices of the country's exports and imports. In the publication the statements and methods of solving the problems of disaggregation of FTI allowing calculating the indices of groups of significant goods and groups of other goods of export and import are described. The proposed index methods allow analyzing changes in the dynamics of these groups of goods taking into account the factors "price-quantity-value". For approbation of methods the commodity Agricultural products and foodstuffs (APF) group (HS 01-24 codes) and a task of the analysis of export of goods of this group from the Czech Republic to the Russian Federation were considered. The information base for the analysis was the mirror statistics of Russia on the import of Czech goods to Russia. Based on the results of calculations, the analysis of aggregate FTI of goods from groups 01-24 was carried out with the allocation of an additional subgroup of goods with the greatest growth in the value of sales. The analysis of the state of Czech goods and goods of other non-CIS countries in the Russian market was also conducted. It was revealed that unlike the non-CIS countries, where the level of sales of APF in the Russian market as a whole decreased due to falling prices and sales volumes, the Czech Republic was able to ensure sales growth of agricultural products on the basis of practically stable prices and growth of natural supplies.

Key words: Index Numbers, Laspeyres index, Agriculture in International Trade, export and import of goods

JEL Classification codes: C43, F14, Q17

1. Introduction

When carrying out marketing analysis of foreign trade of goods, the study of the value indicators of trade must necessarily be supplemented with information on prices and physical volumes of exports and imports of goods. The information on the development of prices and volumes is generally presented in the form of indices. Currently, foreign trade indices (FTI) are one of the tools for analyzing foreign trade and allow us to examine the dynamics of commodity flows taking into account changes in average prices and physical volumes of exports and imports of goods. All methods of calculating aggregated indices are known and are described more than once in classical textbooks on index methods (Allen, 1975; Koves, 1983). Modern approaches to the development of statistics using FTI are generalized and presented by the experts of IMF, WB, OECD, Eurostat in the joint development of the Export and Import price index manual (XMPI Manual, 2009).

As a rule, FTI are included in the standard data set of national statistical systems and are calculated by the aggregation method (Aggregation, 2018) at the macroeconomic level in the form of average price indices and volume indices of a single universal commodity of the country. For the calculation of FTI, statistics forms a list of main goods of the reference and reporting years (the sample depth in it, as a rule, is not less than 95-99 percent of the volume of goods), on the basis of which, using the known Laspeyres (1871) or Paasche (1874) formulas, the aggregate FTI of the average prices and physical volumes of exports and imports are calculated. These indices are subsequently published

by the statistics, but the list of main goods is usually not published in view of its large size, although statistics show some of the most important commodities, for example, in the standard tables of distribution of the most important goods by countries.

We have noticed that with the help of aggregated FTI, calculated by statistics based on the list of main goods, additional tasks can be formulated, such as an analysis of the influence of individual goods and their groups on the positions of other goods of the country's foreign trade (for example, how much the prices and volumes of energy supplies affect the total import index of the country, including the index of other goods). Similar tasks can be solved by disaggregating of the already calculated total indices (Aggregation, 2018, Disaggregation, 2018), when the list of main goods is conventionally divided into two groups - a group of goods selected for analysis and a group of others. For the selected goods using the Laspeyres or Paasche formulas, the indices of their group are calculated, then for the group of the remaining goods, based on the proposed method, the indices of their group are determined by the formulas. Note that disaggregation method is based on equivalent transformations and expands the analytical capabilities of the index methods, without changing the original standards and prerequisites of the latter. We found no analogues of the disaggregation methods for analysis of foreign trade by other authors similar to those proposed by us.

For the first time the general formulation of such a problem was considered by us (Pushkin, 2004), but a specific method for solving it was given without the description of formulas, although it was applied in practice (Pushkin, 2009; Yurik, 2005). In particular, for the foreign trade of Belarus in the publication (Yurik, 2005), using disaggregation methods it was proved that the group of goods exported by private businesses of Belarus without financial state support demonstrates better opportunities for adaptation to crisis phenomena (due to the optimal price reduction and volume changes and assortment of export supplies) than the group of goods produced by large state-owned enterprises with a full set of state benefits and financing.

In general, the solution of the tasks of selection commodity groups and goods is a natural extension of the classical marketing analysis and allows carrying out foreign trade research, for example, within the classification of commodity groups of the BCG matrix (BCG matrix, 2018). In this publication we, as an example, identified a group of products of sustainable growth and analyzed the dynamics of their prices and supplies, as well as a group of other products with an assessment of the prospects for their sales in the Russian market.

The purpose of this research is to describe methods for calculating disaggregated FTI for cases of significant and other goods and commodity groups and assess their practical capabilities. This implies the following: the formulation of economic analysis tasks using indices, the calculation based on the proposed algorithms and real economic data, the economic interpretation of the results obtained with a demonstration of the possibilities of their practical use. The information basis for the analysis is the data of the Customs statistics of the Russian Federation (2018) on the import of Czech goods to the Russian market, including FTI, calculated according to the formula Laspeyres (1). For the first time, the possibility of using mirror statistics for Czech foreign trade with Belarus and Russia using the example of APF was examined by S.Yurik (Yurik, 2017).

2. Materials and Methods

FTI are aggregated and are usually calculated by the average price index I_p . The volume index is then calculated by dividing the value index by the price index. Summation is made by the number of goods exported and imported by the country. The Laspeyres price index assumes the use of weights of the reference period and is calculated by the formula:

$$I_{lps}^p = \frac{\sum p_1^* q_0}{\sum p_0^* q_0}, \quad (1)$$

Denote q_0, q_1 – the quantity of goods in the reference and reporting years; p_0, p_1 – the price per unit of goods in the reference and reporting years, respectively.

The statistics of foreign trade of the Russian Federation represents FTI by the total results for the country, including for the CIS countries and the non-CIS countries, and also calculates FTI for the enlarged commodity sections of the HS.

2.1. Setting the task of identifying the most important (significant) goods and their groups in exports or imports using total foreign trade indices

To describe the calculation algorithm, we use the table–matrix form with the numbering of rows of the matrix from 0 to 3, the columns from A and then alphabetically. The cells of the matrix with known values are marked in blue, description of calculations on the text are given below.

2.2.1. Method A: the allocation of commodity from the total

Given (table 1): FTI total and for the goods. It is required to find: indices of the other goods.

Table 1. Initial data for calculations of variant A

		A		B		C		D		E		F		G		H		I	
		t=0	t=1	t=0	t=1	t=0	t=1	t=0	t=1	Average price index (I_{Lps}^p)	Volume index (I_{vlm}^p)	Value index (I_{vi}^p)							
		Value, thousand \$		Volume, unit		Price, \$/unit													
0	TOTAL	S^0	S^1	-	-	-	-	I_{Lps}^p	$= (S^1/S^0)/I_{Lps}^p$	$= S^1/S^0$									
1	- goods 1	s_1^0	s_1^1	q_1^0	q_1^1	$p_i^t = s_i^t / q_i^t$	$= s_1^1 / s_1^0$										
2	Other *	$= S^0 - s_1^0$	$= S^1 - s_1^1$																

Source: Authors

We carry out additional obvious calculations of the values of the indices of the average prices p_1^0 and p_1^1 (columns E and F) for goods 1 according to the formula:

$$p_i^t = s_i^t / q_i^t, \quad (2)$$

where $i = 1, \dots, n$ – the quantity of goods; p_i^t – the price of goods i in the year t ; s_i^t – the value of the commodity i in the year t .

Also for further calculations, we fill in the two line items "Other" A2 and B2 of Table 1 – these are the value of other goods in the reference and reporting years S_{oth}^0 and S_{oth}^1 :

$$S_{oth}^0 = S^0 - s_1^0; \quad S_{oth}^1 = S^1 - s_1^1, \quad (3)$$

where S^0, S^1 – total value of goods in the reference and reporting years; s_1^0, s_1^1 – the value of goods 1 in the reference and reporting years.

We will also recall that the Average price index (in our case this is Laspeyres price index I_{Lps}^p) is calculated by the statistics according to the formula (1), Value index (I_{vlm}^p) is the ratio of the set values S^1/S^0 (they can also be calculated for all rows by column I of table 1). As a result, the Volume index I_{vlm}^p is calculated by the formula:

$$I_{vlm}^p = (S^1/S^0) / I_{Lps}^p = I_{vi}^p / I_{Lps}^p. \quad (4)$$

Having prepared the information, we proceed to the calculation formula Laspeyres price index I_{Lps}^p for the line "Other" (position L2 of Table 2). Note that Table 2 is an extension of Table 1 with hidden columns C–F and additional columns J–L.

Table 2. Calculations Laspeyres price index using method A

	A		B		G		H		I		J		K		L	
	t=0		t=1		Average price index (I_{Lps}^p)		Volume index (I_{vm}^p)		Value index (I_{v}^p)		Laspeyres price index					
	Value, thousand \$										$p_0 * q_0$		$p_1 * q_0$		I_{Lps}^p	
0	TOTAL		S^0	S^1	I_{Lps}^p		$=(S^1/S^0)/I_{Lps}^p$		$=S^1/S^0$		$=S^0$		$=I^p * S^0$		$I_{Lps}^p = G0$	
1	- goods 1		s_1^0	s_1^1		$=s_1^1 / s_1^0$		$=s_1^0$		$=p_1^1 * q_1^0$		-	
2	Other *		$=S^0 - s_1^0$	$=S^1 - s_1^1$	$I_{Lps}^p * = L2$		$=I2 / G2$		$=B2 / A2$		$=J0 - J1$		$=K0 - K1$		$=K2 / J2$	

Source: Authors

Next we calculate the numerator and denominator (1) using the values of matrix-table 2, so that the formula for calculating Laspeyres price index I_{Lps}^p for the line "Other" will be as follows:

$$I_{Lps}^p = K2 / J2 = (K0 - K1) / (J0 - J1), \tag{5}$$

where the elements of formula (5) are the values at the intersection of the indicated columns K, J and rows 0, 1 of the matrix-table 2. Thus, the unknown indices are calculated.

