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Alfalfa Powder: Healthy Food Supplement for Sustainable Consumption

Abstract. An upward trend for plant dietary supplements has been reported lately in the Romanian market, suggesting that they could become a component of a sustainable food diet for consumers. The aim of this study was (1) to explore consumers' perceptions about alfalfa powder (a plant dietary supplement), to identify their needs and expectations regarding the use of this product and to define the consumer profile; (2) to outline the significant factors of alfalfa sustainable consumption. For this purpose, the evaluation was performed using a questionnaire on a sample of consumers from two important Transylvanian cities (Deva and Cluj-Napoca). The results of the study indicate that the product is consumed by youth, adults and elderly people with upper-class education and high incomes. Emphasis was placed on identifying the main benefits perceived by the use of alfalfa powder. Hence, these are directly related to immunity (10%), detoxification (15%) and healthy dietary supplements (32%). Furthermore, since sustainability is a key factor for increasing quality of life, evidence emerged revealing alfalfa sustainable consumption. Consequently, this study shows that a more sustainable consumption of alfalfa can be stimulated through successful strategies for consumer education through label information including traceability data.

Key words: alfalfa; behaviour; consumer perception; dietary supplements; consumer sustainability, Romania

Introduction

Food consumption is indispensable for human survival. Recent scientific evidence demonstrates that a diet comprising less animal and more plant-derived foods (rich in antioxidants, vitamins and fibers), delivers both nutritional and ecological benefits (Friel *et al.,* 2014; Tuso *et al.,* 2015; Tuso *et al.,* 2013; Joyce *et al.,* 2012). The sustainability of plant-based diets is based on using fewer natural resources and thus being less taxing on the environment (Sabate and Soret, 2014). In addition, policymakers support scientific findings by setting specific objectives to encourage more sustainable and healthy patterns of food and drink consumption, including reduced consumption of livestock products, increased consumption of fruit and vegetables and/or vegetarian food, and reduced consumption of bottled drinks (European Commission, 2012). These objectives aim to change existing food consumption habits in order to promote a healthy lifestyle, while at the same time ensuring the economic, social and environmental benefits for all stakeholders of the food chain (Johnston *et al.,* 2014).

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A sustainable diet has been defined as a "diet that's healthy, affordable, environmentally sustainable and culturally acceptable" (WWF, 2013). In addition, to increase food availability, Foley *et al.* (2011) suggests shifting diets from the current 16 major crops used for feed and biofuels to human food consumption only. Alfalfa (*Medicago sativa*) is an ubiquitary forage crop, important both for livestock feed and supplementing the human diet due to its rich content in proteins, minerals, vitamins and phytochemicals (Gaweł, 2012). Due to its high nutritional value, alfalfa leaf extract is a novel food or a novel food ingredient, safe for human consumption in the European Union (Commission Decision (2009/826/CE), 2009). In 2009 the European Food Safety Authority published the results of a study conducted in 2006 in all 25 EU member states, five of them confirming that alfalfa is used for human consumption as a dietary supplement or as an ingredient in soups and salads (European Food Safety Authority, 2009). Food supplements made from alfalfa are present on the market in the form of capsules, tablets, tinctures and powders (Rodrigues *et al.,* 2014; Karimi *et al.,* 2013; Pandey *et al.,* 2011). The use of alfalfa was approved in the United States, Canada and Mexico as an ingredient in beverages and candy bars, and as sprouts (Gaweł, 2012). Mielmann (2013) and Gawel (2012) consider that alfalfa is a rich source of protein and amino acids, especially exogenous amino and semi-exogenous acids, and that its consumption has beneficial effects for health. Moreover, even the sprouts of alfalfa (Gholami*et al.,* 2014) present important pharmaceutical properties. O'Dea (2003) identified the types of dietary supplements consumed by teenagers, among which there were also herbal supplements. However, it is not specified if these supplements include alfalfa-based products as well. Although there is plentiful evidence that food supplements are frequently used in addition to pharmaceuticals for health enhancement (European Food Safety Authority, 2009; Rodrigues *et al.,* 2014; Karimi *et al*., 2013; Pandey *et al.,* 2011), there is insufficient evidence of consumers perception about the products (Klepser *et al.,* 2000). However, studies on dietary supplement notoriety, performed at the national level in the United States, do not identify top products obtained from alfalfa (Kennedy, 2005). In addition, (De Jong*et al.,* 2003) found that the main determinants of dietary supplement consumption are numerous and depend on the type of product, knowledge and attitudes of consumers. The potential use of alfalfa for human consumption is hampered by the lack of awareness of the benefits of this plant among consumers (Mielmann, 2013). Moreover, in the scientific literature there are no studies about consumer perception of the products obtained from alfalfa, nor about consumer segmentation for sustainable food choices.

Thus, the aim of this novel study was focused on two important goals: firstly, to evaluate the reputation of alfalfa powder among Romanian consumers alongside consumer profiles and identification of their needs and expectations and secondly, to articulate the importance of sustainability issues related to alfalfa consumption.

Materials and Methods

The research design covered exploratory, descriptive and motivational dimensions. The data were collected using a survey questionnaire, structured as follows:
• perceptions and knowledge about alfalfa powder: Q1 – Did you hear about alfalfa powder (yes/no); Q2 – If yes, from what you know, what are the main uses of this product? (open question);

• purchase behaviour (frequency, source, quantity, price): Q3 –Have you ever bought alfalfa powder?(yes/no); Q4 – If yes, how frequently do you buy: weekly or more often/once at two-three weeks/monthly or rarely? Q5 – From where did you buy alfalfa powder last time: specialized shops/ supermarkets/producer/ elsewhere; Q6 – What quantity did you buy last time? (open question); Q7 – How much did you pay for that quantity? (open question);

• consumption behaviour (expectations, fears, quantity), sources/channels of information: Q8 – How often do you consume alfalfa powder: every day or almost every day/once per two-three weeks/monthly or rarely?Q9 – For what purposes do you consume alfalfa powder? (open question); Q10 – Approximately what quantity of alfalfa powder do you consume for a meal?(open question); Q11 – What are your main sources of information concerning the benefits of alfalfa powder consumption: Internet/specialized shops/nutritionist, doctors/friends, relatives/TV shows, radio, press/other members of the family;

• concerns about sustainability issues: Q12 – Please indicate your agreement in purchasing decision of alfalfa powder regarding the following aspects: it was produced in unpolluted areas from local genetic material; it was cultivated without using chemicals; it was produced by using the local labour force; dehydration and grounding of alfalfa were performed with an artisanal system and with low energy consumption; recyclable packaging was used for the product; label information with data about the product's traceability was available; the price is affordable;

• socio-demographic characteristics: gender, age, education, profession, income, residence.

The study was conducted from 1st to 23rd October 2013, on a sample of 104 consumers of food supplements from two Transylvanian cities (Deva and Cluj-Napoca). The questionnaires were applied at four food supplements stores, 1 from Deva and 3 from Cluj-Napoca. Sample stratification was made in relation to market potential of the two cities (number of stores, number of potential customers), therefore, from the total of 104 respondents: 27 were from Deva and 77 from Cluj-Napoca. The structure of the sample is presented in Table 1. The high percentage of women (91,3%) is due to their traditional role in Romanian culture for selection and purchase of foodstuffs. This argument is typical in Eastern Europe and has been previously identified (Kutnohorska and Tomšík, 2013).

Classification techniques were used to provide a typology of consumers who have heard of alfalfa powder. The method used was the Hierarchical Cluster Analysis performed with SPSS Program. Cluster analysis helps to organize multivariate data into subgroups, in order to emphasize the characteristics of a structure (Everitt *et al.*, 2011). The method is used in medicine, psychology and market research. Cluster identification was based on the use of ascendant algorithms for aggregation, and descendant algorithms for division. The two types of algorithms have been brought together in the hierarchical classification (Hierarchical Cluster Analysis). The steps of the hierarchical ascending classification algorithm were: identification of n elements to be classified; determination of the pair of elements which are nearest to each other, obtaining a new element by aggregation; classification of the n-1 remaining elements until there is only one element to classify. For the descending classification algorithm, the same method has been applied in reverse: identification of the total set of elements; in every following step the division of the most heterogeneous group in two subgroups, continuing the algorithm until all the groups constituted had one element (Clocotici, 2014). Identification of consumer clusters was

made in relation to three variables: age, education and income. The variable gender was not relevant for this analysis since 92% of the female participants have heard of this product.

Results and Discussion

Perceptions of and knowledge about alfalfa powder

Data analysis shows that over three quarters (78%) of the respondents have heard of alfalfa powder. An analysis of its notoriety in the main socio-demographic categories indicates that male persons, under 40 years, with secondary education and with a family income of up to 1500 lei per month/member have heard of the product in high proportions, more than 80% (Table 2). The influence of gender and age on the reputation of dietary supplements was previously demonstrated (Kelly *et al.,* 2005), the determinants varying according to the type of supplement (Fennell, 2004).

Table 1. Profile of respondents

		Number of respondents	% of total
Gender	Male	9	8,7
	Female	95	91,3
Age	Maximum 30 years	25	24,0
	Between 31-50 years	57	54,8
	Over 50 years	22	21,2
Education	High school	15	14,4
	Post – high school	6	5,8
	Higher education	47	45,2
	Postgraduate education	33	31,7
	I do not know/I do not answer	3	2,9
Occupation	A student, university student	9	8,7
	Housewife/househusband	2	1,9
	Retired, unable to work	10	9,6
	Employee	65	62,5
	Patron, self-employed	8	7,7
	Other	4	3,8
	I do not know/I do not answer	6	5,8
Family income (lei*)	Maximum 1000 lei	7	6,7
	Between 1001-2000 lei	16	15,4
	Between 2001-3000 lei	18	17,3
	Between 3001-4000 lei	25	24,0
	Over 4000 lei	16	15,4
	I do not know/I do not answer	22	21,2

*1 euro = 4.4560 lei (1st of October 2013, Romanian National Bank)

Source: own research.

After having applied the procedure Hierarchical Cluster Analysis, 3 different clusters were obtained (Table 3), as follows:
- *Cluster* 1: young people with secondary education and income under 3000 lei monthly, unemployed, who match the profile of the student;
- *Cluster* 2: people over 40 years, with high education, income under 3000 lei monthly (but not in the same proportion as the persons from Cluster 1), unemployed, who match the profile of retirees with high education;

- *Cluster* 3: employed people, from the upper class in education and income, with incomes slightly over 3000 lei, who match the profile of persons employed with higher education.

Table 2. Alfalfa powder notoriety for the main socio-demographic categories

		Notoriety
Gender	masculine	89%
	feminine	77%
Age	under 40 years	89%
	over 40 years	66%
Education	secondary education	90%
	higher education	76%
Occupational status	unemployed (student, housewives, retirees)	86%
	employed (employee, employer)	75%
Household income	maximum 1500 lei /month/family member	90%
	over 1500 lei /month/family member	61%
Locality	Cluj-Napoca	81%
	Deva	70%

Source: own research.

Table 3. Clusters obtained after applying Hierarchical Cluster Analysis

	Cluster 1	Cluster 2	Cluster 3
Age	Under 40 years	Over 40 years	Balanced
Education	High school studies	Balanced	Superior
Income	Under 3000 lei monthly	Under 3000 lei monthly	Over 3000 lei monthly
	Rather unemployed	Unemployed	Employed

Source: own research.
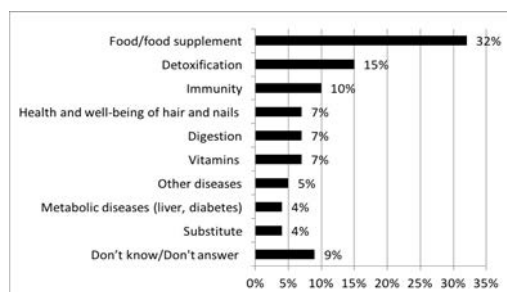
Fig. 1. Perceived benefits of alfalfa powder (N=81)
Source: own calculations.
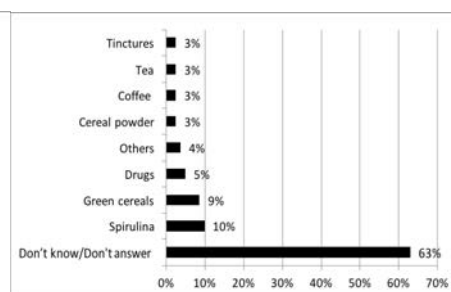
Fig. 2. Perceived substitutes for alfalfa powder (N=81)
Source: own calculations.

Almost a third (32%) of those who have heard of this product acknowledge alfalfa powder as food, 15% indicate its detoxification properties, and 10% think that the product increases immunity (Figure 1). Exhaustive pharmacological studies reveal alfalfa's potential in the treatment of cardiovascular diseases and central nervous system affections (Bora and Sharma, 2011), in diabetes due to important hypoglycaemic effects (Pathak and Das, 2013; Dwivedi and Kumar, 2011; Permender *et al.,* 2010; Singab *et al.,* 2014). Isolated tannins from the alfalfa have remarkable antimicrobial properties against foodborne pathogens (Doss *et al.,* 2011) and antifungal potential. The content of Vitamin C

in alfalfa increases the amount of haemoglobin in the blood, being recommended as a dietary supplement in increasing body resistance (Gaweł, 2012). Lucerne can also be used as an adjunct to improve the health of patients recovering after chemotherapy and radiotherapy or for patients diagnosed with HIV (Gaweł, 2012). According to the respondents, alfalfa powders are viewed as substitutes for spirulina (10%), of green grains (9%) and, to a smaller extent, of some medicines, tea, coffee or tinctures. However, almost two thirds of respondents could not mention a product that can substitute powdered alfalfa (Figure 2).

Purchasing behaviour of alfalfa powder

Approximately 84% of those who have heard of alfalfa powder bought such products. In terms of the frequency of purchase, 31% of consumers buy the products at least once every 2-3 weeks, and 15% of them purchase them weekly (Figure 3a, 3b).

(a)   (b)
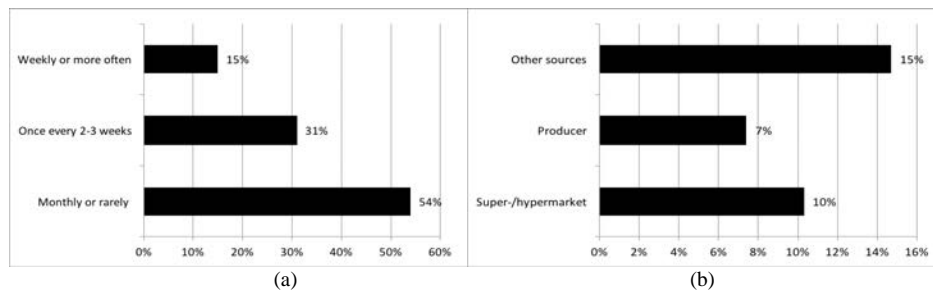
Fig. 3. (a) Frequency of alfalfa powder purchase (N=68) and (b) Purchase source for alfalfa powder (N=68)
Source: own calculations.

Table 4. Shares of alfalfa powder buyers for the main socio-demographic categories

Category	Subcategory	Purchase (% of total subcategory)
Gender	Masculine	88
	Feminine	84
Age	under 40 years	90
	over 40 years	76
Education	secondary education	74
	higher education	87
Occupational status	unemployed (student, housewives, retirees)	89
	employed (employee, employer)	81
Household income	maximum 1500 lei /month/family member	85
	over 1500 lei/ month/family member	89
Locality	Cluj-Napoca	90
	Deva	63

Source: own calculations.

About two-thirds of buyers have most recently purchased alfalfa powder from a specialty store. Another 10% bought it from the supermarket, and 7% bought it directly from the manufacturer. The main buyers of powders are under age 40, with higher education and from Cluj-Napoca (Table 4).

As data emerged three clusters were identified with different consumption behaviours:
- *Cluster 1*: young people, with secondary education and income under 3000 lei monthly, unemployed: 79% consumed alfalfa powder;

- *Cluster 2*: persons over 40 years, with higher education, income under 3000 lei monthly: 100% consumed alfalfa powder;
- *Cluster 3*: employed persons, from the upper class as education and income, with incomes slightly over 3000 lei 86% consumed alfalfa powder.

(a)   (b)
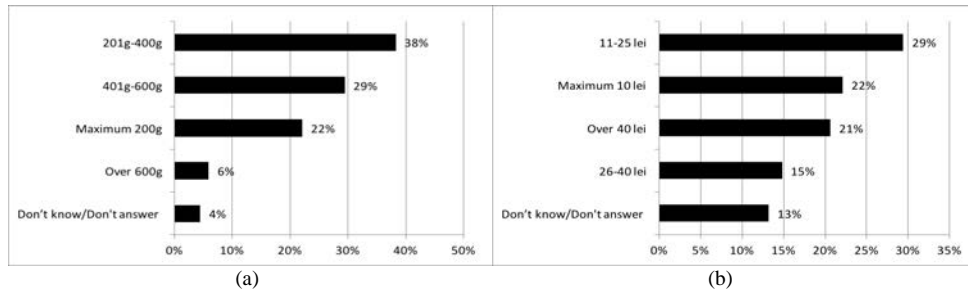
Fig. 4. (a) Purchased quantity of alfalfa powder (N=68) and (b) Price paid for alfalfa powder (N=68)

Source: own calculations.

Modelling a quantitative purchasing behaviour of alfalfa powder, it can be noticed that consumers purchase, on average, about 415g in one shopping session, the most commonly purchased quantity being in the 201g-400g category. The price paid for this amount was on average 27 lei (Figure 4 (a) and 4 (b)).

Consumer behaviour of alfalfa powder

Consumption of alfalfa powder is a daily habit for more than half of buyers. Over 80% of them consume the product at least once a week. There are socio-demographic determinants for frequency of consumption. Thus, daily consumption is more common among women, persons with higher education and employees. A lower frequency of consumption was identified in people over 40 years of age, or those from Deva. The consumption of dietary supplements is influenced by a complex mix of demographic and health-related factors (Egan *et al.,* 2011). Similar associations between socio-demographic characteristics and the consumption of dietary supplements have been identified by (Greger, 2001) as well, with women and more educated people consuming these products more often. Women's stronger propensity to consume dietary supplements is underlined also by other authors (Fennell, 2004; McNaughton*et al.,* 2005).
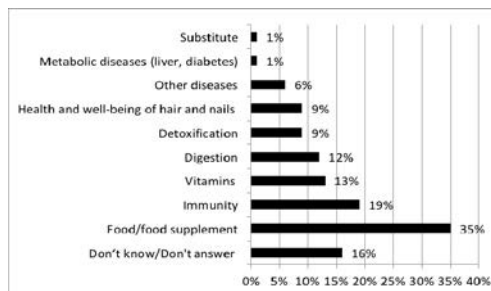
Fig. 5. Motivations for consumption of alfalfa powder (N=68)

Source: own calculations.
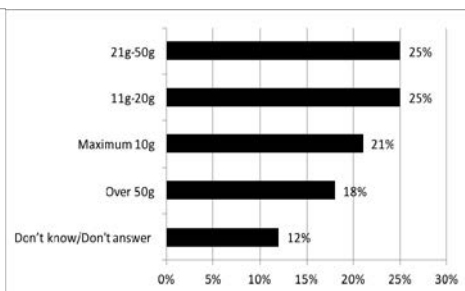
Fig. 6. Quantity of alfalfa powder consumed at a meal (N=68)

Source: own calculations.

Motivation for the consumption of alfalfa powder broadly reproduces the perceived usefulness of the product. Most likely, the transfer was made from motivation to perception of the usefulness (when making the effect for which it is used, the product is very useful to that end). A third of those who consume this product do so by including it in their diet, while 19% do it to get extra immunity. Another 12%-13% consume the product for the additional intake of vitamins or to improve digestion (Figure 5).

On average, for one consumption occasion (meal), 40g of alfalfa powder is consumed. However, there are important segments of consumers who consume less than 20g (46%), indicating non-uniform consumption behaviour (Figure 6).

Sources of information regarding alfalfa powder

One of the main issues raised by researchers regarding dietary supplements brings into discussion the sources of information related to the consumption of these products. Previous studies (Greger, 2001) show that magazines, books, specialty stores and fitness activities are the most used sources of information, to the detriment of information provided by doctors or nutritionists. Moreover, consumers of food supplements do not, in most cases, inform their physicians about the consumption of such products (Greger, 2001).
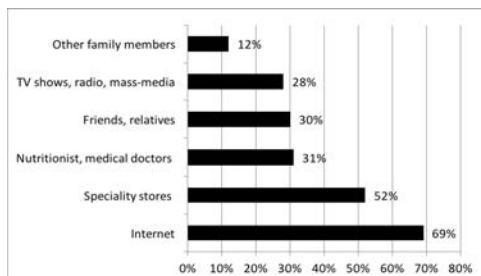
Fig. 7. Sources of information regarding alfalfa powder (N=81)

Source: own calculations.

In this study, the aforementioned conclusions are once again confirmed. The main source of information about alfalfa powder is the Internet, 69% of respondents declaring to have used the Internet to search for information. The second most important source of information is the specialized personnel working in dedicated stores or the stores themselves. Fewer respondents get their information from nutritionists, doctors, mass-media or from friends or relatives. On average, those who search for information use two sources (Figure 7). However, of those who use a single source of information, only 39% choose the Internet. About 9% of respondents do not get information from any of the sources mentioned above. Residence distinguishes different behaviours in terms of gathering information, respondents in Deva using on average 1.6 sources, while those in Cluj-Napoca using 2.4 sources. Of course, there can be seen in some way an expected behaviour regarding sources of information (younger individuals, those with higher education, and those with higher family incomes use more information sources than those over 40, with secondary education, and low family incomes), but the differences are not statistically significant.

Sustainable concerns about alfalfa powder

Previous studies demonstrate that consumer concerns about sustainability differ according to the product category, e.g. packaging-related issue for ice cream, soft milk and social issues for coffee, chocolate and sweets (Grunert *et al.,* 2014). In the present study, the respondents were more concerned about components of environmental sustainability (maintain renewable resource harvest, unpolluted areas and recyclable packaging) (see Figure 8.) This finding is consistent with previous studies (Vanhonacker *et al.,* 2013; Reisch *et al.,* 2013), which have identified the same pattern of environmentally-friendly behaviour like recycling and sorting waste and energy saving. In addition, in the current study the respondents were less concerned about methods of production and label information containing data about product traceability.
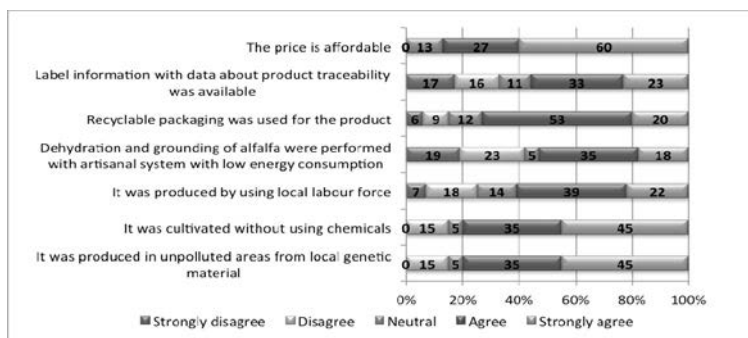
Fig. 8. Respondents' concerns about sustainability issues

Source: own calculations.

Economic access remains a key factor for assuring sustainability and food security (Kneafsey *et al.,* 2013). However, economic sustainability in terms of affordability is still important for Romanian consumers (Figure 8) due to low income. Other research (FAO) also discussed the question of income and suggested two possible directions: either to eat according to income and social status, or to eat responding to multiple goals of quality, environment, health, social, economic and governance (FAO, 2010; Arcese, 2015).

Conclusions

Currently, in Romania, a healthy lifestyle is an ascending trend. To this end, the use of dietary supplements has become a very common practice. Regarding the reputation of alfalfa powder, this product is known mainly by consumers of dietary supplements, the product being perceived as a food that complements a normal diet and as a therapeutic product that prevents, treats or cures certain diseases. Most consumers purchase this product from specialty stores and hypermarkets. Alfalfa powders are consumed by young, adult and older consumers, especially educated persons with reasonable incomes. Before consuming this product, Romanian consumers should be properly informed about the health benefits, the appropriate intake quantity, the moment and the period of administration. Moreover, they should be informed about the importance of consuming food sustainably, thus leading to conscious consumption of "healthy and sustainable" diets. In the present, doctors are the recommended source of information. The Internet, relatives, friends do not

represent reliable channels, expert advice being needed, especially for children, the elderly, pregnant women and people with chronic diseases. The authors believe that consumer education is a key factor in encouraging a more sustainable diet which could have a "win-win" effect on the whole sustainable food chain. This could also create opportunities for policy makers in major fields such as public health, climate change, food security and environmental protection.

Acknowledgments

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Poland's Trade in Services with Germany – EU Membership Experience

Abstract. Services play an increasingly important role in economies and international trade and are a vital element of building competitive advantage of nations. The aim of the paper is to determine the competitive position of Poland in trade in services with Germany and its changes. The RCA index is used to determine the international competitiveness of services. A special attention is devoted to high-tech knowledge-intensive services due to their potential impact on building competitiveness of all sectors of economy. Germany is a reference country as it is the most important trade partner of Poland. The time scope covers generally years 2004-2014. The analysis revealed that services development is lagged in Poland in comparison with Germany, but there is an ongoing convergence of structures of both economies. The share of high-tech services increased in Poland's services exports, but Poland does not reveal comparative advantage in any of high-tech knowledge-intensive services.

Key words: services, knowledge-intensive services, international competitiveness, international trade, RCA, Poland

Introduction

Services have become the main source of economic output and employment in most economies, whether developed or not. They are also increasingly important in international trade, despite the fact that the share of services in global trade compared to manufacturing is still relatively small. As many services are present at virtually every stage of the supply chains and the links between the services sector and manufacturing are tighter (see more in: Chilimoniuk-Przeździecka, Kuźnar, 2016), they play an increasingly important role in building competitive advantage of individual firms, sectors and whole economies.

Poland, as a market economy, experienced de-industrialisation of its economy and the shift towards services. These changes affect Poland's competitive position in services as well. The aim of this paper[2] is to examine Poland's competitive position in trade in services with Germany and its changes since the time Poland had joined the EU. This is a current and important topic because before 1989 the socio-economic policy was aimed at Polish industrial development, neglecting the role of services in economy. The economic transformation and then the accession to the EU have brought significant changes in this area which are worth examining. In order to determine the international competitiveness of Polish service sector, the RCA index was used. As Germany is the most important trade partner of Poland, it has been chosen as the reference country. The analysis was carried out mainly on the basis of Eurostat and OECD statistics. The time scope covers the years 2004-2014 (or earlier, if the data were not available).

Indicators of competitiveness in international trade

Increasing role of services in economies and international trade, whether measured traditionally (gross exports) or on the basis of value added (see Kuźnar, 2014) causes the growing interest in research on the competitive position of individual countries in services (e.g. Wörz (2008) investigated Austria's competitive position in services, Mongiało (2007) examined the export specialisation in services of EU member states, Wyszkowska-Kunia (2014) analysed Poland's competitiveness in international trade in knowledge-intensive services).

The first problem in any analysis of the competitiveness of countries that a researcher encounters, is the definition of "competitiveness". On the one hand, the microeconomic perspective focuses on interests of individual firms, whose objective is to survive and strengthen their market position vis-à-vis their competitors. On the other hand, the macroeconomic perspective deals with an internal and external balance at the country level (İnal, 2003).

The problem is that at the higher level of aggregation of entities (sectors, regions, nations) it is harder to find and point out common goals of these entities. They tend to have different objectives, thus making it difficult to unambiguously define competitiveness (Wörz, 2008). Lengyel (2004) provided a review of definitions and concepts of competitiveness, focusing on its regional dimension. Concentrating in this paper mainly on the country and the industry level makes interesting the definition provided by Trabold (1995). According to him competitiveness involves the strengthening of four abilities: the ability to sell (goods and services) internationally; the ability to attract resources, in particular foreign direct investment (FDI); the ability to adjust to changing external conditions through structural change and upgrading; and finally the ability to earn, which can be measured by GDP and its growth (Wörz, 2008). The OECD defines competitiveness in international trade as a measure of a country's advantage or disadvantage in selling its products in international markets (OECD, n.d.). It highlights one of the four aspects of competitiveness identified by Trabold (1995), i.e. ability to sell.

Another issue that a researcher is confronted with when investigating the competiveness is the way of measuring it. There are mainly two possibilities: using input measures or output measures. Input measures address factors determining competitiveness, such as cost and price factors (e.g. wages, export unit values, factorial or price terms of trade) and output performance (e.g. labour and capital productivity). The output measures investigate country's performance on export markets. The popular ways of measuring such performance is revealed comparative advantage, the size of market shares and their evolution over time (Wörz, 2008). Some other measures of good national trade performance suggested in the literature are: a shift in export composition toward higher value added or high-technology products; and current account surplus (McFetridge, 1995). There are also multidimensional indicators combining the two approaches (composite competitiveness indicators) (Wyszkowska-Kunia, 2014).

In this paper, Poland's trade in services with Germany is analysed through the perspective of international competitiveness, which is understood as the ability to sell services at foreign markets. It is quantified with the output measures, such as:

- market shares in exports and imports of services, total and at industry level;

- export composition with special attention to high-tech knowledge intensive services;
- evolution of market shares over time;
- balance of trade in services;
- revealed comparative advantage (RCA).

Services sector in economies of Poland and Germany as compared to the EU

Since 2004 the structure of value added has not changed significantly in Polish economy. Services then and now account for the largest share of value added, followed by industry and agriculture. Similarly to advanced European economies, the role of agriculture and industry in Polish economy has decreased. However, the share of agriculture in Poland is still significantly higher than in Germany. On the other hand, the share of industry (construction excluded) is similar and relatively high in both economies, reaching around 25%, which is more than the EU average (19%). There is a much larger share of construction in Polish than in German value added. Another difference is that non-market services[3] account for a larger part of value added in Germany than in Poland, whereas there is virtually no difference when it comes to market (or commercial) services (i.e. services that are traded in markets)[4] (fig. 1).

More disaggregated data show that financial and insurance services as well as information and communication constitute a larger share of value added in Germany than in Poland (see figure 2). At the same time, in both these sub-sectors, a higher average annual growth rate was observed in Poland. What may seem a bit surprising, a relatively high share of professional, scientific and technical activities (i.e. business services) is observed in Polish GDP as compared to the German one and – given the growth rate in both countries – this distance is likely to grow. What is more, business services in the EU account on average for the larger share of value added than in Poland, which also indicates a relatively low level of development of this sub-sector in German economy. The dominant contribution of wholesale and retail trade, transportation, accommodation and restaurants in value added in both countries does not indicate the low level of development of services in their economies. Such a feature is regarded as typical for both developing and developed economies (Growiec i in., 2014).

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[3] Services provided to the community as a whole free of charge, or to individual consumers either free of charge or at a fee which is well below 50 per cent of production costs. They are produced by government, private non-profit institutions serving households and by private households who employ domestic staff (OECD, n.d.).

[4] According to the Classification of Economic Activities based on NACE rev. 2 the industry sector covers the following activities: mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; water supply, sewerage, waste management and remediation activities; construction. Market services include: wholesale and retail trade, repair of motor vehicles and motorcycles; transportation and storage; accommodation and food service activities; information and communication; financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities; arts, entertainment and recreation; other service activities; activities of households as employers, undifferentiated goods- and services-producing activities of households for own use; activities of extraterritorial organisations and bodies. Non-market services are the following: public administration and defence, compulsory social security; education; human health and social work activities.

Poland, 2004

Non-market services; 15,7%

Agriculture, forestry and fishing; 3,7%

Industry (except construction); 25,9%

Market services; 48,2%

Construction; 6,5%

Germany, 2004

Non-market services; 17,3%

Agriculture, forestry and fishing; 1,0%

Industry (except construction); 25,4%

Market services; 52,2%

Construction; 4,0%

Poland, 2014

Non-market services; 14,9%

Agriculture, forestry and fishing; 2,9%

Industry (except construction); 25,0%

Market services; 49,7%

Construction; 7,4%

Germany, 2014

Non-market services; 18,2%

Agriculture, forestry and fishing; 0,7%

Industry (except construction); 25,7%

Market services; 50,8%

Construction; 4,6%

Note: sectors according to NACE rev. 2

Fig. 1. Value added by industry in Poland and Germany, 2004 and 2014 (current prices, million euro)

Source: own work based on Eurostat.

7,6%
9,4%
5,5%
9,1%
5,2%
8,7%
2,0%
2,8%
-0,4%
2,5%
3,0%
1,9%

Wholesale and retail trade; Transportation; Accommodation and food service activities

Professional, scientific and technical activities

Real estate activities

Financial and insurance activities

Information and communication

Arts, entertainment and recreation

■ Poland-2014   ■ Germany-2014
■ Poland - average annual growth 2004-2014   ✕ Germany - average annual growth 2004-2014
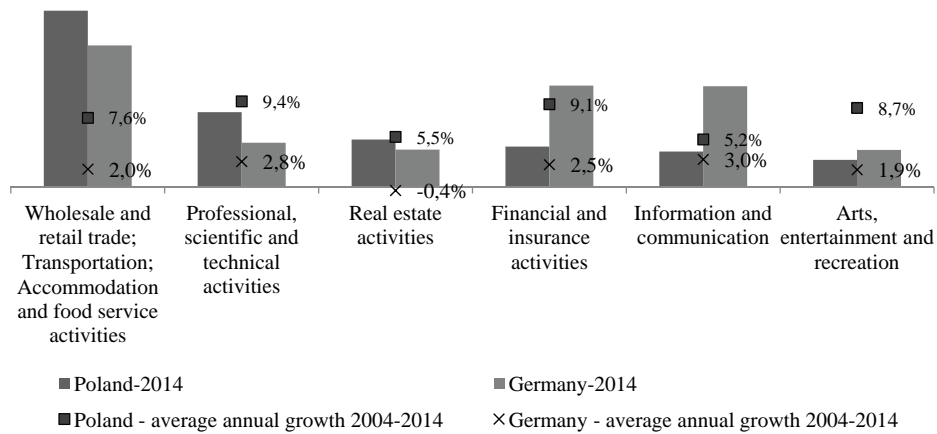
Fig. 2. Contribution of market services to value added in Poland and Germany and average annual growth, 2004-2014 (current prices, million euro)

Source: own work based on Eurostat.