2.2.2. Method B: group N of goods and calculation of the Laspeyres index of the group

Given: all the necessary indicators for a group N of goods (Table 3). It is required to find: total price and volume indices for this group.

In this case the Laspeyres index is calculated by the formula (1), taking into account the statistic values for each commodity (columns A–F) and the additional calculation of the total value of all goods of the reporting year $t = 1$ in the reference year prices $t = 0$ (cell K0 of table 3).

Table 3. Initial data and calculations Laspeyres price index using method B

	A		B		C		D		E		F		G		H		I		J		K		L	
	t=0		t=1		t=0		t=1		t=0		t=1		Average price index		Volume index (I_{vm}^p)		Value index (I_{v}^p)		Laspeyres price index					
	Value, thousand \$		Value, thousand \$		Volume, unit		Volume, unit		Price, \$/unit		Price, \$/unit								$p_0 * q_0$		$p_1 * q_0$		I_{Lps}^p	
0	Total by goods		$S^0 = \sum s_i^0$	$S^1 = \sum s_i^1$	-	-	-	-	-	-	-	-	I_{Lps}^p		$=(S^1/S^0)/I_{Lps}^p$		$=S^1/S^0$		S^0		$=\sum p_i^1 * q_i^0$		$=K0/J0$	
1	- goods 1		s_1^t		q_1^t		$p_1^t = s_1^t / q_1^t$														$=p_1^1 * q_1^0$			
2	- goods 2		$i=1, N$		$i=1, N$		$i=1, N$		$t=1.2$		$t=1.2$										$i=1, N$			
...																							
N	- goods N																							

Source: Authors

We note that method B can be combined with method A. As a result, we are able to analyze the indices of a certain sample and other goods in a common set of export or import goods. Obviously, it is possible, if necessary, to increase the number of groups of goods, including significant for the analysis goods in them. The calculation algorithms will be similar to methods A and B.

Also it is necessary to make appropriate changes to the formulas in Tables 2–3 (columns J and K), if for the calculation of FTI the statistical bodies the Paasche formula is used:

$$I_{psch}^p = \frac{\sum p_1 * q_1}{\sum p_0 * q_1}, \tag{6}$$

Using methods A and B listed above, the required index indicators of the tables were calculated to analyze the supply of Czech products to the Russian market.

3. Results and Discussion

3.1. Approbation of methods and discussion of results

The initial statistical basis for calculations was the data of "mirror statistics" on the import of Czech goods to the Russian market. Data source – Federal Customs Service of Russia (2018).

It should be noted that, as is known, the value of exporting Czech goods to the Russian market is represented by Czech statistics in FOB prices, while imports of goods from the Czech Republic

to Russia are represented by Russian statistics at CIF prices, which additionally include the costs of insurance and transportation of goods. According to the IMF, the world average CIF/FOB value is 1.06 (Bogdanova, 2010). For Russia the average conversion rate was 1.04 (Seltsovsky, 2004). Thus, values of the mirror flows considered by us at recalculation of the prices of SIF/FOB differ slightly. Moreover, when calculating indices, the difference between Russian and Czech statistics almost disappears, as the conversion factors for APF remain virtually unchanged due to fairly stable prices for international insurance and transportation services and their small share in the final value of production. We turn directly to the analysis of supplies of Czech goods to the Russian market.

3.2. List of Czech goods of groups 01-24: calculation of price indices and natural supplies

As the Russian customs statistics don't show FTI separately for each country, we calculated them ourselves using the Laspeyres formula (1). To calculate the average price index, the following goods were included in the list of the main goods of Czech imports of APF to the Russian market in 2015-2016. At the beginning of Table 4 the data of Czech imports to Russia for APF shown by Russian customs statistics are presented. The list of these products includes 32 items (4-digit HS code) from commodity groups (01–24), which are presented separately in 32 products in table 4, as well as the total result, including FTI calculated using the Laspeyres formula. As follows from Table 4 the list of 32 goods is more than 99% of the value of Czech imports which allows us to consider their aggregated indices as common over the country in the analysis of groups 01-24 of the Czech imports to the Russian market. Table 4 shows that, compared to 2015, the supply of Czech goods of groups 01-24 to the Russian market in 2016 by value increased by 9 percent or by \$ 8.9 million. This growth was due to the growth in physical volumes (by 10.2%), which allowed, among other things, to compensate for a slight decrease in average prices (by 1.1%).

Table 4. Russian import from the Czech Republic: main goods

	HS code			2016			Indices 2016/2015			2016-2015, thous. \$
				Quantity	Value, thous. \$	Share	price	volume	value	
		Russian import from non-CIS countries								
		- total		162 724 500	100%	0.978	1.026	1.003		1 031 800
		- HS (01-24)		20 428 500	12.6%	0.971	0.947	0.920		-1 785 200
		Russian import from the Czech Rep.								
		- HS (01-24) from the Czech Rep.		109 323	100%	-	-	1.089		
		- share (01-24) from non-CIS		0.54%						
		- 32 main goods		108 393	99.3%	0.989	1.102	1.090		8 933
1	2309	Animal feed	t	13630	24 704	22.6%	1.137	1.274	1.448	7 648
2	0407	Birds'eggs	t	6627	21 556	19.7%	0.768	1.317	1.012	248
3	2203	Beer made from malt	l	17635211	16 301	14.9%	0.979	1.142	1.119	1 731
4	1207	Other oil seeds and oleaginous fruits	t	7376	12 011	11.0%	0.863	1.197	1.034	393
5	2208	Spirits, liqueurs and other spirituous, beverages	l	358817	3 672	3.4%	0.926	1.102	1.021	76
6	1302	Vegetable saps and extracts	t	249	3 530	3.2%	1.451	1.556	2.258	1 966
7	1704	Sugar confectionery (including white chocolate)	t	1392	3 375	3.1%	0.987	0.928	0.916	-310
8	1210	Hop cones	t	342	3 352	3.1%	0.974	1.239	1.207	574
9	1107	Malt, whether or not roasted	t	6230	3 343	3.1%	0.970	0.977	0.948	-182
10	2106	Other food products	l	300	2 792	2.6%	1.575	0.476	0.750	-931
11	2101	Extracts of coffee, tea or mate'	t	808	2 495	2.3%	1.018	1.140	1.160	344
12	1602	Other prepared or preserved meat	t	898	2 397	2.2%	0.994	0.681	0.676	-1 147
13	1905	Pastry, cakes, biscuits and other	t	401	1 826	1.7%	1.513	0.599	0.906	-190
14	1209	Seeds of a kind used for sowing	t	138	1 080	1.0%	1.134	1.221	1.385	300
15	0106	Live animals oth.	pcs.	2405	893	0.8%	1.716	1.696	2.910	586
16	1904	Prepared foods obtained	t	205	694	0.6%	1.050	0.554	0.582	-498
17	1901	Malt extract	t	221	640	0.6%	0.738	0.931	0.613	-403
18	2008	Fruit, nuts and other	t	187	510	0.5%	1.060	0.773	0.819	-113
19	2201	mineral water without sugar	l	818039	427	0.4%	1.022	0.843	0.861	-69
20	2202	Waters mineral, containing sugar	l	575304	401	0.4%	1.013	1.226	1.242	78
21	2206	Other fermented beverages	l	219650	328	0.3%	0.904	0.266	0.241	-1 034
22	0105	Live poultry	pcs.	421560	301	0.3%	1.102	1.233	1.360	80
23	2007	Jams, fruit jellies, marmalades	t	280	301	0.3%	0.807	0.720	0.581	-218
24	2209	Viengar and substitutes	l	798000	258	0.2%	0.970	1.462	1.418	76
25	1902	Pasta	t	271	225	0.2%	1.028	1.726	1.774	98
26	2005	Other vegetables prepared	t	141	214	0.2%	0.868	0.972	0.844	-40
27	1514	Rape	t	119	166	0.2%	1.047	0.930	0.974	-5
28	1001	Wheat	t	183	159	0.1%	1.740	0.600	1.044	7
29	2103	Sauces and preparations therefor	t	61	142	0.1%	1.059	0.726	0.769	-43
30	0208	Other meat and edible meat offal	t	40	135	0.1%	0.996	2.000	1.993	67
31	1520	Glycerol	t	240	115	0.1%	0.923	0.632	0.583	-82
32	1806	Chocolate and other food	t	11	52	0.0%	0.845	0.478	0.404	-77

Source: own calculations on the basis of data of the Federal Customs Service of Russia, 2018.

3.3. Goods with growing value

As one example of the use of FTI, we will analyze data on goods with the largest growing value in 2016 (the last column of Table 4). In the group of selected products we include only those in which all three indices are greater than one (in Table 4 there are eight such goods, they are marked with a fill). We will include in the group with growing value five products with the largest volume of value growth and the indices of all indices are more than one. In addition, we show the position of beer as a separate line, since the increase in its value has the third result in the list—32 goods, although the average price index of 0.979 is slightly less than one.

The calculated data of Table 5 show that the five allocated goods expand their presence in the Russian market, having high competitiveness, which allows them to simultaneously increase the price and increase natural volumes of supplies. In general prices and natural supplies for selected five goods (30.2% of total imports of goods) increased by 15.6% and 29.4% respectively, which increased the value of supplies by 1.5 times or by \$ 10.9 million. As a result, there was a change in the structure of imports, where the share of the five allocated goods—leaders increased from 22% in 2015 to 32.7% in 2016. In a somewhat different way, it was possible to increase the volume of beer sales – this became possible due to a small decrease in prices (by 2.1%) and growth in natural supplies (by 14.2%), with the result that the value of beer sales increased by \$1.7 million for the year. The remaining 26 goods from Table 4 were able to keep the volume of natural supplies (the index of quantity is 1) only because of a fall in prices (by 5.8%), which caused a decrease in the value of sales by \$3.6 million.

Table 5. Russian import of APF from the Czech Republic: goods with growing value

HS code			2016			2016-2015, thou \$	Indices 2016/2015		
			Quantity	Value, thou \$	Share		price	volume	value
	32 main goods			108 393	100%	8 933	0.989	1.102	1.090
	- 5 goods with growing value			32 701	30.2%	10 845	1.156	1.294	1.496
2309	Animal feed	t	13630	24 704	22.8%	7 648	1.137	1.274	1.448
1302	Vegetable saps and extracts	t	249	3 530	3.3%	1 966	1.451	1.556	2.258
2101	Extracts of coffee, tea or mate'	t	808	2 495	2.3%	344	1.018	1.140	1.160
1209	Seeds of a kind used for sowing	t	138	1 080	1.0%	300	1.134	1.221	1.385
0106	Live poultry	pcs.	2405	893	0.8%	586	1.716	1.696	2.910
2203	- Beer made from malt	l	17635211	16 301	15.0%	1 731	0.979	1.142	1.119
	- Other 26 goods			59 392	54.8%	-3 642	0.942	1.000	0.942

Source: own calculations on the basis of data of the Federal Customs Service of Russia, 2018.

Thus, the analysis of goods from the group of unconditional sales leaders allows us to indicate their contribution to the growth of exports of goods to the market and a change in the share in exports, as well as to determine the characteristics of the indices of other goods (in our case, there was a drop in sales, comparable to a decrease in average prices).

3.4. Czech Republic, Visegrad Group, non–CIS countries: competitive positions in the Russian agricultural and food market

Table 6 shows the volumes of imports data of APF (groups 01–24) from non–CIS countries, the Visegrad Group (VG), including separately from the Czech Republic. Also, relevant indices of foreign trade are given, which for non-CIS countries are calculated by the Russian statistics, and for the other positions were calculated by us using method A. For the Czech Republic the list of main goods includes 32 items (Table 4), for the VG-countries – 139 items (due to lack of space, we do not list them), while the depth of the sample in the two lists was more than 99% (in accordance with the methodology for calculating indices, the goods delivered in one of the years only were not included in the lists).

Table 6. Russian import of agricultural products and foodstuffs (HS 01-24): trade indices

	2016		2016-2015, thous. \$	Indices 2016/2015		
	Quantity	Share		price	volume	value
Russian import from non-CIS countries	20 428 700	100.0%	-1 784 900	0.971	0.947	0.920
Russian import from the Visegrad Group (VG)	702 444	3.44%	-11 452			0.984
- 139 main goods	696 788	3.41%	-8 414	1.058	0.912	0.965
Russian import from the Czech Republic	109 323	0.54%	8 791			1.087
- 33 main goods	108 391	0.53%	8 902	0.989	1.102	1.089
Russian import from non-CIS countries (without VG)	19 726 256	96.6%	-1 773 448	0.968	0.948	0.918

Source: own calculations on the basis of data of the Federal Customs Service of Russia, 2018.

As can be seen from Table 6, in general, imports of APF from non-CIS countries decreased by 8%, while volumes of supplies decreased (by 5.3%) and average prices fell (by 2.9%). Imports of APF from VG for main goods also fell by 3.5% or \$ 8.4 million, while natural supplies decreased more significantly by 8.8% than in the non-CIS countries, with an increase in average prices of 5.8%. In other words, the decline in the volume of trade of VG on the Russian market continued in 2016 and affected both cost and natural deliveries with an increase of average prices by 5.8%, while other non-CIS countries (without VG) reduced average prices by 3.2%. Of course, this situation requires a separate analysis for each of the countries of the VG.

At the same time, imports of goods from the Czech Republic, on the contrary, increased by 9%, or by almost \$9 million, with an increase in physical volumes of supplies (by 10%) and almost unchanged average prices (they decreased by only 1.1%). In other words, the Czech Republic expanded the presence of its agricultural products on the Russian market, practically without reducing average prices for products. Thus, the competitive position of the Czech Republic on agricultural trade in the Russian market in terms of the ratio of changes in the "price-quantity-value" factors looks more preferable in 2015-2016 than the average for non-CIS countries (without the Czech Republic), because due to its indices the Czech Republic stands significantly higher than the average level of non-CIS countries and has an increase in sales in the Russian market, unlike the rest of the non-CIS countries, where sales decreased in value by 8.1% or \$ 1.8 billion due to a 2.9% fall in the average price and a 5.4% decrease in natural supplies.

It is clear that with the availability of information, the analysis can be continued, for example, with the allocation of countries of major competitors. In addition, it can be selected another or other commodity groups. The calculation algorithms for solving these new problems will in principle be the same as in the cases considered above.

4. Conclusion

1. Foreign trade indices (FTI) are calculated using the well-known Laspeyres and Paasche formulas in aggregate form on the basis of a list of the basic export or import goods. From the point of view of foreign trade analysis, it seems interesting to solve the "reverse" problem - the disaggregation of indices, when the influence of the dynamics of changes in trade of significant goods or their groups on general trade changes, as well as on other commodities, is analyzed using statistically calculated FTI. With the help of disaggregation methods, tasks can be formulated and solved, for example, within the framework of BCG matrix classifications, as well as many others.

2. In the research the statements of two basic problems of aggregation FTI for large groups of goods taking into account their importance are considered and the methods of their solution with formulas of calculations in a table-matrix form are described. The first method of calculation allows us to calculate the total price index of group (or groups) of goods, the second method is intended for calculations of price indices of other goods out of the allocated group (or groups). It is noted that the combination of the methods considered makes it possible to select and analyze the state

of the indicators of commodity groups taking into account changes in the "price–quantity–value" factors.

3. For approbation of methods, APF from commodity groups HS 01–24 were included into the study group. For the indicated commodity group of Czech goods it was necessary to analyze the state and conditions of sales in the Russian market. On the basis of the Russian customs statistics (was chosen as the source of data for the solution of the task) calculations of the aggregated price indices for import of all Czech APF to the Russian market were made, as well as calculations with allocation of additional group of the goods which have provided the greatest expansion of sales.

4. Thus, the calculations of the indices and the analysis of the presence of Czech goods and goods of other non–CIS countries on the Russian APF market showed the following: in 2015–2016 the rest of the non–CIS countries (without the Czech Republic) reduced their sales (by 8%) due to a simultaneous fall in prices (by 3%) and volumes of sales (by 5%). At the same time, unlike the rest of the non–CIS countries, the Czech Republic was able to ensure the growth of sales of APF (by 9%) on the basis of growth in supplies (by 10%) and practically stable average prices (a decrease by 1%). Further, the analysis of the list of the main goods of Czech imports to the Russian market showed that the total growth in sales of Czech goods on the Russian APF market was provided by the group of goods of the greatest growth. These commodities have high competitive potential and increase sales volumes with simultaneous price (by 16%) and natural supplies (by 29%) increase. Although the rest of Czech goods preserved volumes of natural supplies, as a whole they reduced the value of sales due to the fall in average prices (by 6%).

In the future, with the use of FTI, we plan to conduct research on the trade of the countries of the VG with Russia in the agricultural and food market. In particular, it is supposed to analyze the state and influence of the Russian sanctions on trade of the countries, as well as assess the possibilities of restoring trade volumes by expanding sales of non-sanction goods.

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THE CREDIT POSITION OF FARMS AND THE CONTINUITY OF PRODUCTION: THE EXAMPLE OF POLAND

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Abstract: Mutual crediting of contractors in the course of trade plays an important role in agricultural activity. On the one hand, it is a loan granted by the supplier to the recipient with the sale of goods and services (receivables from the supplier), on the other hand, it is a short-term source of financing of current supplies (liabilities to the supplier). This form of financing of agricultural activity with limited access to external sources of financing ensures the continuity of production processes. The purpose of the study is to indicate the credit position of farms in Poland. The goal is realized in two stages. In the first stage, on the basis of the review of the current research results, the role and significance of trade credit in business activity was determined. In the second stage, the credit position of farms in Poland was determined. Research results should help determine whether mutual lending can effectively provide and increase agricultural production. The analysis was carried out on the basis of accounting data obtained in 2010-2015 by agricultural holdings that keep accounting under the Polish FADN. To determine the credit position of agricultural holdings, the credit position indicator was used, which is the relation of trade receivables to trade payables. The obtained research results indicate that among farms in Poland a much larger percentage are farms that credit their recipients than they themselves use deferred payment terms for delivered goods or services. The credit position of farmers is significantly different due to the type of production, economic size and area of agricultural land. Taking into account the average production volume, it should be noted that farmers from farms who take the position of recipient of commercial credit reach a much higher value of production than farmers who have credited their recipients.