Much greater differences between the two countries exist in the structure of employment (Figure 3). In Poland, in contrast to Germany and the EU, much of the labour force is still employed in agriculture. In 2014 it was 11.5% of total employment (compared to 5% in the EU and 1.5% in Germany). However, a positive trend of declining share of agriculture in employment is observed for the benefit of the service sector. The share of persons employed in industry remains stable, reaching approx. 23% in Poland, whereas it was 15.6% in the EU and 18.9% in Germany.
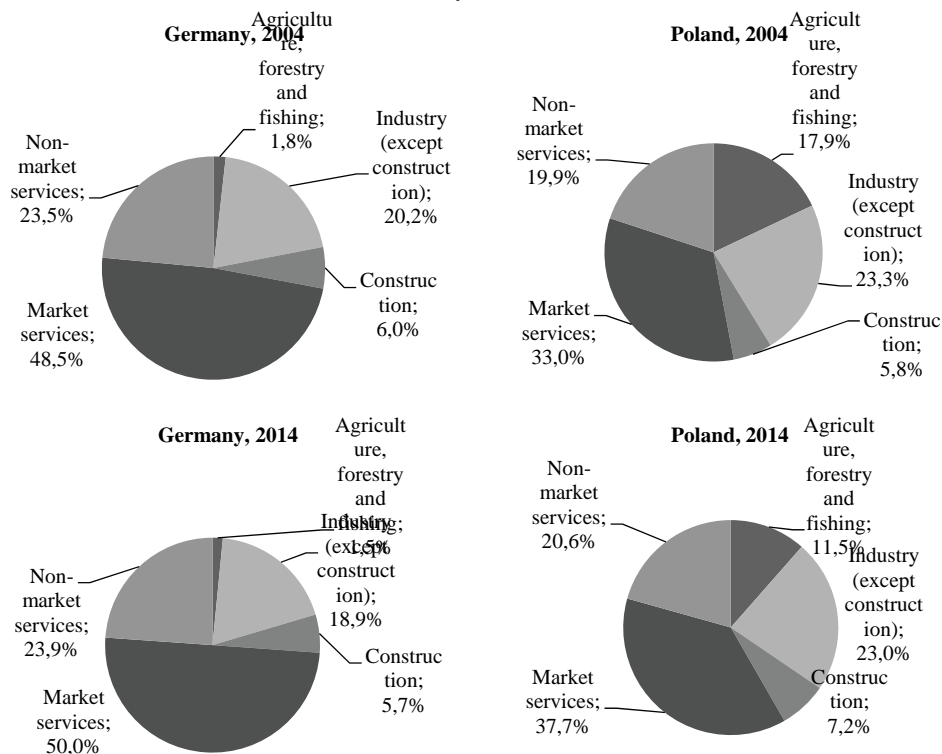
Note: sectors according to NACE rev. 2

Fig. 3. Employment by industry in Poland and Germany, 2004 and 2014

Source: own work based on Eurostat

The share of employed in market services in Poland reached 37.7% in 2014. Another 20.6% of total labour force were employed in non-market services. Altogether the services accounted for 58.3% of employed persons. These figures are much less than in Germany, where the corresponding values were 50%, 23.9% and 73.9%. Given the similar share of services in valued added in Poland and Germany and differences in the structure employment, further investigation is needed as how to explain the relatively high share of services per employee in Poland (the usual reason – relatively higher labour productivity – seem to be questionable, especially if years of underinvestment in service sector in Poland is taken into account).

The role of knowledge-intensive services in economies of Poland and Germany

Due to the role played in improving the competitiveness and innovativeness of countries, a specific services sub-sector that can be distinguished and subject to a more detailed analysis is knowledge-intensive services (KIS). These services are considered to be the most dynamic components of services sub-sectors in most industrialized countries (Strambach, 2001) and are essential to the development of knowledge-based economy (Muller, Zenker, 2001). In turn, transforming the EU economies into smart, sustainable and inclusive economies based on knowledge and innovation is the aim of the Europe 2020 strategy (Europe 2020, 2010).

Knowledge-intensive services are regarded as activities that rely heavily upon professional knowledge and either are themselves primary sources of information and knowledge or use knowledge, technology and highly-skilled professionals to provide services for their clients. They are not only users but also providers of knowledge and technology, which explains their importance in improving competitiveness of businesses and whole economies.

Eurostat classifies an activity as knowledge intensive if employed tertiary educated persons represent more than 33% of the total employment in that activity[5] (Eurostat, n.d.). In addition, Eurostat also distinguishes high-technology knowledge-intensive services (hereinafter referred to as: high-tech KIS), which include[6]:

- motion picture, video and television programme production, sound recording and music publishing activities;
- programming and broadcasting activities;
- telecommunications;
- computer programming, consultancy and related activities;
- information service activities;
- scientific research and development.

The Eurostat data on employment in knowledge-intensive sectors by level of education indicates that in 2014 on average 64% of employed in high-tech KIS in EU-28 completed at least first or second stage of tertiary education, whereas in case of total KIS the corresponding number reached 52%[7]. Due to unusually high graduate-intensity in high-tech KIS, the relation between the level of production of high-tech KIS and the competitiveness of countries seems to be relatively stronger than in case of remaining KIS, therefore they are further analysed in more detail.

The share of high-tech KIS in both Polish and German economies is quite limited. In case of value added it does not exceed 5% and in employment it is less than 3% (table 1). There are no significant differences in favour of Germany, which might have been

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[5] According to Eurostat, knowledge-intensive market services (excluding financial intermediation and high-tech services – see below) include: water transport; air transport; legal and accounting activities; activities of head offices, management consultancy activities; architectural and engineering activities; technical testing and analysis; advertising and market research; other professional, scientific and technical activities; employment activities; security and investigation activities.

[6] http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Knowledge-intensive_services_(KIS) (date of access: 10.07.2016).

[7] http://ec.europa.eu/eurostat/web/products-datasets/-/htec_emp_nisced2 (date of access: 10.07.2016).

expected. Moreover, during the years 2004-2014 the share of employed in high-tech KIS in Poland increased by 0.7 p.p. whereas in Germany it has increased only by 0.2 p.p. Opposite situation is observed in statistics regarding the valued added – Poland has experienced a slight decrease of the share of high-tech KIS in value added (by 0.3 p.p.) while Germany noted small increase of this share (by 0.2 p.p.).

Table 1. Share of high-tech knowledge intensive services in value added end employment, Poland and Germany

	2004		2014	
	Germany	Poland	Germany	Poland
Value added in high-tech KIS, million euro	99763	7997	130870	14882
including NACE rev. 2 services:				
Motion picture, video, television programme production; programming and broadcasting activities	13.0%	13.4%	11.8%	12.1%
Telecommunications	37.3%	58.1%	20.0%	31.2%
Computer programming, consultancy, and information service activities	35.9%	19.2%	53.0%	42.9%
Scientific research and development	13.8%	9.2%	15.2%	13.8%
Share of high-tech KIS in total value added	*4.8%*	*4.4%*	*5.0%*	*4.1%*
Employment in high-tech KIS, thousand persons	1 023	220	1 207	355
including NACE rev. 2 services:				
Motion picture, video, television programme production; programming and broadcasting activities	11.8%	15.5%	10.9%	12.7%
Telecommunications	19.4%	38.4%	10.4%	28.2%
Computer programming, consultancy, and information service activities	54.5%	27.1%	62.1%	48.9%
Scientific research and development	14.3%	19.0%	16.7%	10.2%
Share of high-tech KIS in total employment	*2.6%*	*1.6%*	*2.8%*	*2.3%*

Source: own work based on Eurostat.

There were more significant changes in the internal structure of these services in Poland. The share of telecommunications in value added in high-tech KIS fell by almost a half, but it is still relatively high in comparison with Germany (31,2% share in value added in Poland in 2014 was almost as big as it was in Germany ten years earlier). Positive changes occurred with regard to computer programming, consultancy, and information service (hereinafter referred to also as: IT) as well as in case of R&D activities. The share of IT in value added in high-tech KIS more than doubled (from 19.2% to 42.9%), narrowing the gap between their role in Polish and German economy. Poland has also improved its position in the share of R&D services in value added in the last 10 years, reaching the level of 13.8% (which is 1.4 p.p. less than in Germany and 4.6% more than it was in Poland in 2004). The last high-tech KIS sub-sector, motion picture, video, television programme production; programming and broadcasting activities did not experience significant changes.

The shift in the structure of value added was accompanied by corresponding changes in employment in Poland. There was a growing share of employed in IT services, and decreasing share – in all remaining services listed in table 1. Whereas it was somehow expected in case of telecommunications and motion picture…, etc., it may be surprising when it comes to R&D as we observed the growing share of R&D in value added. This result may indicate increasing productivity of employees in this sub-sector.

To sum up, there is a process of gradual of convergence of structures of value added and employment in high-tech services in both analysed countries indicating increasing innovativeness and competitive abilities in Poland.

The role of services in international trade of Poland

The position of Poland in international trade in services is quite modest. Poland is the 29th world exporter and 31st world importer of commercial services, with shares of 0.97% and 0.75% respectively (WTO, 2015). Germany, on contrary, is the main exporter and importer of services, with respectively 4th and 3rd position in the world. At the same time, the value of exports of services in relation to total merchandise and services exports (18.2%) and to GDP (8.7%) is larger in Poland than in Germany (14.8% and 6.9%, respectively). It indicates that the level of internationalisation of services in Poland is relatively high.

Table 2. Exports of commercial services per capita, EU-28 and selected member states (euro and percentages)

Country/region	2004	2013*	Percentage change 2013/2004
Poland	281	794	182
Czechia	757	1602	112
Slovakia	556	1034	86
Hungary	851	1626	91
Germany	1355	2717	101
EU-28	1742**	2982	71

* Data for 2014 is not available.
** 25 member states.

Source: own work based on Eurostat.

One of the measures of international competitive position of countries is the value of exports per capita. Comparison of the values of exports of services per capita in Poland and Germany, as well as in other Central European countries (table 2) leads to the conclusion that the competitive position of Poland is low, both in relation to more advanced countries and countries which in past also experienced the period of neglecting role of services in their economies. However, the most dynamic increase of exports per capita occurred in Poland, therefore the distance to other countries in 2013 was smaller than in 2004.

Geographical and sectoral structure of Poland's trade in services

The main foreign market for services from Poland is the EU. In 2014 the total value of services exported to the EU was 25.5 billion euros, which accounted for over 70% of Poland's exports of services (OECD 2015). It is facilitated by close geographical and cultural distance – especially that provision of many services requires simultaneous interaction between the provider and the customer – accession to the EU and implementation of so-called Services Directive (2006). Apart from these institutional aspects, there is no doubt that Polish enterprises had to adapt their offer in order to meet requirements on the demanding markets of more developed EU countries.

The largest Polish EU partner is Germany. In 2014 Poland exported to this country 35% of services directed to the EU-28 market (figure 3). However, its share is systematically decreasing. In 2004 Germany purchased 55% of Polish services sold in the EU. The EU is also the main provider of services to Poland. In 2014 the combined share of imports from all EU member states reached 78%. Germany accounted for 28% of Poland's imports from the EU.
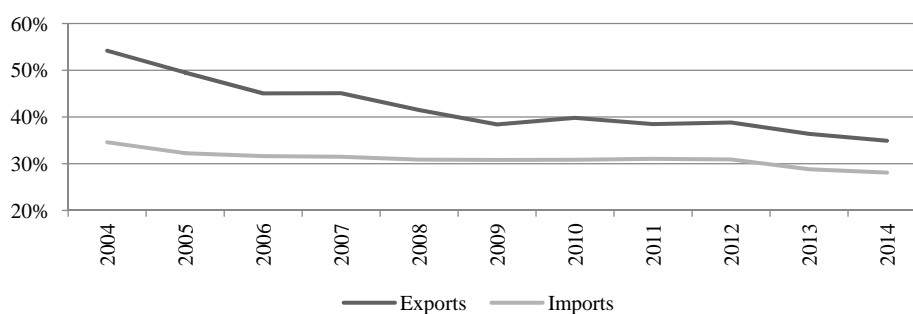
Fig. 3. Share of Germany in Poland's trade in services with the EU-28 (EU-28=100%)

Source: own work based on OECD. Datasets: EBOPS 2002 and EBOPS 2010 - Trade in Services by Partner Country.

The trade balance in services with the EU and Germany is positive. The surplus with Germany is the largest among EU members, reaching 2822 million euro in 2014, and it is increasing (with the exception of 2009 – see figure 4), which is a positive trend from the perspective of competitive position of Poland in trade in services.
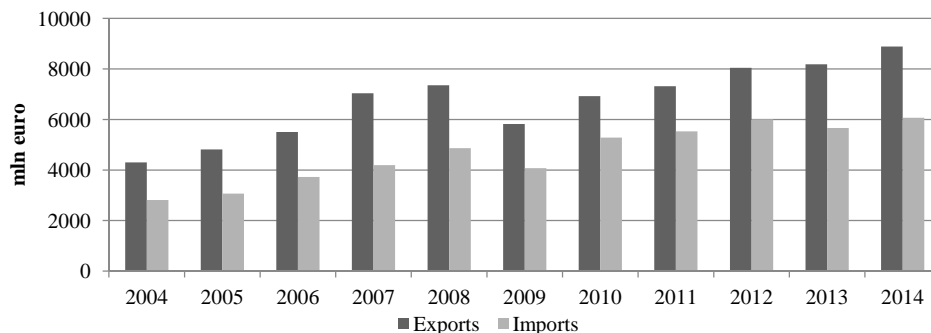
Fig. 4. Poland's trade in services with Germany, 2004-2014

Source: own work based on OECD. Datasets: EBOPS 2002 and EBOPS 2010 - Trade in Services by Partner Country.

There were substantial changes occurring in the sectoral structure of Poland's exports of services to Germany. In 2004 the most important service sub-sectors in exports were travel (62%) and transport (20%). The share of travel in exports of services to Germany was exceptionally high, as exports of this sub-sector to the EU at that time accounted for much less, i.e. 44% of Poland's services exports.
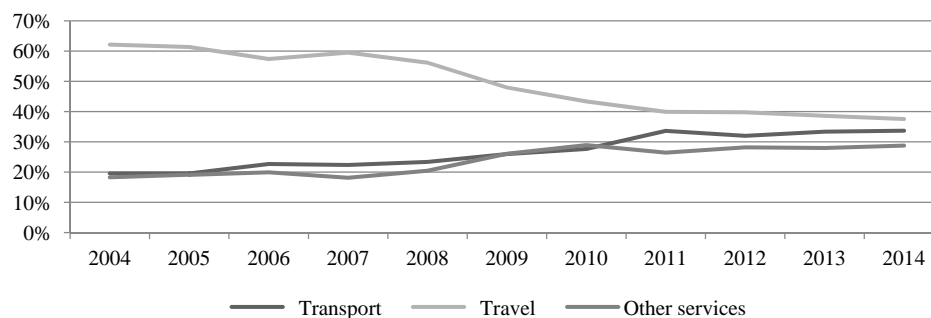
Fig. 5. Sectoral structure of Poland's exports of services to Germany, 2004-2014

Source: own work based on OECD. Datasets: EBOPS 2002 and EBOPS 2010 - Trade in Services by Partner Country

As of today the structure of services exports to Germany and the EU is similar. In 2014 travel was still at the first position, with much lower share than 10 years earlier (38%). The second place was taken by transport (34%) and the lowest share was recorded in other services (29%). The high share of travel services is due to the popular at the cross-border area phenomenon of crossing the border for the purpose of purchasing goods and services. These are the so-called one-day trips, which by definition are also treated in the balance of payments statistics as travels.

Some favourable changes in the internal structure of other services' exports to Germany occur. Construction services have traditionally been important in exports to Germany. Recently they were responsible for 17% of other services exports, but a sharp

decline was observed (from 35% in 2004). There is an increasingly strong positive contribution of other business services to other services exports. In 2014 this category of services accounted for 60% of other services exports, while ten years earlier it was 44%. The most striking change is the increased share of computer services exports from 3% of other services exports in 2004 to 16% in 2014. Since the last two mentioned categories represent important knowledge-intensive activities, the increased shares in exports indicate positive trend.

The role of knowledge-intensive high-tech services in Poland's foreign trade

The Eurostat data indicate that the role of high-tech knowledge intensive services in Poland's trade in services with Germany increases, both in exports and imports. In 2004 the total share of this sub-sector accounted for 2.8% of exports of services to Germany, while in 2012 this share increased to 5.1%. In imports the respective numbers we 4.8% and 7.2%.

During the analysed period of time, a significant increase of exports of IT services in exports of high-tech KIS was noted (from 18,1% to 70.4%) at the expense of telecommunications (decrease from 57% to 16.4%). Unfavourable situation is observed in case of R&D services, as their role in high-tech KIS exports dropped from 22.1% in 2004 to 12% in 2012 (table 3). However, it is worth to note that many German companies establish R&D centres in Poland and provide services locally (e.g. Volkswagen in Poznan, Siemens in Wroclaw).

As many services are key inputs increasing efficiency in all other sectors of the economy, analysis of imports of high-tech KIS is also important in the study on the competitiveness of Poland's trade in services. Similarly to the situation observed in exports, a dynamic increase of imports of computer and information services (from 34.5% to 67%) was noted in parallel with a high decrease of telecommunications (from 49.5% to 19.5%), and a slight decrease of R&D and audioviusal services in imports of high-tech KIS from Germany.

Poland recorded a deteriorating trade balance in high-tech KIS with Germany. In 2012 the deficit was observed in all categories but R&D. The relatively poor performance of Poland in high-tech KIS does not necessary gives cause for concern, as their imports may be a valuable supplement for domestic offer and they may enhance competitive position of Poland in future.

Table 3. The role of high-tech knowledge intensive services in Poland's trade in services with Germany, million euro and percentages

		Telecommuni cations	Computer and information	Research and development	Audio-visual and related	High-tech KIS
2004	Exports	68.9	21.9	26.7	3.3	120.8
	Share in exports of high-tech KIS	57.0%	18.1%	22.1%	2.7%	100%
	Imports	66.3	46.2	17.2	4.2	133.9
	Share in imports	49.5%	34.5%	12.9%	3.1%	100%

	of high-tech KIS					
	Net exports	2.7	-24.3	9.5	-0.9	-13.0
2012*	Exports	60.7	261.0	44.4	4.5	370.6
	Share in exports of high-tech KIS	16.4%	70.4%	12.0%	1.2%	100%
	Average annual growth 2004-2012	-1.6%	36.3%	6.6%	4.0%	15.0%
	Imports	80.3	276.0	43.3	12.4	412.0
	Share in imports of high-tech KIS	19.5%	67.0%	10.5%	3.0%	100%
	Average annual growth 2004-2012	2.4%	25.0%	12.2%	14.5%	15.1%
	Net exports	-19.6	-15.1	1.2	-7.9	-41.3

* Data for 2013 or 2014 not available.

Source: own work based on Eurostat.

Poland's competitive position in services as revealed by trade flows with Germany

In this paper, David Ricardo's principle of comparative advantage is applied for the analysis of competitiveness in services. Relative advantage of countries arises from lower opportunity costs in the production of goods or services due to differences in endowments (e.g. natural resources, labour, capital, human capital), different technologies, legal and institutional differences, etc. As these are difficult to measure, Balassa (1965) used trade flows to draw conclusions on the underlying factors that determine competitiveness[8] (Wörz, 2008). The Balassa's RCA index (hereinafter also Balassa Index, BI) was designed to analyse merchandise trade flows only, but there are no reasons to exclude it from using with respect to services trade (except the fact that services trade flows are more difficult to measure).

A nation's RCA can be calculated on an industry basis or for disaggregated products. The RCA for country *i* in product/sector *j* is defined by the following formula:

$$BI_{ij} = RCA_{ij} = [(\text{exports of product/sector } j \text{ by country } i)/(\text{world exports of product/sector } j)]/[(\text{total exports of country } i)/(\text{total world exports})] \qquad (1)$$

The index measures a country's exports of a product or sector relative to its total exports and to the corresponding export performance of group of countries. If RCA>1, then a comparative advantage is revealed. There are several suggestions which modify and overcome shortages of the original Balassa's formula[9]. In this paper, a symmetric RCA

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[8] RCA has been applied to measure competitiveness at the industry and nation level [Porter, 1990] and is now widely used as the competitiveness indicator.

[9] The Balassa's Index has been criticised for several shortcomings: incomparability across time and space, which originates from its asymmetry (the BI values fall on between zero and infinity with the comparative-advantage-

index as proposed by Dalum et al. (1998) is used. It is called the symmetrical revealed comparative advantage (SI). The SI index is calculated as follows:

$$SI_{ij} = \frac{BI_{ij} - 1}{BI_{ij} + 1}, \text{ where:} \tag{2}$$

$$BI_{ij} = RCA_{ij} = \frac{X_{ij} / X_{ik}}{X_{nj} / X_{nk}} \tag{3}$$

where: X_{ij} represents exports of product/sector j from country i, X_{nj} represents exports of product/sector j from the world or reference group of countries k. SI ranges from -1 to +1. When SI is above 0, country i's competitiveness in product j is greater than its average competitiveness. In other words, country i's comparative advantage in this product is revealed.

In this paper the numerator represents the percentage share of a given service sector in Poland's total services exports to Germany. The denominator represents the percentage share of a given service sector in total services exports of EU-27 (without Germany) to Germany. As a result the index shows competitiveness of Poland at German services market compared to the position of EU-27 countries in Germany (this interpretation is based on the study by (Hagemejer, Michałek, Michałek, 2008, p. 11)).

The results of calculations of the symmetric revealed comparative advantage index in Poland's trade in services with Germany are presented in table 4.

Table 4. Revealed Comparative Advantage of Poland in trade in services with Germany, 2004-2012

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Transportation	0,11	0,08	0,12	0,13	0,11	0,17	0,17	0,26	0,25
Travel	0,19	0,19	0,19	0,23	0,21	0,15	0,14	0,10	0,10
Other services	-0,37	-0,37	-0,36	-0,42	-0,37	-0,27	-0,24	-0,27	-0,26
Communications services	-0,03	-0,29	-0,30	-0,27	-0,32	-0,03	-0,06	-0,06	-0,15
Construction services	0,64	0,66	0,67	0,63	0,67	0,65	0,63	0,63	0,65
Financial services	-0,70	-0,79	-0,87	-0,85	-0,81	-0,68	-0,79	-0,82	-0,78
Computer and information services	-0,78	-0,74	-0,66	-0,72	-0,71	-0,66	-0,39	0,02	-0,38
Royalties and license fees	-0,80	-0,92	-0,67	-0,83	-0,93	-0,79	-0,77	-0,75	-0,84
Other business services	-0,26	-0,16	-0,15	-0,26	-0,17	-0,04	-0,05	-0,11	-0,07
Personal, cultural and recreational services	-0,27	-0,29	-0,22	-0,26	-0,24	0,02	0,30	0,40	0,16
High-tech KIS:									
Telecommunication services	0,20	-0,03	-0,07	-0,08	-0,27	-0,02	-0,04	-0,07	-0,03
Computer and information	-0,78	-0,74	-0,66	-0,72	-0,71	-0,66	-0,39	0,02	-0,38

neutral point being 1), unstable mean across time and space, and aggregation effect (the BI varying depending on the aggregation level of countries or reference groups) (Sanidas, Shin, 2010).

services									
Research and development services	0,04	-0,21	-0,47	-0,59	-0,55	-0,46	-0,48	-0,54	-0,50
Audio-visual and related services	-0,55	-0,24	-0,47	-0,35	-0,62	-0,49	-0,20	-0,43	-0,49

Notes: insurance services have been excluded since in some cases exports takes negative value which cannot be taken into account in the symmetric RCA index. The possibility of negative value results from the way the value of insurance services is expressed. In general, it is the margin between charged premiums and paid claims.

Source: own work based on Eurostat.

Compared to other EU member states a comparative advantage of Poland in 2012 at German market was revealed in transportation, travel, construction and personal, cultural and recreational services. Among transportation services, the RCA was positive and relatively high in rail transport (freight on rail only), road transport (freight and passenger on road) and pipeline transport, which can be explained by Poland's geographical position as a transit country. In travel services Poland recorded high RCA in health-related personal travels (0.72 in 2012), which indicates not so much the tourist attractiveness of Poland but rather lower costs of health services. The largest revealed comparative disadvantage was recorded in royalties and license fees, financial services, and in all high-tech knowledge intensive services. The situation in IT services is ambiguous, as since 2004 there was an increasing specialisation in exports of these services and a positive RCA value in 2011, but in 2012 the RCA fall below zero again. The opposite trend occurred in R&D – in 2004 Poland benefited from RCA equalling 0.04, whereas in 2012 RCA fell to -0.50.

Conclusions

The analysis of Poland's trade in services with Germany carried out in this paper shows that Poland is still affected by the underinvestment in the service sector in the years before political and economic transformation. However, the growing convergence of employment and value added structures between Poland and Germany is also well visible, indicating a positive direction of changes. Since 2004, when Poland joined the EU, substantial changes in the structure of Poland's exports were observed. They are to a lesser extent reflected in the structure of services exports to Germany, which is still dominated by travel and transport services. Both of them and additionally construction services are among categories in which Poland recorded revealed comparative advantage. The share of high-tech services increased in Poland's services exports, but Poland does not reveal comparative advantage in any of high-tech KIS. The conclusive assessment of changes in RCA is not possible. Some of them are positive, as for example the decreasing disadvantage in computer and information services or other business services, and others are negative as in case of R&D and telecommunications, with initial advantage transformed into disadvantage, or travel services with decreasing revealed comparative advantage. Further investigation would be needed to explore the specific reasons of low values of RCA in high-tech KIS, royalties and license fees, financial services, but one reason might be insufficient amounts and quality of human capital, which is a particularly important factor of provision of these services. The relatively weak position of Poland in trade in these services may have negative effects with regard to building competitive position in all other

sectors of the economy but it may also be positive as imported services are important inputs in all sectors, enhancing their innovativeness and competitiveness.

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The Stability of Component Assets in Optimal Portfolios of Stock and Commodity Indexes

Abstract. The turbulences in financial markets increased the interest in commodity investments as an alternative asset class for potential risk diversification. A plethora of past and present studies documents the diversification benefits achieved by adding commodities to the traditional security portfolios. Most of commodity diversification papers ignore the stability of component assets in the optimal portfolio. This paper examines both, the stability and performance of optimal Markowitz portfolios over time. The portfolios are composed of commodity and stock indexes. Their risk and returns are compared to the risk and return of the equally weighted benchmark portfolio.

Key words: stock and commodity indexes, Markowitz portfolio optimization, component stability

Introduction

Modern finance owes its origin to the introduction of Markowitz portfolio theory, which subsequently became a basic tenet of finance. Since Markowitz' seminal paper (Markowitz, 1952) we have known that diversification can increase portfolio expected returns while reducing volatility. Following Markowitz, many researchers worked on his model and extended it by adding a variety of assumptions, constraints or objectives such as cardinality constraint, transaction costs, skewness and kurtosis to make it more realistic, because the criticism on the model is mainly focused on the fact it oversimplifies reality through some of its assumptions, e.g. normally distributed returns or efficient markets (Gasser, Rammenstorfer and Weinmayer, 2017). Mashayekhi and Omrani (2016) provide a detailed review of studies which extended the Markowitz model. According to Zopounidis, Doumpos and Fabozzi (2014), the principles introduced through the model are still at the core of many modern approaches for asset allocation, investment analysis, risk management, capital budgeting, and decision making under uncertainty. Although the complexity, vulnerabilities and the uncertainties involved in the globalized business and financial environments increase, the framework introduced by Markowitz continues to be highly relevant.

Originally, in Markowitz portfolio theory the diversification effect was achieved by the increase in the number of shares in the portfolio. However, changes in international financial markets, e.g. high volatility and contagion risk arising from increased financial integration and interdependence among stock markets have reduced diversification benefits for institutional investors and created higher systemic risk (Bekiros et al., 2016). This has driven some investors and portfolio managers to seek for diversification benefits in other asset classes, such as commodities. According to Nijman and Swinkels (2008), the interest

in portfolio diversification through commodity investments dates at least back to Bodie (1980) who points out the potential benefits of commodities for pension funds. Froot (1995) suggests that commodities are better portfolio diversifiers than, for example, real estate. Chow et al. (1999) indicate that commodities can be particularly valuable diversifiers in adverse economic circumstances, when other alternative assets tend to correlate more with traditional assets. More recently, Erb and Harvey (2006), Conover et al. (2010), You and Deigler (2012) document the diversification benefits from adding commodities to a stock- or bond-portfolio.

Although it is well known that commodity investment provides diversification benefits to a portfolio, most commodity diversification papers ignore an important issue that is the stability of component assets in the optimal portfolio. That is why the aim of the paper is to examine the stability of the weights of the components in the Markowitz portfolio composed of commodity and stock indexes. The inspiration for the research is the paper by You and Deigler (2012), who employ a wide variety of types of futures contracts to study the potential portfolio benefits of adding individual commodity futures to a traditional portfolio and to study the stability of portfolio's components from year to year. Our investigation focuses on commodity indexes as they offer broad exposure to commodity assets, subsectors and markets. Moreover, they have low correlations to traditional asset classes such as fixed income and equities, so we would expect a diversification benefit by adding an allocation to commodity indexes to a portfolio of bonds and stocks.

Although there are several major investable indexes, with a range of compositions and methodology of construction, the most popular among investors is the Standard & Poor's Goldman Sachs Commodity Index (S&P GSCI) and the Dow-Jones AIG Commodity Index that was rebranded under its current name – the Bloomberg Commodity Index (BCOM) in 2014. In order to provide a comprehensive review that considers a variety of commodity index options, we additionally take into account the Thomson Reuters/Core Commodity CRB Index (TR/CC CRB) and the Deutsche Bank Liquid Commodity Index (DBLCI). The investigation also covers the most important stock indexes: the Financial Times Stock Exchange 100 Index (FTSE 100),the IBOVESPA, the Standard & Poor's 500 (S&P 500), the Nikkei 225, the Shanghai Composite Index (SSE), and the All Ordinaries Index (AOI).

Methodology

In order to set an optimal portfolio composed of commodity and stock indexes we employ two options of the classical Markowitz model:

- option **A** that minimizes the portfolio variance of returns:

$$s_p^2 = \sum_{i=1}^{k} \sum_{j=1}^{k} x_i x_j k_{ij} \qquad (1)$$

subject to:

$$\sum_{i=1}^{k} x_i = 1, \qquad (2)$$

$$\sum_{i=1}^{k} x_i \bar{z}_i \geq \gamma, \qquad (3)$$

$$x_i \geq 0 \quad i = 1, \dots, n, \tag{4}$$

where:

x_i - weight of the *i*-th asset in the portfolio,

γ - predetermined portfolio return fulfilling the assumption that $\gamma \leq \max \bar{z}_i$,

$\bar{z}_i$ - mean return on the *i*-th asset,

k_{ij} - covariance between the returns on the *i*-th and the *j*-th assets;

   - option **B** that maximizes portfolio return:

$$R_p = \sum_{i=1}^{k} x_i \bar{z}_i \tag{5}$$

subject to:

$$\sum_{i=1}^{k} x_i = 1, \tag{6}$$

$$s_p^2 = \sum_{i=1}^{k} \sum_{j=1}^{k} x_i x_j k_{ij} \leq \omega, \tag{7}$$

where:

ω – predetermined portfolio variance of returns fulfilling the assumption that $\omega \leq \max S_i^2$ (S_i^2 – variance of the *i*-th asset).

  We also construct the benchmark portfolio which is the traditional portfolio generated by equally weighting the assets (indexes).

Data and preliminary analysis

  Empirical data covers daily quotes of four commodity indexes and six stock indexes, representing Australian, North and South American, Asian and European stock markets, from January 5, 2009 to December 30, 2015. As it is mentioned in the introduction, the commodity indexes under consideration are the following:

    ● the Thomson Reuters/Core Commodity CRB Index,
    ● the Bloomberg Commodity Index,
    ● the S&P Goldman Sachs Commodity Index,
    ● the Deutsche Bank Liquid Commodity Index.

  Table 1 presents their main characteristics. In theory, commodity indexes share a similar goal: to create a broad indicator of commodity price movement. In practice, portfolio weightings, construction, and calculation methodology vary dramatically from one index to another. The TR/CC CRBI, originally designed to provide dynamic representation of broad trends in overall commodity prices, has equal weightings for each of the component commodities. The S&P GSCI uses a weighting rule that attempts to capture the rationale behind market-capitalization weighting. It weights each constituent commodity by a dollar estimate of the global production of that commodity. The DLBCI considers both world production and world inventory. The S&P GSCI uses open interest on the futures contract but focuses on economic factors by attempting to filter out purely speculative interest.

The stock indexes under consideration represent stock markets from different continents:
- British Financial Times Stock Exchange 100 Index (FTSE 100) – Europe,
- Brazilian IBOVESPA – South America,
- the U.S. Standard & Poor's 500 (S&P 500) – North America,
- Japanese Nikkei 225 – Asia,
- Chinese Shanghai Composite Index (SSE) – Asia,
- the All Ordinaries Index (AOI) – Australia.

Table 1. Description of commodity indexes

Characteristic	Index name			
	Thomson Reuters/Core Commodity CRB Index	S&P Goldman Sachs Commodity Index	Bloomberg Commodity Index	Deutsche Bank Liquid Commodity Index
Start of back-filled history	1982	1969	1991	1988
Start of investable history	1986	1992	1998	2003
Indexing strategy	Equal-weighted	World-production weighted	Liquidity and dollar-adjusted production-weighted	World production and inventory-weighted

Source: www.vanguard.com.

Figures 1 and 2 show the performance of stock and commodity indexes in the period from January 5, 2009 to December 30, 2015. They let us notice that three out of four commodity indexes reached their lows in December 2015 and all of them reached their highs in April 2011, whereas the majority of stock indexes reached minimal levels in March 2009. Their maximal levels were hit in mid-2015, when commodity indexes, exhibiting their counter-cyclic nature, were falling down.

In tables 2 and 3, there are reported mean logarithmic returns and standard deviations for all commodity and stock indexes under consideration. The results vary from year to year, however the detailed analysis of estimates in table 2 let us conclude that 2009 is the only year when all indexes generate positive mean returns. Taken into account the whole period from 2009 through 2015, almost all commodity indexes are characterized by negative mean returns. The only exception is the Bloomberg Commodity Index (BCOM). The highest positive expected rate of return is that of S&P500 and also all other stock indexes exhibit positive mean returns. However, the S&P 500 is the only index providing positive mean returns in each of considered annual periods.
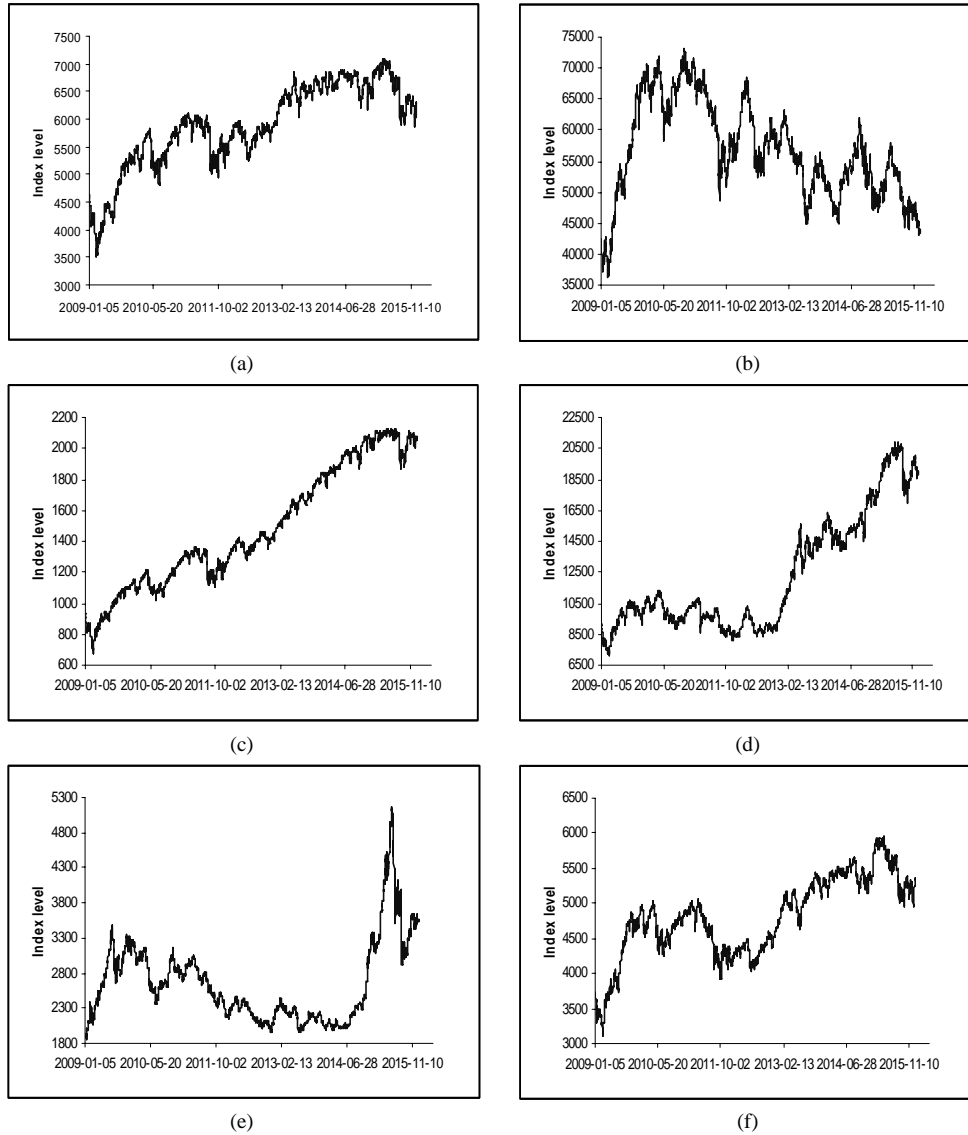
Fig. 1. Stock indexes from January 5, 2009 to December 30, 2015: FTSE 100 (a), IBOVESPA (b), S&P 500 (c), Nikkei 225 (d), SSE (e), AOI (f)

Source: own elaboration.