Key words: trade credit, credit position, farms

JEL classification: Q12, Q14, O13

1. Introduction

The growing population means that the problem of food security is becoming an important challenge for the modern world. According to FAO estimates, global food supplies will have to increase to provide food demand. By the end of 2050, the global population will reach 9.1 billion, which is 34% more than at present. These changes will require an increase in global food production by 60%. To meet these challenges it is necessary to ensure the continuity of production processes and support farmers at every production level. Mutual lending of counterparties in the course of trade can be crucial in agricultural activity, especially with limited access to external sources of financing. This transaction is commonly referred to as a commodity loan, supplier's credit, merchant's or commercial loan. On the one hand, it is a loan granted by the supplier to the recipient in connection with the sale of goods and services (receivables from the supplier), on the other hand, it is a short-term source of financing of current supplies (liabilities to the supplier) (Deari, 2015). The decision on granting a commercial loan is a short-term investment decision whose long-term goal is a certain level of sales in connection with stable customer relations. Emery (1987) showed that trade credit is a tool to counter the changing demand by offering more favourable credit conditions in a situation of limited demand for products - to increase turnover, or limited credit conditions when demand is high. In the scientific literature, the broad aspect of mutual lending to contractors is emphasized. Schwartz (1974) treats commercial loan as an additional offer, outside the product range, addressed to the recipient, and the loan terms as an integral part of the supplier's pricing policy. Schwartz

and Whitcomb (1978) suggest that credit terms may also be used to mask price discrimination in a manner that is not noticeable to competition and to facilitate the distinction of the offer by the recipients. Nadiri (1969) fits into the research trends that treat trade credit as an expense related to the promotion of products. Jain (2001) focuses on commercial credit as a form of mediation in the flow of capital in the bank-company relationship and supplier-recipient relationship. Trade credit is analyzed in macroeconomic terms (Laffer, 1970; Brasch, 1972), microeconomic considerations take into account the conditions of postponement of payments in commercial transactions and the demand for commercial credit (Scherr, 1996; Smith, 1987; Summers and Wilson, 2002; Canto-Cuevas, Palacin-Sanchez and Pierro, 2016). The research is dominated by the perspective of the supplier - creating conditions for the credit policy. The issue of demand for financial resources obtained through commercial credit and the factors shaping this demand is rarely discussed in scientific investigations. An enterprise using this source of capital makes a financial decision regarding the emergence of obligations towards suppliers of goods and services in the structure of financing sources (Hill et al., 2017). The purpose of the study is to indicate the credit position of farms in Poland. The goal is realized in two stages. In the first stage, on the basis of the review of the current research results, the role and significance of trade credit in business activity was determined. In the second stage, the credit position of farms in Poland was determined. The study proposes a thesis that the credit position of farms in Poland is variable and highly dependent on the type of agricultural production, the profitability of agricultural holdings and the area of agricultural land.

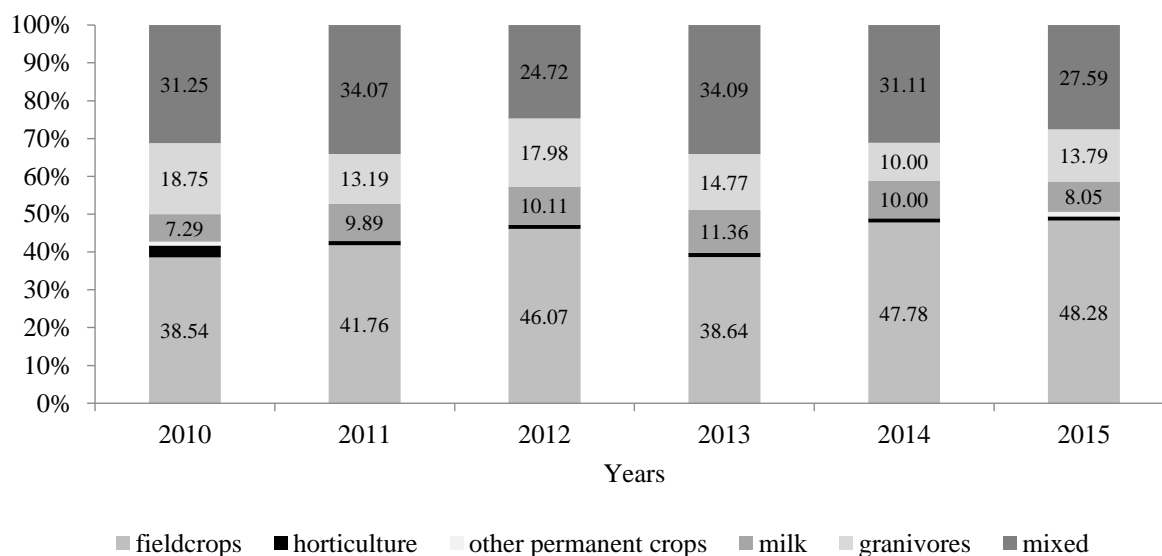
2. Materials and Methods

The study was based on accounting data obtained in 2010-2015 by agricultural holdings that keep their accounting for the needs of the Polish FADN. The study covered individual farms of over 2 ESU. Among the analyzed farms, about 10% were entities that showed receivables from recipients for deliveries and services, while about 2% of entities showed liabilities to suppliers for deliveries and services. A small percentage of farmers showed both receivables and liabilities in connection with agricultural activity (0.8%). The level of trade credit granted and received was different in individual years. As far as receivables are concerned, it is noted that from year to year their average value decreased from 15.3 thousand PLN to 13.4 thousand PLN. Which means that farm managers credit their contractors to a lesser extent. On the other hand, the average value of liabilities towards suppliers increased from 7.8 thousand PLN to 12.7 thousand PLN. It is connected with the popularization of the use of trade credit in the course of trade and increasing its role in short-term financial decisions of agricultural holdings as a source of financing of current supplies. To determine the credit position of agricultural holdings, the credit position indicator was used, which is the relation of trade receivables to trade payables. This indicator expresses the efficiency of settlements with customers and suppliers. The higher the level of this index is from one, the more the farm is a lender than the borrower.

3. Results

The analysis showed that the use of trade credit was diversified due to the type of agricultural production. The highest percentage of farms using trade credit, both as recipients and the providers of this loan, was recorded among farms specializing in field crops and those involved in mixed production (Figure 1).

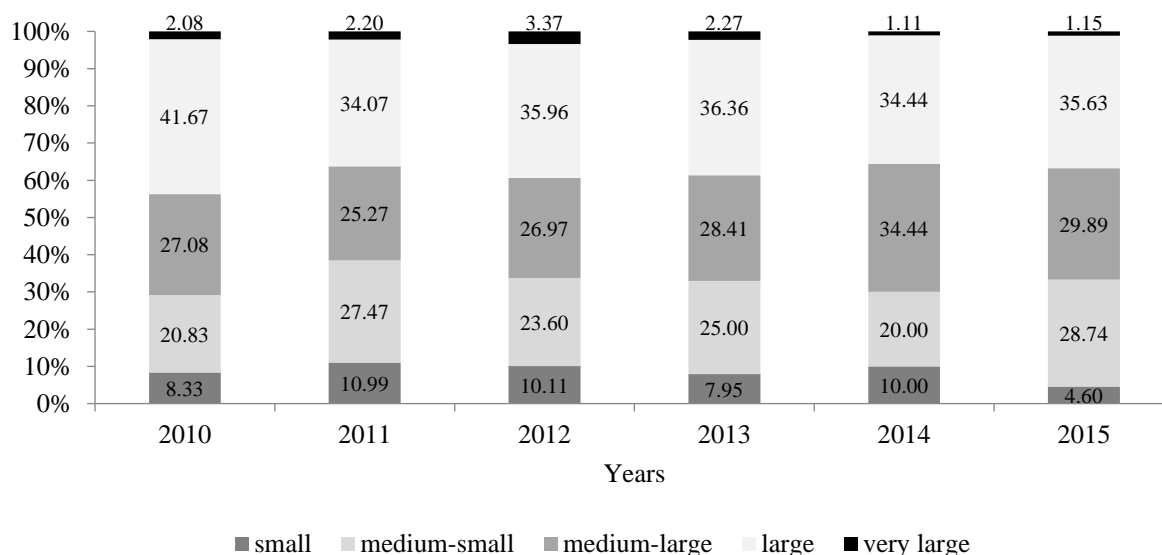
Figure 1. Percentage of farms using trade credit by type of production



Source: own study

The use of trade credit was clearly differentiated due to the economic size expressed in European Size Units. An analysis of farms by economic size class indicates that among farms being both recipients and commercial credit providers, the largest group were large farms (8-9 ESU). Trade credit was barely used on very large farms (10-14 ESU) and small farms also used it to a small extent (Figure 2).

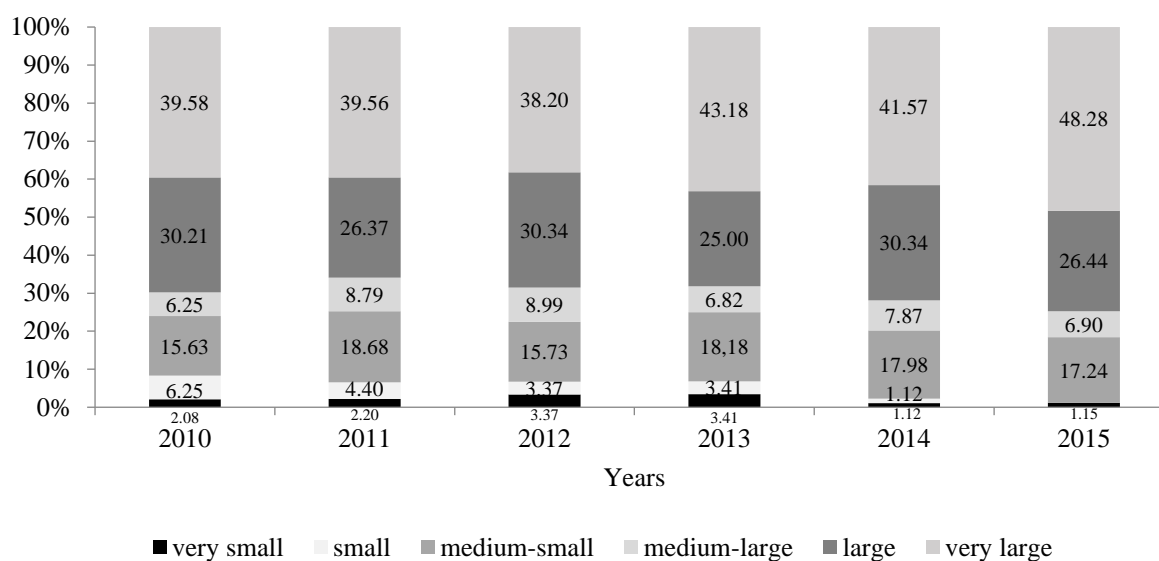
Figure 2. Percentage of farms using trade credit by economic size(ESU)



Source: own study

Sales with deferred payment terms were practiced among agricultural holdings with a large (30<50 ha) and very large (>50 ha) arable land (Figure 3). It was not significantly used on very small (<5 ha) and small farms (5<10 ha).

Figure 3. Percentage of farms using trade credit by utilised agricultural area (UAA)



Source: own study

Determining the credit position of farms in Poland in 2010-2015 shows that these entities are to a large extent the providers of commercial credit and not its recipients. The value of trade receivables exceeds the value of short-term liabilities for deliveries and services (the exception is 2015). This is reflected in the value of the credit position indicator (Table 1).

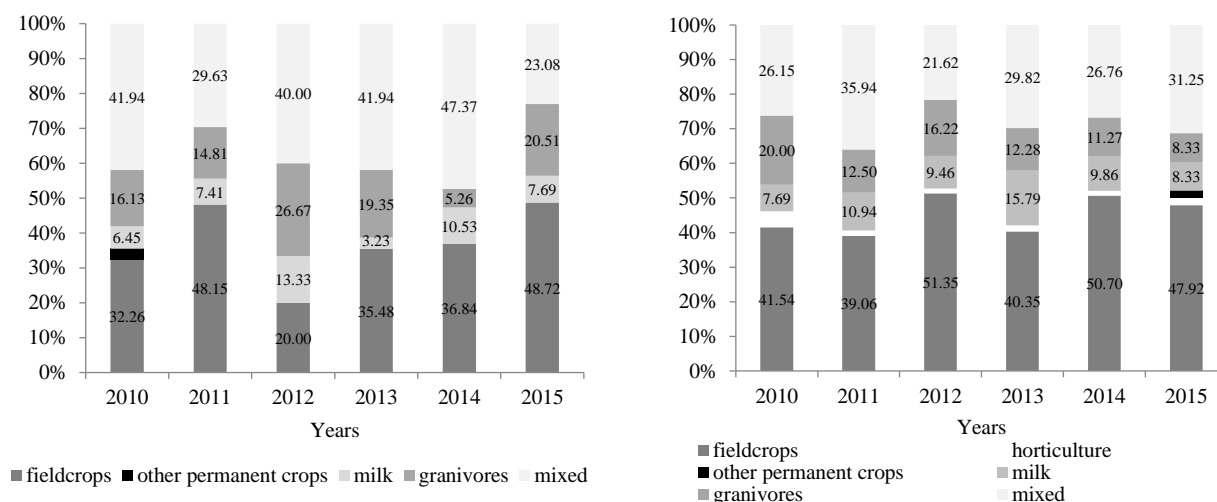
Table 1. Trade credit position of farms in Poland in 2010-2015 (the ratio of trade receivables to current liabilities for goods and services)

Years	Short-term receivables for deliveries and services (in millions PLN)	Short-term liabilities due to deliveries and services (in millions PLN)	Credit position indicator
2010	5.63	3.48	1.62
2011	5.28	3.65	1.45
2012	6.56	3.38	1.94
2013	5.72	4.87	1.17
2014	4.85	2.40	2.02
2015	3.29	3.68	0.90

Source: own study

The production type was a significant differentiating factor in the credit position of farms. Entities specializing in crop production were much more likely to provide loans than to receive them (Figure 4). The situation was similar in the case of farms specializing in dairy cattle breeding. It should be assumed that this is related to the adopted strategy aimed at stimulating more sales of produced goods, as well as with reducing the costs of maintaining inventories. In addition, the lack of possibility of storing raw milk makes it necessary to sell it quickly. In turn, the position of recipient of commercial credit was more often accepted by farms characterized by multidirectional production and specialized in the cultivation of granivorous animals. These farms require large expenditures for seeds, organic fertilizers, mineral fertilizers or for forage and labor, therefore they use deferred payments more often. A low level of short-term receivables in relation to short-term liabilities may mean that the owners of these farms conduct a proper receivables management policy. They manage the relationship between short-term receivables and short-term liabilities in a rational manner, which allows them to maintain financial liquidity.

Figure 4. Production type and the credit position of agricultural farms in Poland in 2010-2015



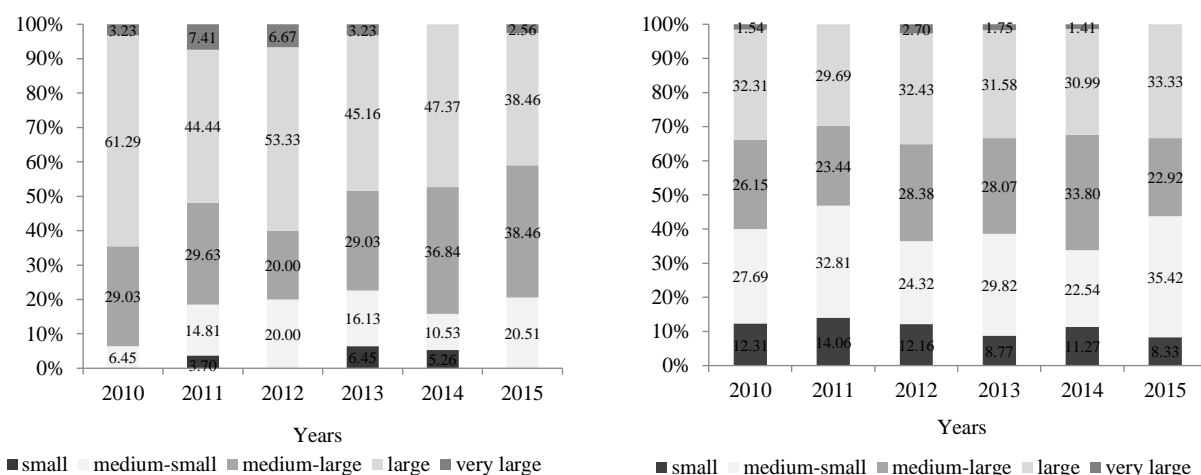
Credit position indicator < 1 - loan taker

Credit position indicator > 1 - loan provider

Source: own study

The research shows that short-term liabilities exceed short-term receivables for deliveries and services in a group of farms determined in terms of ESU size as medium-large, large and very large (Figure 5). They are economically strong farms. The risk related to the repayment of liabilities in these farms is smaller, therefore they are much more likely to receive loans from producers and sellers of products or goods used for agricultural production. In addition, the low balance of receivables should be assessed positively. Receivables settled by the recipient contribute to an increase of cash in these farms.