(a)

(b)

(c)

(d)
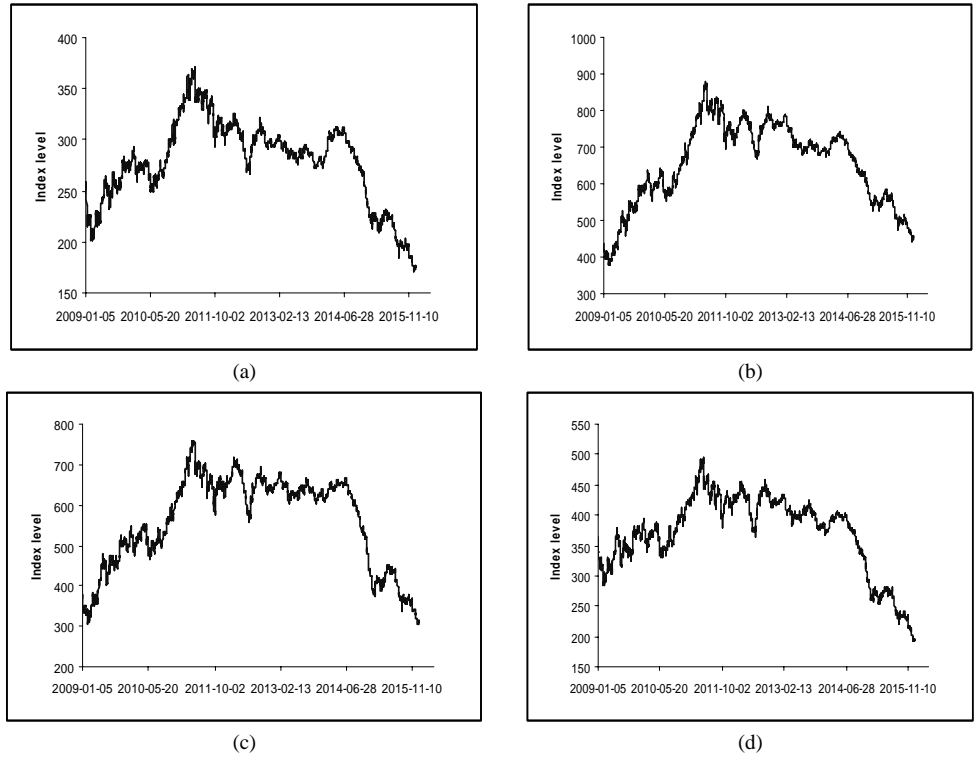
Fig. 2. Commodity indexes from January 5, 2009 to December 30, 2015: the Reuters/ Core Commodity CRB Index (a), Bloomberg Commodity Index (b), S&P Goldman Sachs Commodity Index (c), Deutsche Bank Liquid Commodity Index (d)

Source: own elaboration.

Table 2. Mean returns for commodity and stock indexes

Index	Year							
	2009	2010	2011	2012	2013	2014	2015	2009-15
TR/CC CRB	0.00047	0.00062	-0.00033	-0.00013	-0.00020	-0.00077	-0.00107	-0.00020
BCOM	0.00141	0.00077	-0.00007	0.00015	-0.00036	-0.00082	-0.00084	0.00003
S&P GSCI	0.00135	0.00072	0.00008	0.00001	-0.00009	-0.00162	-0.00118	-0.00010
DBLCI	0.00022	0.00045	-0.00004	0.00003	-0.00039	-0.00120	-0.00146	-0.00034
FTSE 100	0.00065	0.00033	-0.00022	0.00022	0.00052	-0.00011	-0.00018	0.00018
IBOVESPA	0.00200	0.00002	-0.00076	0.00029	-0.00075	-0.00013	-0.00050	0.00002
S&P 500	0.00072	0.00046	0.00000	0.00049	0.00101	0.00042	0.00001	0.00044
Nikkei 225	0.00062	-0.00012	-0.00076	0.00077	0.00175	0.00032	0.00031	0.00041
SSE	0.00217	-0.00060	-0.00095	0.00012	-0.00027	0.00166	0.00035	0.00035
AOI	0.00115	-0.00003	-0.00064	0.00049	0.00053	0.00003	-0.00003	0.00021

Source: own calculations.

Table 3. Standard deviations for commodity and stock indexes logarithmic returns

Index	Year							
	2009	2010	2011	2012	2013	2014	2015	2009-15
TR/CC CRB	0.01636	0.01042	0.01159	0.00880	0.00580	0.00645	0.01103	0.01058
BCOM	0.01530	0.01115	0.01174	0.00840	0.00607	0.00596	0.00961	0.01023
S&P GSCI	0.02028	0.01282	0.01429	0.01052	0.00731	0.00832	0.01503	0.01331
DBLCI	0.01778	0.01245	0.01381	0.01045	0.00747	0.00787	0.01321	0.01232
FTSE 100	0.01449	0.01078	0.01316	0.00844	0.00753	0.00711	0.01066	0.01062
IBOVESPA	0.01860	0.01241	0.01530	0.01311	0.01255	0.01538	0.01394	0.01460
S&P 500	0.01657	0.01114	0.01450	0.00783	0.00686	0.00711	0.00958	0.01106
Nikkei 225	0.01662	0.01260	0.01428	0.00990	0.01652	0.01218	0.01285	0.01374
SSE	0.01868	0.01380	0.01137	0.01060	0.01116	0.01097	0.02388	0.01510
AOI	0.01255	0.00948	0.01181	0.00719	0.00753	0.00684	0.01016	0.00960

Source: own calculations.

Results in table 3 show that the least risky asset is the AOI exhibiting the lowest standard deviation values in 2009, 2010 and 2012 as well as in the whole period under consideration (2009-2015). The highest standard deviation in the whole period as well as in 2010 and in 2015 is generated by the Shanghai Composite Index (SSE) which makes it the riskiest one among investigated indexes.

In table 4, there are presented values of Pearson correlation coefficient. Obviously, commodity indexes returns reveal strong linear dependences (the strongest positive correlation among commodity indexes is the one between S&P GSCI and DBLCI). Although previous studies often reported negative correlations between commodity and stock returns (Greer, 2000; Gorton and Rouwenhorst, 2004; Schofield, 2007; Chevalier and Ielpo, 2013), we do not find such relations in our data. All commodity and stock indexes are characterized by positive linear correlation, however the weakest dependencies are between commodity indexes and the Nikkei 225.

Table 4. Correlation coefficients between commodity and stock indexes logarithmic returns

Index	TR/CC CRB	BCOM	S&P GSCI	DBLCI	FTSE 100	IBOV ESPA	S&P 500	Nikkei 225	SSE	AOI
TR/CC CRB	1									
BCOM	0.918	1								
S&P GSCI	0.916	0.917	1							
DBLCI	0.915	0.930	0.965	1						
FTSE 100	0.467	0.505	0.470	0.444	1					
IBOVESPA	0.446	0.441	0.436	0.421	0.519	1				
S&P 500	0.474	0.475	0.485	0.466	0.651	0.625	1			
Nikkei 225	0.146	0.126	0.112	0.094	0.257	0.115	0.137	1		
SSE	0.183	0.203	0.150	0.151	0.183	0.161	0.113	0.262	1	
AOI	0.190	0.194	0.172	0.149	0.324	0.206	0.238	0.470	0.224	1

Source: own calculations.

Empirical results

In the first step of the research, for the purpose of examining portfolio performance and stability over time, the data is divided into seven annual periods. Employing the two options of Markowitz model, we receive optimal portfolios for each of the periods, individually. Tables 5 and 6 present the composition of optimal portfolios.

Table 5. Composition of Markowitz optimal portfolios (%) – option A

Index	Year						
	2009	2010	2011	2012	2013	2014	2015
TR/CC CRB	0.00	23.18	28.12	0.00	49.21	12.60	0.00
BCOM	20.43	0.00	0.00	19.04	0.00	32.78	42.66
S&P GSCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DBLCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FTSE 100	19.25	12.29	1.49	9.24	13.92	10.23	6.05
IBOVESPA	0.00	7.14	0.00	0.00	1.09	0.00	0.00
S&P 500	14.20	17.92	16.17	32.63	22.19	20.97	28.68
Nikkei 225	27.97	24.75	13.67	20.08	3.61	7.34	22.38
SSE	17.80	14.36	40.39	18.80	9.86	15.93	0.00
AOI	0.36	0.37	0.16	0.21	0.12	0.15	0.23
Total	100	100	100	100	100	100	100

Source: own calculations.

Table 6. Composition of Markowitz optimal portfolios (%) – option B*

Index	Year						
	2009	2010	2011	2012	2013	2014	2015
TR/CC CRB	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BCOM	0.15	66.93	63.79	0.00	0.00	0.00	0.00
S&P GSCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DBLCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FTSE 100	0.00	1.44	0.00	0.00	0.00	0.00	0.00
IBOVESPA	45.83	0.00	0.00	0.00	0.00	0.00	0.00
S&P 500	0.00	25.63	32.94	7.72	31.49	0.88	0.00
Nikkei 225	0.00	5.94	1.59	92.28	68.51	0.00	38.02
SSE	53.78	0.00	1.57	0.00	0.00	99.12	61.98
AOI	0.25	0.05	0.11	0.00	0.00	0.00	0.00
Total	100	100	100	100	100	100	100

*The predetermined maximal portfolio variance of returns is set to 75% of $\max S_i^2$. Relaxing this constraint results in the limitation of portfolio composition to one or maximally two assets.

Source: own calculations.

The results in table 5 show that portfolios' component assets, as well as their weights, generally change from year to year with the exception of the S&P GSCI and DBLCI. They are not components of any of the portfolios. The shares of commodities represented by commodity indexes range between 19.04% in 2012 and 49.21% in 2013. Most of the component assets for year *t* remain in the optimal portfolio for year *t*+1, although the weightings can vary considerably.

The results in Table 6 also show the instability of portfolios' components and their weights with exception of the TR/CC CRB Index, S&P GSCI and DBLCI. Their weights are equal to zero regardless the year under consideration. This time commodities play less important role in optimal portfolios. The BCOM is the only one of commodity indexes in optimal structures. However, it appears as portfolios' component only in 2009 and in 2010. In general, the number of components in portfolios of option B is lower than the number of components in portfolios of option A.

In practice, investors have to determine the portfolio weights at time (*t*) for the subsequent period [*t*, *t*+1] using only data available at time (*t*). It would be interesting to compare the ex-post results to the equally weighted portfolios, then. Thus, in the next step of the research, in order to examine the resultant ex-post "optimal" portfolios at time (*t*+1), we apply the optimal weights at year (*t*) to the data in year (*t*+1), e.g. the component weights of the optimal portfolio from 2009 are applied to data from 2010, etc. The return and risk of optimal and equally weighted portfolios are presented in tables 7 and 8.

Table 7. Return and risk of optimal and equally weighted portfolios (option A)

Year	Optimal portfolios		Equally weighted portfolios	
	Mean return	Standard deviation	Mean return	Standard deviation
2010	0.00015	0.00841	0.00026	0.01295
2011	-0.00049	0.00901	-0.00037	0.01431
2012	0.00020	0.00658	0.00024	0.01071
2013	0.00061	0.00592	0.00018	0.01004
2014	-0.00013	0.00427	-0.00022	0.00937
2015	-0.00038	0.00823	-0.00049	0.01289

Source: own calculations.

Table 8. Return and risk of optimal and equally weighted portfolios (option B)

Year	Optimal portfolios		Equally weighted portfolios	
	Mean return	Standard deviation	Mean return	Standard deviation
2010	-0.00031	0.01060	0.00026	0.01295
2011	-0.00009	0.01065	-0.00037	0.01431
2012	0.00027	0.00717	0.00024	0.01071
2013	0.00170	0.01529	0.00018	0.01004
2014	0.00035	0.00887	-0.00022	0.00937
2015	0.00032	0.02365	-0.00049	0.01289

Source: own calculations.

Investors should prefer optimal Markowitz portfolios only if they provide return and risk diversification benefits that are superior to equally weighted portfolios. The results in table 7 show that in 2013, 2014 and 2015 "optimal" ex-post portfolios (option A) outperform equally weighted portfolios, reducing the risk of investing and enhancing the profits. In other cases they provide lower standard deviations (lower risk), however combined with lower profit. The results in table 8 show that "optimal" ex-post portfolios (option B) outperform equally weighted portfolios in 2011, 2012 and 2013. In other cases they offer higher profits combined with higher standard deviations (with the exception of 2010). Summing up the results for options A and B, we can conclude that 2013 is the only year when "optimal" ex-post portfolios outperform the equally weighted one, regardless the option of Markowitz optimization model.

Concluding remarks

Since early 2000s, commodities have emerged as an additional asset class alongside with traditional ones as stocks and bonds. Slightly negative return correlations between commodity and stock returns imply an opportunity for diversification and thus attracts investors. This growing interest results in number of papers examining diversification benefits of adding to portfolio of stocks or bonds different commodity investment vehicles, such as commodity-related stocks, commodity futures or commodity indexes. Studies on commodity diversification typically focus on the risk and/or return benefits of adding a commodity to a portfolio of stocks and bonds and they often employ an equally weighted portfolio instead of generating optimal portfolios. Moreover, they usually ignore the stability of optimal portfolio weights over time and the performance of optimal portfolio in subsequent periods of time.

In this study we examine the stability of the weights of the components in the Markowitz portfolio composed of commodity and stock indexes. Optimal portfolios are set by employing two options of Markowitz model: one that minimizes portfolio variance of returns and the other one that maximizes portfolio return. When we examine the components of the Markowitz portfolios, we find that portfolio composition and weights are not stable over time. Thus, if the stability of the component assets is the primary goal, then equally weighted portfolio is preferable. Comparing equally weighted and optimal portfolios' risk and return characteristics, we find optimal portfolios outperforming equally weighted ones in half of analyzed cases. Our results are in general consistent with findings of You and Deigler (2012), however they examine the diversification benefits of using individual futures contracts instead of commodity indexes.

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Genetic Technology Transfer to Kenyan Agriculture in the Context of Biotechnology Research[3]

Abstract. Technology development is a crucial issue for economic development in Sub-Saharan African countries. In this paper current research on biotechnology and the potential of biotechnology absorption in Kenya is analyzed. The institutional character, areas of research and funding mechanisms of the research institutions contributing to agriculture sector technological advancements were examined in the context of local farmer's needs. Also factors, such as legal framework and cultural and social values for the biotechnology research in the region were explored. Literature review and the qualitative analysis of data on research facilities and the papers from the region were applied in the research. OLS correlation method was applied in the analysis of the data.

Key words: technology development, biotechnology, research and development, Sub-Saharan Africa, GMO, Cartagena Protocol, technology transfer

Introduction

Majority of population in Africa is employed in the agriculture, but the productivity of the sector is limited. A number of factors, such as decline in food production caused by flawed agricultural policies, political and institutional instability, chronic droughts, disease epidemics, environmental degradation, deterioration of infrastructure, and insufficient investments in agricultural research, have negative influence on Sub-Saharan African (SSA) agriculture performance (Paarlberg, 2005; Karembu et al., 2009; Jha et al., 2011; Interview, 2015). The agricultural policy reforms are advocated especially in the states with growing population (Cochrane, 2014), part of them leading to increased interest in the science based approach to improve the performance of the sector. In order to enhance pro-poor growth, amelioration of the productivity of farming with benefit for the least favored groups is needed. It is crucial to seek means of insertion of technology, which could be used by dominating group of small scale farmers, who use minimal external input (Karembu et al., 2009). For these reasons, and based on the green revolution experiences from Asia, biotechnology became a potentially promising branch of applicable science which could serve the needs of the region (Gordillo and Jimenez, 2006; Bothma et al., 2010; Uctu and Jafta, 2014).

Biotechnology is any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use

(UN, 1993). It has therefore wider meaning than only genetically modified organisms (GMO) or genetically modified living organisms (LMO). Tissue culture, genetic modification (genetic engineering) and molecular breeding (marker-assisted selection) are most commonly used scientific techniques in the agriculture (Karembu et al., 2009). Compared to traditional methods, genetic ones are described as rapid, cost-effective and precise technology which enable improvements in agricultural production (Karembu et al., 2010). Currently, developed countries are still more advanced in the biotechnology research. Some biotechnology technics for strain improvement, which are widely employed in developed countries (eg. classical mutagenesis and conjugation, hybridization) are only beginning to be applied in developing countries for the improvement and development of starter cultures (FAO, 2011). However, the situation is dynamic, and the North is now facing a strong increasing market competition from both emerging economies and developing countries. Especially farmers from Chile, Argentina or China which are capable to profit from genetically modified crops are important competitors for producers from developed markets (FAO, 2011).

The use of biotechnology as a panacea for productivity problems in agriculture in African, and especially Sub-Saharan countries is an up to date topic in scientific literature. Current scientific research focuses on both the suitability of biotechnology for the farmers (constraints, opportunities, mechanisms), and on biotechnology solutions *sensu stricto* for Sub-Saharan agriculture. However, there is a number of issues of social, political, institutional, economic, legal and ethical character considering biotechnology use in African states, which need to be addressed. A systemic analysis of the biotechnology research in Sub-Saharan African states requires especially institutional and legal context, as twin processes of modern biotechnology transfer and development of a regulatory regime evolve in some African states (Kingir, 2011).

The aim of this study was to verify how the scope of the research in the Sub-Saharan Africa responds to the technology transfer challenges described in economic literature. First literature review on the suitability of biotechnology transfer in the agriculture of the region in the context of social and institutional challenges was conducted, then current biotechnology research in Kenya was presented. Next statistical data for Kenyan agriculture for the period of 1982-2010 was explored and analyzed the content of biotechnology research papers affiliated in Kenya, which was chosen as a case study. The idea was to verify, whether biotechnology research in this country support the capacity to produce locally focused innovations suitable for the technology transfer inside the country. Our results include the correlations of economic growth with agricultural research in Kenya and the assessment of biotechnology research goals.

The rationale for selecting Kenya was based on several individual factors. First, it has the experience with biotechnology use. Kenya has tested with GM since 90s, and because of establishment of legal framework is in the confined field testing phase. Moreover, there is a significant body of literature on Kenya (in some cases on Kenya and Uganda) experiences with GMO crops. Also improved agricultural production is an important factor of Kenyan GDP performance. An inductive approach was adopted. Methods of system and comparative analysis were applied in order to find crucial factors of institutional and legal capacity for biotechnology application in the Sub-Saharan region. Discovering the scope of the biotechnology research in these countries in the context of legal and social factors of technology transfer allowed some overall concluding remarks.

Data and method

This research was organized in two phases of empirical analysis. First, a method of ordinary least squared modelling was applied in order to check the influence of selected explanatory variables on economic growth in Kenya in 1982-2010. Economic growth value was taken in per capita measure and constant 2005 USD value. Since the goal of the study was to verify the importance of knowledge and research on economic expansion in Kenya, a set of explanatory variables consisted of: number of primary education pupils, researchers in higher education as a share of all researchers, the overall number of researchers per 100 000 farmers, and the agriculture value added (as annual % of growth). Data was extracted from the World development indicators and Agricultural Science And Technology Indicators, which provide on-line datasets. The analysis was conducted with the use of Gretl software.

In the second step of the research, biotechnology research papers were studied and their content analysis was conducted to review the scope of genetic modification possible application in Kenya. Papers were analyzed with the aim to determine the orientation of biotechnology research and did not focus on their biological scientific aspects. The Scopus database was searched using the keywords such as "transgenic crop", "transgenic plant", "agricultural biotechnology", "bt maize", "bt cotton" for Kenya. The screening was performed on publications from 2005 to January 2015. The papers were affiliated in Sub-Saharan African institutions, however for many cases, they were delivered in collaboration with the facilities from outside the region. 114 papers were found. All of them were analyzed against the methodology, crop species, institutions responsible and funding sources.

Literature review

By some researchers, increased use of biotechnology in agriculture could improve yields also in African agriculture and ameliorate food security (Chataway, 2005; Karembu et al., 2009; Dargie et al., 2013; Abidoye and Mabaya, 2014). It is expected to contribute especially towards arresting the effects of climate changes (savings in carbon dioxide emissions, fewer insecticide and herbicide sprays, conservation tillage) and drought-tolerant traits (Karembu et al., 2009; Bothma et al., 2010; Jha et al., 2011). Particularly, biotechnology may address problems such as effective control of the plant parasitic nematodes and other diseases of crops (Hassan et al., 2013). According to Food and Agriculture Organization (FAO) report, in the nearest future, a broad range of additional species and traits combinations will be launched in different regions of the World. Among them four crops: soybean, maize, cotton and canola, and two traits: herbicide tolerance and insect resistance, are the most likely to be released as GMOs in the World trade (FAO, 2014).

Nevertheless, the recognition of the advantages of biotechnology use in developing countries agriculture is ambiguous in the literature. First, implementation of biotechnology is costly, while especially small farmers in Sub-Saharan Africa (SSA) suffer because of insufficient level of state funding and domination of private equity (Chataway, 2005). The GM seeds as the object of Intellectual property protection (IPR) are expensive (Chataway, 2005). Apart from IPR, the international trade barriers and regulations concerning modified products are a potential limitation for the farmers to profit from biotechnology use. Diverse biotechnology regulations and zero tolerance policy in some countries affect the international trade of modified products (Paarlberg, 2005; FAO, 2014). Developing

countries policy makers fear of running commercial risks of losing sales to markets such as European Union, where the consumers are not confident about GMO safety for health and the environment (Paarlberg, 2005). Rejection or market withdrawals of modified products by importers in developed countries may have several socio-economic impacts on producers, consumers and agribusiness firms (FAO, 2014). Different policies on GMOs, unintentional movement of GM crops, different timing of approvals for GMOs, and difficulty in accessing information for products are the major constraints in the GMO related trade according to FAO (FAO, 2014). For less experienced farmers they may prove to be insurmountable.

Moreover, a wide social support for genetic technologies is indispensable for large scale on field application of biotechnologies, and it is not evident in Africa. According to Muchopa, Munyuki-Hungwe and Matondi, Africans exist in a value system which respects products as provided by the Creator both socially and culturally, so the ideas of cloning or by-products thereof are not acceptable in African beliefs and myths and affect the social and cultural lives of African people (2006). The opposition to GMO is represented in Sub-Saharan Africa by organizations such as South African Freeze Alliance on Genetic Engineering (SAFeAGE), The African Centre for Biosafety (ACB) and Biowatch South Africa (Bothma et al., 2005). According to Ogungbure's comment on applicability of biotechnology in Sub-Saharan, the culture in the region which embodies the totality of human experience and the tendency for survival within a social environment is in compliance with biotechnology (2011:94).

The reception of Western culture patterns, including technology and biotechnology in particular, may not be thoughtless process; attitudes towards biotechnology should be neither too enthusiastic nor too hostile, but rather cautious, rational and controlled (Tangwa, 2005). Application of modern biotechnology shall not conflict with conservation of traditional values and native heritage (Steenkamp and Wingfield, 2013). Successful introduction of biotechnology techniques in the region requires appropriate integration of science-based and traditional knowledge sources (Dargie et al., 2013). In this context, lack of incentives from private companies to research tropical plants constitute a certain risk for the maintenance of traditional crops (poor farmers may be perceived as week target market) (Paarlberg, 2005). People fear the risk of dominance of agricultural production for exports over-responding to local demand for consumption and the reinforcements of big plantations position in comparison to small ones (Andrzejczak, 2014). However, at the same time a niche for locally focused African biotechnology research appears.

Despite divergent opinions, the process of commercialization of biotechnology crops commenced in African continent (Egypt, Burkina Faso, South Africa) and is expected in other countries, such as Kenya (ISAAA, 2016). A *sine qua non* for biotechnology transfer to be enhanced is the introduction of an adequate legal framework. Research and innovation in biotechnology with respect to health and environment issues require a well-designed regulatory framework to evaluate genetically modified crops (Cochrane, 2014).

Biotechnology as an element of a broader concept of biosafety is an internationally regulated issue and requires implementation of multilateral agreements into national system. The laws derive from the Rio de Janeiro 1998 United Nations Summit, where the Convention on Biological Diversity was adopted under the UN Environment Programme. Kenya was the first country to sign the Cartagena Protocol, but it took Kenya almost a decade to enforce the National Biosafety Framework (NBF) (SCBD, 2014). Some African states, such as Burkina Faso, Liberia or Senegal made their biosafety framework

operational before Kenya, and some have not yet succeeded (e.g. Democratic Republic of Congo, Djibouti) (COP-MOP, 2014).

Based on the evidence from Kenya, the consensus between key government actors, clearly assigned responsibilities, strategy plan to advocate desired law and policy, alliances with different stakeholders, engaging experts from different fields in the regulation process, communication strategy, stakeholder mapping, involvement of good legislators, media strategy, involvement of public opinion are fundamental elements of the biotechnology legislation process (Karembu et al., 2010). Introduction of biotechnology laws does not mean allowing GMO crops in the economy. In the regulatory process in Kenya a decision to ban the import and planting of GMOs in 2012 due to health concerns ended the period of legal uncertainty on the issue (Nang'ayo, 2014). Since the decision to allow the cultivation of GMO maize and cotton are currently being pushed for approval by pro-GMO organizations, the situation may change according to different on-line sources, such as Ecowatch. In the meantime, there is a number of initiatives of international and regional character aimed at capacity building and direct biotechnology research in Kenya (NBS, 2016). These programs aim at solving institutional problems of research and education systems. Institutions such as International Institute of Tropical Agriculture (IITA) concentrate on research for development issues R&D, finding solutions for hunger, malnutrition, and poverty, including biotechnology research.

In Kenya large as well as small-scale farmers produce the crop and a significant part of the population depends on maize farming as an income-generating crop. The main problem are high yield losses and the necessity of pesticide application caused by five major stem borer species *Chilo partellus*, *Chilo orichalcociliellus*, *Eldana saccharina*, *Sesamia calamistis* and the economically important *Busseola fusca* (Mugo et al., 2005). The Insect Resistant Maize for Africa (IRMA) project is a collaborative effort between the International Maize and Wheat Improvement Centre (CIMMYT) and the Kenya Agricultural Research Institute (KARI). It has been developing genetically modified maize varieties by incorporating modified gene with constitutive expression derived from the soil dwelling bacteria *B. thuringiensis* (Bt) (Mugo et al., 2005).

Bt maize leaves were first introduced into Kenya in 2002 following National biosafety regulations (Mugo et al., 2005). This was followed by the first introduction of Bt maize seeds in 2004, after completion of biosafety facilities including the first Biosafety Level II green house and the first confined field trial site for growing the transgenic maize plants in Kenya (Mugo et al., 2005). From that time on they are still research carry on new resistance genes identification, safety use as well as fast detection of GM plants.

There are some evidence that pests quickly develop resistance to Bt maize. To delay the development of insect resistance to Bt maize it is recommended that farmers create a "refugia" of non-GE crops for the pests to feed on (Mulaa et al., 2011). Most small-scale farmers will not be able to create the required buffer zone or allocate land for a "refugia". That's why the interesting approach is the push-pull system, which was developed by International Centre of Insect Physiology and Ecology (ICIPE) in Kenya. Close collaborators include the governmental KARI and the Institute of Arable Crop Research (IARC) in UK. This technology intercropped repellent plants "push" the insects out of the fields to trap crops outside the fields that "pull" the insects in. It has been developed for integrated management of stemborers, striga weed and soil fertility. It is appropriate and economical to the resource-poor smallholder farmers in the region as it is based on locally available plants, not expensive external inputs, and fits well with traditional mixed cropping

systems in Africa (Pickett et al., 2014). It is now beyond the trial phase and is being actively disseminated in Kenya. Push-pull is a sustainable farming system, which can also protect the new generation of GM crops against development of resistance by pests (King et al., 2013). Genome engineering and creation of synthetic crop plants by combining approaches including new crop genomic information can contribute to push–pull farming systems (Pickett et al., 2014).

Another type of biotechnological approach in Kenya is *Agrobacterium*-mediated transformation. This approach is the gene delivery system, which is most preferred by plant biotechnologists because of its easy accessibility, tendency to transfer low copies of DNA fragments carrying the genes of interest at higher efficiencies with lower cost and the transfer of very large DNA fragments with minimal rearrangement (Gelvin, 2000). Therefore, plant transformation through Agrobacterium-mediated DNA transfer has become a favored approach for many crop species (Barampuram and Zhang, 2011). However, there are only few articles concerning uses of this modification to transferring important traits such as viral and bacterial disease resistance, prolonged shelf life and nutritional enhancement for African farmer-preferred cultivars of maize (Ombori et al,. 2013) as well as cassava (Nyaboga et al., 2013) and bananas (Uganda mainly, Tripathi et al,. 2010, Tripathi et al., 2012; Namukwaya et al., 2012).

New type of modification, which is now developed worldwide not excepting the African researchers is RNAi-mediated gene silencing. RNA interference (RNAi) is a promising gene regulatory approach in functional genomics that has significant impact on crop improvement. RNAi has also been exploited in plants for resistance against pathogens, insect/pest, nematodes, and virus causing significant economic loss (Younis et al., 2014).

The scope of the research which is conducted in Kenya will be reflected in the potential introduction of biotechnology to Kenyan agriculture. This will have important consequences for the market structure, the overall situation in the sector as well as the whole economy. In the next section, the assessment of the research will be provided in the context of economic development and agricultural research nexus in Kenya.

Results and implications

Agriculture is an important engine of growth for Kenya, so the decisions concerning rejection of genetic modifications of crops will have serious consequences for the future development. A model of the importance of the number of primary education pupils, researchers in higher education as a share of all researchers, the overall number of researchers per 100 000 farmers, and the agriculture value added (as annual % of growth) for the GDP per capita in Kenya in the period of 29 years was devised. The R squared correlation value for the OLS model was 0.67. It was found, that both the education on basic level and the research in agriculture do contribute to the overall economic outcomes in Kenya, and hence, constitute an important factor for its economic development possibilities. The more educated is the population, and the stronger is the role of education system both on the basic level, and the research – especially research in agriculture, the better are the outcomes of rural sector in the economy, and hence the economic performance of the country contributes to individual conditions of citizens.

Kenya is among the leaders of the region not only due to regulative activity, but also in the agricultural R&D spending and human resource capacity. Along with Nigeria, South

Africa, these three countries accounted for half the region's agricultural R&D investments in 2012 (WDI, 2016). In Kenya much more researchers are employed in the public sector than non-profit researchers. Among them, the number of researchers in higher education is significantly smaller than in the government agencies, but its share is constantly growing (ASTI, 2013). This indicates an increasing role of tertiary education and increasing importance of universities. On the other hand, negative correlation of researchers in higher education with per capita growth revealed by the model may indicate that researcher contribute more to economic development while conducting their studies than while engaging in the education process.

Table 1. Variables of GDP per capita (constant USD 2005) using observations for 1982-2010 in Kenya

Variables[a]	Coefficient	Std. Error	t-ratio	p-value	
const	−3134.13	561.271	−5.5840	<0.0001	***
Enrol. Prim Edu. log	540.632	83.3762	6.4842	<0.0001	***
Researchers HE	−3.82166	1.0405	−3.6729	0.0011	***
Res. Total per 100 000 farmers	11.1317	3.66303	3.0389	0.0055	***
Agric. VA annual growth	1.86145	0.78503	2.3712	0.0257	**

[a]No collinearity problem was detected, Variance Inflation Factors were respectively: 5.042, 4.048, 1.861, 1.113.

Source: (WDI, 2016), own elaboration.

Being aware of the possible revolution in Kenyan agriculture with a possible GMO allowance, current research in the field of biotechnology was analyzed. It was found that maize is the most important food crop in Kenya. The crops researched in Kenya are under the confined field trials, with the exception of Bt cotton, which is in commercial use in the latter. The analysis of biotechnology research papers allowed to report what kind of crops are modified in Kenya and for what purposes (Table 2). The techniques used in the research papers which were explored, are generally less advanced methods than current research conducted in USA, for corresponding purposes. Because of the differences of GMO regulations in USA and Europe, the scope of the research in Kenya is more closely related to issues in North American research on commercialized GMO. Commercial purposes genetic modifications are not conducted in the regions which rejected GMOs. A majority of papers was based on the genetic modifications developed by Monsanto or Syngeta companies. Only 6 papers concerning local plant based modification were found. Therefore the research is rather focused on the endogenous modifications which are subject of transfer into local environment, than on indigenous modifications.

Study results reveal, that research conducted in cooperation with the USA scientists and funded by Monsanto, concentrate mainly on GMO crops effectiveness and increased GMO resistance to larvae compared to non-GMO. They also focus to prove neutral character of GMO to the environment. Whereas the works done in cooperation with French or English researchers embrace fast pest resistance to endotoxines introduced to GMO plants. They also aim at proving the superiority of natural species refugia and technologies such as push-pull (without GMO) over genetic modifications of plants. Majority of publications on Bt rice were funded by Monsanto company. The papers which were published independently by scholars from African universities were in minority. So was the number of papers on new GMO for local farmers.