Figure 5. Economic size and the credit position of agricultural farms in Poland in 2010-2015



Credit position indicator < 1 - loan taker

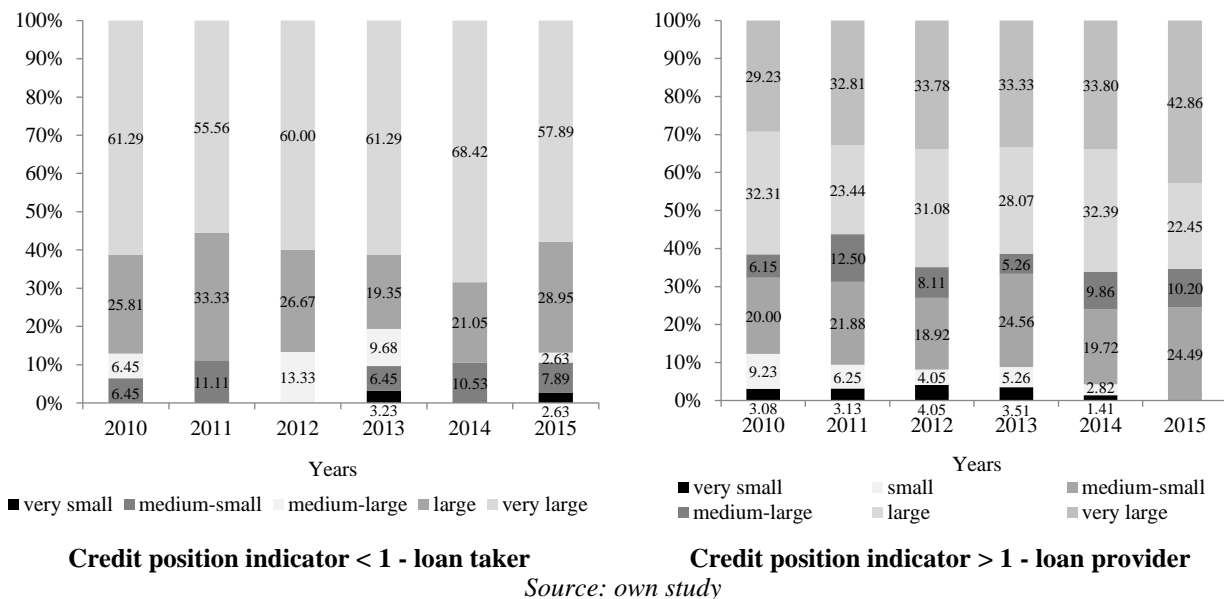
Credit position indicator > 1 - loan provider

Source: own study

Furthermore, when analyzing the average size of agricultural production revenues, it can also be noticed that farms taking the position of a loan recipient achieve a relatively higher average income than those in the position of a loan provider. In 2010-2015, the average value of production in farms showing the surplus of short-term liabilities over short-term receivables for deliveries and services fluctuated at the level of 670.88 thousand PLN to 635.62 thousand PLN. On farms crediting their contractors, the average production volume amounted to 536.04 thousand PLN to 426.70 thousand PLN. Trade credit therefore plays an important role in maintaining and increasing production volumes in agricultural holdings that use it to finance current supplies. Receivers of commercial credit are

in particular farmers from very large farms with an area of agricultural land exceeding 50 ha (Figure 6). The vast majority of farms is characterized by the prevalence of short-term receivables over short-term liabilities due to supplies of goods and services. The lowest percentage of farms using trade credit was recorded in very small farms (<5 ha) and small farms (5<10 ha). In the group of very small and small farms, there were no short-term liabilities in the analyzed period (the exception was 2013 and 2015). This may be due to the limited level of connection between these entities and the market and payments being made in cash due to the small scale of purchases.

Figure 6. The area of agricultural land and the credit position of agricultural farms in Poland in 2010-2015



4. Conclusions

The obtained research results indicate that among farms in Poland a much larger percentage are farms that credit their recipients than they themselves use deferred payment terms for delivered goods or services. In addition, the amount of receivables from suppliers was twice as high as liabilities to suppliers. The credit position of farmers is significantly different due to the type of production, economic size and area of agricultural land. Farmers from mixed farms were definitely more likely to be recipients of commercial credit than its providers, similarly to farms of granivorous type. In contrast, the reverse situation was typical for farms with field crops, dairy cattle and horticultural and permanent crops. Farmers from farms with an economic size above 50,000 euro more often made use of deferred payment terms than they credited their recipients, and this trend was also visible in farms with a very large area of agricultural land. Farmers from other farms more often credited their recipients. Taking into account the average production volume, it should be noted that farmers from farms who take the position of recipient of commercial credit reach a much higher value of production than farmers who have credited their recipients. It can therefore be concluded that commercial credit can play a key role in ensuring and increasing agricultural production.

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USING FORECASTING METHODS FOR THE BREAD CONSUMPTION IN THE CZECH REPUBLIC

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Annotation: The paper deals with trends in consumption of bread as one of the basic foods. In general, food production is growing steadily. However, the bakery industry experiences a decline in bread consumption. In addition, bakeries are negatively influenced by various economic effects. E.g. after 2009, a number of bakery producers claimed that the sharp rise in their main material (flour) significantly reduces their profitability. The rise in flour prices stopped around 2012 and, lately, the price of flour declines again though not back to pre-2009 levels. The aim of this paper is to identify future developments in bread consumption. The partial objective will be to compare the consumption forecasts obtained using different forecasting methods and to identify other causes that influence the development of the bakery industry and its economic stability. Several methods are used to predict bread consumption. In order for them to be comparable with each other, the mean absolute percent error (MAPE) is provided for each method. The used methods are the sliding average method, the Holt method, the linear and exponential regressions. The forecast was based on the period from 1996 to 2016, i.e. for the period when complete and relevant data from the Czech Statistical Office are available. Results of the quantitative research show that the most accurate estimate of future bread consumption provides the use of a Holt method; it gives the results with a great precision. Nevertheless, this prediction procedure is far from sufficient for ensuring the future economic stability of bakery companies. Finally, the Discussion offers other factors influencing bread consumption.

Key words: Bread Consumption, Demand Forecast, Forecasting Methods, Holt Method

JEL classification: Q180, C440

1. Introduction

Bread is a basic foodstuff in the Czech Republic. Rye-wheat bread containing 55-70% of rye became the dominant kind in the 19th and 20th century (Obiloviny v lidské spotřebě, 2015). This type of bread is made by almost all bakeries, although there are other types of bread that are becoming popular these days. Bakers experiment with various non-traditional forms of cereals in order to increase the contents of thiamin, niacin, total polyphenols, total dietary fiber and higher values of antioxidant activity (Boz and Karaoğlu, 2013; Devani et al, 2016; Laknerová et al., 2014). Smaller bakeries try to rouse an interest of customers by adding pieces of various kernels (nuts, almonds) or seeds (sunflower seeds, flaxseeds or multigrain mixtures). At present, bakeries offer whole grain breads, but their share is smaller when compared with multigrain breads and in comparison with rye-wheat bread they only represent a marginal offer. Gluten-free bread is another marginal but very important item that is bought not only by those suffering from celiac disease. While bakeries add some ingredients with the purpose of increasing customers' interest, they try to limit the amount of ingredients that bread does not necessary need to contain, especially animal fats, additives and stabilizing agents (Quilez, and Salas-Salvado, 2016). The required quality parameters of bread are achieved using specific types of wheat. The volume of bread is strongly affected by both protein quality and protein quantity (Hrušková, Hanzlíková and Varáček, 2011).

Although bread is a basic foodstuff in the Czech Republic, its consumption has been almost exclusively decreasing since 1991 (CSO, 2018). By contrast, pastry consumption constantly increased between 1991 and 2007, it saw an asymmetric development later and since 2008 it has been higher than bread consumption. There are probably several causes why bread consumption is on the decrease. Bakeries pointed particularly to an increase in the price of flour in 2009, as flour

is the main ingredient and it made them raise prices of bread. However, the rise of flour price came to a halt in 2012 and the price even slightly dropped later on while bread consumption continued falling. Analyses evidently show that reactions in terms of adjusting prices to unit price hikes and drops are slow (Rumánková, 2014). It is likely that in the case of growth of bread price that is due to flour price increase there is no adequate substitute that consumers could switch to. At the same time, the demand is distinctively inelastic (Syravátka and Lechanová, 2005), which is why even a sharp increase in prices causes only a very slight decrease in demand.

Bread consumption is unaffected by special offers and discounts, although these are still the most significant marketing tools and retailers use discounts systematically (Glauben et al., 2011), bread is a short-term consumption commodity. Therefore, discounts can only influence customers' immediate decision making concerning which kind of bread they pick, but not the general demand. What actually has influence is retail chains and retail networks in general where discounts, or the purchase price of flour to be precise, are contracted for long periods of time (Rumánková, 2016). Other opinions explaining the drop in bread consumption claim that it is due to weaker purchasing power of the population or decrease in bread quality, although the evidence is ambiguous. By contrary, the drop in consumption may be due to factors on the part of the offer such as unwillingness to work in an industry with low price of labor and irregular working hours.

Therefore, there are many risk factors that may significantly influence the prosperity of bakeries. Nevertheless, the sensitivity analysis shows that the most significant factors are the price and volume sold (Dyntar and Strachotová, 2017). Total sales are naturally given by market demand. That is why this paper focuses on predicting bread consumption using various forecasting methods so that bakeries could use this approach for planning their resources more precisely. If there is not sharp trend in predicted values Moving Average is used (Gros and Dyntar 2015) Methods that are often used include Exponential Smoothing Methods (Kasturi et al., 2017), while the authors prefer Holt-Winters Method (Kasturi et al., 2017, Siregar, et al., 2017) if there is sufficient amount of data. The third category of frequently used prognostic methods are methods based on mathematical functions (Gros and Dyntar 2015). With respect to the fact that forecasting demand development is a prognosis, it is advisable to use multiple methods and compare their results.

2. Materials and Methods

We used in our research the method of Moving Average (with respect to the aggregated data on consumption for the entire year it was not necessary to calculate the Weighted Moving Average), Double Exponential Smoothing (Holt Method), Linear and Exponential Regression.

Other two generally known methods, Naive Method and Simple Average, are too simplifying, while Triple Exponential Smoothing (Holt-Winters Method) is far too complicated and it takes into consideration seasonal fluctuations in demand that were not perceptible when using aggregated data. In literature (Pinnington et al., 2016) we can also come across four-dimensional data analysis, however, this method requires observation of a large number of parameters, use of cutting-edge software, while results may be significantly affected by mistakes made during observations.