Table 2. Biotechnology research scope and funding sources in agriculture research in Kenya between 2005 and January 2015

Research interest – crop	Goal of modification	Type of institution	Funding (private, public, country)
Maize	Genetically modified (GM) with *Bacillus thuringiensis* (Bt) endotoxins for insect resistance : - environmental impact - GM detection by PCR (polymerase chain reaction) - Effectiveness of bt modification - Evaluation of maize genotypes - bt vs insect resistance RNAi-mediated, VIGS (virus-induced gene silencing) system	Universities, as well as CIMMYT, ICIPE, KARI, in cooperation with USA and Canada universities	Mainly Syngenta Found. for Sustainable Agriculture and the Rockefeller Found. International Found. for Science (IFS)
Push-pull farming system	Push–pull farming systems for pest control together with bt modification	Universities with cooperation with UK	Governments of SE., DE, CH, DK, NO, FI, FR, KE, GB Gatsby Charitable Found., Kilimo Trust and the EU, Rockefeller Found., Biovision, McKnight Found., Bill & Melinda Gates Found.
Cassava	*Agrobacterium*-mediated transformation for east African farmer-preferred cultivars; transferring virus resistance and prolonged shelf-life	University, IITA in cooperation with swedish university	IITA, USAID
Banana	Gene transfer from rice enhanced resistance against Xcm coused Banana Xanthomonas wilt (BXW)	IITA from Kenya and Tanzania, USA	CGIAR Research Program on Roots, Tubers and Bananas as well as Bill & Melinda Gates Found. and IITA
Sorghum	Anti-fungal genes introduced by particles bombardment	KIRDI* institute in cooperation with German university	n/a
Cowpea	Genetically modified (GM) with *Bacillus thuringiensis* and electroporation-mediated insecticide genes	Universities in Kenya and Nigeria	IITA Nigeria
Sweetpotatoes	Genetically modified (GM) with *Bacillus thuringiensis* - analysis of non-target effects in agroecosystems caused by GM	Uganda university and NaCRRI** cooperation with Kenya African Institute for Capacity Development, International Potato Center	Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)
Yam	*Agrobacterium*-mediated transformation using axillary buds as explants	IITA Kenya	(IFS)

* Kenya Industrial Research and Development Institute
** National Crops Resources Research Institute

Source: own elaboration.

At this point they are financed by a variety of partners national and international, public and private and cooperate with a number of actors on the local level for the purposes of research and the transfer of developed technology solutions. However, large institutions

such as IITA, with a developed collaborative network should concentrate to constitute a framework for conducting research in Africa and focused on African economy's needs. Increasing role of such institutions is crucial, for the agricultural research to serve the needs of Sub-Saharan societies.

Based on these findings, it can be concluded that the agricultural research on biotechnology in Sub-Saharan Africa is highly dependent on the goals of funding entities. Research funded by the private companies and American resources are generally aimed at the promotion of biotechnology, while quite the opposite objectives motivate the Europeans. Neither actually concentrates on local farmer's needs. This is a strong argument towards the increased involvement of state and regional institutions to engage in the selection of research topics and scope.

Conclusions

Innovations, understood as more effective use of resources, require enabling economic environment. The entrepreneurs must be motivated to introduce and use technology, research facilities motivated to conduct research suitable for commercialization and education system to train human capital capable to manage and use the technology. Governments should provide required environment and to finance elements of these processes. Such systems are needed in Sub-Saharan region in order to enhance the catching-up process for pro-poor economic development. The question remains, whether biotechnology can be a potential leverage for African agriculture, which should be supported by vast groups of local interests supporters. This paper addressed agriculture biotechnology research conducted by Kenyan scientists and the focus of that research in the context of the importance of the research for agriculture development and country's economic performance. Our model revealed that Kenyan GDP per capita performance is correlated with the research in agriculture and the level of education of the society. Therefore it can be concludes, that the scope of the research and its future application on the market are important factors of economic development in this country. If a thesis that using genetic modifications increases productivity of agriculture is accepted, than we can assume, that indeed adoption of pro-GMO policy could contribute to economic growth in Kenya.

However, Sub-Saharan African countries represent vast array of approaches to genetic modification, from rejection to approval. Contradictory opinions and polarized attitudes towards the use of biotechnology make regulation process in Kenya challenging – the country first supporting biotechnology commercial use, then rejected it in 2012. Now the question of allowing GMOs is back on the table. This decision is urgent, since appropriate legal framework is required to enable the emergence of a systemic approach for the innovations and transfer contributing to local needs. Financing research from international resources of private and public character is indeed beneficial, but it may not become profitable mainly to the foreign entities. Based on our findings, the choice of technologies appropriate for absorption and research should be motivated by national interests of farmers, not a decision depending on private companies R&D departments. Monsanto and Syngenta companies activities are severely criticized for hostile attitudes towards Kenyan market. At the same time, these companies are financing large part of the local research and hence influence its scope. Foreign governmental agencies are realizing their policy goals

from approval to rejection, by choosing the research goals corresponding to their agenda. This indicates that the research in biotechnology is currently orientated towards external interests and promotion of the donor agenda.

The role of regional organizations in Sub-Saharan Africa, as coordinators of regional policy should be enhanced for that matter. Successful research projects require not only the financial resources but also the institutional framework to manage the resources offered. International, indirect technology transfer projects can help overcoming the constraints and building the capacity both to produce or to absorb technology. They may support local technology research initiatives oriented towards local demand, using their experience, knowledge and skills. If Kenya will allow biotechnology in commercial use, effective communication strategy will be required and a national strategy to manage government and foreign funded projects for the profit of local farmers not transnational companies' or foreign developed countries.

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Changes in Polish Foreign Trade of Cattle Livestock and Beef

Abstract. The main objective of the study was to analyse the changes and the conditions of foreign traded beef. The economic and political situation has had an impact on Poland's foreign trade of agricultural food products. The main factors affecting international trade, and which have significantly decreased the growth rate of exports and imports of animal products, are the following: decreased oil prices and exchange rate fluctuations, uncertainties related to the conflict in Ukraine, restrictions in trade with Russia, destabilisation in the Middle East and concerns about the future of the euro zone.

Key words: export, import, foreign trade, livestock, beef, Poland

Introduction

The main objective of this paper is to analyse changes and conditions of Poland's foreign beef trade in 2011-2014. The country's foreign trade in agricultural-food products has been influenced by the economic and political situation (Rynek rolny, 2016). The main factors affecting international trade have been the fall in oil prices and exchange rate fluctuations, the uncertainty associated with the conflict in Ukraine, restrictions on trade with Russia, destabilisation in the Middle East and concerns about the future of the euro zone. Both the growth rate of exports and the growth of imports of animal products decreased significantly during the 2011-2014 period.

In 2015, the situation in Polish foreign trade was influenced by the following factors:
- the economic situation in the countries of the EU and other developed countries;
- Poland's trade partners;
- economic growth in developing countries;
- the economic situation in markets to the east (CIS, especially Russia and Ukraine);
- political and legal factors (restrictions on exports to Russia, restrictions related to African swine fever, ritual slaughter);
- deterioration in the relationship of supply and demand on the national markets and the stabilisation of plant products on global markets;
- the improving relationship between supply and demand on national markets for animal products;
- low agricultural commodity prices on global markets;
- appreciation of the zloty to the euro and weakening of the euro to the US dollar.

In 2015, meat, offal and other meat product exports were expected to increase. Market dynamics were expected to stem the decline of red meat and slightly increase the import of animal products. Live animal and meat product imports were expected to rise (Handel…, 2015).

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Methods

This research has been carried out using following methods: monographic, analysis, synthesis and statistical analysis. The data were collected by Poland's Central Statistical Office (CSO), Ministry of Finance and The Institute of Agriculture and Food Economics – the National Research Institute. The study used methods of descriptive analysis and comparison, based on the material collected. The analysis covers the period 2011-2014 and estimates for the year 2015. The descriptive analysis is support by tables to present the information.

Results and discussion

During 2011-2014, chilled beef was the most commonly exported beef product (it commanded a 63% share of total beef exports). Frozen meat accounted for 20%, while offal of bovine animals (11%) and livestock beef (6%) commanded a lower share. The European Union took 87% of Poland's beef products. In 2014, Japan abolished its embargo on beef product imports from Poland, which had been introduced in 2001 in response to the presence in Europe of mad cow disease. Despite Russia's placing an embargo on certain beef products from the EU and Poland, the volume of Polish exports of beef products in the last months of 2014 were similar to 2013 figures.

During the analysed period, the commodity structure of imports of beef products underwent significant changes from the four years that preceded it. The share of live bovine animals in the value of imports increased from 30% to 56%, while the share of imports of frozen meat fell over the same period from 16% to 7%, as did beef offal, from 25% to 10%. Traditionally canned beef (4%) accounted for a small share of imports (Handel …, 2016). Throughout this period, approximately 99% of the value of imported beef products came from the EU. Poland imported beef mainly from Germany, Ireland, Slovakia and the UK.

It is expected that the volume of exported beef products will be similar this year to last year. Beef products imports are likely to increase by about 13%, mainly due to a significant increase in the import of live bovine animals. In the end, a decline in the positive balance of foreign trade turnover was primarily due to increased imports.

The Global Beef Market

The global production of beef in 2015 was 58,4 million tonnes, or about 2,2% less than 2014 production. This resulted mainly from a decline among the leading beef manufacturers—The United States (2.4%), Brazil (3.1%) China (2.8%), Australia (1.8%), Russia (1.1%) and Canada (4.5%). This large reduction could not compensate for the increase in EU-based producers (up 2.3%), Mexico and Argentina (up, respectively, 1.3% and 1.5%) (Rynek …, 2016).

In almost all countries that saw a fall in production, a shorter- or longer-term reduction in cattle numbers preceded it. In the United States, this occurred in the last eight years. In December 2014, the cattle population was about 8% less than in 2006, but at the same time about 1% higher than in the previous year. The main factors in the per annum growth were improving pasture conditions and lower feed costs. Brazilian beef production declined due

to drought, which occurred in the most important areas of production and lasted for two consecutive years.

In China, the production decline was a reflection of the rising costs of rearing cattle and the Chinese processing industry's preference for imported bovine animals, which are often cheaper than native cattle. In 2015, China imported 663,000 tonnes of cattle and beef, a 59% rise over the previous year. A decisive factor in the increase was China's agreement with Australia on free trade and the high competitiveness of Australian cattle. Imports also promoted demand (Rytko, 2015).

In Russia, the decline in livestock and beef production has now lasted for twenty-five years. During that time, the cattle population has decreased by approximately 70%. For the sector, there are 53 operating programmes distributing 10.2 billion rubles in support funds. This support goes mainly to companies with large-scale production. In 2015, capital available for investment decreased as a result of the economic crisis, which weakened the ruble and brought high volatility, as well as accelerated inflation and rising interest rates. More farm animals were imported in an attempt to rebuild and improve the gene pool. In 2015, 100,000 head of cattle intended for further breeding were purchased from foreign customers. More than half of them (55,000) came from Australia. This marked a 72% increase over the previous year's total (Rynek …, 2016).

In 2015, beef production in the EU-28 increased. The highest growth occurred in Italy (11.1%), Spain (9.5%), Belgium (3.9%), Austria (3.2%) and France (2.2%). Italy is the third-largest producer of beef in the European Union, though the country's production has fallen in successive years. Italy has a preponderance of relatively small, family farms that specialise in cultivating young calves, imported from France or from Poland. In 2015,those imports were 20% lower than in 2012. As a result, Italy's share of the EU's beef production decreased from almost 13% in 2012 to 10% in 2015 (Rynek …, 2016).

Spanish beef production is done on the strength of relatively cheap feed and high production efficiency. Spain is the fifth-largest producer of beef in the EU-28. It accounted for 8.2% of EU-28 production in 2015, higher than the 7.7% it made up in 2012.The EU's largest beef producer, France saw a relatively small increase in production in 2015 over 2014. The country's long-term trend line nonetheless points upward, though growth will remain relatively poor. In 2015, France boasted the largest herd of suckler cows in the EU-28, accounting for 34% of the bloc's overall population. At approximately 19%, France's share of EU beef production has been relatively stable for many years.

In December 2015, the world's cattle population was 971.5 mln units, or 1% higher than in 2014. In China, the decline in the population (0.2%) was small enough that the herd size could be considered stable. The population declined 4.1% in Australia, 2.1% in Russia, 3.5% in Mexico, and 2.5% in Canada. Brazil (2.9%), the USA (3.5%) and the European Union (0.2%) all saw their populations increase (Rynek …, 2016).

In Russia, the reduction of herds is the continuation of a long-term downward trend, caused by low profitability, particularly of milk production. This has helped to reduce the number of cows, as the end result is a decline in livestock and beef production in connection with the global crisis and the difficult access to credits. Moreover, imported animals have become too expensive for many beef producers.

In Australia, the rising price of cattle and beef and the lack of feed, especially in the northern part of the country, the country's centre of cattle ranching, contributed to substantial reductions in the number of cows and heifers, especially in 2013-2014.This reduction was facilitated by the free trade agreement with China and other Asian countries

and the attractive prices of exports. As a result, in December 2015, the bovine population was 10% smaller than in December 2012.

Brazil has increased its cattle population as a result of improved genetics and production efficiency. However, producers complain of the depreciating Brazilian currency, which does promote exports, but also leads to higher cattle production costs due to the need to import animals with improved genetic characteristics, medicine or feed ingredients.

In 2015, Australia exported 1.336 thousand tonnes of live cattle, which was 3% more than in 2014 and twice more than in 2012. Exports to Indonesia accounted for 15% less and to China 30% less than in 2014, which had reached a record level. At the same time, exports to Vietnam were higher by about 81%.

In Argentina, the party that ruled until the end of 2015 had sought to provide cheap beef to Argentinean consumers. However, the provisions in force in the period 2005-2015 resulted in a decline in production and exports. Exports were taxed; the export of meat was reduced and in some cases banned, while quotas on the provision of cheap beef to local supermarkets were imposed. As a result, Argentinean beef production decreased by 17% between 2007 and 2015. The meat industry also bore the losses as numerous slaughterhouses and processing plants were shuttered. The newly elected government has changed its policy governing the beef sector, including eliminating the 15% export tax.

The European Commission predicts that in the EU-15, the average increase in beef production may reach 1.4%, but in some countries will be much larger. Production may increase by 6.2% in Belgium, 4.1% in France, 3.4% in Italy and 2.2% in the UK. In these countries, increased slaughtering of cows would additionally increase beef production. In the UK, increased production could increase exports by upwards of 30% and decrease imports by approximately 1%. In the EU-13, production is expected to rise by about 7%, mainly in Romania, Czech Republic and Lithuania.

Poland's cattle population and beef production

In the last several years in Poland the number of cows has fallen steadily, while cattle numbers have increased. This has led to changes in the structure of the overall bovine population (Table 1). There has been a slight increase in the number of suckler cows - a few to several thousand units per year - but at 6.5%, they make up only a small share of the total cow population.

At the end of 2014, the cattle population stood at 5,660,300 units, or 1.1% more than in 2013. The number of cows was lower by 1.6% while other cattle increased by 3.3%. A positive development for the potential of Poland's beef market was the increase in the population of young cattle and calves by, respectively, 5.5% and 2.4%. Slightly improved profitability helped the number rise, though it was accompanied by a decline in the price of fattening calves and young cattle for slaughter. The share of the remaining cattle numbers increased to 58%, while cows decreased to 42% (tab. 1 and 2).

The increase in the number of cattle varied by farm type. The number on individual farms, home to 94% of the cattle population, grew less than the average. At the same time, the number of private companies and cooperatives of agricultural production engaged in the rearing of all age groups of animals increased In the public sector the cattle population remained at 2014 levels, but its importance was marginal.

Table 1. The number of cattle at the end of the second quarter and annual beef production

Years	Population in thousands of units	Including				Production of beef in thousands of tonnes
		cows		other cattle		
		thous.units	%	thous.units	%	
2011	5 762	2 626	46	3 136	54	751
2012	5 777	2 578	45	3 199	55	718
2013	5 861	2 526	43	3 335	57	714
2014	5 920	2 479	42	3 441	58	805
2015	5 960	2 444	41	3 516	59	918

Source: the author's own calculations based on "Market Analysis: Meat market. Status and prospects". Market analyses. Ed. IAFE - NRI, ARR. Warsaw 2015 and 2016.

Table 2. The number of cattle and beef production

Years and half-years	Cattle older than 1 year in thousands of units	Percent of slaughter cattle older than 1 year	Production of beef in thousands of tonnes
2011	X	16,2	751
I half-year	4 173	16,1	374
II half-year	4 280	16,3	377
2012	X	15,3	718
I half-year	4 139	14,9	345
II half-year	4 309	15,7	373
2013	X	15,2	714
I half-year	4 132	14,0	332
II half-year	4 275	16,4	382
2014	X	16,7	805
I half-year	4 179	16,2	394
II half-year	4 312	17,2	411
2015	X	18,5	918
I half-year	4 225	17,6	418
II half-year	4 291	19,2	500

Source: the author's own calculations based on "Market Analysis: Meat market. Status and prospects". Market analyses. Ed. IAFE - NRI, ARR. Warsaw 2015 and 2016.

Despite stagnation in the cattle population last year, beef production rose significantly, to 807,000 tonnes, a 13% rise over the previous year. This includes the effect of rising imports of calves, which increases beef production. In 2014, 31,900 calves were imported, a 45% increase over 2013.

According to CSO data, 2 million calves were born in 2014, or 10% more than a year earlier. 17% of the calves born were slaughtered, compared to 21% in 2013, and 24% in 2011 (Table 3). The ratio of calves slaughtered to calves born has been decreasing gradually for years, partially because more calves are being exported. 120,000 calves were exported in 2014, a full 33% less than in 2013. The drop in calf exports is offset by higher beef exports.

Table 3. Birth and slaughter of calves and cattle calf production

Years and half-years	The birth of calves in thousands of head	Slaughtered calves in %	Production of live cattle in thousands of tonnes
2011	1 967	29	47
I half-year	1 193	25	24
II half-year	774	36	23
2012	1 879	24	41
I half-year	1 123	22	22
II half-year	756	25	19
2013	1 835	21	33
I half-year	1 043	18	17
II half-year	792	24	16
2014	1 899	16	30
I half-year	1 210	14	15
II half-year	689	18	15
2015	1 992	5	14
I half-year	1 199	6	8
II half-year	793	5	6

Source: the author's own calculations based on "Market Analysis: Meat market. Status and prospects". Market analyses. Ed. IAFE - NRI, ARR. Warsaw 2015 and 2016.

34,000 tonnes of veal was produced, or 3% more than the previous year. The successive increase in the last few years is the result of growing imports and the decreasing number of calves exported.

Foreign trade in the beef market

Despite Russia placing an embargo on beef imports from the EU, Polish exports of live cattle, meat, offal and processed beef were, at roughly 350,000 tonnes, about the same in 2014 as they had been in 2013. The value of exports decreased by 6% to about 1,050 million due to a decline in transaction prices, among other factors (Skup …, 2012). Although Russia accounted for 25% of EU exports of beef products to third countries, Polish beef remained competitive in terms of price on the EU market. Therefore, the restrictions Russia placed on imports did not have such a large impact on Polish exports of beef products. The European Commission reported that in 2014, EU beef export volume increased by 29% due to an increase in exports to countries such as Hong Kong, the Western Balkans and the Philippines. EU imports from third countries increased during this time by just 1%. Meanwhile, imports from Argentina and Uruguay fell as a result of internal policies, while Australia and Brazil both increased sales to the EU.

Table 4. Foreign trade turnover of beef equivalent meat products (thousands of tonnes)

Specification	2011	2012	2013	2014	2015
Total export	312,8	315,0	332,4	359,7	414,4
Cattle	24,5	18,6	14,3	11,5	10,8
Meat and offal	288,3	296,4	318,1	348,2	403,6
Total export	22,0	23,1	28,1	34,1	42,5
Cattle	4,9	6,9	12,6	15,0	15,7
Meat and offal	17,1	16,2	15,5	19,1	26,8
Balance	290,8	291,9	304,3	325,6	371,9

Source: the author, based on "Market Analysis: Foreign trade in agri-food products. Status and prospects". Market Analysis IAFE-NRI, AMA and the Ministry of Agriculture and Rural Development. Warsaw, April 2016.

Polish imports of beef products increased by 21%, primarily as the result of an 18% increase in imports of live cattle, as well as chilled meat and beef offal. At the same time, imports of frozen beef decreased by 15% to 3,400 tonnes.

Foreign trade in beef showed a 933 million-euro surplus, but was approximately 79 million less than in 2013. 300,000 more tonnes of beef were exported than imported, which was 3.3% lower than in the previous year (Table 4).

Table 5. Foreign trade of beef (in millions of euros)

Specification	2011	2012	2013	2014	2015
Total exports including	979,8	1 083,0	1 114,0	1 107,6	1 359,6
Chilled beef	682,4	731,7	753,7	742,3	934,8
Frozen beef	124,9	161,9	196,2	213,6	266,8
Canned beef	57,2	69,8	71,5	67,1	71,3
Offal	16,4	21,9	25,6	31,7	35,0
Beef and veal livestock	98,9	97,7	67,0	52,9	51,7
Total imports Including:	75,9	81,4	101,7	121,5	142,5
Chilled beef	26,3	29,0	26,3	34,7	44,6
Frozen beef	14,2	11,2	15,2	10,7	15,5
Canned beef	4,2	4,6	6,4	6,6	6,8
Offal	11,2	7,1	5,7	8,0	10,8
Beef and veal livestock	20,0	29,5	48,1	61,5	64,8
Balance	903,9	1 001,6	1 012,3	986,1	1 217,1

Source: the author, based on "Market Analysis: Foreign trade in agri-food products. Status and prospects". Market Analysis IAFE-NRI, AMA and the Ministry of Agriculture and Rural Development. Warsaw, April 2016.

As in 2013, 290,000 tonnes of chilled and frozen beef were exported in 2014 (Table 6). EU-bound beef exports decreased by 2.5% and to third countries increased by 20%. The increase in non-EU countries was primarily due to an increase in exports to countries

outside the CIS. Beef exports to CIS countries decreased by 4,700 tonnes, including to Russia by about 4,300 tonnes. Nearly 66% of the exported beef was exported to Italy, Germany, the Netherlands, Spain, France and Greece, which together accounted for 67% of Poland's total beef export volume.

Table 6. Polish exports of livestock, meat and beef by destination (thousands of tonnes)

Specification	2011	2012	2013	2014	2015
Beef fresh, chilled, frozen Including to:	266,0	272,9	290,0	308,8	366,7
UE-15	163,6	195,3	237,2	243,4	289,8
UE-13	17,1	16,8	24,3	31,3	31,9
Other countries	85,3	60,8	28,5	34,1	45,0
Including: ESL	13,5	16,7	18,2	13,5	8,3
Canned beef Including:	17,2	19,3	18,8	19,5	20,6
UE-15	12,3	13,6	13,6	14,4	14,7
UE-13	4,7	5,5	5,0	4,8	5,7
Other countries	0,2	0,2	0,2	0,3	0,2
Including: WNP	0,0	0,2	0,0	0,0	0,0
Cattle and calves total in the thousands of heads Including to:	344,6	305,0	226,8	161,9	138,7
UE-15	279,4	258,3	192,1	130,3	109,5
UE-13	17,1	8,4	17,7	13,0	10,2
Other countries	48,1	38,3	17,0	18,6	19,0

Source: the author, based on "Market Analysis: Foreign trade in agri-food products. Status and prospects". Market Analysis IAFE-NRI, AMA and the Ministry of Agriculture and Rural Development. Warsaw, April 2016.

Canned beef exports totalled 19,500 tonnes and were 4% higher than in the previous year. The decline in the value of exports of canned beef was the result of lower prices, among other factors. 99% of exports of canned went to EU countries, including to Sweden (4,400 tonnes), Germany (3,600 tonnes), Finland (2,900 tonnes) and Czech Republic (2,000 tonnes). 161,000 head of cattle and calves were exported last year—nearly 30% less than in 2013 (Rocznik …, 2013), with a value which likewise decreased, by 22% to 52.5 million euro. The average weight of exported animals increased by 14 kg. The export of calves mainly decreased. In 2014 it was about 58,000, which was slightly lower than in 2013. The weight of calves exported increased, while the price per unit declined. The drop in cattle and calf exports was due to their lower profitability and decreasing interest among Member States in purchasing them from Poland. Exports to the EU-28 decreased by 32%, but rose to non-EU countries by 10%. Cattle exports to EU countries including Italy, the Netherlands, Spain and Croatia recorded the largest drop, while to Bosnia and Herzegovina exports rose slightly. The export price of cattle and calves also fell slightly.

Table 7. Polish exports of livestock, meat and beef by destination (in millions of euros)

Specification	2011	2012	2013	2014	2015
Beef fresh, chilled, frozen Including:	807,3	893,6	950,0	955,9	1 201,6
UE-15	504,9	656,5	779,8	769,3	962,9
UE-13	55,8	59,0	78,8	91,2	99,9
Other countries	246,6	178,1	91,4	95,4	138,8
Including: ESL	38,1	50,8	61,2	39,8	29,1
Canned beef Including:	57,2	69,8	71,5	67,1	71,3
UE-15	40,8	48,8	52,6	49,9	52,1
UE-13	15,9	20,4	18,6	16,6	18,7
Other countries	0,5	0,6	0,3	0,6	0,5
Including: ESL	0,1	0,4	0,1	0,1	0,0
Total heads of cattle and calves (in thousands) Including to:	98,9	97,7	67,0	52,9	51,7
UE-15	69,1	69,3	49,4	37,3	35,0
UE-13	12,5	6,7	10,4	6,6	6,2
Other countries	17,3	21,7	7,2	9,0	10,5

Source: the author, based on "Market Analysis: Foreign trade in agri-food products. Status and prospects". Market Analysis IAFE-NRI, AMA and the Ministry of Agriculture and Rural Development. Warsaw, April 2016.

Imports of cattle increased by almost 22,000head, due mainly to higher imports of calves (9,300) mainly from Lithuania and Slovakia as well as domestic cattle weighing more than 300 kg for slaughter. The increased imports brought about a decline in prices. The average weight of imported animals decreased by 10%, with cost savings of 3%.

Imports of beef were 2,500 tonnes higher than a year earlier, mainly due to a 38% increase in chilled beef imports. Polish beef was imported principally by Germany, Ireland, Slovakia, Great Britain, the Czech Republic and Lithuania.

Imports of canned and beef offal were higher by approximately 29% compared to 2013. This was mainly the result of a 45% increase in imported beef offal. The principal markets for the supply of canned beef were Germany, the Netherlands and Belgium, while the Netherlands, United Kingdom, Germany and Ireland were the largest importers of Poland's offal.

The European Commission predicts that this year, beef production in the EU could be approximately 1.5% higher than last year. Exports will increase by 8%, while imports will fall by approximately 1%. The situation in the pork market and the increase of poultry production may affect the beef market, especially increased cost-competitiveness and the related substitution effect.

Exports of beef products from Poland in 2015 may be at a level similar to 2014. Exports may favour a slight increase in the consumption of beef in the EU and the anticipated increase in EU exports to third countries. The drop in beef prices should come

to an end, which ultimately should result in an increase in the value of exports to 1,046 million euros.

Polish imports of beef products are likely to grow at 13% as a result of increased imports of live bovine animals. Exports are expected to outstrip imports this year by more than 293,000 tonnes. The decrease in the positive balance of the foreign trade of beef to approximately 917 million euros will be primarily the result of growth in imports.

Conclusions

Despite the introduction of the embargo on beef imports from EU countries by Russia, Polish exports of meat and live cattle, meat offal and milk was similar to the level of the 2014. The value of Polish exports fell by 6% due to, among other factors, a decline in transaction prices. Polish beef prices were competitive on the EU market - the limits imposed by Russia didn't have a significant impact on Polish beef exports. Polish imports of beef rose by 21%, primarily because the country brought in more chilled meat and beef offal. In 2015, a slight increase in exports is expected to result from increased domestic production. The increase in exports would also maintain the price advantage Polish beef exported to the EU market commands. A possible recovery in demand for beef in EU countries and the expected increase in demand for beef in Asian countries (eg. Hong Kong and China) would also be a boon. The decision of the Constitutional Court of December 2014 regarding the ban on ritual slaughter as being out of compliance with the Constitution could also have a beneficial effect on the Polish beef market.

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Innovative Clusters Development: Polish Experience for Ukraine while Building Triple Helix Ecosystem in Agribusiness

Abstract. The article is dedicated to the investigation of international experience on innovative clusters development in agribusiness from two different angles (on the example of the whole of Poland and of the Warsaw University of Life Sciences Cluster of Innovation in Agribusiness, in particular). The current Ukrainian innovation model is analyzed and compared to the Polish one, within the EPIC framework. Principal lessons Ukrainian policy-makers can learn from Polish experience are identified and analyzed through the prism of SWOT as long as some recommendations for national innovation development strategy are provided.

Key words: cluster, innovations, agribusiness, triple helix, innovations development framework, innovation models, Poland, Ukraine

Introduction

Recent world globalization processes have resulted in situations where simple scientific research and inventions of new products have been outrun by the commercialization of innovations. In this paper we will focus on clusters as a way of bringing the actors of innovative processes closer in order to improve competitiveness, get access to new technologies, and make the process of implementing innovations cheaper, faster, and easier in agribusiness. M. Porter in his 'The Competitive Advantage of Nations' (1990) described so-called first clusters (business cluster, competitive cluster), which referred to geographic concentrations of interconnected businesses, suppliers, and associated institutions in a particular field. Clusters evolved into something more complicated and the phenomena of 'regional innovative models'; however, they are still based on the integration of different market players for creation of mutual benefits. Today they are represented by clusters themselves, techno parks, industrial districts, resource areas, competence blocks, networks, local production systems, and others (Brodzicki, 2002). We will use the term 'cluster', but still research results could be applied to any of above-mentioned embodiment forms of regional innovation models.

For Ukraine, which has faced serious political and economic challenges over recent years, innovation policy is a promising tool to improve national competitiveness and overcome deep crisis. Agribusiness is a critically important sphere of the Ukrainian national economy as, for example, food products accounted for 38% of national goods exported in 2015 according to UkrStat State Statistics Service (2016). In addition to this, the sector suffers from low efficiency due to obsolete equipment and almost not using the potential of

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related R&D projects (Androshchuk, 2009). Therefore, the results of this research could be extremely valuable for stakeholders in one of the biggest economic spheres of Ukraine. The paper's methodology encompasses a general situation overview in Ukraine, investigation of recent Polish experience in terms of cluster development, country comparisons under EPIC framework, and building a SWOT-analysis matrix. We investigate the potential of implementing in Ukraine foreign experience of cluster development both on macro- (generally in Poland) and microeconomic (on the example of particular organization) levels as well as figure out potential challenges Ukraine may face in the future.

Analysis of current innovation in Ukraine

For emerging countries (Ukraine in particular) it is of vital importance not only to utilize foreign innovations but also to produce them in order to bridge the gap to developed countries (Bazhal et al., 2015). The innovative potential of Ukraine developed when it was part of the USSR, and currently decent quantitative indicators characterize its current level. However, after the collapse of the USSR, systematic economic problems spread into the innovative sphere as well (Poruchnyk, 2004). Andoshchuk (2009) in his research figured out that lack of financing (as indicated by 80,1% of surveyed enterprises) was a primary barrier to implementing innovations in Ukraine. In our view the problem is more comprehensive with a core weakness in the national innovation system and commercialization of innovations. Nevertheless, Ukrainian innovative potential is still preserved, which could be proven by active participation of Ukrainian scientists in different international research projects. On the other hand, they are doing it mostly by themselves, so national economy does not receive direct benefits (Androshchuk, 2009). Among possible reasons for low commercialization of innovations is the poor role played by universities in the national innovative process. In practice there are no strong ties between universities and companies in most economic sectors, state research centers and universities, and state research institutes and companies in Ukraine. The Ukrainian innovation model is characterized by several 'double helix' models of university-industry or government-industry cooperation (Romanovskyi, 2012). Fragmentation of innovative systems is not a unique case for Ukraine, as all the countries that were under communism ideology experienced it. In fact, such a system eliminates entrepreneurial (third) role of universities building a decent ecosystem for commercializing new ideas and products (Gryshchenko, 2012). Most research in Ukraine (75%) is performed by State Academy of Science under conditions of extreme underfunding. Only 50% of national universities participate in applied R&D projects in cooperation with business while in small towns the situation is even worse (Yegorov, 2009). More than 75% of university professors are engaged only in the teaching process. Moreover, Ukraine is facing the problem of science aging and brain drain as youth prefers building careers abroad or in the private sector due to extremely low salaries in state-controlled research institutions. State owned and funded universities get low financial support for research, which results in obsolete research facilities (Yegorov and Ranga, 2014). Ukrainian legislative base regarding innovation implementation is still far from perfect: some laws are non-compliable with each other; state budget is oriented towards populist steps of cutting down the budget deficit but not long-term R&D projects. Currently, the point is in how Ukraine can reform its innovative model in order to increase national competitiveness under globalization challenges and *Deep and Comprehensive Free*

Trade Area with the EU. Unfortunately, in Ukraine the government innovative strategy for 2010-2020 does not include any systematic reformat but only too-broad recommendations to change the legislative base, make business climate more friendly for investments, and increase the funding of research activities. Moreover, there is no standardized framework which will stimulate and coordinate local innovative initiatives (clusters) development. In the agricultural sphere all the problems of the national innovation model are clearly manifested. Therefore, we will try to look at this problem from another perspective – investigating foreign experience and trying to find lessons Ukrainian policy-makers can learn from it.

As has been previously mentioned, clusters are considered to be a powerful tool of improving enterprise competitiveness and introducing innovative solutions. In Ukraine there are many regional clusters, which were formed mostly on the basis of industrial cooperation for increasing competitiveness all over the country but not as a source of innovation implementation (Gutz, 2015). However, their innovative potential is not used completely. According to Ffowcs-Williams (2015) because of current economic realities successful functioning of clusters is possible only under triple helix ecosystem of business-government-science integration. There are some examples of such new generation clusters in Ukraine - the best clusters were created by the institutes of the National Academy of Sciences of Ukraine with strong technological orientation (Paton Institute for Electric Welding and the Institute of Mono-crystals). They accounted for more than 95% of all Ukrainian innovative production developed and commercialized in 2000–2010 by techno parks (Yegorov and Ranga, 2014). Unfortunately, decent results were shown only until the cancellation of a preferential tax regime in 2005. Today a few clusters are working efficiently in Ukraine (Strogilopulos, 2011). To specify, Kyiv Polytechnic University Science Park and Lviv IT Cluster have shown rapid growth recently but still their activities are mostly oriented on acquiring new cluster members and educational events while innovative research activities remain secondary. In agribusiness the potential of cluster cooperation and triple helix ecosystem is also not utilized properly (Stanasyuk and Olihovska, 2014).

Polish national experience in cluster development

According to Porter (2000) the first clusters were created spontaneously – mostly based on geographical proximity and industrial cooperation. However, today their creation has become a significant part of regional innovation policy all over the world and in EU countries in particular. In Poland, past organizational solutions such as co-operatives, guilds and economic self-governments have lost their effectiveness and become invalid (Mazur, 2015). In the context of innovation commercialization, a relatively new concept of triple helix came to the fore front. According to Leydesdorff and Etzkowitz (1995) the relations of university-industry-government (so called triple helix) evolved from industry-government cooperation due to the increasing role of universities as research institutions. This phenomenon has great potential of overcoming the challenges of the linear innovation model and making the process of implementing and commercializing innovations more efficient. For market economies that were under direct communism impact (e.g. Ukraine and Poland) triple helix clusters are an extremely promising solution for improving the whole national innovation model.

Joining the EU has provided Poland with support programs for innovation development, which turned into a tool of Union policy, enabling such things as funding of

B2B relations, establishing co-operation between entrepreneurs, scientific centers and administration (Plawgo, 2014). Creation of innovative clusters in Poland is a part of programs, projects, and tools under EU *Cohesion Policy 2007-13: National Strategic Reference Framework*, which forms a complex of factors that individually and jointly participate in generation, selection, and diffusion of innovations. Polish innovation models currently are primarily based on the cooperation of three sectors: government, science, education and the business sector (Świadek, 2011). According to Mazur (2015) on the macro level Polish long-term strategy of innovative development is captured in several state regulations and accompanied by local initiatives.