Moving Average method

The forecast (μ) was calculated using formula (1)

$$\mu_{T+1,T} = (1 - \alpha)\mu_{T,T-1} + \alpha D_T \quad (1)$$

where coefficient $\alpha = 1/T$ within the interval ($0 < \alpha \leq 1$), and D_T is actual value of Consumption of bread. This formulation is appropriate as it does not need values of the entire time series to forecast another period, only forecast and facts from the previous period.

Double Exponential Smoothing (Holt method)

This method uses as a criterion for adjusting the difference (d) between consecutive values of a time series:

$$d_T = D_T - D_{T-1} \quad (2)$$

Therefore, the relationship for adjusting a time series is:

$$\mu_{T+1,T} = (1 - \alpha)(\mu_{T,T-1} + d_{T-1}) + \alpha D_T \quad (3)$$

Calculated differences also need to be adjusted following the relationship:

$$d_T = (1 - \beta)d_{T-1} + \beta(\mu_{T+1,T} - \mu_{T,T-1}) \quad (4)$$

where β coefficient is selected in the interval (0,1). The relationship for forecasting the T+1 period is then as follows:

$$\mu_{T+1,T} = \mu_{T,T-1} + d_{T-1} \quad (5)$$

For the purpose of this study we used the version with the solver (in MS Excel) that automatically suggests the optimum value of the β parameter. Otherwise this parameter would have to be determined with respect to the apparent trend or estimated.

Linear regression

Linear regression is used for modeling the measured data into a line. It is the simplest type of dependency, but it is sufficient in some cases. The modeling follows the following relationships:

$$\mu_i = a + bt_i \quad (6)$$

$$a = \frac{\sum_{i=1}^T D_i}{T} - b \frac{\sum_{i=1}^T t_i}{T} \quad (7)$$

$$b = \frac{T \sum_{i=1}^T D_i t_i - \sum_{i=1}^T D_i \sum_{i=1}^T t_i}{T \sum_{i=1}^T t_i^2 - (\sum_{i=1}^T t_i)^2} \quad (8)$$

Exponential regression

In the case of non-linear trend it is advisable to use exponential or polynomial modeling. Parameters of the exponential regression are as follows:

$$\mu_i = a \cdot b^{t_i} \quad (9)$$

$$\log a = \frac{\sum_{i=1}^T \log D_i}{T} - \log b \frac{\sum_{i=1}^T t_i}{T} \quad (10)$$

$$\log b = \frac{T \sum_{i=1}^T \log D_i t_i - \sum_{i=1}^T \log D_i \sum_{i=1}^T t_i}{T \sum_{i=1}^T t_i^2 - (\sum_{i=1}^T t_i)^2} \quad (11)$$

Research data

Our survey uses dataset from 1996-2016 which represents a sufficiently long period and it was obtained from the Czech Statistical Office which gathered it using the same methods in the same

territory. For each of the methods used we calculated the mean absolute percentage error (MAPE) and we used it as an indicator for comparing the results.

$$MAPE = \frac{100\%}{n} \sum_{i=1}^n \left| \frac{D_i - \mu_i}{D_i} \right|, \quad (12)$$

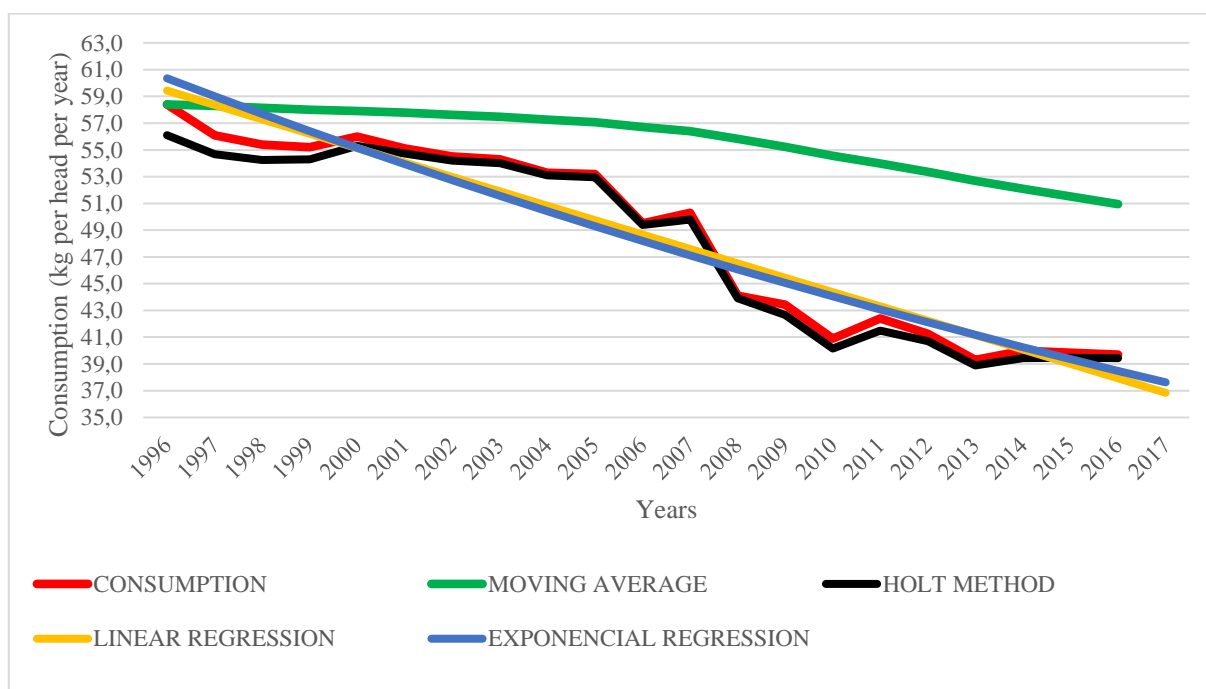
where D_i is actual value of Consumption of bread and μ_i is forecast value.

We made a forecast for 2017. Thus, it is not a forecast in the real sense of the word. However, it gives us a possibility to compare the results of the most suitable forecasting method with reality and to recommend bakeries that they use that method for forecasting future demand. We used historic data from a twenty-year period (since 1996), which is sufficient for a forecast, while the period is not affected by the 1989 revolution or split of Czechoslovakia and many changes that occurred at that time.

3. Results and Discussion

In order to make forecast of bread consumption we used the four above mentioned methods. The results of the methods are shown in a graph (Figure 1) below.

Figure 1. Bread Consumption – Overview of used Methods



Source: CSO, 2018; own processing

For each method we calculated a value representing bread consumption forecast for 2017 and the mean absolute percentage error for comparing the methods used (Table 1).

Table 1. Comparison of used methods

Methods	Consumption Forecast (kgs)	MAPE (%)
Moving average	50.94	17.91
Holt method using solver	39.44	2.47
Linear regression	36.84	3.54
Exponential regression	37.62	3.70

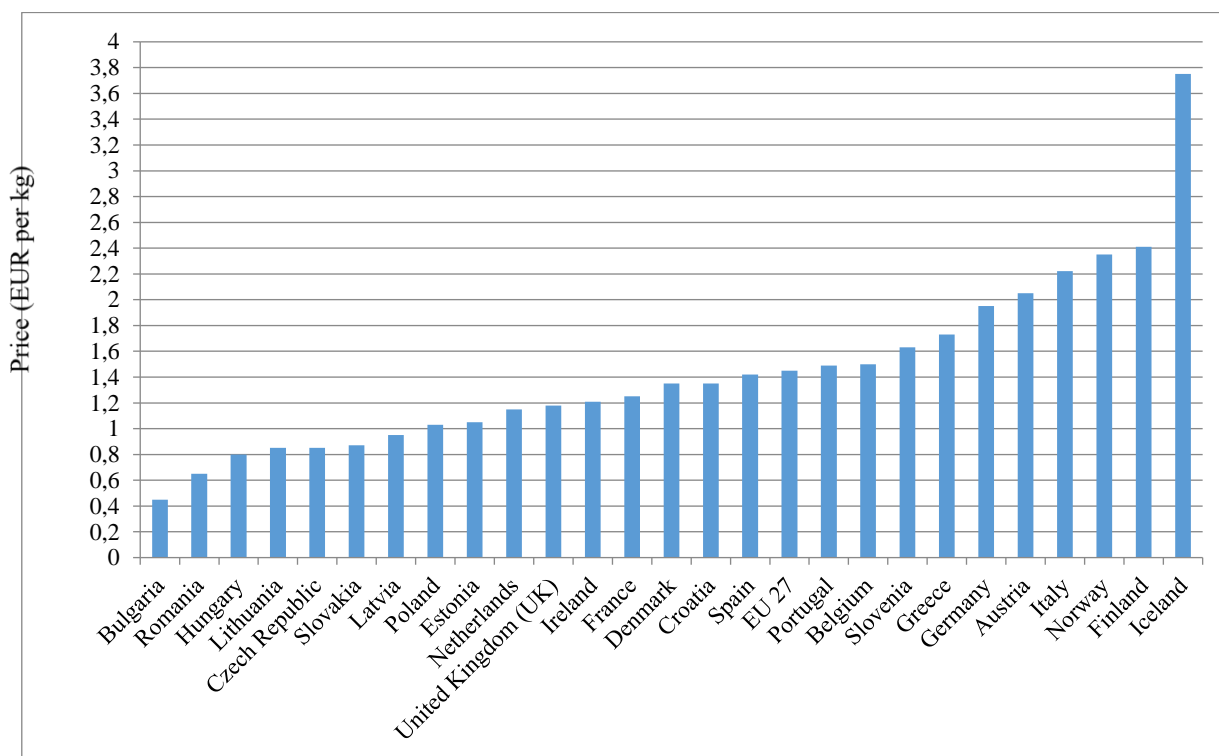
Source: CSO, 2018; own processing

It is apparent that the most reliable prognosis results from Holt method using the solver. This method predicts further decrease in consumption, but much more moderate than in the previous years. The other two methods that we used with relatively low MAPE predict a decline in consumption for 2017.