Cluster Benchmarking in Poland – Edition 2014 General Report states that entrepreneurs represent 81,3% of cluster members (44,4% are micro, 31,9% small, 17,8% medium and 5,9% large companies). 7,3% of cluster members are support institutions, 7,6% is R&D sector and the remaining entities account for 3,8%. It means that micro and small enterprises, representing together 76,3% of cluster members, are a major driving force of cluster development. Moreover, SMEs have the highest interest in joining clusters and consider them as a decent source of improving competitiveness. More than 51% of cluster enterprises declared that they had conducted R&D activities and 58% of them confirmed implementation of innovative solutions. This is evidence that clusters create a pro-innovative milieu for enterprises and especially small and medium enterprises (SME) (Plawgo, 2014). Several European Commission research projects stated that there is a positive correlation between cluster existence and GDP per capita value depending on cluster strength (Dzierzanowski, 2011). Other researchers could not find direct correlation between national cluster quantity or strength and GDP, but still it was concluded by Figiel and Kuberska (2013), for example, that development of business clusters and supporting cluster initiatives is a decent solution to improve competitiveness of the EU national economies. Grabowska (2015) provided quantitative analysis of existing clusters in Poland trying to explore their impact on the whole economy – it was concluded that Polish clusters are mostly at the beginning of their development, primarily oriented on organizational and marketing innovations, but not technical breakthroughs. In addition to this, lack of facilities in advanced research centers was identified as the most lagging factor in the Polish innovative system. Based on a survey of 21 representatives of triple helix institutional players in Lodz (7 enterprises, 7 universities, 7 administration bodies) Trippner-Hrabi (2014) concluded that businesses still do not understand the mechanics of possible cooperation completely due to different barriers (mostly lack of information and bureaucracy obstacles). In its national or regional innovative activities government should be more active while interacting with business, especially by revealing more about research activities. Cooperation inside the triple helix should be organized in order to stimulate demand for produced innovative goods but not as another way of delivering knowledge, which may not be commercialized on the market.

WULS Cluster in Agribusiness as a benchmark for Ukrainian universities

In our view one of the most important characteristics of the modern innovation system in the EU and Poland in particular is decent conditions for 'bottom to top' initiative growth. The government provides framework, funding, and warranties, while researchers and

enterprises act with their projects and initiations. These so-called dotted activities are cumulatively oriented on improving national competitiveness by solving local problems and introducing customized innovative products. One bright example of newly created triple helix cluster initiative in Polish agribusiness is Warsaw University of Life Sciences (WULS) Cluster of Innovation in Agribusiness. The cluster was created on the university's basis according to all canons of triple helix concept. It is completely a university initiative as a step towards promoting its entrepreneurial role and building an efficient innovative ecosystem in one of Europe's best agri-universities (Zelazowska-Przewloka et. al., 2014). WULS Cluster was developed in order to overcome the barriers for innovations development in agribusiness. To specify, SMEs in Poland do not use their innovational potential, innovation implementation is too expensive, faces transformations in this economy sector, and suffers from institutional challenges (Kusto et. al., 2014).

WULS Cluster of Innovation in Agribusiness has been created as a part of the *Regional Operational Program of Mazovia Region 2007-2013* (*Priority I - Creating conditions for development of innovation potential and entrepreneurship in Mazovia, Measure 1.6. Promoting cooperative relations of regional significance*). The main focus of the cluster is to transfer the knowledge into business –"science to business" (S2B), improve the efficiency of technology and knowledge transfer between participants in the cluster, and consequently increase the innovative potential of the Mazovia region (Szczupska et. al., 2012). Today WULS Cluster of Innovation in Agribusiness is an independent faculty-based institution, aggregating many members, working primarily through the web portal. Creation and development of the cluster was accompanied with active industry research and cooperation activities. Firstly, the general potential of the Mazovia region of Poland as a strong agribusiness player on national scale was identified – it holds leading positions in different spheres of agribusiness among all Polish regions (Analiza sytuacji..., 2013), which defines general vector and relevance of cluster development. In addition to this, the survey of businesses in Mazovia district showed their appreciation of cluster initiatives as a way to reduce production costs, ease access to new technologies, and coordination of marketing activities. On the other hand, industry representatives considered the cooperation with local administration bodies and higher education institutions as not very important. Respondents proved these conclusions by figuring out difficulties while understanding cluster roles and activities as well as lack of cooperation with the scientific environment to be primary barriers of cluster development (Analiza sytuacji..., 2013).

Using dedicated web portals all the members can access two cluster modules. *Food Safety* module consists of an online tool for supply chain management and consulting forum of experts. *Food Professional* stands for online e-learning platform, bank of ideas and working group tools. All of these activities quite often are interconnected but still this is a unique case in Poland where traditional entrepreneurs got easy and fast access to science achievements (Zelazowska-Przewloka et. al., 2014). Another intriguing initiative of WULS Cluster is *Experts Database* – a collection of business related research materials structured and accessible for members from the cluster web page. However, it is still only at the beginning of its development. It is important to mention that cluster activities are not restricted to an online environment only. During 2012-2014 the cluster initiated several national scale conferences and congresses as another way of connecting science and business as well as promoting the Cluster itself. Finally, different advertising channels (both online and offline) were used as well as regular bulletins prepared and published in order to extend the Cluster and invite new members.

At the beginning, Cluster creation and development was a part of the EU Regional Operation Program, which resulted in sufficient funding. Currently Cluster is primarily focused on internal activities - seeking for funding by applying to other projects. Consequently, the intensity of organized events and advertising campaigns has fallen significantly. In fact, for such Clusters there is a way for self-maintaining by organizing different business activities, however, according to S. Jarzebowski (Head of Cluster) in WULS they do not use that technique currently. There are two possible reasons: first, as long as it is under university authorities (also in funding context) which complicates appropriate procedures, and second, because of being too small currently. Moreover, the Cluster Head put an accent on the fact that funding is the main (if not the only) barrier of development for all innovative clusters in Poland.

Lessons Ukraine can learn from Poland on explored topic

In order to understand whether Poland is a relevant benchmark for Ukraine in terms of innovation model development it is important to understand key factors that can affect related decisions in both countries. We use the EPIC framework which was primarily developed for assessing the maturity level of countries with respect for their supply chain activities. However, it is possible to adapt this framework to comparing the countries in other contexts and innovation development in particular, which has been done in this research.

Table 1. EPIC factors comparison: Poland and Ukraine

	Variable (data source)	Poland	Ukraine
Economy	GDP (CIA World Factbook)	$1 003 bln	$334,3 bln
	GDP Growth Rate, last 3years average (CIA World Factbook)	2,86%	-5,93%
	Population Size (CIA World Factbook)	38,6 mln	44,4 mln
	Investment (Global Innovation Index)	32 (points)	21,4 (points)
Politics	Institutions (Global Innovation Index)	75,3 (points)	52,2 (points)
	Public Sector Performance (World Economic Forum GCI)	3,2 (points)	2,9 (points)
	Intellectual Property Rights (Int. Property Rights Index)	5,9 (points)	3,9 (points)
Infrastructure	ICT (Global Innovation Index)	55,8 (points)	38,2 (points)
	Market Sophistication (Global Innovation Index)	49,0 (points)	43,9 (points)
	Business Sophistication (Global Innovation Index)	35,2 (points)	32,4 (points)
Competences	Human Capital and Research (Global Innovation Index)	37,2 (points)	40,4 (points)
	Knowledge and Technology Output (Global Innovation Index)	28,3 (points)	36,4 (points)
	Creative outputs (Global Innovation Index)	35,4 (points)	31,3 (points)

Source: own work with databases: CIA World Factbook 2014-15, Global Innovation Index 2015, World Economic Forum GCI 2014-15, Intellectual Property Rights Index 2015.

The maturity level of countries is assessed along four dimensions that are represented by the EPIC acronym: Economy, Politics, Infrastructure, and Competence. The majority of the variables in the EPIC structure are assessed using results from in-depth studies conducted

by established organizations (Srinivasan, 2014). Each of these dimensions is evaluated by a number of variables impacting innovation activities. In our view the advantage of the EPIC method is that it provides an opportunity to explore the complex of factors that may have an impact on the investigated object. Table 1 summarizes the comparison of Poland and Ukraine within economy, politics, infrastructure, and competence dimensions.

Table 2. Polish experience of triple helix implementation opportunities for Ukraine SWOT-analysis

Strengths	Weaknesses
▪ Preliminary market observations and industry surveys help develop and position the Cluster according to real business needs, but not only theoretical concepts; ▪ In clusters scientists benefit more from their research activities not only by receiving salaries but also for participating in potential profit-sharing programs, selling ideas, receiving grants and so on. Moreover, researchers in this case receive money not for ranks or citations number (which of course is also important) but for results of commercialized research work; ▪ Embodying innovative Cluster as a web portal is excellent initial step in connecting science and business as it helps to bootstrap in case of insufficient funding and adjust cluster development strategy.	▪ In Poland SMEs are poorly informed regarding Cluster activities and university initiatives, which requires powerful promotional campaigns. In Ukraine the situation is even worse as SMEs are concentrated on surviving but not investing into innovations; ▪ Deep economic crisis in Ukraine (both as a continuation of transformation to market economy and a result of partial Russian occupation) set other priorities for state funding and support (e.g. external debt service, currency volatility, pension funds deficit). Now Ukrainian budget simply could not afford any expenditures on long-term projects. To compare, Poland received approximately 0,5 mln. EUR donation from the EU while developing WULS Cluster under one project; however, there were several follow-up development projects.

Opportunities	Threats
▪ Joining the EU Horizon 2020 program gives opportunity to apply for external funding on initial stages of development under global programs of economic reform; ▪ Venture funding could be used as alternative source for sustaining the function of bodies in the future by paying commission from each commercialized project; ▪ Clusters could be 'multi branch' as the lessons in agribusiness cluster development are applicable in other economy sectors; ▪ As learning platforms Clusters have great potential of improving educational system (with the help of e-learning platforms) and increasing employment.	▪ Local triple helix initiatives need to operate under standardized framework (set of rules) for all players. In this case, inability of Ukrainian government to create appropriate framework may result in collapse of the whole triple helix ecosystem; ▪ Corruption and politics lobbying may affect local initiatives negatively primarily in terms of funding distribution; ▪ Government inability to develop preferential tax regime for SMEs might thwart Cluster initiatives of implementing innovations because of too high load of innovation costs and tax pressure. As happened in Paton Techno Park after 2005, which resulted almost in complete activity shrinking. ▪ In Ukraine the best universities are completely under state control and funding. Consequently, the procedure of starting commercial initiatives by cluster (even for self-maintaining) could be overloaded by bureaucracy.

Source: own work.

Table 1 confirms the fact that Poland performs significantly better in terms of economy, politics, and infrastructure dimensions. However, Ukraine has great potential for becoming an innovation-driven country, which is proven by the competences dimension. Undoubtedly, it needs global reformation, which in turn will affect the innovation

ecosystem not only in agribusiness but in the whole economy. In this context Polish experience would be incredibly valuable due to the countries' similarities (primarily historical, political, and economical). As part of building a strategy of improving the innovative ecosystem of Ukraine we will use SWOT – analysis in order to observe the opportunities of applying the Polish experience of triple helix development. SWOT is considered to be one of the most popular and flexible analytical tools used in strategy building (Humphrey, 2005). It implies identification of the most important internal factors (strong and weak sides of an object) and matching them with external influence (opportunities and threats). Results of such identification are usually presented in 2x2 matrix – see Table 2 for details.

Conclusion

In this research we investigated the experience of cluster development in the Polish agribusiness sphere from different angles: in the whole country and on the example of specific institution (WULS Cluster of Innovations). Despite the fact that Poland is not a leading country worldwide in terms of innovations, there are many lessons Ukraine can learn from its experience. We provided an exploration of how Poland is transforming its innovative model into an integrated one and implementing triple helix postulates both on macro- and microeconomic levels. EPIC framework helped us to assess Poland and Ukraine maturity with respect to their innovative ecosystems. It was identified that Ukraine has great potential for innovative development but its economy, politics, and infrastructure needs reforms. Based on the SWOT-analysis performed in this paper it might be concluded that Ukrainian policy-makers at first should pay attention to the creation of a framework of national innovative development, which in turn might push the development of local initiatives. Funding seems to be one of the biggest challenges for cluster development; however, preferential tax regimes, venture funding, and cluster commercial activities should be identified as considerable alternatives. The concept of clusters reveals great potential for increasing competitiveness not only in agribusiness but for the whole SME layer in Ukraine. On the other hand, corruption, political populism, and lobbying are potential threats for most cluster activities. The crucial thing is that mostly external factors might have serious negative impacts on the process of building the triple helix ecosystem in Ukraine as internal drawbacks of Polish model are easily solvable. In this case it is of vital importance to work on this issue comprehensively and develop the framework first.

Triple helix clusters are an excellent chance for Ukraine to make significant breakthroughs in the national system of innovation development, and it is important to apply relevant international experience. However, before application all of the above-mentioned Polish lessons are subject for future investigation.

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Changes and Evolutions of Beekeeping Sector in Poland between 2010-2015, in the Context of EU Adhesion

Abstract. Changes in the beekeeping sector in Poland in the years 2010 to 2015 with particular focus on regional differences are discussed. The situation of amateur and professional beekeepers in terms of their socioeconomic statuses with regard to number of bee colonies, productivity, number of hives per 1 km sq., losses in the bee colonies is presented. The main sources of information, including the Central Statistical Office (CSO), FAOSTAT 2016, the reports and studies of S. Pieniążek Research Institute of Pomology and Floriculture in Skierniewice Division of Apiculture in Puławy, the materials of the Polish Association of Beekeepers. The comparative and descriptive methods have been applied in the analysis of the research problem. The article shows who is the beekeepers, how is the situation in the number and structure of bee colonies by province, inform about average size of an apiary, and density of honeybee colonies (number of colonies per 2 km sq.). The fragmentation of apiaries in Poland is a factor that has direct impact on the low profitability of production, while the associated high costs, small scale of production, and lack of investment capital, significantly reduce the economic results and hinder further development.

Key words: beekeeping sector, beekeepers, bee colonies, colonies, honey production

Introduction

When assessing the last two decades of the beekeeping industry in Poland two distinctive periods can be identified. The first period covers the functioning before Poland's accession to the EU when the beekeeping was indirectly supported by the state budget. Such support included, among others, co-financing of the, so called, biological progress in breeding the bees or the purchases of honey within the framework of intervention activity of Agricultural Market Agency (purchase in summer season and sales in winter and spring) (Borowska, 2011a). Besides, the beekeepers could also buy sugar for feeding the bee colonies at a preferential price. Also, the high level of customs duties on honey imports used to act as a protective instrument in the pre-accession period. The second period covers the time after Poland's accession to the EU in 2004 which is characterized by the increased institutional support for the beekeeping sector through the implementation of "Support for Bee Products Market" mechanism operating under the successive three-years' National Apiculture Programs (Borowska, 2010, 2013). The resulting favorable changes of organizational, sanitary-hygienic, technological and technical nature observed in the apiary farms, especially in the farms run by the beekeepers associated in apiculture organizations, can be referred to the economic aspects of managing the apiaries, as well as the enhancing quality of apiculture products such as: royal jelly, wax, propolis, bee venom, pollen, bee bread, and honey are the main source generating income for the beekeepers in Poland (Wilde, 1998, 2016). Both, the objective factors (beyond control of the beekeepers, such as weather conditions, availability of honey flows, etc.), and subjective factors: formal (the

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well-developed educational and scientific backup, well-functioning structures of the beekeepers associations, high quality of the beekeeping equipment, and a wide range of domestic honey assortment offered at competitive prices) as well as informal (traditions, customs, habits, social relations, etc.) significantly contributed to the development of honey production, especially in the years 2000-2015. The fragmentation and amateur nature as well as the small share of professional apiaries and individual and usually intuitive marketing of apiary products are still the main weaknesses of the Polish beekeeping sector (Semkiw et al., 2007, 2012, 2015; Majewski, 2010; Wilde, 2016). The negative factors include also high production costs, growing share of imported honey on the domestic market, and export of high-quality raw materials, etc. In consideration of these few reasons the issue of the beekeeping industry in Poland and the relevant changes are worth assessment

Objective, source material, and research methods

The objective of this paper is to show changes in the beekeeping sector in Poland in the years 2010-2015, with particular account for the differences between the regions. The secondary sources of information, including the statistical yearbooks issued by the Central Statistical Office (CSO), FAOSTAT, Eurostat, the reports and studies of S. Pieniążek Research Institute of Pomology and Floriculture in Skierniewice Division of Apiculture in Puławy, the materials of the Polish Association of Beekeepers, foreign trade database, are used in this study. The comparative and descriptive methods have been applied in the analysis of the research problem.

The situation in the beekeeping sector in Poland

In 2009 approximately 71.2% of the beekeepers were still members of the beekeeping organizations, however that number decreased in the subsequent years to drop to 62.5% in 2015 when about 39 thousand beekeepers owned a total of over 1 million bee colonies, i.e. 72.5% of their total number (tab.1). According to CSO, about 3/5 of the bee colonies were run by the beekeepers having their own farms, the remaining part belonged to people not connected professionally with agriculture. The number of professional beekeepers in the country grew steadily, albeit rather slowly. In the period from 2009 to 2015 they accounted for less than 0.55 % of the total number of beekeepers with 237 persons at the beginning of that period and 324 six years later. According to the Institute of Horticulture in Skierniewice in November 2015, there were over 1.44 million bee colonies in the apiaries in Poland, out of which over 88 thousand in commercial apiaries (with more than 150 hives) which constituted a little over 6% of hives in the country.

In 2015 the most of beekeepers kept apiaries in the Małopolskie province (over 7 thousand) followed by Lubelskie (6.6 thousand), Podkarpackie (approx. 5.8 thousand), and Śląskie (5.7 thousand) provinces. For years the Podlaskie province (with about 1.5 thousand beekeepers), and Lubuskie, Opolskie and Pomorskie provinces with the number of beekeepers within the range of 2.1 thousand were the least interested in this kind of economic activity (Wilde 2016). Regarding the structure of apiaries, most of them comprised up to 20 bee colonies. According to the beekeeping organizations – the Polish

Association of Beekeeping - the natural aging of the beekeepers environment was observed in Poland for over two decades. Persons of old age and post-production age dominate among the Association members and from 2004 to 2015 their number even increased by 12.6% to totaling more than 65% of members. As regards the beekeepers over 50 years of age, in 2015 the producers from 51 to 65 (i.e. 35.5% of the total number) were a dominant subgroup, while those born before 1950 constituted approximately 30%.

Table 1. Estimated number of the beekeepers who were and were not members of the beekeeping organizations and the estimated number of bee colonies in Poland in the years 2004-2014

Specification	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014*
	The estimated number of the beekeepers										
Total	39894	36636	38536	40486	39018	38961	36453	38872	39504	39741	39500
United	29375	27104	29786	29480	27869	27758	28379	29470	30160	30907	-
Non-united	10519	9532	9750	11006	11149	11203	8074	9402	9344	8834	-
	The estimated number of bee colonies										
Total	93006	82741	84331	85994	85776	87007	87629	92218	93781	95442	138602
By united beekeepers	788582	702346	737376	722771	717061	711169	764368	793459	824789	835600	-
By non-united beekeepers	141484	125073	105943	137173	158703	158901	111926	128730	113023	118829	-

Source: Statistical Yearbook of Agriculture, CSO, Warsaw, 2010 Polish Association of Beekeepers http://zwiazek-pszczelarski.pl/statystyki/ [Access: March 2016]; *own calculation.

The beekeepers not exceeding 35 years of age were the least numerous and their share, in spite of the slow increase from 9% to 12%, still should be considered too low to guarantee the replacement of generations in that professional environment. The beekeepers between 36 and 50 years of age constituted slightly more than 1/4- 1/5 of the beekeepers age structure (Table 2). In 2015 Semkiw emphasized that the young beekeepers kept apiaries of mainly 11 to 20 hives, while the apiaries run by the middle-aged beekeepers (36 to 50) usually comprised from 11 to 50 colonies. The similar situation was observed in the group of older beekeepers (more than 50), while those over 65 years of age focused mainly on running the apiaries with 5 to 10 hives and from 11 to 20 colonies.

Table 2. Age structure of the beekeepers who are members of beekeeping organizations in Poland in 2004-2015, %

Years of the beekeepers	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2015
< 35	9,0	10,7	9,8	11,7	9,8	9,8	9,9	10,2	10,7	10,4	12,1
36-50	37,9	34,5	33,1	31	29,5	29,5	25,5	24,6	23,6	21,8	22,21
> 50	53,1	54,8	57,1	57,3	60,7	61,7	64,6	65,2	65,7	67,8	65,7

Source: Polish Association of Beekeepers http://zwiazek-pszczelarski.pl/statystyki/ [Accesss: March 2016] data in the period 2009-2015 and in 2015 Semkiw P. Sektor pszczelarski w Polsce w 2015 r., Instytut Ogrodnictwa, Zakład Pszczelnictwa w Puławach, Puławy, 2015, 8.

The apiculture sector is an important part of the EU agriculture. The total number of beekeepers was estimated at 630 000 and 16 million of hives in the EU, producing 234.000 tons of honey per year[2]. According to Eurostat data, 59% of beekeepers are over 55 years

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[2] http://ec.europa.eu/food/animals/live_animals/bees/health/index_en.htm(20.09.2016)

old in the EU, and only 5.5% of them are younger than 35; 34.5% are between 35-54 years old. Thus, the EU is having the same problem as Poland as regards beekeeper generation replacement. Moreover, having regard to the definition of a professional beekeeper, i.e. a person who owns more than 150 hives, it can be concluded that beekeeping industry exists due to non-professional beekeepers. Around 95% of beekeepers are non-professionals; they keep approximately 60% of the EU hives. However, most of the non-professionals depend on beekeeping for living while the economic incentive and profit is not usually the primary interest of hobbyist beekeepers[3]. Moreover, 80% of bee keeping farmers manage an agricultural area which does not exceed 10 ha.

Table 3. Bee colonies in selected EU Member States in the period 2000-2013, in 1000 beehives

Year/Country	2000	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2013 2000=100
Austria	310	283	281	275	298	300	330	368	368	376	382	124
Belgium	29	29	29	29	30	30	30	30	31	32	32	108
Bulgaria	335	410	450	672	715	719	653	613	548	529	542	164
Cyprus	44	40	40	40	45	40	35	40	38	38	39	92
Czech Rep.	535	557	552	526	520	461	498	528	565	541	533	103
Estonia	23	35	33	33	38	30	25	28	26	41	39	192
Finland	42	46	53	54	53	43	41	37	37	38	43	112
France	1150	1000	1000	977	1014	1000	884	840	820	795	789	64
Germany	902	930	930	940	900	692	695	685	695	699	700	78
Greece	1290	1302	1314	1333	1343	1340	1340	1340	1340	1340	1340	104
Hungary	590	612	658	641	493	553	421	432	610	729	678	130
Italy	900	900	950	930	940	500	500	500	500	500	500	58
Lithuania	73	81	83	85	88	101	102	103	94	90	88	121
Luxembourg	9	11	11	10	8	8	6	5	5	4	4	16
Poland	1300	1300	1250	1400	1450	1450	1450	1450	1465	1470	1500	115
Portugal	298	300	300	305	320	310	320	325	330	330	332	111
Romania	614	840	888	888	891	982	998	1057	1275	1295	1254	176
Slovakia	279	192	237	277	246	248	216	232	240	257	255	101
Slovenia	190	100	90	40	40	41	46	52	60	63	63	23
Spain	2125	2397	2338	2345	2313	2389	2390	2439	2440	2429	2430	114
Sweden	53	54	54	50	50	50	45	46	48	48	48	92
World	70708	74089	75327	76183	75129	75967	76188	78078	78566	80516	81056	114

Source: FAOSTAT 2016.

The greatest number of bee colonies in the EU is recorded in Spain (over 2.4 million), followed by Poland (approx. 1.5 million), Greece (1.3 million) and Romania (1.25 million). In the period 2000-2013 those four countries accounted for approx. 50-56% of all bee colonies in the EU (Table 3). Although the global increase in the number of bee colonies in the period under consideration reached 14% on average, particular EU Member States recorded various results. An increase by a few per cent was recorded in Belgium, the Czech Republic or Greece, more than 10% increases were recorded in Finland, Poland, Portugal and Spain, and the greatest increases were noted in Hungary (by 30%), Bulgaria (by 64%),

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[3] Evaluation of the CAP measures related to apiculture Agriculture and Rural Development DG -Final Report http://ec.europa.eu/agriculture/evaluation/market-and-income-reports/2013/apiculture/chap3_en.pdf.

Romania (by 76%) and Estonia (by 92%). A reverse trend was noticed in France (decrease of the number of beehives by the average of 36%), Italy (by 42%), Luxembourg (by 84%), Slovenia (by 77%), Germany (by 22%), Cyprus and Sweden (by 8%) (Table 3). The reasons for decrease include environmental changes or pathogens. Each EU beekeeper held an average of 23 colonies but Spanish beekeepers had the highest average number of colonies (103/per beekeeper) whereas British beekeepers owned the smallest average number of colonies (only 5[4]); at the same time, the average number of colonies in Poland was approx. 23-25.

In the years 2011 to 2015 the number of bee colonies in Poland increased by 29% from approximately 1.1 million to over 1.44 million. The majority of bee colonies were noted in the Lubelskie, Warmińsko-Mazurskie, Podkarpackie, Małopolskie, and Wielkopolskie provinces (48.2% of the total number of colonies), while their lowest number was recorded in the Podlaskie, Opolskie, Lubuskie and Pomorskie provinces (12.3% of the total number of colonies). The review of particular provinces showed the growth of number of hives in the Śląskie province (66.4%), Lubelskie province (44%) and the Zachodniopomorskie, Świętokrzyskie and Łódzkie provinces where the growth of more than 30% to 37% was noted (Table 4).

Table 4. Number and structure of bee colonies in Poland in 2011-2015 by province

Provinces	Number of bee colonies previous year = 100						The structure of bee colonies				
	2011	2012	2013	2014	2015	2011-2015	2011	2012	2013	2014	2015
Dolnośląskie (A)	100	114,4	105,9	100,3	105,1	127,6	7,5	7,6	7,6	7,4	7,5
Kujawsko-pomorskie (B)	100	111,1	105,2	101,5	103,1	122,2	5,1	4,9	5,0	4,9	4,8
Lubelskie (C)	100	126,3	103,9	104,1	105,4	143,9	11,5	12,8	12,6	12,8	12,9
Lubuskie (D)	100	111,8	105,0	102,7	95,8	115,4	3,7	3,6	3,6	3,6	3,3
Łódzkie (E)	100	104,4	116,0	101,9	111,1	137,3	4,2	3,9	4,3	4,2	4,5
Małopolskie (F)	100	107,0	102,0	104,9	103,7	118,8	9,5	8,9	8,6	8,8	8,7
Mazowieckie (G)	100	112,4	101,3	100,8	112,5	129,2	7,5	7,4	7,1	7,0	7,5
Opolskie (H)	100	107,1	115,7	107,3	96,8	128,8	2,7	2,6	2,8	3,0	2,7
Podkarpackie (I)	100	111,0	104,5	102,8	102,1	121,9	9,8	9,6	9,5	9,5	9,3
Podlaskie (K)	100	107,9	106,1	100,0	107,9	123,2	2,7	2,5	2,6	2,5	2,6
Pomorskie(L)	100	113,5	101,4	105,1	100,6	121,7	4,0	3,9	3,8	3,9	3,7
Śląskie (M)	100	147,2	103,6	99,7	109,5	166,4	3,9	5,0	5,0	4,8	5,0
Świętokrzyskie (N)	100	114,9	105,6	103,9	106,7	134,5	4,3	4,3	4,4	4,4	4,5
Warmińsko-mazurskie (O)	100	116,1	101,1	104,0	105,1	128,3	9,5	9,7	9,3	9,4	9,4
Wielkopolskie (P)	100	106,4	108,9	104,5	99,1	119,9	8,5	8,0	8,3	8,4	7,9
Zachodniopomorskie (R)	100	109,8	107,4	104,8	105,2	130,0	5,6	5,3	5,5	5,6	5,6
	Number of bee colonies (1000)						100	100	100	100	100
Poland (T)	1123	1280	1344	1386	1448	129					

Source: Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarstwa Oddział Pszczelnictwa w Puławach, for the period 2010-2015.

The number of bee colonies in an average apiary in the country dropped (decrease of approx. 7.6%) in the assessed period of time. In 2015 there were 23.1 hives in an average

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[4] No data available for UK, Finland, Denmark, Germany, Ireland, Malta, The Netherlands, Austria, Sweden

apiary i.e. the same number as in 2004. While in most provinces, a decrease of an average apiary size was recorded with drop of 20.8 % in the Pomorskie province above all, in the case of the Dolnośląskie province an increase of 16%, and in the Lubelskie and Śląskie provinces a small increase of 6% were recorded. The largest apiaries were located in the north- eastern Poland, i.e. the Warmińsko-Mazurskie province (with 40.7 bee colonies), and the north –western Poland, i.e. the Zachodniopomorskie (30.2), Dolnośląskie (28.9), and Lubelskie (28.1) provinces. The smallest apiaries with an average of about 13 bee colonies were noted in the Śląsk region. In 2015 the beehive stock comparable to the national average was recorded in the Podlaskie, Podkarpackie, and Lubuskie provinces (Table 5).

Table 5. Average size of an apiary in Poland and density of honeybee colonies (number of colonies per 2 km sq.) in 2010-2015 by province

Provinces/years	Average size of an apiary					Density of honeybee colonies (no. of colonies per 2 km sq.)					
	2010	2012	2013	2014	2015	2010	2012	2013	2014	2015	2010 - 2015
Dolnośląskie (A)	24,9	27,7	28,4	28,3	28,9	4,3	4,9	5,1	5,2	5,4	127
Kujawsko-pomorskie (B)	27,5	26,1	25,8	25,5	24,3	3,2	3,5	3,7	3,8	3,9	123
Lubelskie (C)	26,3	29,5	29,2	28,5	28,1	5,2	6,5	6,8	7,0	7,4	143
Lubuskie (D)	26,6	26,9	26,4	25,7	23,0	3,0	3,3	3,5	3,6	3,4	115
Łódzkie (E)	19,5	19,2	18,5	18,3	17,7	2,6	2,7	3,2	3,2	3,6	139
Małopolskie (F)	19,8	19,4	18,8	18,3	17,8	7,0	7,5	7,6	8,0	8,3	119
Mazowieckie (G)	22,9	22,0	21,8	22,0	20,7	2,4	2,7	2,7	2,7	3,1	131
Opolskie (H)	22,6	20,1	20,6	20,0	18,6	3,3	3,5	4,1	4,4	4,2	128
Podkarpackie (I)	25,9	24,7	24,4	24,0	23,2	6,2	6,9	7,2	7,4	7,5	121
Podlaskie (K)	26,2	25,1	26,0	24,8	23,6	1,5	1,6	1,7	1,7	1,8	120
Pomorskie(L)	31,2	28,9	27,9	27,6	24,7	2,4	2,8	2,8	2,9	3,0	124
Śląskie (M)	11,9	13,1	13,2	13,3	12,7	3,5	5,2	5,4	5,4	5,9	167
Świętokrzyskie (N)	29,3	27,3	26,7	25,6	24,6	4,1	4,7	5,0	5,2	5,5	133
Warmińsko-mazurskie (O)	45,2	44,2	42,7	41,3	40,7	4,4	5,1	5,2	5,4	5,7	129
Wielkopolskie (P)	25,5	24,2	24,1	23,6	22,2	3,3	3,4	3,7	3,9	3,9	119
Zachodniopomorskie (R)	32,7	30,5	31,0	30,2	30,2	2,7	3,0	3,2	3,4	3,5	128
Poland (T)	**25,0**	**24,7**	**24,4**	**24,1**	**23,1**	**3,7**	**4,1**	**4,3**	**4,4**	**4,6**	**125**

Source: own calculation and Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarstwa Oddział Pszczelnictwa w Puławach, for the period 2010-2015.

The considerable fragmentation is characteristic for the Polish beekeeping. The assessment of structure of the beekeepers in relation to the structure of their apiaries indicated that more than a half of them (50.6%) run small apiaries ranging in size from 6 to 20 hives and only 16.4% had less than 5 colonies. In 2010-2015 the number of colonies in both those groups totalled approximately 30.5% (i.e. a little over 442 thousand) (Table 6).

It could be assumed that they were typical amateur apiaries. Nearly 20% of the beekeepers owned medium-sized apiaries with 21 to 50 hives. In the Lublin, Zachodniopomorskie, and Warmińsko-Mazurskie provinces such medium-sized apiaries accounted for 30% - 35%. Over the last six years about 6.5% - 7% of the beekeepers run the beekeeping farms with 51 to 80 hives and 2.2% run the commercial apiaries with more than 80 hives which constituted 13.7% of the total number. It is worth mentioning in this

place that in Poland the apiaries not exceeding 80 colonies are not subject to mandatory registration in a respective agricultural production sector, and for that reason in their case no taxes are applicable (such as 3,56 PLN /hive income tax in 2015). Therefore it is not surprising that the beekeepers (especially those who run small apiaries in own backyards as a hobby or on a slightly larger scale only) are interested in running apiaries not exceeding the statutory limit and, what is more, some of them register their apiaries formally as the, so called, small or medium-sized apiary (and thus divide the colonies into bee colony members)[5].

Table 6. The structure of beekeepers and bee colonies in relation to the structure of apiaries in Poland in 2015 by province

Provinces/ hives	The structure of beekeepers in relation to the structure of apiaries									The structure of bee colonies								
	Total	to 5 hives	6-10 hives	11-20 hives	21-50 hives	51-80 hives	81-150 hives	151-300 hives	>301 hives	No. of bee colonies	to 5 hives	6-10 hives	11-20 hives	21-50 hives	51-80 hives	81-150 hives	151-300 hives	>301 hives
A	**6,0**	11,8	21,0	27,1	28,0	7,9	2,8	0,9	0,5	**7,5**	1,6	6,5	15,8	33,5	18,5	10,6	6,5	7,0
B	**4,6**	13,6	22,2	26,6	28,6	6,7	1,8	0,4	0,0	**4,8**	1,8	8,0	18,5	41,2	18,5	8,1	3,2	0,6
C	**10,6**	8,4	21,6	27,6	30,3	9,8	1,8	0,5	0,1	**12,9**	1,1	6,9	16,7	38,2	24,7	7,0	4,0	1,4
D	**3,3**	15,2	22,1	24,7	28,8	7,3	1,4	0,2	0,2	**3,3**	1,9	7,6	16,7	40,2	20,1	6,4	1,8	5,4
E	**5,9**	17,3	29,1	29,7	20,2	3,1	0,4	0,2	0,0	**4,5**	4,1	14,8	28,1	36,9	11,4	2,4	1,7	0,6
F	**11,3**	22,2	31,3	23,9	18,2	3,3	0,7	0,2	0,1	**8,7**	4,9	15,3	22,2	34,6	12,8	4,5	2,6	3,0
G	**8,4**	15,3	27,7	27,5	22,9	5,0	1,2	0,3	0,0	**7,5**	2,7	11,4	22,0	37,7	16,6	6,1	2,9	0,7
H	**3,4**	23,9	27,2	25,0	17,4	5,2	1,0	0,1	0,1	**2,7**	3,8	12,7	21,9	32,0	19,3	6,1	1,4	2,8
I	**9,3**	11,2	25,8	29,5	25,1	6,5	1,5	0,4	0,0	**9,3**	1,8	10,0	21,3	37,3	19,3	6,9	3,1	0,3
K	**2,5**	11,8	23,8	27,3	29,8	5,4	1,6	0,3	0,0	**2,6**	1,8	9,0	19,5	43,9	15,4	7,7	2,7	0,0
L	**3,5**	20,0	19,2	23,7	28,0	6,7	1,5	0,7	0,3	**3,7**	1,6	6,9	16,4	39,5	18,6	6,3	5,6	5,0
M	**9,1**	33,4	30,5	22,3	11,7	1,6	0,3	0,1	0,0	**5,0**	9,1	20,1	28,6	29,5	8,5	2,6	1,6	0,0
N	**4,2**	14,0	25,3	26,2	24,1	7,8	2,2	0,3	0,1	**4,5**	1,9	9,2	17,8	35,2	22,0	9,8	2,3	1,7
O	**5,4**	4,7	13,8	22,7	35,1	16,6	5,4	1,3	0,4	**9,4**	0,5	3,1	9,7	31,4	28,6	13,7	6,4	6,7
P	**8,3**	20,8	23,0	24,2	23,1	6,4	1,9	0,4	0,1	**7,9**	2,8	9,2	18,3	35,5	19,9	8,8	4,3	1,0
R	**4,3**	9,8	17,9	24,2	33,9	10,6	2,9	0,5	0,1	**5,6**	1,2	5,3	13,6	40,9	23,7	10,5	3,3	1,5
T	**100**	16,4	24,7	25,8	24,3	6,6	1,6	0,4	0,1	**100**	2,5	9,4	18,7	36,3	19,4	7,6	3,7	2,4

Source: own calculation and Semkiw P. (2015). Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarstwa Oddział Pszczelnictwa w Puławach, 5-7.

A commercial apiary, as defined in European Commission Regulation (EC) No 917/2004, must comprise more than 150 hives, Such apiaries, if only because of their scale and specialization, operate as specialized beekeeping farms in which the economic efficiency of operation and even the total production volume stem from their focus on increase of honey yield and better quality of honey offered on the market. The quality of honey is a result of many factors, both dependent and independent of a beekeeper, and seasonal variables that though cannot be predicted are likely to ultimately have effect on the

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[5] Data provided by the Research Institute of Pomology and Floriculture, Division of Apiculture in Puławy

product. Such factors include the intensity of presence or absence of honey flows, weather conditions, and human factors such as knowledge, experience, competence, skills in running the apiary business (inclusive of types and procedures of application of medicines, harvesting honey from each honey flow i.e. the production of honey varieties, honey extraction from supers and frames, moment of harvesting - honey maturity), technical and sanitary conditions of harvest, as well as processing of harvested honey (i.e. the way honey is processed, quality of collective packaging, conditions of storage, preparation for sale, packaging for retail - unit packaging, etc.).

Regardless of the scale of activity of a beekeeping farm, more and more beekeepers are convinced that honey of attractive taste, flavour, delicate texture, and high quality will attract target consumers, which has been proved in practice by the producers of regional honeys in Poland. The growing interest of consumers in the natural products, including the ecological regional honeys, led to the gradual increase of percentage of the apiaries with more than 80 hives, including those run by professional beekeepers. In the years 2011 to 2015 the number of professional beekeepers increased by 5.5% i.e. 17 persons to 324 in the whole country, and the number of bee colonies in such commercial beekeeping farms grew by 7.4% (by nearly 7 thousand i.e. a total of over 88 thousand colonies).

It is worth noting that about 75% of the beekeepers in the Łódzkie, Małopolskie, Mazowieckie and Opolskie provinces run the apiaries with up to 20 hives. The percentage of such apiaries accounted for 86% in the Śląsk region, while in the Warmińsko-Mazurskie province there were 41% such apiaries. That latter region with the largest number of professional apiaries run by more than 7% of the beekeepers operating there stood out from the other provinces. In the whole country scale the professional apiaries constitute 20.3% of over 88 thousand apiaries with more than 150 bee colonies, i.e. 17.9 thousand hives run by 56 professional beekeepers.

An uneven distribution of bee colonies, i.e. the number of bee colonies per 1 km sq., is characteristic for Poland. The above results from, among others, availability and condition of honey flows, their diversity, local climatic conditions, profitability of the beekeeping business in a given area, traditions of honeybee breeding and rearing (Borowska 2010a, 2010b). An appropriate number of bee colonies in a given region is a condition for maintaining the, so-called, biodiversity in nature and facilitate proper pollination of the entomophilous crops. Unfortunately, the situation in some provinces is not always good which translates into unsatisfactory pollination of the entomophilous plants of the agriculture and pomology sector. In Poland the diversity in number of colonies per 1 km sq. is still considerable. In the years 2010 to 2015 the average density increased by 25% from 3.7 to 4.6 colonies per 1 km sq. (Table 5).

For years the highest density of colonies (8.3 hives), understood as a large number of colonies on a small acreage, was recorded in the south - eastern and north - eastern regions of Poland, especially in the Małopolskie province, while the lowest density of colonies was noted in the Podlasie region, central Poland (the Mazowieckie province), Pomorze, and western part of Poland (1.8, 3.1, and 3 hives, respectively). According to the estimates of Apiculture Division in Puławy, about 3 colonies per 1 km sq. is considerd optimal. However, despite the growing number of pollinators in the last decade, the research conducted by Majewski 2010 indicated that was still inadequate in view of the growing demand for pollination in Poland.

In most provinces the density of colonies was insufficient to even minimally pollinate the crops. The shortage of colonies in Poland was estimated at over 1.5 million in total. The

Małopolskie province was an exception. Taking into account the economic impact of that problem in Poland, in 2007 the annual benefit from pollination of rape only was within the range of 600 million PLN (Semkiw, Ochał, 2010) to 700 million was recorded (Semkiw ,2007). In the case of fruit crops the respective figure was over PLN 3 billion. About 33,3% of the agriculture production was achieved thank to the pollination by insects whereas the losses in the Polish economy in resulting from the shortage of bee colonies were estimated at about 2.5 to 3 billion (Semkiw, Gerula, Węgrzynowicz, 2007). Of course, similarly to other regions, also in Poland the annual losses in bee colonies was an important issue. Until recently, the losses occurred usually during wintering and the extent of losses was determined during the first inspection of hives at early spring. The losses were rated typically at a few percent. In the recent years however (2010 to 2015) the intensifying phenomenon of mass deaths of bees after wintering (assessed in spring) amounting to even 11% to 18% of the colonies was observed.

Table 7. Number of professional beekeepers, number of bee colonies in professional apiaries, and average size of a professional apiary in Poland in 2009 - 2015 by province

Province	Number of professional beekeepers					Number of bee colonies in professional apiaries (1000)					Average size of a professional apiary				
	2009	2012	2013	2014	2015	2009	2012	2013	2014	2015	2009	2012	2013	2014	2015
A	13	36	38	49	51	2,5	8,6	9,8	12,4	14,6	193,5	239,7	259,1	253,9	287,1
B	10	11	10	12	12	2,3	2,4	2,5	2,6	2,6	236,5	221,4	224,5	217,8	220,8
C	29	35	38	37	39	7,1	8,9	9,9	9,6	10,1	243,3	255,6	260,9	260,0	258,8
D	7	7	8	8	8	3,3	3,3	3,4	3,4	3,4	465,7	465,7	430,0	430,0	430,0
E	7	10	11	10	7	1,4	1,9	2,1	1,9	1,5	203,7	189,7	192,5	189,7	208,4
F	17	21	20	21	21	5,2	6,9	6,8	7,1	7,1	307,6	332,3	338,9	337,7	337,7
G	15	18	18	20	17	3,6	4,1	4,0	4,5	3,9	239,3	228,6	224,2	223,0	231,7
H	7	4	5	5	5	1,7	1,2	1,4	1,6	1,6	254,3	310,0	284,0	330,0	330,0
I	20	24	26	26	22	4,3	5,3	5,6	5,5	4,6	216,3	220,0	216,1	212,3	208,1
K	7	6	6	6	5	1,2	1,3	1,3	1,3	1,0	175,7	218,3	218,3	218,3	202,0
L	14	23	22	20	22	4,8	7,3	6,1	5,2	5,7	348,6	317,0	276,8	261,5	261,4
M	3	7	6	7	6	0,5	1,4	1,2	1,3	1,2	180,0	201,4	198,3	191,7	198,3
N	9	9	9	9	10	2,2	2,2	2,2	2,2	2,6	250,0	250,0	250,0	250,0	261,0
O	42	61	61	59	56	10,7	18,5	17,9	16,7	17,9	256,2	304,1	293,9	283,2	319,9
P	23	23	26	28	26	5,6	5,6	6,5	6,8	6,2	242,3	246,8	252,0	243,1	238,0
R	14	12	12	13	17	2,9	2,7	2,5	2,6	3,8	212,1	225,0	213,3	204,5	226,6
T	**237**	**307**	**316**	**330**	**324**	**59,7**	**81,9**	**83,3**	**85,0**	**88,0**	**252,1**	**267,0**	**263,6**	**257,7**	**271,8**

Source: own calculation and Semkiw P. Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarstwa Oddział Pszczelnictwa w Puławach, for the period 2009-2015.

Until recently, the sporadic incidences of deaths, poisoning, intoxications, or significant weakening of the colonies in the beekeeping season resulted from improper agricultural treatment (especially chemical, e.g. the plant protection products applied at a wrong time of day), especially in case of the plantations of rape (winter or spring) and fruit crops, although there were cases of intoxications in the crops of tobacco, potatoes, corn, mustard, berry bushes, phacelia, buckwheat, and others. In 2012-2015 beekeeping season less losses caused by both, the acute poisoning and intoxication, were suffered and dropped from, respectively, over 3 thousand and 14.3 thousand to about 1.1 thousand and 2.8 thousand colonies. It should be assumed that it was a consequence of better farmers' knowledge of damage to bee colonies they could cause, training in the proper use of plant protection products, and cooperation with the beekeepers including inter alia the

dissemination of information on migratory hives in the region (for instance their presence in orchards, oilseed rape cultivation sites, etc.), as well as heavy fines and possible cancellation of agricultural production subsidies under RDP (Rural Development Programme) imposed on parties found guilty of damage.

In the years 2009-2015 the number of professional beekeepers increased by 36.7% up to 324 entities running more than 88 thousand bee colonies. The most of professional apiaries were established in the two provinces: Warmińsko-Mazurskie and Dolnośląskie. An almost three-fold increase was reported in the first province and growth by 33,3% in the second one which constituted over 56% of the total number of the professional beekeepers in the country. In two provinces however, namely Opolskie and Podlaskie, several professional beekeepers withdrew from the honey production business. The lowest number of professional beekeepers (5 to 7) were noted in the Opolskie, Podlaskie, Śląskie and Łódzkie provinces. At the beginning of the assessed period 78.5% of the professional apiaries had 150 to 300 hives, the remaining number of hives belonged to 68 beekeepers running the beekeeping farms with more than 300 colonies, whereas in 2015 a change of the professional beekeepers structure, consisting in 40% growth in the number of the largest apiaries with more than 300 hives, was noted (Table 7).

Table 8. Number of beekeepers in relation to the structure of apiaries and number of bee colonies in professional apiaries (of over 151 hives) in Poland in 2015 by province

Province	Number of beekeepers in relation to the structure of apiaries			Number of bee colonies in professional apiaries (of over 151 hives)					
	151-300 hives	>301 hives	Total	151-300 hives	> 301 hives	Total	Structure (%)		
							in total	15-300 hives	>301 hives
A	34	17	51	7028	7612	14640	16,6	48	52
B	11	1	12	2220	430	2650	3,0	84	16
C	34	5	39	7432	2663	10095	11,5	74	26
D	4	4	8	840	2600	3440	3,9	24	76
E	6	1	7	1087	372	1459	1,7	75	25
F	15	6	21	3282	3810	7092	8,1	46	54
G	15	2	17	3159	780	3939	4,5	80	20
H	3	2	5	550	1100	1650	1,9	33	67
I	21	1	22	4229	350	4579	5,2	92	8
K	5	0	5	1010	0	1010	1,1	100	0
L	15	7	22	3040	2710	5750	6,5	53	47
M	6	0	6	1190	0	1190	1,4	100	0
N	7	3	10	1520	1090	2610	3,0	58	42
O	42	14	56	8692	9220	17912	20,3	49	51
P	23	3	26	4987	1200	6187	7,0	81	19
R	14	3	17	2668	1184	3852	4,4	69	31
T	**255**	**69**	**324**	**52934**	**35121**	**88055**	**100**	**60**	**40**

Source: own calculation and Semkiw P. Analiza sektora pszczelarskiego w Polsce, Instytut Sadownictwa i Kwiaciarstwa Oddział Pszczelnictwa w Puławach, for the period 2009-2015.

In 2015 an average apiary in Poland comprised about 23 colonies, while the average professional apiary 272 colonies. The smallest average apiaries run by professional beekeepers were located in the Śląskie and Podlaskie provinces (with 189 and 202 hives,

respectively), and the largest ones in the Lubuskie, Małopolskie, and Opolskie provinces (with 430, 338, and 330 hives, respectively). The difference between the minimum and maximum extremes reached 241 hives. The highest percentage of about 13 % of colonies in the professional apiaries in relation to the total number of colonies was reported in the Warmińsko - Mazurskie and Dolnośląskie provinces, the lowest number in the Śląskie (1.6%), Łódzkie (2.2%), and Podlaskie (2.7%) provinces. The respective country average was 6.1%. In Poland, the relation of number of the professional beekeepers to the other ones is very small (0.6 %), while in the other EU countries the respective average relation stands at around 3.5 %, and in Greece (Bee Mortality 2008, The honey... 2009) and Spain over 33,3% and 25% (Borowska 2011b, Semkiw 2007, 2010). The fragmentation of apiaries in Poland is a factor that has direct impact on the low profitability of production, while the associated high costs, small scale of production, and lack of investment capital, significantly reduce the economic results and hinder further development. For those reasons the structure of apiaries in Poland did not changed substantially in the recent years.

The activities undertaken within the framework of the successive National Apiculture Support Programmes were, and still are, directed at the development of beekeeping, preserving the colonies volume, and enhancing the quality of products offered on the market, inclusive of honey. In view of nature of this sector of economy and its changes the following issues are considered important: raising the level of beekeeping knowledge among the beginners and persons already engaged in the beekeeping, provision of support in the modernization of beekeeping farms (through purchase of professional beekeeping equipment), support to the laboratories carrying out physical and chemical analyzes of honey, mitigation of problems associated with combating the diseases of bee colonies inclusive of varroa, supporting the activities contributing to restocking of hives, rationalization of the seasonal movements of hives, and cooperation in the scientific and research programs. The new program also supports the research of commercial quality of honey and exploration and identification of honey varieties on the market. So far, the beekeepers were supported under the three-year "National Beekeeping Support Programme in Poland" (NBSP) accepted by the European Commission. In the years 2004-2016 four NBSP programmes[6] with total budget amounting to more than EUR 66.56 million were implemented in Poland (National Beekeeping Support Programmes 2007-10 and 2016-19, Borowska, 2013). It is worth mentioning that in the years 2014-16 Poland was granted 8.3%[7] of the total EU-28 budget (EUR 99.3 million) allocated for financial support of the beekeeping taking the fifth place after Spain (16%), France (10.7%), Romania (10.1%), and Italy (8.6%).

Conclusions

Basing on changes of the beekeeping sector in Poland in the years 2010-2015 the following conclusions can be drawn:

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[6] The budget of 1st NBSP in the years 2004/05-2006/2007 was EUR 11.7 M, 2nd NBSP in 2007/2008-2009/10 - EUR 13.3 M, 3rd NBSP in 2010/2011-2012/2013 - EUR 15.1 M, 4th NBSP in 2013/2014-2015/2016 - EUR 26.46 M, and the planned budget of 4th NBSP = over EUR 18.22 M.
[7] EU funding for Apiculture Programmes 2014-2016 (in €) http://ec.europa.eu/agriculture/newsroom/121_en.htm [Access" March 2016].

1. The proportion of the beekeepers who do not belong to any professional organization in the total number of the country's beekeepers decreases. Besides, the number of professional beekeepers systematically and gradually increases (by over 1/3 in the examined period), although their number of 324 entities keeping over 88 thousand bee colonies is still one of the lowest in the EU. People of mature age and retirement age dominate among the beekeepers (65%).

2. Considerable fragmentation and apiaries often run by amateurs are characteristic for the beekeeping in Poland. In 2015 an average apiary in the country had 23 colonies, while a professional apiary comprised 272 hives. More than half of the beekeeping farms had from 6 to 20 hives and as much as 16.4 % did not exceed 5 colonies. Only 2.2% of the beekeepers run the commercial apiaries with more than 80 bee colonies which constituted 13.7% of their total number.

3. Although 29% increase in the number of colonies up to more than 1.44 million was recorded in the reporting period, the number of hives in an average apiary gradually decreased (about 23 hives in 2015 – a drop of nearly 8%).

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Economic Activity of Farms Against Farms Countries of the European Union

Abstract. The development of an economic activity has been considered as a driving force for economic development, creating a chance to remove the rural population outside the agricultural sector. This article presents an analysis of the development of non-agricultural activities on farms in Poland and other countries in the European Union. A spatial variation in entrepreneurial farms in the EU in the years 2005, 2007 and 2010 indicated the dominant form of non-agricultural activities.

Key words: rural area, other gainful activity, agricultural farm

Introduction

The issue of rural areas development is still relevant and researched by many scholars as Wilkin (2010), Kłodziński and Rosner (1996), Czyżewski and Kułyk (2011), Adamowicz and Zwolińska-Ligaj (2009). The notion of rural areas (*les territoires villages, zone rurali)* is not clearly defined. It can be examined in terms of geographical, economic and sociological terms. Sociologists define rural areas considering local communities or peasant society features among which are spatial-demographic with territorial features, namely, the geographical community and a group of people selected on the grounds of the territory.

In terms of social features, related to similarities in the living conditions they define distinct type of solidarity, predominance of private and informal forms of communication and limited number of social institutions. In terms of cultural features, representing the same standards and values they define joint actions taken by the locals, individuality of its own culture (traditions, concepts, attitudes) and economic features, which is the connection of work in the fields with preindustrial structure against developed trade and craftsmanship, with a specific division of work and market structure (Kaleta, 1998).

In sociology, rusticity, in comparison to urbanity, is mostly defined as a distinct bond of human and nature, landscape and housing (Cloke, 2006). Reference books on economic geography and planning include several kinds of definitions of rural areas. The main concern of geographical research focuses on the issue of space and its environmental, economic and socio-cultural processes. The subject of geographical research is rural areas, which are distinguished based on their unique structures mostly referring to demography, land cultivation and economic elements.

As it was emphasised by Gilg (1985) and Wibberley (1972), the definition of rural areas should be based on the characteristics of the landscape and the intensity of land use. Kostrowicki (1976) considers rural areas as *a place which was dominated by farming for years and complemented by other forms of activity related to exploitation of natural resources.*

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Whitby and Willis (1978) emphasize that accepting land use as a criterion of rusticity is inadequate without considering social issues. According to the authors, a rural area may be dwelled by people not associated with farming or forestry, which are the directions of extensive land use. Therefore, a workplace or a sector in which people live may be a crucial criterion as defined by Banski (2012). Disorganisation of social and economic structures in the countryside is related to the activation of unused resources located in the rural areas, so above all, human resources, land and natural and cultural environment. It should be noted that it was farming which had a decisive influence on shaping a cultural image of the countryside (Adamowicz, 2004).

Although farming is still a dominating factor shaping the features of most rural areas, and it will remain a dominant share of rural economy in most regions for a long time, the process of diversification of businesses in rural areas, and integrating new non-agricultural and non-commodity outputs functions, is becoming more visible (Sikorska-Wolak, 2009).

Landscape analysis allowed for spatial identification and evaluation with a perspective of socio-economic development in some regions in European scale. Cavallo *et. al.*, (2010) point the importance of traditional agrarian landscape for territory which urgently requires an examination of the study of transformation and evaluative dynamics. In regions with unique natural and cultural potential, the most recommended direction of development is sustainable tourism, based on landscape values. One of such types of tourism is rural tourism, including agritourism (Jaszczak and Žukovskis, 2011).

The introduction of market mechanism in the economy resulted in the fact that more and more people living in the countryside started establishing their own trade, service and crafts businesses using their household resources. An important way of developing the business activity among a considerable number of countryside dwellers is a diversification of farms towards non-commodity outputs such as agritourism, pre-processing of farm products, crafts and handcrafts. In this way, some farmers may secure an additional source of income for their future.

Such a concept popularises a "European model of agriculture", which has at its core functioning and development, juxtaposed to highly competitive farms and is tightly connected with non-agricultural cells of agribusiness, including family-run farms, supplying market goods beyond the agribusiness structure (processing regional goods, direct sale, processing agricultural raw materials, non-commodity outputs and non-market goods in form of landscape values, biodiversity and restoring balance in natural environment.

The institutional development of rural areas is displayed in farm owners participating in cultural events, public life by using mass media. The aim of farming is not only maximising the effectiveness but also the realisation of pro-social and pro-environmental functions. As it is shown in the delimitation of rural areas, tourism may play a crucial role in being a significant branch of local economy and acts as a stimulus of endogenic development. The research conducted in randomly selected communities in Finland and Norway (Huse *et al.,* 1998; Saarinen, 2003 and Kosmaczewska, 2013) indicates that the influence of tourism on socio-economic development is more beneficial in case of larger communities than smaller ones, which, according to the authors, stems from more diversified economic structure.

Methodology

The primary objective of the study is the analysis of non-agricultural activities of farms in Poland and selected countries in the European Union. The research is based on economic activity and its spatial and temporal diversity. It deals with the level of entrepreneurial farms in the EU and in Poland in the years 2005, 2007 and 2010 indicated the dominant form of non-agricultural activities. The basic method of the study is a comparative analysis with the use of used selected methods of descriptive statistics.

The priorities of rural development policy in EU focus on multifunctional farming sector and supporting alternatives sources of income in rural areas such as those connected with tourism, crafts or services. Not only does undertaking additional businesses contribute to raising income, but also enables a better use of resources as well as allows the rural population to stay in their dwellings. In 2007, apart from agricultural activities, more than 1361 thousand farms in EU (27 countries) ran businesses other than farming. They constituted approximately 10% of all the farms (Figure 1). The percentage has been changed in the following years. In comparison to the previous years, the largest number of farms running additional businesses registered in the EU was in 2010 (Agriculture …, 2013).
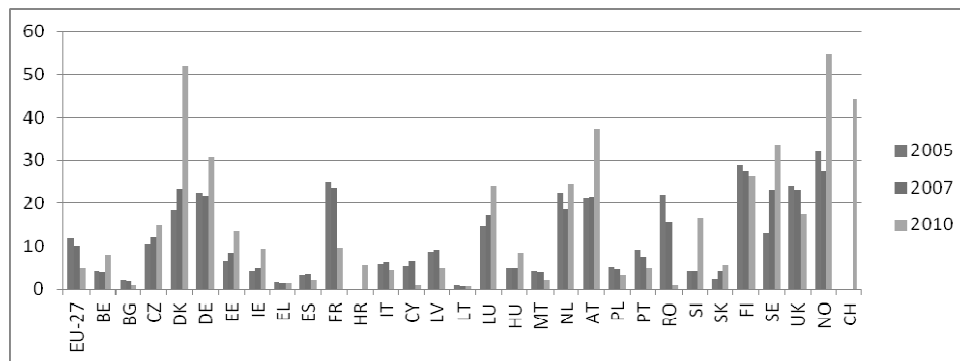
Fig. 1. The percentage of farms engaged in economic activities other than agriculture (% of households) in 2005, 2007 and 2010

Source: Author's calculation based on Eurostat 2007; Agriculture, forestry and fishery statistics 2013, Eurostat Pocketbooks.

Among EU countries in 2007 the highest proportion of farms with additional non-agricultural outputs was Finland with 28,9% and Norway with 32,2% (a country affiliated with EU). In 2007 there was a downfall in the number of farms by approximately 2% in comparison to 2005, but still the number was much higher (60%) than in 2003. The highest number of farms running non-agricultural businesses in 2007 was registered in Finland (28,9% households), in France (23,6%), in Germany (23,4%) while in 2010 in Denmark (50%), in Austria (37,3%), in Norway (54,7%) and in Croatia (44,5%).

In Poland merely 4,8% farms in 2007 went into additional businesses while in 2010 there was a considerable drop by 2,1% in comparison to 2005. Although diversification of rural economy is desired and supported by rural development policy in EU, there are countries in which the percentage of entrepreneurial farms is systematically decreasing.

This conclusion refers to Latvia (a decrease by 61% in comparison to 2003), to Hungary (a decrease by 55%), to Bulgaria (a decrease by 49%) as it is shown in Maps 1 and 2.
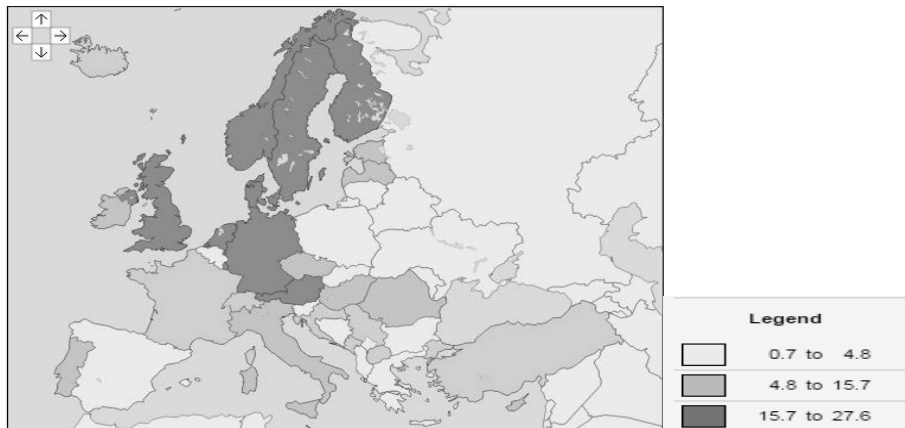
Map 1. Percentage of farms engaged in economic activities other than agriculture (% of households) in 2007

Source: Author's calculation based on OECD 2008.
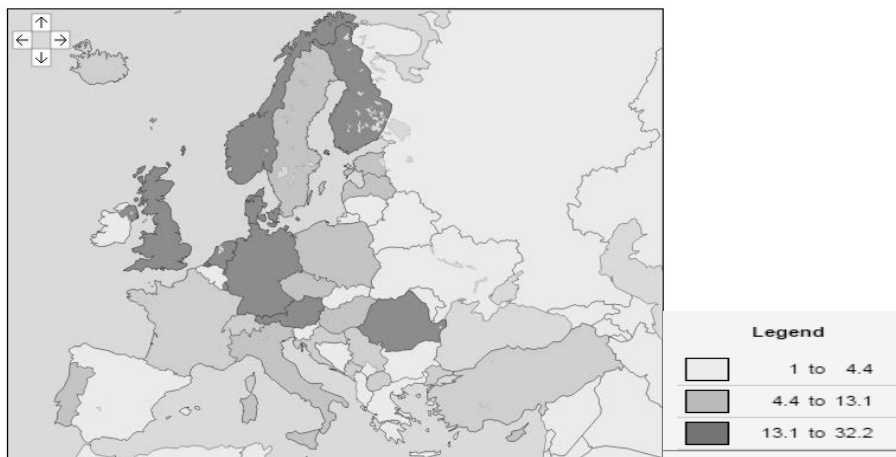
Map 2. Percentage of farms engaged in economic activities other than agriculture (% of households) in 2005

Source: Author's calculation based on OECD 2006.

Analysing the types of non-agricultural activities it is worth noticing that the highest number of farms (60%) ran businesses related to processing of agricultural products. According to Eurostat, the dominating business activities are services (15% of households) and tourism (9,2% of households).

Among the farms engaged in tourism those specialising in grazing livestock dominated over others amount to 44%. Tourism was also the domain of the farms with field crops and permanent crops (accordingly 15,5% and 15,2% of all non-agricultural outputs).

In Poland, dominant non-agricultural activities are unclassifiable. Among the most popular business activities in Polish farms are service activity using own machinery (29% of farms), aquaculture (10%) and tourism (9%). Services sector is a dominant form of business activity among farmers (increase by 29,2 % in 2013 in comparison to 2005). Agritourism took the second position (increase by 5% in comparison to 2005). The presented data indicate that between 2005 and 2013 there was the increase in the interest in the agritourism and services on the national scale. There was also a decrease in the number of the following activities: wood processing (4,2 percentage point), plant cultivation and stock farming in water environment (aquaculture – 8,2 percentage points) and other activities (23 percentage points). Production of renewable energy for the market changed marginally from 0,2% to 0,3% (Table 1).

Table 1. Types and number of non-agricultural enterprises in farms in Poland in 2005, 2007 and 2013

Types and number of non-agricultural activities	2005		2007		2013	
	Thous.	%	Thous.	%	Thous.	%
Services with the use of own equipment	31,6	23,6	33,2	28,8	36,9	52,8
Agritourism, room to let and others	9,1	6,8	10,2	8,9	8,2	11,8
Processing of agricultural products	5,3	4,0	3,2	2,8	2,4	3,4
Wood processing	9,0	6,7	6,8	5,9	1,7	2,5
Handicrafts	2,1	1,6	2,1	1,8	2,3	3,3
Cultivation and breeding of plants and Animals in water environment	13,6	10,2	11,5	9,9	1,4	2,0
Generating renewable energy for the market	0,3	0,2	0,2	0,2	0,2	0,3
Other activities	62,8	46,9	48,0	41,7	16,6	23,9

Source: Author's calculation based on: Charakterystyka gospodarstw..., GUS 2006, 2008, 2014 Warszawa.

Recently farming has been undergoing many changes including quantity, size and the direction of business activities. The growing number of farms, mainly small, is moving from traditional methods, looking for non-agricultural sources of income (Johannesson, Skaptadottir, Benediktsson, 2003). Undertaking an additional economic activity not only contributes to the increase of income, but also allows a more effective use of resources that are in our possession.

The state of development of non-agricultural business activity is regionally diversified. There are more farms located in northern and western voivodships than in typically farming-oriented districts (podlaskie, lubelskie, mazowieckie and wielkopolskie) (Charakterystyka, 2012). Service sector constitutes the dominating form of business activity among farmers, the increase by 21,2% in comparison to 2005. Agritourism took the second position (increase by 2,7% in comparison to 2005).

The presented data indicate that between 2005 and 2013 there was an increase in the interest in the agritourism and services on national scale. There was also a decrease in the number of the following activities: wood processing (6%), plant cultivation and stock farming in water environment (aquaculture – 11,6%) and other activities 38,9%. Only production of renewable energy for the market did not change and was only 0,3%.

Conclusion

The available data of mass statistics do not determine precisely the scale of enterprises related to agrotourism and the number of people using this form of relaxation. The number of farms dealing with agrotourism and rural tourism is growing year by year in most Polish voivodships. Also, in many EU countries the number of farms offering agrotourism services is growing rapidly. Italy may serve a good example here, as the number of farms between 2003 and 2007 doubled (OECD, 2008).

The share of agriculture in gross domestic product is systematically reduced, in rural areas is taking place an increased diversification of business activity. Unfavourable indicators scissors prices make farmers increasingly forgo the typical agricultural activities and occupy the alternative sources of income.

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Structural Changes in Wheat Market

Abstract. Time series analysis is based on the assumption of stationarity. Stationarity implies the parameters are constant over time. Structural break occurs when at least one of the parameters changes at some date. Structural breaks can lead to huge forecasting errors and unreliability of the model. Modelling structure breaks is very popular in the literature of macroeconomics and finance. However, there are still too few publications about structural breaks in agricultural market.
The goal of research is to identify structural breaks in wheat prices time series. A few structural break tests are applied. It has been shown that there is at least one significant structural break in the analysed time series. Both Quandt-Andrews and Bai-Perron tests show that there is a significant breakpoint in 12.09.2007. The estimated break date is associated with the beginning of global financial crisis. It may imply that wheat prices have become more prone to changes in global financial market.

Key words: agricultural commodity, wheat market, structural breaks, Bai-Perron test

Introduction

First decade of 21st century has brought on incredible structural changes to the commodity market. Commodity markets, including agricultural commodities, have become more like financial markets (Domanski, Heath, 2007). During 2007–2008 and 2010–2011 commodities' prices, including agricultural commodities, have increased substantially. Baffes and Haniotis (2010) claim that economic factors cannot fully explain the recent increase in commodity prices. They find the investors' activity in commodity futures market as one of the main driving forces behind the sharp prices rise of agricultural commodities. High activity of speculators has pushed up commodities' prices beyond fundamental levels. Furthermore, growing interest of speculators in the commodity futures market increases price volatility in this market (Czech, 2013). Nowadays, the researchers need to apply models and techniques which have been used so far mainly for financial time series data. There are a few main issues that arise with agricultural commodity's prices time series. One among others is the problem of structure breaks that may affect any or all of the models parameters.

Fundamental econometric models are based on the assumption that parameters are constant over time. Structural changes occur if at least one parameters in the model has changed at some date (*break date*). This change may involve a change in mean or a change in other parameters of the process that produce the series. Being able to identify when the structure of time series changes can give researchers insights into the analysed problem. In order to determine when and whether there is a significant change in data, one can apply structural break tests.

It is generally known that the identification and modelling structural breaks is important to generate the precise estimates of the model and its forecast. Modelling structure breaks is very popular issue in literature concerning empirical macroeconomics

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and finance. For instance, Malik (2003) or Rapach and Strauss (2008) detect structural breaks in the exchange rate market, Bai and Perron (2003) in the US interest rate market or Aggarwal, Inclan and Leal (1999) in the securities market. The application of structural break tests on commodities' time series is not as popular as on macroeconomic and financial time series. The problem was analysed by Jin and Miljkovic (2010), Zainudin and Shaharudin (2011), Narayan et al. (2013) among others. Jin and Miljkovic find six structural breaks in the US relative farm prices. Zainudin and Shaharudin (2011) investigate the spot and future palm oil prices time series. They identify two significant structural breaks in analysed data. Narayan et al. (2013) detect significant structural breaks in the gold, oil and silver market. It needs to be emphasized that identification of structure breaks is essential in the volatility clustering modelling. Structure breaks have an impact on the accuracy of volatility parameters estimation. Detecting structural breaks is also the first step to build econometric models with regime-changes.

The primary goal of research is to identify structural breaks in the wheat prices time series. The paper is organized as follows: section 2 depicts literature reviews concerning the methods of identifying structural breaks in time series data, section 3 discusses analysed wheat prices' data and examines the results of applied breakpoint tests, and section 4 contains conclusions.

Methodology

Structural change will be discussed in the context of simplest dynamic model, the first-order autoregressive model (1):

$$y_t = \alpha + \beta y_{t-1} + \varepsilon_t \tag{1}$$

where ε_t is a time series of serially uncorrelated shocks, α, β are the parameters of the model. Time series y_t is being modelled as a regression on its own past. The explanatory variables y_{t-1} are lagged values of observed endogenous variables y_t. The well-known assumption of stationarity implies that model parameters α, β are constant over time. Structural break is said to occur if at least one of these parameters has changed at some date in the sample period. This date is popularly called as the break date.