It has turned out that the use of the solver, which automatically searches for the optimal value of purposeful functions and parameters, is effective. This method is suitable for users who do not have enough experience for the forecast. All prognostic methods are based on certain estimates of individual parameters (e.g. β). Inaccurate determination of these parameters leads to inaccurate forecasts, see Figure 1.

The other important factor for bread consumption is price. The comparison amongst European countries shows that bread in the Czech Republic is very cheap (Figure 2).

Figure 2. Price of bread in 2017



Source: http://www.svazpekaru.cz/attachments/693_EUROSTAT%20Ceny%20chleba%20v%20EU.pdf Retrieved 20th of June, 2018; own processing

Because Germany and Austria have much higher prices, it is possible to increase the price of bread in the Czech Republic after Euro adoption. Unfortunately, Czech (and also Slovak) people have anchored low price of bread and after price increasing they will be unsatisfied.

All these data are focused on bread generally. Unfortunately data for special breads are not published.

4. Conclusion

Our research proved a falling trend in bread consumption that has recently been gradually slowing down. The graph of previous consumption shows that demand for bread has decreased in approximatively 20 kg since 1996. Despite current marketing offers it is likely that bread consumption will not reach similar values in near future. If there will not be great changes it seems, that the most reliable estimate of further development proved to be the Holt method with the solver that predicts a decrease to 39.44 kg per capita. The reason for usage Holt method with solver is the fact

that only in this method is parameter β *counted with using optimization. The other methods are based on presumptions.*

Marketing surveys show that people like to try non-traditional breads - especially with the addition of seeds and kernels. Customers accept a higher price for these breads. Traditional rye-wheat bread is, however, anchored in the Czech Republic with a low price. Since it is a heavily inelastic commodity, it could theoretically be possible to increase the price continuously, without any significant drop in demand.

Possible opportunity to increase bread prices is the adoption of the euro in the Czech Republic. Prices of different commodities should be closer to the prices in the surrounding countries and bread in the Czech Republic is very cheap. On the other hand, Slovakia still adopted euro and the bread price is similar to the Czech one.

The limitation of this research is that it was focused on bread in general. In deeper differential could be identified some partial segments of bread with different trends. Further research should focus on the causes of bread consumption decrease and revealing any substitute commodities. Also it is important to find out the role of supermarket chains. It seems that they pressure to price decreasing for all commodities.

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JEL Classification System / EconLit Subject Descriptors

Basic classification and detailed classification you can find on a web page:

<https://www.aeaweb.org/econlit/jelCodes.php>

A. General Economics and Teaching

- A1 General Economics
- A2 Economic Education and Teaching of Economics
- A3 Collective Works

B. History of Economic Thought, Methodology, and Heterodox Approaches

- B1 History of Economic Thought through 1925
- B2 History of Economic Thought since 1925
- B3 History of Economic Thought: Individuals
- B4 Economic Methodology
- B5 Current Heterodox Approaches

C. Mathematical and Quantitative Methods

- C1 Econometric and Statistical Methods and Methodology: General
- C2 Single Equation Models • Single Variables
- C3 Multiple or Simultaneous Equation Models • Multiple Variables
- C4 Econometric and Statistical Methods: Special Topics
- C5 Econometric Modeling
- C6 Mathematical Methods • Programming Models • Mathematical and Simulation Modeling
- C7 Game Theory and Bargaining Theory
- C8 Data Collection and Data Estimation Methodology • Computer Programs
- C9 Design of Experiments

D. Microeconomics

- D1 Household Behavior and Family Economics
- D2 Production and Organizations
- D3 Distribution
- D4 Market Structure, Pricing, and Design†
- D5 General Equilibrium and Disequilibrium
- D6 Welfare Economics
- D7 Analysis of Collective Decision-Making
- D8 Information, Knowledge, and Uncertainty
- D9 Intertemporal Choice

E. Macroeconomics and Monetary Economics

- E1 General Aggregative Models
- E2 Consumption, Saving, Production, Investment, Labor Markets, and Informal Economy
- E3 Prices, Business Fluctuations, and Cycles
- E4 Money and Interest Rates
- E5 Monetary Policy, Central Banking, and the Supply of Money and Credit
- E6 Macroeconomic Policy, Macroeconomic Aspects of Public Finance, and General Outlook

F. International Economics

- F1 Trade
- F2 International Factor Movements and International Business
- F3 International Finance
- F4 Macroeconomic Aspects of International Trade and Finance
- F5 International Relations, National Security, and International Political Economy
- F6 Economic Impacts of Globalization

G. Financial Economics

- G1 General Financial Markets
- G2 Financial Institutions and Services
- G3 Corporate Finance and Governance

H. Public Economics

- H1 Structure and Scope of Government
- H2 Taxation, Subsidies, and Revenue

- H3 Fiscal Policies and Behavior of Economic Agents
- H4 Publicly Provided Goods
- H5 National Government Expenditures and Related Policies
- H6 National Budget, Deficit, and Debt
- H7 State and Local Government • Intergovernmental Relations
- H8 Miscellaneous Issues

I. Health, Education, and Welfare

- I1 Health
- I2 Education and Research Institutions
- I3 Welfare, Well-Being, and Poverty

J. Labor and Demographic Economics

- J1 Demographic Economics
- J2 Demand and Supply of Labor
- J3 Wages, Compensation, and Labor Costs
- J4 Particular Labor Markets
- J5 Labor–Management Relations, Trade Unions, and Collective Bargaining
- J6 Mobility, Unemployment, Vacancies, and Immigrant Workers
- J7 Labor Discrimination
- J8 Labor Standards: National and International

K. Law and Economics

- K1 Basic Areas of Law
- K2 Regulation and Business Law
- K3 Other Substantive Areas of Law
- K4 Legal Procedure, the Legal System, and Illegal Behavior

L. Industrial Organization

- L1 Market Structure, Firm Strategy, and Market Performance
- L2 Firm Objectives, Organization, and Behavior
- L3 Nonprofit Organizations and Public Enterprise
- L4 Antitrust Issues and Policies
- L5 Regulation and Industrial Policy
- L6 Industry Studies: Manufacturing
- L7 Industry Studies: Primary Products and Construction
- L8 Industry Studies: Services
- L9 Industry Studies: Transportation and Utilities

M. Business Administration and Business Economics • Marketing • Accounting • Personnel Economics†

- M1 Business Administration
- M2 Business Economics
- M3 Marketing and Advertising
- M4 Accounting and Auditing
- M5 Personnel Economics

N. Economic History

- N1 Macroeconomics and Monetary Economics • Industrial Structure • Growth • Fluctuations
- N2 Financial Markets and Institutions
- N3 Labor and Consumers, Demography, Education, Health, Welfare, Income, Wealth, Religion, and Philanthropy
- N4 Government, War, Law, International Relations, and Regulation
- N5 Agriculture, Natural Resources, Environment, and Extractive Industries
- N6 Manufacturing and Construction
- N7 Transport, Trade, Energy, Technology, and Other Services
- N8 Micro-Business History
- N9 Regional and Urban History

O. Economic Development, Innovation, Technological Change, and Growth†

- O1 Economic Development
- O2 Development Planning and Policy
- O3 Innovation • Research and Development • Technological Change • Intellectual Property Rights†
- O4 Economic Growth and Aggregate Productivity
- O5 Economywide Country Studies

P. Economic Systems

- P1 Capitalist Systems
- P2 Socialist Systems and Transitional Economies
- P3 Socialist Institutions and Their Transitions
- P4 Other Economic Systems
- P5 Comparative Economic Systems

Q. Agricultural and Natural Resource Economics • Environmental and Ecological Economics

- Q1 Agriculture
- Q2 Renewable Resources and Conservation
- Q3 Nonrenewable Resources and Conservation
- Q4 Energy
- Q5 Environmental Economics

R. Urban, Rural, Regional, Real Estate, and Transportation Economics

- R1 General Regional Economics
- R2 Household Analysis
- R3 Real Estate Markets, Spatial Production Analysis, and Firm Location
- R4 Transportation Economics
- R5 Regional Government Analysis

Y. Miscellaneous Categories

- Y1 Data: Tables and Charts
- Y2 Introductory Material
- Y3 Book Reviews (unclassified)
- Y4 Dissertations (unclassified)
- Y5 Further Reading (unclassified)
- Y6 Excerpts
- Y7 No Author General Discussions
- Y8 Related Disciplines
- Y9 Other

Z. Other Special Topics

- Z1 Cultural Economics • Economic Sociology • Economic Anthropology
- Z2 Sports Economics‡
- Z3 Tourism Economics‡