The researchers of structural changes look for systematic methods to identify and understand structural breaks. The classical test for structural change is introduced by Chow (1960). In his test the sample is split into two sub periods, then after parameter estimation for each sub periods, the equality of two sets of parameters test is applied. However, there is an important limitation of the test. In the Chow test, researcher must know in advance the break date. It needs to be emphasized that the choice of exact break date is hard and problematic. Moreover, results are highly sensitive to the choice of break date and as a result different researchers may come to different conclusions. Therefore, there are two main disadvantages of the Chow test (Hansen, 2001). First of all, the Chow test may occur to be uninformative because the true break date can be missed. Moreover, the Chow test may be misleading, when the test indicates the break date while, in fact, none exist.

It is believed that better approach to find proper breakpoints is to treat the break date as unknown. Such idea was developed by Quandt (1960). He suggested taking the largest Chow statistic over „all" possible break dates. The estimated largest Chow statistic is called Quand't statistic. The conventional solution is to consider all break dates in the interior τ percent to ($1-\tau$) percent of the sample, where the trimming parameter τ is typically between 5 percent and 15 percent. For many years, however, the Quandt statistic had no practical application, because there were no proper critical values for the Quandt's test. In the 1990's this problem was simultaneously solved by several scientists. Andrews (1993), Andrews and Ploberger (1994) provide tables of critical values, Hansen (1997) provides method to calculate p-value for Quandt's test.

Another disadvantage of both Chow's and Quandt's tests is the fact that they are able to detect only one break date. Dufour (1982) extended Chow's test. He applied non-parametric methods to detect multiple changes in regression coefficients that occur at unknown time. Another interesting approach applied to detect multiple structural changes is the test developed by Bai and Perron (1998, 2003). They proposed a sequential method which starts by testing for the single break date existence. If the null hypothesis that there is no structural break is rejected, then the sample is split into two subsamples. It needs to be emphasized that the sample is divided on the basis of estimated break date. This sequence test is carried out until each subsample test fails to find evidence of a structural break.

Research results

In order to identify structural breaks in wheat commodity market the first-order autoregressive model is built. Daily futures prices data for wheat from January 1995 to December 2015 (5 479 observations) provided by Thomson Reuters DataStream are applied to analysis. Figure 1 presents wheat prices from January 1995 to December 2015 in US dollars per bushel.
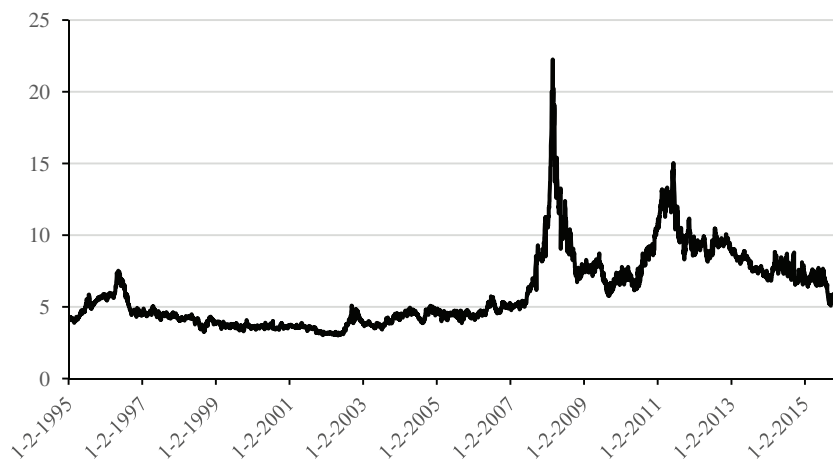
Fig. 1. Daily wheat prices from 01.1995 to 12.2015 (in US dollars per bushel)

Source: own calculations.

Figure 1 shows that the volatility of wheat prices increased substantially since the end of 2007. It needs to be emphasized that the period of extreme wheat prices' growth covers with the period of the beginning of global financial crisis. Before the end of 2007 wheat market was more stable, that is the volatility of wheat prices was much lower than in the next period. Based on figure 1 we can expect that there is some structural break in analysed wheat prices time series.

The process of structural break testing should be begun with estimating the proper econometric model. Following Hansen (2001) the first-order autoregressive model (1) is built. Estimation of coefficients of model (1) requires variables to be stationary. The Augmented Dickey-Fuller (ADF) (1979) test is conducted for testing the null hypothesis of a unit root versus the alternative of a stationarity. Table 1 presents ADF test of futures wheat prices time series. Let w_t be the natural logarithm of the wheat time series variable and dw_t be the first difference of w_t.

Table 1. Augmented Dickey-Fuller test results

Variable	Intercept	Intercept and trend
w_t	-2,44	-2,88
dw_t	-61,53***	-61,53***

Note: *** H_0 of a unit root is rejected at 1%, ** 5%, and * 10% significance level.

Source: Thomson Reuters DataStream, own calculations.

The ADF test indicates that the hypothesis of a non-stationary level cannot be rejected for w_t time series. However, dw_t time series (the first difference of w_t) occurs to be stationary at least at 1% significance level. Therefore, it implies that the first-order autoregressive model (1) should be built on the basis of stationary variable dw_t. The variable dw_t is the observed endogenous variable of the model (1). Moreover, model (1) consists of constant regressor and first order lagged values of observed endogenous variables. Table 2 presents the estimated coefficients of model (1) for the wheat prices time series.

Table 2. First-order autoregressive model (1) for wheat prices time series

Coefficient	Value	t-statistic
constant (α)	0,01	0,14
dw_{t-1} (β)	-0,14	-10,77***

Note: *** H_0: coefficient is equal zero is rejected at 1%, ** 5%, and * 10% significance level.

Source: own calculation.

On the basis of the results presented in table 2 it can be noticed that intercept coefficient is not significant. The null hypothesis that coefficient β equals zero has been rejected at 1% significance level. The estimated model (1) is applied to identify structure breaks in the wheat market from 01.1995 to 12.2015.

First, we start from tests that identify single break date. As it is hard to detect exact break date, it is good to begin with Quandt (1960) test which treats the break date as unknown. The trimming percentage of 15 is employed. The trimming value implies that regimes are restricted to have at least 15 observations. The calculations has been made in

Eviews 8 econometric software. As many as 3836 break dates has been compared. The results of Quandt test is presented in Table 3.

Table 3. Quandt-Andrews unknown breakpoint test

Statistics	Value	Probability
Maximum (max F) (12.09.2007)	10,83	0,00
Exponential (exp F)	2,69	0,00
Average (ave F)	3,14	0,01

Source: own calculations.

The highest value of the Chow test has been estimated for date 12.09.2007. The maximum (max F), average (ave F) and exponential (exp F) test statistics are applied. P-values presented in the third column indicate that the null hypothesis of no break is rejected. It is shown that the estimated breakpoint date is significant.

Another, more advanced and complex, way to detect structure breaks is the sequential Bai-Perron test. The merit of the test is the fact that it can identify more than one breakpoint. Before we conduct the test, there are some assumptions that should be made. First, the maximum number of breaks is 5, trimming percentage is 15 and significance level for sequential testing is 0,05 (denoted by *).

Table 4 displays scaled F-statistic and the Bai-Perron critical values (Bai and Perron 2003). F-statistic is scaled by the number of varying regressors. Assumed significance level is 0,05. The sequential Bai-Perron test shows that there is only one breakpoint in 12th September 2007, which is consistent with the results of Quandt-Andrews test. A null hypothesis of zero breakpoint is rejected in favour of an alternative of 1 breakpoint (m=1). However, with this series, there is no evidence for a second break.

Table 4. Sequential Bai-Perron test

Break test	Scaled F-statistic	Bai-Perron critical value
0 vs. 1*	22,66	11,47
1 vs. 2	6,35	12,95
Break date	12.09.2007	

* significant at a 0,05 level

Source: own calculations.

The Bai Perron test presented above requires the specification of the number of breaks (m) under the alternative hypothesis. Bai and Perron (1998) proposed another form of multiple breakpoint test where we test the null hypothesis of no structural break against the hypothesis of M globally optimized breaks. In the test the maximum number of breaks is assumed to be 5, trimming percentage is 15% and significance level is 0,05. Test results are presented in table 5.

Table 5 displays scaled F-statistic, weighted F-statistics and the Bai-Perron critical values (Bai and Perron, 2003). Estimation procedure of above test statistics is described in the paper written by Bai and Perron (1998). The Bai-Perron test of 1 to M globally determined breaks is performed from 1 to the maximum number of breaks until we cannot reject the null hypothesis. In each case the individual test statistic (both scaled and weighted) exceeds the critical value. Therefore, the multiple breakpoint test indicates that there are as many as 5 breakpoints.

Table 5. Bai-Perron test of 1 to M globally determined breaks

Breaks	Scaled F-statistic	Weighted F-statistics	Critical Value
1*	22,66	22,66	11,47
2*	11,35	13,36	9,75
3*	12,71	17,44	8,36
4*	14,95	23,85	7,19
5*	10,49	20,58	5,85
UD_{max}	22,66	UD_{max} critical value**	11,70
WD_{max}	23,85	WD_{max} critical value**	12,81

* significant at a 0,05 level.
** Bai-Perron (2003) critical values for UD_{max} and $WD_{max.}$

Source: own calculations.

However, the application of scaled and weighted maximized statistics indicates different number of breakpoints.[2] The maximized value of scaled F-statistic (UD_{max}) clearly exceeds the critical value. A null hypothesis of no breaks is rejected in favour of an alternative hypothesis of a single break. The break date is 12.09.2007, exactly the same as in previous tests. The value of maximized weighted statistics (WD_{max}) is also higher than critical value which indicates that the null hypothesis is rejected. In that case however, the WD_{max} test statistics indicates that there are 4 breakpoints. The null hypothesis of 3 breakpoints is rejected in favour of hypothesis of 4 breakpoints. The estimated break dates are as follows: 14.10.1998, 10.07.2002, 12.09.2007 and 04.11.2010. It needs to be emphasized that the results based on WD_{max} test statistics are different than before, but one break date (12.09.2007) appears in each test.

All results reported up to this point show that there is at least one breakpoint in the analysed wheat prices' time series. 12th September 2007 is found to be a break date. It needs to be stressed that September 2007 is the time of the crisis in American housing market. The subprime mortgage crisis transformed very quickly into global financial crisis. The estimated break date shows that financial crisis has affected not only the shares or foreign exchange market but also the commodity market. Moreover, it doesn't concern only the most actively traded commodity like oil, but also soft commodities including wheat.

Conclusions

The preceding analysis can be summarized as follows:
- From a perspective of generating the precise estimates of a model and its forecast, the identification of structural breaks is extremely important,
- The problem of structural breaks in food commodity market cannot be ignore, it can lead to inaccurate forecasts, misleading or worse policy recommendation,
- The results show that structural breaks exist in wheat prices time series. Both Quandt-Andrews and sequential Bai-Perron tests show that there is one significant breakpoint in 12.09.2007. The results of the Bai-Perron test of 1 to M globally determined breaks

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[2] The test which is based on maximized scaled or weighted statistic is called a double maximum test (Bai and Perron 1998).

are not clear and unambiguous. The maximized value of scaled F-statistic (UD$_{max}$) indicates the existence of one break date (12.09.2007). The value of maximized weighted statistics (WD$_{max}$), however, indicates that there are as many as 4 breakpoints,

- All conducted tests show that there is structural break in 12.09.2007. It needs to be emphasized that the estimated date is covering with the time of the beginning of global financial crisis. It may suggest that wheat prices have become more and more sensitive to changes in global financial markets.

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Can Unprocessed Food Prices Really Be One of the Main Responsible Causes for not Achieving Inflation Targets in Turkey?

Abstract. Parallel to international conjecture, as of 2006 food prices, particularly those of unprocessed foods, have displayed high levels of fluctuation and it is know that these fluctuations have increased in more recent years. In the explanations and reports issued by economic circles and fiscal authorities, it is frequently emphasized that fluctuations seen in food prices result in negative influences on inflation and particularly the fluctuations observed in unprocessed foods create serious uncertainties by making inflation forecasting quite difficult. In the current study, whether there is some kind of interaction between 2006:01-2016:03 inflation realizations in Turkey and food prices, processed and unprocessed food prices and uncertainties obtained by using GARCH-type volatility forecasting models was analyzed through VAR Granger causality tests.The findings obtained in the current study support the explanations of economic circles to a great extent.

Keywords: unprocessed food price index, processed food price index, food price index, GARCH-type volatility forecasting models, VAR Granger causality/block exogeneity wald tests, inflation targeting, Turkey

Introduction

Since 2002 when an inflation targeting regime was adopted in Turkey, with the exceptions of 2002-2005 and 2010, the targets have not been achieved. In some years, more than a hundred percent deviations were observed. Globally, on the other hand, as of the second half of 2000, commodity prices have greatly increased and volatility in food prices has also increased, mainly as a result of: increases in energy prices, changing climate conditions, fluctuations in exchange rates, increases in the utilization of agricultural products for the production of bio-fuel, income growth, low and uncertain stock levels, and changing demand structures of developing countries due to their wealth and population growth (FAO, 2010, 2011, 2012; FAO et al., 2011; OECD-FAO, 2011, USDA, 2011).

The negative effects of this conjecture on Turkey became more remarkable in 2008 and 2011 when serious crises were experienced in the world. On the other side, food prices started to fall after 2011 in the world and in February 2016 food prices dropped by 14.5% and came to the lowest value of the last six years (FAO, February 2016). However, in Turkey, food prices continue to increase by significantly deviating from their historical trends and international food prices. In addition, especially unprocessed food prices exhibited important volatility and this volatility has been increasing more in recent years.

In this regard, particularly as of 2006, the main focus of many basic policy articles has been the rapid increases in food prices that are outside the control of the Central Bank, remarkable increases in inflation due to adjustments made on products whose prices are administered and unforeseen fluctuations. It is stated that especially excessive volatility

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experienced in the prices of unprocessed foods leads inflation to follow a volatile path in monthly frequency. Accordingly, the basic driving force of the rise in inflation is pointed out to be unprocessed foods, especially fresh fruit and vegetables, and a high level of fluctuations in the annual inflation of unprocessed food prices is claimed to be resulting in a considerable prediction uncertainty (CBRT, 2006a-2016a; CBRT; 2012b-2016b).

In this respect, in the current study, whether there were any interactions between inflation realizations in Turkey in the period of 2006:01-2016:03 and food prices, processed and unprocessed food prices and the uncertainties determined by using GARCH-type volatility forecasting models such as symmetric ARCH Engle (1982), GARCH (Bollerslev, 1986) and asymmetric EGARCH Nelson (1991) and TGARCH/GJR-GRARCH Glosten, Jagannathan and Runkle (1993) and Zakoinan (1994) were analyzed by means of VAR Granger Causality/Block Exogeneity Wald Tests.When the test results were examined, the existence of one-way causality from the uncertainty of unprocessed food prices to food prices; one-way causality from both of them to annual inflation and one-way causality from annual inflation to food prices could not be refuted. The obtained findings support the statements of CBRT to a great extent. Uncertainties occurring in unprocessed food prices were revealed to be both a direct cause of annual inflation and an indirect cause of it over food price fluctuations.

Inflation Targeting and Inflation Realizations in 2002-2015

The Turkish economy, experiencing a serious inflation problem as of the 1970's, became very fragile up to 2000, particularly as a result of the consecutive economic crises occurring in the 1980's. In addition to this, the financial crises experienced in 2000-2001 symbolized a turning point in Turkey and then macro-level economic measures were considered to realize a series of fiscal, economic and legal amendments. At the same time, the Central Bank of the Republic of Turkey (CBRT) declared implicit inflation targeting in 2002-2005 following the crises and as of 2006, explicit inflation targeting was adopted (CBRT, 2005; 2006c). The inflation targets and their realizations during the period when the implicit inflation targeting was adopted are given in Table 1.

Table 1. Annual CPI Percentage Changes and Targeted Inflation Values in 2002-2005

Years	2002	2003	2004	2005
Realization	29.7	18.4	9.35	7.72
Target	35	20	12	8

Source: Cenrtal Bank of Republic of Turkey (CBRT).

As can be seen in Table 1, the Central Bank mainly focused on price stability as of 2002 and the inflation that descended to single digit level after long years came under the targets. On the other hand, price stability involves not only achieving low inflation levels but also sustaining this price stability and settings where low inflation levels can be sustained are regarded as the settings where price stability is attained. That is, when inflation level descends to the level ranging from 1% and 3% and then increases to the level higher than 10%, it means that price stability could not be achieved (Serdengeçti, 2002; CBRT, 2006c, 2013c).

In a similar manner, middle-term price stability is defined by the European Central Bank as the increase of HICP (Harmonized Index of Consumer Prices) less than 2% when compared to the previous year (Duisenberg, 2001). Accordingly, though the annual inflation started to be realized at single digits, it can be seen that it is still highly over the inflation rates of developed countries in Table 2.

Table 2. The Targeted, Realized Inflation Rates and Deviation Status in Period 2006-2015

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Mean
Target	5	4	4	7.5	6.5	5.5	5	5	5	5	5.3
Uncertainty Band	3.0-7.0	2.0-6.0	2.0-6.0	5.5-9.5	4.5-8.5	3.5-7.5	3.0-7.0	3.0-7.0	3.0-7.0	3.0-7.0	3.3-7.3
Realization	9.7	8.4	10.1	6.5	6.4	10.4	6.2	7.4	8.2	8.8	8.2
Deviation[1] (%)	94	110	152	-13.3	-1.5	89	24	48	64	76	56.4

[1] Deviations were calculated

Source: Central Bank of Republic of Turkey (CBRT).

The inflation levels realized during the implicit inflation targeting period could not be attained as of 2006 when explicit inflation targeting was adopted by CBRT. In this regard, it has been emphasized by both CBRT and economic circles that the reason behind the inflation rates' being higher than the expected and limiting the speed of inflation decrease is the negative trend in food prices. At the same time, such developments delay the improvement in the inflation outlook and thus force inflation to move upwards; as a result, in terms of the realization of inflation target, increases seen in food prices play an important role (Başçı, 2014a, 2014b, 2014c). As in every type of price fluctuation, it is known that fluctuations in food prices make it difficult for the Central Bank to produce short-term and middle-term inflation forecasting and underestimate the informative value of estimations and thus negatively affects the management of expectations (Başkaya, Güngör and Öğünç, 2008). Moreover, it is stated that food group is one of the sub-groups making the greatest contribution to the upward movement of inflation and that deviations result from the jumps in the administered prices that are out of control of fiscal policy and in unprocessed food prices (CBRT, 2006a-2016a).

As is known well, climate changes, decrease in the stocks of agricultural products, increases in the costs of energy and other inputs, population growth, increasing amount of agricultural products used for different purposes such as the production of bio-fuels, resulted in excessive increases in food prices in the world and price fluctuations in the second half of 2000. Particularly in developing countries, depending on population and welfare growth, demand for agricultural products has been increasing and thus food prices have been kept staying high (Ministry of Development, 2013).

The increasing prices of fresh fruit and vegetables, rapid changes in climate conditions and differentiations of the seasonal structures of prices and structural elements and estimation-related elements; all of these can impose some pressure on the inflation outlook. These factors lead to larger uncertainty intervals determined for the inflation target in Turkey when compared to many other countries implementing inflation targeting regimes (Atuk and Sevinç, 2010).

It is widely believed that the high increases observed in the prices of international agricultural raw materials since mid-2005 have led to increases in inflation rates in many

developing countries, including Turkey where food purchases constitute a large part of gross consumer spending (Başkaya et al., 2008).

As in other developing countries, food products have a relatively greater share in the consumer basket. On the other hand, in developed countries, high-technology products have a greater share. As a result, high efficiency increases in technology-intense products have positive reflections on the inflation rates of developed countries. However, the increase in the prices of world food products can be accelerated by factors such as fast transition from agriculture sector to industry and service sectors in developing countries, low productivity in agriculture and increasing share of developing countries in the global demand. When all these developments are combined with the relatively larger share of food products in the consumer basket, then higher inflation rates are witnessed in developing countries (CBRT, 2006a-2013a). As food products have a large share in consumer price index in Turkey, it has been frequently stated that fluctuations in food prices are an important source of uncertainty in the analysis and prediction of consumer inflation and complicate the process of expectation management (Orman, Öğünç, Saygılı and Yılmaz, 2010).

In this connection, since the period when inflation targeting was adopted in Turkey, compared to other developing countries keeping the uncertainty interval for their information target as 2 percent in both directions of the target, Turkey has relativelylarger uncertainty intervals and the main reason for this is the impact of fruit and vegetable prices on inflation forecasting (Atuk and Sevinç, 2010).

Therefore, close monitoring of these prices and thus detecting the factors increasing the fluctuation and taking the required measures to prevent these fluctuations are of great importance in terms of establishing middle-term price stability. In our study, the following graphs were drawn to evaluate whether it would be correct to deal with food prices as the main culprit of the price fluctuations seen in Turkey and to see the trends of food prices in the world and in Turkey.
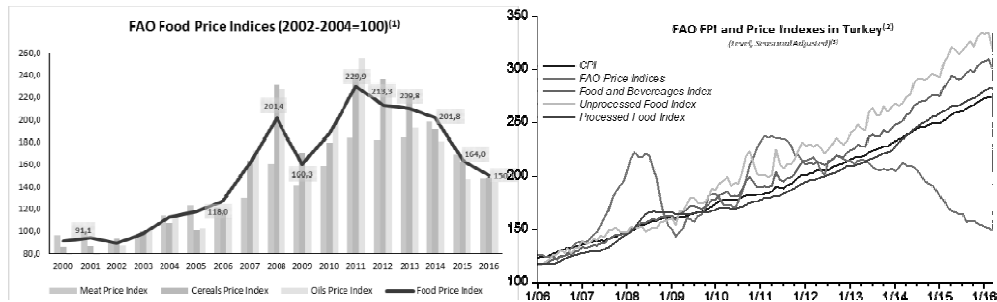
Fig. 1. Trends of Food Prices in the World and in Turkey

Source :   (1) Food And Agriculturel Organization of the United Nations, World Food Situation FAO Nominal Food Price Index (February value just for 2016). It indicates the annual average values.
http://www.fao.org/worldfoodsituation/foodpricesindex/en/
            (2) Price Indexes in Turkey are obtained from the offical website of Turkish Statistical Institude (TSI)
            (3) Indexes are seasonally adjusted using Census X-13 method.

While FAO food price index entered a trend of increase as of 2006, particularly between 2008 and 2011 serious jumps were observed, since 2012 there has been a relative decrease in these prices in that in February 2016 food prices dropped by 14.5% and came to the lowest value of the last six years (FAO, February 2016). On the other hand, it can be clearly seen from

Figure 3 that as a result of fast increases seen in domestic food prices in recent years, they deviated from both their historical trends and from international food prices. When Turkey's food indexes were drawn together, taking 2011 as the starting point when FAO attained its highest value, this deviation from international prices can be more clearly seen.

Empirical Framework

Preliminary Analysis of Data

Data set is composed of Consumer Price Index (CPI), Food and Non-Alcholic Beverages (FPI), Unprocessed Food Index (UFI) and Processed Food Index (PFI). All data is taken from The Turkish Statistical Institute (TSI) and Central Bank of Republic of Turkey (CBRT) covers the time period from 2006:01 to 2016:03, with the base year of 2003.The descriptive statistics and stationarity conditions of the investigated variables are given in Table 3.

Table 3. Descriptive Statistics and Stationarity Conditions of The Investigated Variables

Statistics	Price Indexes				Cyclic Component of Price Indexes			
	CPI	FPI	UFI	PFI	Annual Inflation	FPICYC**	UFICYC**	PFICCYC**
Mean	190.8758	200.2546	211.9326	188.4054	8.313943	-1.73E-11	-2.81E-11	-3.53E-11
Median	183.9300	192.2200	208.2403	179.5570	8.280488	-0.326613	-1.367969	-0.548976
Maximum	274.4400	315.2200	347.5136	283.9699	12.06461	16.28675	27.72780	11.86836
Minimum	123.5700	117.6100	118.6834	116.3651	3.986038	-9.985823	-18.85494	-6.774389
Std. Dev.	43.52085	54.68397	63.09850	46.66904	1.736061	5.413422	10.00429	3.744414
Skewness	0.263258	0.385802	0.362511	0.371321	-0.196276	0.358718	0.321324	1.031996
Kurtosis	1.923145	2.125302	2.060917	2.193891	2.722704	2.771590	2.578675	4.529353
Prob. (J-B)	0.025175	0.030617	0.027138	0.046033	0.553269	0.233952	0.220207	0.000000
Stationarity*	I(1)	I(1)	I(1)	I(1)	I(0)	I(0)	I(0)	I(0)

* For the determination of the integration degree of the series, Philips-Perron (1988) PP and Kwiatkowski-Phillips-Schmidt-Shin (1992) KPSS stationarity tests were employed, constant and trend variables were included in the models.
** While administering Serilere Hodrick-Prescott (1980) filtering method to the series, adjustment parameter (lambda=14400) was used.

Source: own research.

Fig. 2. Cycle Series of Price Indices and Annual Inflation and Price Indices Isolated from the Trends
Source: own research.

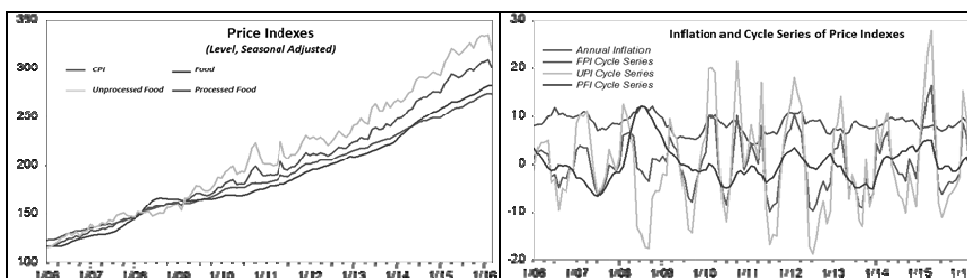Price indices' continuous tendency to increase over time indicates trend effect and positivity of the means support this. Moreover, the differences between the minimum and maximum values of the series offer some preliminary information. This difference is most notable in food and unprocessed food indices. Another sign of volatility, standard deviation values give the same variables and this indicates that these variables might be under the volatility. Median values lower than means indicate that volatility mostly concentrates on price fluctuations taking place over the mean. At the same time, though positive price fluctuations are more than negative price fluctuations, it can be seen from skewness and kurtosis values that most of the index realizations occur around the mean at similar frequencies.

As known, for the models to be set in research to support their hypotheses, the series must be stable. Though it is possible to stabilize variables by taking the difference of unstable series in time series, this operation leads to loss of both data and information; first elements that can disturb the stability (structural break, trend etc.) should be handled. In this regard, as can be seen in Table 3, price indices were found to be not stable and on the basis of the idea that what disturbs the stability is trend effect, Hodrick-Prescott (1980) filtering method was administered to the series. As is known well, this method is widely used in separation of long-term tendency in such a way as to obtain a cycle in macro-economic time series.

Under the inflation targeting regime, year-end inflation rates calculated as the 12-month change in the CPI are set as the target variable in Turkey. In the current study, annual inflation rates were considered as inflation series and it was observed that when CPI was converted into annual inflation, it became stationary. At the same time, cycle series obtained as a result of filtering administered to the other series were observed to become stationary. Similar to the price indices, the indices where volatility effect became the most notable in cycle series are food and unprocessed food prices.

Investigating the Causal Relationship of Price Indices in Turkey

Knowing the direction of long-term relationships between the variables is of great importance for policy makers and as known, this information is related to determination of causality between variables. In this regard, in order to elicit the interactions between the variables addressed in the current study, uncertainty series of the variables under investigation were obtained by using symmetric and asymmetric GARCH-type volatility forecasting models whose details are given in Table 4.

While determining the GARCH model best representing ARCH impact in error from among the models, in addition to the biggest log-possibility, significance of the coefficients at the level of 5% were taken into consideration (Demetriades et al., 2006). GARCH-type models satisfying all of these characteristics at the same time are given in Table 5.

As can be seen in Table 5, as annual inflation realizations and ARCH effect on processed food prices could not be determined, only uncertainties for unprocessed food prices (UNUFICYC) EGARCH(0.4) and food price index (UNFPICYC) ARCH(1) could be obtained.

At the second stage of the analysis, causality tests will be utilized in order to determine the direction of the long-term relationships between the variables. Methodologically, the causality relationship between series started to be tested with "Granger Causality Test" developed by Clive W.J. Granger (1969). This test was originally developed to determine whether a variable is

necessary for the prediction of another variable. It is an easy-to-calculate test; therefore, it is one of the most commonly preferred methods in causality analysis.

Table 4. Symmetric and Asymmetric GARCH-type Volatility Models and Coefficient Restrictions

Models	ARCH(q)	GARCH(p,q)	EGARCH(p,q)	GJR/TGARCH(p,q)
	$Y_t\|I_{t-1} \sim N(X_t\beta, h_t)$ $\varepsilon_t\|I_{t-1} \sim N(0, h_t)$ $E(\varepsilon_t\|I_{t-1}) = 0,$ $V(\varepsilon_t\|I_{t-1}) =$ $h_t z_t \sim N(0,1)$ $\varepsilon_t = z_t\sqrt{h_t}$ $h_t = \sigma_t^2 = V(\varepsilon_t^2\|I_{t-1})$ $= \omega + \sum_{i=1}^{q} \alpha_i\, \varepsilon_{t-i}^2$	$y_t\|I_{t-1} \sim N(x_t\beta, h_t)$ $\varepsilon_t/I_{t-1} \sim N(0, h_t)$ $\varepsilon_t = y_t - x_t\beta$ $h_t = \omega$ $+ \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j}$	$logh_t$ $= w$ $+ \sum_{j=1}^{p} \beta_j\, logh_{t-j}$ $+ \sum_{i=1}^{q} \alpha_i \left\|\frac{\varepsilon_{t-i}}{\sqrt{h_{t-i}}}\right\|$ $+ \sum_{k=1}^{r} \gamma_k \frac{\varepsilon_{t-k}}{\sqrt{h_{t-k}}}$	σ_t^2 $= \omega + \sum_{i=1}^{q} \alpha_i\, \varepsilon_{t-i}^2$ $+ \sum_{i=1}^{q} \gamma_i\, S_{t-i}\varepsilon_{t-i}^2$ $+ \sum_{j=1}^{p} \beta_i\, \sigma_{t-j}^2$ $S_{t-i} = \begin{Bmatrix} 1 & \varepsilon_{t-i} < 0 \\ 0 & \varepsilon_{t-i} \geq 0 \end{Bmatrix}$
Coefficient Restrictions				
Non Negativity	$w > 0, \alpha_i \geq 0$ $i = 1,2,3,....,q,$	$p \geq 0,\ \ q > 0,\ \ w > 0,$ $\alpha_i \geq 0\ \ i = 1,2,3,....,q,$ $\beta_j \geq 0\ \ j = 1,2,3,....,p$		$\omega > 0, \alpha_i \geq 0,$ $i = 1,....,q(\alpha_i + \gamma_i)/2$ ≥ 0 $\beta_j \geq 0\, i = 1,.....,p$
Cov.Stationarity/ Stability	$\sum \alpha_i < 1$	$\sum \alpha_i + \sum \beta_j < 1$		$\left\| \frac{\sum_{i=1}^{q}(\alpha_i + \gamma_i)}{2} + \sum_{j=1}^{p} \beta_j < 1 \right\|$
Mean Reverting Level	$\dfrac{\omega}{(1 - \sum \alpha_i)}$	$\dfrac{\omega}{1 - \sum \alpha_i - \sum \beta_j}$		

Source: own research.

In this connection, the causality between the variables handled in the current study will be tested by using VAR Granger Causality/Block Exogeneity Wald Tests on a standard VAR model constructed independent of which variables are exogenous and which are endogenous.

Prior to the investigation of causality relationship, stationarity tests of the series should be conducted because the method to be used to conduct causality analysis varies depending on whether the stationarity of the series has been attained or not. If all series are not stationary with a lag order of 1 and are not co-integrated, we should implement VAR in the first difference. If all series are not stationary with a lag order of 1 and co-integrated, we should implement VAR in levels (Enders, 2003). In addition to this, as the variables are stationary in the study, by using level values of the series and considering seasonal effects, six-variable unrestricted VAR(p) model (Pesaran and Shin, 1998);

$$y_t = a_0 + a_t + \sum_{j=1}^{p} \phi_j y_{t-j} + bx_j + \varepsilon_t$$

was constructed. Here, y represents (Annual Inflation, FPICYC, UNFPICYC, UFICYC, UNUFICYC, PFICYC) variables, a_0 ve a_t 6x1 represent coefficient vector; $\phi_j j = 1, ..., p$ represent coefficient matrix in lag order, b represents exogenous (seasonal dummy variables) variable matrix and t shows the trend. The time lag length of the model was determined with AIC (Akaike's Information Criterion), FPE (Final Prediction Error), SC (Schwarz criterion), and HQ (the Hannan & Quinn (1979) criterion) information criteria, whether there is an autocorrelation in the errors of the determined VAR model was tested

with VAR residual serial correlation LM test and assumption of normality (residual normality) was tested with normality test and then whether no AR roots lies outside the unit circle - stability condition was met or not was tested (Lutkepohl, 2005).

Table 5. Symmetric and Asymmetric GARCH-type Volatility Forecasting Models and Coefficient Restrictions

Coefficient	Annual Inflation	FPICYC	UFICYC	PFICYC
Mean Equation				
c	1.393238 (0.0478)			
θ_1	1.040311 (0.0000)	0.650623 (0.0000)	0.647012 (0.0000)	1.512139 0.0000)
θ_2	-0.225915 (0.0180)	-0.230793 (0.0119)	-0.216794 (0.0209)	-0.589999 (0.0000)
θ_3	0.165181 (0.0845)		0.187278 (0.0392)	-0.184245 (0.0565)
θ_4	-0.143740 (0.0956)		-0.227625 (0.0170)	0.274737(0.0228)
θ_5	-0.516285 (0.0000)			-0.148558 (0.0045)
θ_6	0.507971 (0.0000)			
SD(1)		3.953961 (0.0001)	8.192966 (0.0000)	
SD(2)		3.016719 (0.0039)	7.142064 (0.0008)	0.437734 (0.1306)
SD(3)		2.996741 (0.0024)	8.050277 (0.0001)	
SD(4)		2.628527(0.0123)	5.542603 (0.0091)	
SD(5)				-0.615318 (0.0402)
SD(6)		3.953961 (0.0003)	-8.012256 (0.0003)	
SD(7)		3.016719 (0.0176)	-7.159618 (0.0016)	
SD(8)		2.996741 (0.0025)	-5.462040 (0.0076)	
SD(9)		2.628527 (0.0441)	-4.309851 (0.0363)	
SD(10)				
SD(11)		-1.723727 (0.0895)	-3.994410 (0.0445)	
Adj.R-squared	0.834334	0.730085	0.716625	0.948891
B-G Serial Corr LM	0.175711[1] (0.6751)	0.110801[1] (0.7392)	0.000000 (1.0000)	0.002729 (0.9583)
ARCH Heteros. Test	0.451194 [1] (0.7980)	11.74257 [1] (0.0006)	17.03310 (0.0002)	0.300210 [1] (0.5838)
Norm. of Residuals	0.147641 (0.928838)	2.691658 (0.260324)	3.591050 (0.166040)	0.610227 (0.737040)
Variance Equation				
ω		2.943713 (0.0000)	12.50715 (0.0067)	
α			0.637247 (0.0275)	
γ		0.378154 (0.0038)		
β_1		0.751234 (0.0000)		
β_2		-1.166719(0.0000)		
β_3		0.590219(0.0056)		
β_4		-0.753431(0.0000)		
Log likelihood		-286.0324	-337.9167	
ARCH-LM Test		0.108450 [1] (0.7419)	0.164955 [2] (0.6846)	

* The values within the square brackets show the most suitable time lag length and the values in the brackets show p-values.
** Mean equation $\pi_t = w + \sum_i^p \pi_{t-i} + u_t$ was modeled as autoregressive. Moreover, while establishing the model, autoregressive lags of the variable best explaining the model were selected and if there was seasonality effect, significant seasonality dummy variables were included in the model.

Source: own research.

In order to know the causality between those six time series, we should apply the Granger causality/ Block exogeneity Wald test (Enders, 2003). This test detects whether the lags of one variable can Granger-cause any other variables in the VAR system. The null hypothesis is that all lags of one variable can be excluded from each equation in the VAR

system. For example, this test helps to answer whether or not all lags of FPI can be excluded from the equation of AI or not. Rejection of the null hypothesis means that if all lags of FPI cannot be excluded from the AI equation, then AI is an endogenous variable and there is causality of FPI on AI.

In the VAR system established on the basis of these explanations, the equation for annual inflation is given below. In the system, as shown in equation 2, each variable is made a dependent variable in turn and whether the coefficients belonging to the lags of endogenous variables altogether equal to zero was estimated with Wald test. Thus, the hypothesis that whether the dependent variable of each of the endogenous variables is Ganger-cause or not was tested. The results related to VAR Granger Causality/Block Exogeneity Wald Tests conducted over VAR satisfying the system assumptions (App.1) by following the given procedure are presented and the obtained relationship structure is shown in Figure 3.

$$AI_t = a_0 + \sum_{j=1}^{10} \phi_j AI_{t-j} + \sum_{j=1}^{10} \phi_j FPICYC_{t-j} + \sum_{j=1}^{10} \phi_j UNFPICYC_{t-j} + \sum_{j=1}^{10} \phi_j UFICYC_{t-j} + \sum_{j=1}^{10} \phi_j UNUFICYC_{t-j}$$
$$+ \sum_{j=1}^{10} \phi_j PFICYC_{t-j} + b_1 SD(1) + b_2 SD(5) + b_3 SD(6) + b_4 SD(7) + b_5 SD(8) + b_6 SD(9)$$
$$+ b_7 SD(10) + b_8 SD(11) + b_9 SD(12) + \varepsilon_t$$

When the test results were examined, it was seen that the variables outside the annual inflation, food prices and unprocessed food prices uncertainties are exogenous.At the same time, the existence of one-way causality from the uncertainty of unprocessed food prices to food prices; one-way causality from both of them to annual inflation and one-way causality from annual inflation to food prices could not be refuted.
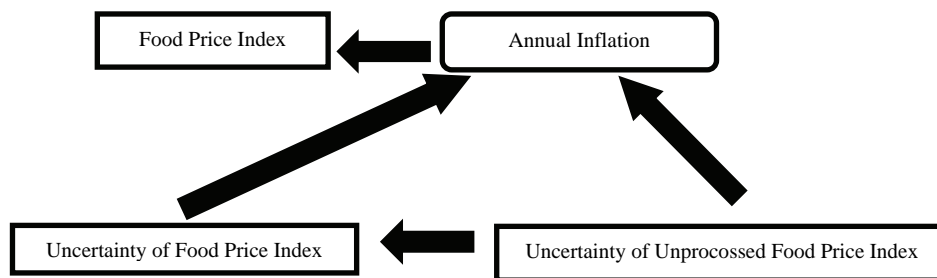

Fig. 3. Representation of VAR Granger Causality/Block Exogeneity Wald Tests' Results
Source: own research.

The obtained findings support the explanations made by CBRT to a great extent. Uncertainties occurring in unprocessed food prices were revealed to be both a direct cause of annual inflation and indirect cause of it over food price fluctuations.

Results and Discussion

Explicit commitment made by fiscal authorities to keep the inflation at the target level puts them under the responsibility for accountability. In this regard, when a deviation occurs from the declared target, the reasons for this deviation need to be explained and the measures to be taken for the target to be achieved should be defined. In the inflation targeting regime, central banks shape their policies depending on the future inflation expectations rather than the realized inflation.

In the inflation targeting in Turkey, as the target, variable end-of-year inflation ratios calculated on the basis of 12-month changes of CPI are taken and inflation targets are determined as point targets. However, target value is determined to be relatively higher when compared to developed countries and uncertainty interval is kept to be wider when compared to many countries implementing inflation targeting regime with 2 percent possible deviation from the target at both sides. Yet, Turkey has made great strides in terms of price stability, stated to be the main objective since 2002 when inflation targeting was adopted. On the other side, parallel to the developments in the world, important increases in food prices were observed after 2006. In the same period, problems were experienced in achieving the inflation targets and there were some years when more than a hundred percent deviation from the target was seen.

In this regard, it is emphasized by CBRT and economic circles that the cause of inflation rates being realized higher than the predicted rates and the one limiting the decreasing speed of inflation is the negative trend of food prices. In many of the explanations and reports issued, it is stated that uncertainties experienced in food prices and particularly in unprocessed food prices are one of the basic negative elements putting pressure on inflation outlook and that this makes it difficult to achieve the end-of-year inflation targets.

Considering the above-given information, the current study investigated the interactions between consumer price level (CPI), food price index and processed and unprocessed food indices and fluctuations, if there are any. As is known well, prior to the investigation of causality relationship, stationarity tests of the series should be conducted because the method to be used to conduct causality analysis varies depending on whether the stationarity of the series has been attained or not. On the basis of the idea that what disturbs the stability in the variables found to be not stationary as a result of the stationarity tests is trend effect, Hodrick-Prescott (1980) filtering method was administered to the series and it was observed that the obtained cycle series became stationary. Previously, annual inflation rates were investigated as inflation series and it was observed that when CPI was converted into annual inflation, it became stationary; thus, it was exposed to filtering. For the uncertainty of the series, some symmetric ARCH (Engle, 1982), GARCH (Bollerslev, 1986) and asymmetric EGARCH (Nelson, 1991) and TGARCH/GJR-GRARCH (Glosten, Jagannathan and Runkle, 1993; Zakoinan, 1994) GARCH-type volatility forecasting models were drawn on. As the annual inflation realizations and ARCH effect on processed food prices could not be determined, uncertainties were obtained only for unprocessed food prices (UNUFICYC) EGARCH (0,4) and food price index (UNFPICYC) ARCH(1).

At the second stage of the analysis, in order to determine the direction of long-term relationships between the variables, VAR Granger Causality/Block Exogeneity Wald Tests were administered.The test results revealed that there might be one-way causality from the

uncertainty of unprocessed food prices to food prices; one-way causality from both of them to annual inflation and one-way causality from annual inflation to food prices.

The findings of the current study seem to support the explanations coming from economic circles and CBRT but also reveal some other remarkable results. First, no uncertainty was detected in the annual inflation realizations within the framework of the utilized volatility forecasting models. As known well, volatility of a variable is defined as this variable's excessive rise or fall around the mean value. In this case, inflation volatility encompasses changes and instabilities experienced at varying degrees in inflation and here rather than the variance of all the changes taking place in inflation, the variance of the ones of these changes that are not expected (Ball and Cecchetti, 1990) correspond to the uncertainty. Moreover, what is meant by unpredictability in inflation uncertainty defined as subjective unpredictability of the price level is forecasting uncertainty (Tsyplakov, 2010). In light of these definitions, it can be argued that during the period of 2006:M01-2016:M03 there was no unexpected change in the inflation realizations or unpredictability that might lead to forecasting uncertainty.

Due to the fact that there is no volatility in inflation, the proposition that unprocessed food and food prices volatility creates estimation uncertainty in inflation may not be true. In this context, the related volatilities may be effective in the realizatons of high and low inflation rates. However there is no sign to reach the conclusion that the volatilities from food and unprocessed food prices lead the inflation uncertainty interval to above realization.

In this case even if the inflation values are high it may not be true to express that they are unexpected. As it is known when CBRT determines the inflation targets, just in case, not only they tend to present relatively high inflation taking the inflation dynamics of Turkey into consideration but also they determine a wide range of uncertainty interval to reduce possible fluctuations such as in exchange rates, production and employment effected by the instability of energy and food prices that are out of monetary policy control.

Moreover, as it stated in the Law on the Central Bank of the Republic of Turkey, in the case of a remarkable violation of the inflation target, the CBRT is in charge for reporting to the Government and announcing to the public the reasons behind the failure to meeting the inflation target and the necessary measures to be taken.

In this context, the transition to inflation targeting regime in Turkey since 2006, 17 open letters stating that the inflation target has been outside the determined uncertainty range except only the years 2011 and 2013 have been published. Generally, the increase in food prices, developments in energy prices, drought and financial crisis, the effect of transition to exchange rates are expressed as key elements in overcoming the inflation target (CBRT, 2006d-2016d). Hence, the explanations made have raised the opinion that due to the developments outside the domain of monetary policy the inflation targets have led to failing to meeting the required level. At the same time, examining all these years it is remarkable to notice that Central Bank keeps determining the inflation target as 5% when the inflation rate has never been observed under 6.2% obtained in 2012.

There is some research looking at the reasons for the increases in food prices in Turkey while regressions were seen in food prices in the world. For example, Orman et al., (2010) reported that remarkable fluctuations seen in unprocessed food prices are one of the main factors increasing the fluctuation in inflation. They also explained the structural reasons such as high degree of climate-dependence in production, insufficiencies in agricultural know-how, high number of intermediaries in the supply chain, uncertainties

surrounding agricultural subsidies, weaknesses in the regulatory, supervisory and monitoring framework, concentration of production in certain geographic areas and fluctuations in external demand for the fluctuations in food prices especially unprocessed food prices in Turkey. Meanwhile, Öğünç (2010) revealed that it would not be very accurate to explain price changes in the food sector on the basis of climate changes in Turkey, because low levels of fluctuations in unprocessed food prices were observed in other Mediterranean countries that are also the producers of these food items. For instance, in his study revealed that in 2004-2009; though Turkey was in the position of a producer, monthly food prices fluctuations were four times higher than the fluctuations in 27 European Union countries and unprocessed food price fluctuations were six times higher than the fluctuations in these countries. One of the sub-groups of unprocessed foods, meat prices were found to have ten times higher fluctuations and fruit and vegetable prices exhibited a similar trend of fluctuation in the same period. In addition to the structural factors, Atuk and Sevinç (2010) compared variable and fixed weight approaches in the CPI calculation and showed that inflation rates of fresh fruit and vegetables calculated by the fixed weighting method display lower volatility. Furthermore, in Balkan, Kal and Tümen (2015)'s study have been stated that the fuel-price increases have a potential to lead to more-than-one-for-one increases in the wholesale prices of fresh produce.

Conclusion

In Turkey, inflation targets do not meet the required level to a large extent. though the size of the inflation is unknown, the volatilities arising from elements such as social, structural, food and especially unprocessed food prices can have effect on the appearance of the inflation indeed. However, this effect is not creating uncertainty in the mid term inflation outlook, emerging with actual inflation.

As a result; to be successful in inflation targeting regime, it is thought that appropriate policies beyond the elements of monetary policy control which are minimizing the effect of structural measures must be implemented in time. As it is known, one of the main features of that regime has the chance to be updated quickly when there is a requirement in policy change. Therefore, insisting on keeping the targeting unchanged is in fact inconsistent with the inflation targeting itself. Moreover the consequences from a loss of credibility arising from conservativeness of the regime may be more severe due to the loss of arising changing objectives.

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Appendix 1

VAR Granger Causality/Block Exogeneity Wald Tests

Sample: 2006M01 2016M03

Included observations: 103

Dependent variable: YEARINFPER

Excluded	Chi-sq	df	Prob.
FOODCYC	9.843978	10	0.4543
FOOEGARCH04	19.89937	10	0.0302
PROCCYC	8.130608	10	0.6161
UNPROCCYC	10.24030	10	0.4197
UNPROCARCH01	21.42892	10	0.0183
All	71.53148	50	0.0245

Dependent variable: FOODCYC

Excluded	Chi-sq	df	Prob.
YEARINFPER	18.31130	10	0.0499
FOOEGARCH04	9.066812	10	0.5258
PROCCYC	12.22760	10	0.2701
UNPROCCYC	14.69132	10	0.1437
UNPROCARCH01	12.15976	10	0.2745
All	49.12858	50	0.5083

Dependent variable: FOOEGARCH04

Excluded	Chi-sq	df	Prob.
YEARINFPER	11.25151	10	0.3383
FOODCYC	8.245198	10	0.6049
PROCCYC	8.757738	10	0.5552
UNPROCCYC	10.01716	10	0.4390
UNPROCARCH01	33.03934	10	0.0003
All	182.0861	50	0.0000

Dependent variable: PROCCYC

Excluded	Chi-sq	df	Prob.
YEARINFPER	16.43406	10	0.0879
FOODCYC	16.91350	10	0.0763
FOOEGARCH04	13.87453	10	0.1788
UNPROCCYC	15.57537	10	0.1125
UNPROCARCH01	14.49087	10	0.1518
All	53.32359	50	0.3477

Dependent variable: UNPROCCYC

VAR Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation at lag order h

Sample: 2006M01 2016M03

Included observations: 103

Lags	LM-Stat	Prob
1	49.32813	0.0685
2	28.77987	0.7983
3	36.97517	0.4237
4	23.26979	0.9500
5	42.00369	0.2268
6	41.15644	0.2551
7	33.55780	0.5853
8	39.37375	0.3214
9	28.47258	0.8099
10	38.36234	0.3629
11	32.35822	0.6425
12	26.52885	0.8753

Probs from chi-square with 36 df.

Inverse Roots of AR Characteristic Polynomial
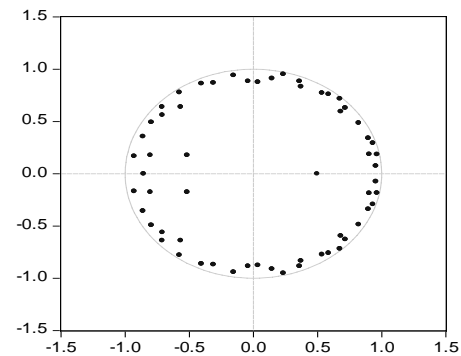
No root lies outside the unit circle.

VAR satisfies the stability condition.

Excluded	Chi-sq	df	Prob.
YEARINFPER	17.66976	10	0.0608
FOODCYC	12.95371	10	0.2263
FOOEGARCH04	8.172315	10	0.6120
PROCCYC	10.35656	10	0.4098
UNPROCARCH01	11.79982	10	0.2987
All	47.07670	50	0.5914

Dependent variable: UNPROCARCH01

Excluded	Chi-sq	df	Prob.
YEARINFPER	17.80225	10	0.0584
FOODCYC	11.01440	10	0.3564
FOOEGARCH04	5.389214	10	0.8637
PROCCYC	10.72546	10	0.3793
UNPROCCYC	10.87971	10	0.3670
All	68.31993	50	0.0435

VAR Residual Normality Tests
Orthogonalization: Cholesky
(Lutkepohl)
Null Hypothesis: residuals are
multivariate normal
Sample: 2006M01 2016M03
Included observations: 103

	Component	Chi-sq	df	Prob
Joint	Skewness	4.766383	6	0.5741
	Kurtosis	0.990540	6	0.9860
	Jarque-Bera		df	Prob.
	5.756923		12	0.9278

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Transportation Costs of Containers from Asia to Europe via DCT Gdansk and Hamburg Seaports

Abstract. The aim of this study was to compare the transportation costs of containers being transported from Asia to Europe via Hamburg and Gdansk seaports. Three indexes are considered to be important for a logistic operator while choosing the transport route for 20 TEU containers: costs, time, and distance. This study confirms that Deepwater Container Terminal in Gdansk transports containers more effectively.

Key words: transport, seaport, maritime transport, intermodal transport, Hamburg, DCT Gdansk

Introduction

World supply chains are evaluating, developing, and prolonging which make them more and more complex. Globalization, production, regionalization, and consolidation of production are the factors that generally determine these changes. Globalization and other factors have led to the fact that goods from all continents are to be transported across the world. Supplying goods tends to be a strong part of acting logistic operators.

The aim of this paper was to compare the transportation services offered by DCT Gdansk and Hamburg seaports with regard to non-special cargo from Asia to Europe. Three indexes are considered to be important for a logistic operator while choosing a transport route: costs, time, and distance. This study hypothesizes that Deepwater Container Terminal in Gdansk transports containers from Shanghai to Moscow more effectively from the perspective of cost and time.

Through years of development, seaports have undergone a significant evolution. From the time seaports have started to handle basic cargos and involve in transportation, they have become significant links in land-sea supply management. Based on various studies (Grzelakowski & Matczak, 2012; Montwiłł, 2014) modern seaports are divided into four categories (Table 1).

The fourth category of seaport is described as areas that connect water and land passenger streams, industrial multimodal and intermodal transport, as well as port and urban functions, simultaneously realizing the port's function and connecting it, for example, with trade, distribution, logistics, and urban aspects, such as services and industrial and communications functions.

Therefore, modern seaports synchronize and integrate worldwide supply chains. In those key-links of supply networks, the variety of economic activity is carried out. It includes comprehensive support for moving the object, sea-land transport involved in the carriage cargo etc (Bichou, 2009). Ports are managed based on technological, organizational, logistical, economical, and legal processes (Klimek, 2012; Baran &

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Górecka, 2014). Seaports are rarely considered as bodies of supply chain management, but they provide logistics services to logistics operators (Bernacki, 2012). The increasing assimilation and amalgamation of ports into supply chains (Pettit & Beresford, 2009) have amplified the potential of ports in supply chain disruptions.

A significant moment in the history of maritime transport was the introduction of standardized containers that helped in the development of intermodal transport. In fact it was the beginning of broadly understood logistics chains, which encompasses a combination of both sea and land transports. Since 1980 the use of containers has increased rapidly. The largest increase was observed after the year 2000 (Fig. 1). Shippers have standardized the market in terms of legal, technical, organizational, and technological requirements. The demand for high-quality service has changed. Today, standard logistic process is understood as door-to-door system. Moreover, price is still a very important factor for buyers. Therefore, these two indexes (time and price) are extremely important when taking "good transport" into consideration.

Table 1. Characteristics of seaports of the first, second and third generation (UNCTAD TD/B/C.4/AC.7/14, 1991)

	I generation	II generation	III generation
Limit dates	Until 1960;	After 1960	After 1980
Dominant factors	Labor and capital	Capital	Capital. Technology and know-how
Dominant tape of cargo	Dry bulk cargo, Other cargo nes,	Dry and liquid bulk cargo, Other cargo nes,	Dry and liquid bulk cargo, Large containers Ro-ro mobile
Main objective function	Transport	Transport, Industrial, Commercial	Transport, Logistics & distribution
The basic role of the port	Transport hub / note	Transport-industrial complex connected to commercial center	Distribution center / Logistics center / Logistics platform, Information center
Strategy	Conservative	Expansive	Market
Basic principle of the strategy	Seaport waiting for cargo	Port acquires areas, and stimulates the development of the port industry, thus obtains loads	Port co-creates supply chains
Range of service	Handling and storage services for the cargo. Simple administrative services, manipulation and control for cargo	Handling and storage services for the cargo. Processing and production of goods Complex administrative services, manipulation and control for cargo	Handling and storage services for the cargo. Distribution cargo Logistics services for cargo Gathering and processing of information Organization chain supply
VAL	Low	Higher	High
Operating principles the port environment (internal environment harbor)	Atomization Informal relationships with port users	There are no permanent links between deferent sectors port A close relationships with port users Ad hoc relationships with city	Unity of action sphere of operation Integration of organizational or capital sea port companies with its users Close relationship with the port city and region

Source: Montwiłł 2014, p. 259.
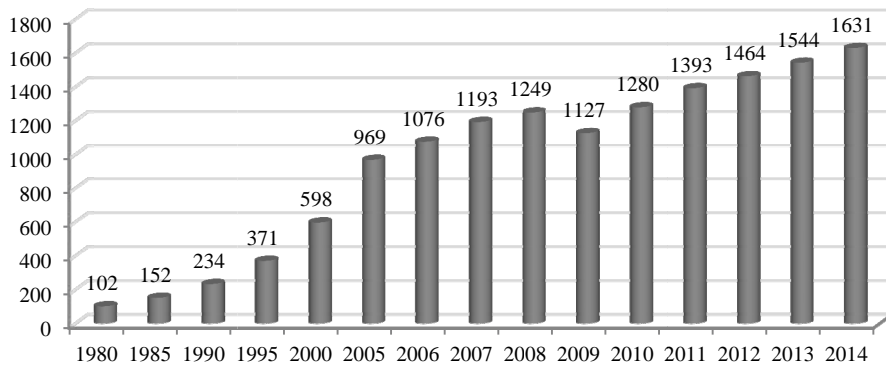
Fig. 1. International seaborne trade carried by container ships from 1980 to 2014 (in million tones loaded)

Source: statista.com

Seaports act as individual companies that compete with each other. The competition among them is based on three factors: cost, time, and distance. Meersman et al. (2010) emphasized that in recent years competition has evolved between individual ports and entire supply chains in such a way that for a port to succeed it must be part of an efficient supply chain.

Research methods

Preliminary and secondary data were used in this study. Reports collected from a logistic operator and data of interviews conducted with managers of logistics were taken as preliminary data. Name of the organization was kept confidential at the participant's request. A literature review with a strong emphasis on the meaning of seaports in supply chains served as secondary data. Indicators such as cost, time, and distance were compared and analyzed. For simulation purposes, Shanghai was chosen as the starting point and Moscow as the end point of the route. In this study, transport process was offered via two seaports in Europe: Hamburg and Deepwater Container Terminal in Gdansk. Six routes with different possible transport modes were compared:

- Shanghai–Hamburg–Moscow   (sea-road)
- Shanghai–Gdanks–Moscow   (sea-road)
- Shanghai–Hamburg–Warsaw–Moscow   (sea-rail-road)
- Shanghai–Gdansk–Warsaw–Moskow   (sea-rail-road)
- Shanghai–Hamburg–Warsaw–Moskow   (sea-road-rail)
- Shanghai–Gdansk–Warsaw–Moskow   (sea-road-rail)

Spearman rank correlation (r_s) test was used to compare the data to determine the factors that influence the total transportation costs of container (1) (1966).

$$y = \frac{\frac{1}{6}(n^3-n)-(\sum_{i=1}^{n} d_i^2)- T_x- T_y}{\sqrt{\frac{1}{6}(n^3-n)- 2T_x)(\frac{1}{6}(n^3-n)-2T_y)}} \qquad (1)$$

where:

$d_i = Rx_i - Ry_i$ the difference between *i-th* rank for variable *x* and *i-th* rank for variable *y*

$T_x\,T_y$ the factors for tied ranks described by (2):

$$T = \frac{1}{12} \sum_j(t_j^3 - t_j) \qquad (2)$$

where:

t_j number of observations for *j-th* rank in the analyzed data set

The following factors were used in the calculation of Spearman rank correlation:

y – total transportation costs for the route

x_1 – distance in km

x_2 – transportation time

x_3 – total costs of container handled in the seaports

x_4 – costs of additional modes of transports

From the perspective of a logistic providers, one of the most important factors that influence seaport choice is cost. Seaport cost comprises various elements. The first element is the fee collected as per the international trade rules based on sales, costs, responsibility of the purchaser, and the type of transport - Incoterms. For simulation purposes, in this study, Incoterms of Group F (FOB[2]) were adopted. Group F refers only to transport by water.

The next element is the type of THC (terminal handling charge). This fee is imposed in maritime transport to remove a container from a ship to storage yard and transport cargo to the warehouse, from the warehouse, onto the truck, etc.

Customs policy and legal conditions differ from one country to another and, therefore, customs service fee is included under seaport cost. Some of them are as follows:

- BAF (Bunker Adjustment Factor) – a fee collected in case of an unexpected rise in the fuel costs;
- CAF (Currency Adjustment Factor) – a fee to balance currency fluctuations in reference to operators;
- DDC (Destination Delivery Charge) – fee determined in relation to container size. It defines total waste resulting from container handling on the terminal;
- other custom service fees.

Custom service charges have been aggregated as per the requirement of this study.

Another fee that a logistic provider considers when choosing a seaport is documentary charges determined in the port of loading/unloading. In this study, documentary charges refer to transport documents transmitted to participants in supply chain.

In addition, in DCT Gdansk, a minimum charge of 150 PLN (34 EUR) has to be paid to the security customs duties and taxes. All costs refer to a single standard (20 TEU) container with non-special cargo (e.g., clothes). Comparison helps to identify the most appropriate solutions for a logistic operator.

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[2] FOB – "Free on board" indicates port of loading.

Comparison of DCT Gdansk and Hamburg seaport operations

Hamburg seaport contributes significantly to the entire German economy, with an added value of approximately 20 billion Euros. Port of Hamburg along with other seaports worldwide links more than 5700 (stat.gov.pl, 2015) containers across the world. This fact underlines its position as a European leader in cargo handling and distribution. However, to maintain this leader status and to attain an optimal port throughput, infrastructure of roads, rails, and inland waterways needs to be developed, which attracts more investment. Owing to the modern strategy consequently implemented by the management, 2014 was the breakthrough year with the record in handling operations. More than 7.4 million TEU were loaded loaded/reloaded, which is 20,000 TEU per day. German ports create a seamless communications network with the mainland, which gives them an advantage over other ports in Europe.

Compared to Hamburg seaport, DCT Gdansk is a new terminal and it received its first vessel in June 2007. During its first years of operations, the terminal specialized in handling feeder vessels, thereby gaining important operational experience. Since January 2010, DCT Gdansk is the only deep-sea terminal in Poland. It started receiving 8,000 TEU container vessels on a weekly basis departing from the Far East bringing Polish imports, picking up Polish exports, and carrying trans-shipment for the key Baltic ports. This direct connectivity with Asia boosted the development of DCT Gdansk and it became the Baltic Sea hub, achieving 180% growth in 2010 that made DCT one of the fastest growing terminals in the world. The new era for DCT bloomed in May 2011 when it started to handle Maersk Line's E-type class container vessels with a capacity of 15,500 TEU. As a result, DCT joined a prestigious group of North European deepwater container ports, thereby serving ultra-large container vessels on a weekly basis, which is the only such facility in the East of the Danish Straits. In 2012, the container terminal handled its second millionth TEU since its operations have begun, with another annual volume record of approximately 900,000 TEU. In 2013, it handled more than 1.15 million TEU. This record has put DCT permanently on the map of the world's major container terminals and ensured its position as the biggest container terminal in the Baltic area (dctgdansk.pl, 2016).

Hamburg and Gdansk seaports differ not only in the location, size, or number of containers handled (available infrastructures) but also in the characteristics of services offered (Table 2).

Table 2. Comparison of the non-infrastructural characteristic of the service in Hamburg and Gdansk seaports.

Characteristics	Hamburg port	DCT Gdansk
Time of container handling in the port	Short	Long
Large number of direct services=better punctuality	Yes	No
Fast and efficient customs service	Yes	No
Deferred VAT	Yes	No
Possibility of making customs clearance in the simplified procedure	No	Yes
Costs: • seaport costs	High	Low
• loading control costs	High	Low
• possible container downtime	High	Low
Offices rigor	Low	High

Source: own elaboration based on euro-dane.com.pl

Loading time, punctuality, and deferred VAT are the strengths of Port of Hamburg, whereas simplified customs procedure is the strength of DCT Gdansk. Although the fact is that German port has higher charges, the legal terms and conditions of the customs offices of the Polish port are more stringent (dctgdansk.pl, 2016).

Simulation of cost, time, and distance for the transport of 20 TEU containers from Shanghai to Moscow

Costs, time, and distance are the key factors that are analyzed in this study (Table 3). Results show that the total costs of container transport were low for the route Shanghai–Gdansk–Warsaw–Moscow using sea–rail–road intermodal transport (1,449 EUR). The second lowest total costs (1,535 EUR) were for the route Shanghai–Gdansk–Warsaw-Moscow by sea–road–rail transport. The third possibility (2,206 EUR) was through Hamburg (Shanghai-Hamburg-Warsaw-Moscow). With regard to transport time, Shanghai-Gdansk-Moscow route along with sea–road transport was found to be the most preferable route with a traveling time of 33 days and 12 hours. On the other hand, it is worth noting that this route is the second expensive route. The second fastest route is via Shanghai–Gdansk–Warsaw–Moscow with a traveling time of 33 days and 20 hours.

Table 3. Simulation of costs, distance and time of transporting container from Shanghai to Moscow

Route	Shanghai-Hamburg-Moscow	Shanghai-Gdansk-Moscow	Shanghai-Hamburg-Warsaw-Moscow	Shanghai-Gdansk-Warsaw-Moscow	Shanghai-Hamburg-Warsaw-Moscow	Shanghai-Gdansk-Warsaw-Moscow
Transport modes	sea-road	sea-road	sea-rail-road	sea-rail-road	sea-road-rail	sea-road-rail
Distance (km)	22265	21714,5	22385	21907,5	22385	21907
Time (days)	34	33,5	34,2	33,85	34,45	33,9
Port operation costs (EUR)						
FOB	396	396	396	396	396	396
THC	260	140	260	140	260	140
Custom fee	115	150	115	150	115	150
Documentary fee	5	8	5	8	5	8
Additional fee	0	34	0	34	0	34
Total	776	728	776	728	776	728
Additional transport mode cost (EUR)	2000	1950	1430	721	1680	807
TOTAL COST (EUR)	2776	2678	2206	1449	2456	1535

Source: own elaboration based on logistic operator data.

With regard to distance (Table 3), the shortest transport route is the Shanghai-Gdansk-Moscow route (21,714.5 km). The factors that are correlated with total transportation costs are analyzed using Spearman rank correlation test (Table 4).

Table 4. Correlation of time, time and distance of the transport

Variable	Spearman Rang Correlation				
	y	x_1	x_2	x_3	x_4
y	1.000000	0.057977	0.142857	0.487950	1.000000
x_1	0.057977	1.000000	0.927634*	0.891133*	0.057977
x_2	0.142857	0.927634*	1.000000	0.878310*	0.142857
x_3	0.487950	0.891133*	0.878310*	1.000000	0.487950
x_4	1.000000	0.057977	0.142857	0.487950	1.000000

*correlation coefficients are important for $p < 0.05000$

Source: own elaboration calculated in Statistica 12 software.

The results show a moderate dependency (0,48795) between the cost (y) of container transport and total costs of container handling in the seaports included in this study (x_3) and a high dependency (1,00) on the costs of additional mode of transports (x_4).

Summary

This study focused on the problems of transporting goods from Asia to Europe. A logistic operator chooses the route from Shanghai to Moscow based on three important criteria: costs, distance, and time. All other alternatives are based on the idea of intermodal transport through Hamburg seaport in Germany or DCT Gdansk in Poland.

The results show that transportation costs vary depending on the seaports selected for the service. Comparison analysis also confirmed the hypothesis that the transportation costs via DCT Gdansk is lower when goods are transported via two intermodal combinations: sea-rail-road and sea-road-rail. Transporting via DCT Gdansk takes a shortest traveling time and the traveling route is also much shorter; however, in this case transportation costs are much higher.

Spearman correlation test drew an interesting result, that is, the total costs of shipping container from Shanghai to Moscow depends mostly on the costs of additional mode of sea transport. Sea transportation costs via Hamburg or Gdansk seaport slightly differ from each other. This might be significant information for logistic operators who focus on reducing the total costs of shipping. They can reduce the transportation costs by using non-sea transport simulation. It should be noted that the factor "distance" also seems to increase the transportation charges and fees. On the other hand, for fast sipping, logistic operator can opt for suitable routes with higher costs.

Northern Europe has been depending on the Hamburg seaport for its seaport market until 2007. Therefore, logistic operators started to work on new alternatives that will help increase worldwide supply chains. Three effective factors such as costs, time, and distance, including DCT Gdansk, are to be considered. Nevertheless, the threats posed by the Polish port such as the difficulties faced during transportation, stringent regulations of public offices, and complexity of documentation processes are to be rectified.

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Support of Eco-innovation Projects in Agriculture: Case of Poland

Abstract. The study attempts to investigate Polish practices to support the eco-innovation in agriculture that ensure the sustainable development of the sector. The specificities and barriers to eco-innovative activities of agricultural enterprises were defined. The paper focuses on the analysis of the supporting mechanism of eco-innovation in Polish agriculture both on national and EU's levels. Using the factor and SWOT analyses, the author determines the effectiveness, opportunities and challenges of Polish support of agri-ecological innovation. The relationships between the eco-innovative indicators and the level of support for farmers are also shown.

Key words: eco-innovation, agriculture, support, Poland

Introduction

Nowadays, development through innovation is crucial both for economic growth and long-term economic sustainability. Innovative development is one of the main factors providing international competitiveness of an agricultural sector of national economies, but eco-innovation in agriculture is currently a neglected area. As a whole, agriculture is a sensitive sector of the economy which faces various problems among which economic crisis, flagging rural development, climate change and environmental degradation. These problems have been observed in all countries all over the world, moreover, they do not depend on the level of economic development. Thus, agriculture requires a balanced government policy and state support. Now we can see the increasing role of the adoption of eco-innovation for environmental protection, sustainable development, implementation of international treaties as well as for the provision of international competitiveness. Therefore, the EU current growth strategy – Europe 2020 – stresses the importance of eco-innovation in agriculture. Under the new EU framework, known as the Innovation Union, the EU implements a complex approach to this sphere via reforming the Common Agricultural Policy (CAP) towards the ecologization of agriculture, realizing the Rural Development Policy and creating the European Innovation Partnerships that will promote knowledge transfer for agricultural productivity and sustainability.

The Polish government also regards eco-innovation as part of the growth strategy of the national economy, but researchers noticed that in practice, however, these goals are not treated as priorities, and the institutions supporting the development of agriculture consider environmental issues to be of secondary importance (Kassenberg, 2015). But nowadays Poland has a wide range of possibilities for both conducting a research and introducing eco-innovation projects in agriculture. Thus, the goal of presented paper is to make an attempt to investigate Polish practices to support the eco-innovation in agriculture that ensure the sustainable development of the sector.

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Objectives

The main objective of the paper is to investigate the support of eco-innovation activities in Polish agriculture under the European Innovation Partnership. Poland has a well-developed agriculture sector, which is one of the fastest growing sectors of national economies among the UE members, and in the frame of the Common Agricultural Policy (CAP) and the European Innovation Partnership the country receives the most funds, a significant portion of which is aimed at the eco-innovative development of agriculture. But nowadays, according to the Eco-Innovation Scoreboard, Poland is on the penultimate position among the EU members with the result of 59 points in 2015 (Eco-innovation index…, 2016). Only Bulgaria is rated worse.

Analyzing the results of the eco-innovation index in terms of individual groups of indicators it can be noted that the relatively strongest area of Polish innovation is the area of social and economic effects resulting from the introduction of eco-innovation (20th position) and the achieved results (23rd position). In the other three areas – expenditures on eco-innovation, eco-innovation activity and achieved environmental effects Poland takes the 26th position (Wskaźniki…, 2016).

Polish disadvantageous position in the eco-innovation ranking could be explain by many factors especially various kinds of barriers, among which are the lack of financial provision of agricultural producers and consumers, insufficient awareness of farmers' benefits from adoption of eco-innovation projects, low state support of eco-innovation, low level of funding for R&D activities, mental opposition to the innovation changes.

Thus, other objectives of presented research are:
-    to explore the barriers to the adoption of eco-innovation and analyse the mechanism of support for eco-innovation projects in Polish agriculture;
-    to determine the problems and possibilities of the eco-innovative development in Polish agriculture.

Research methods and material

There are many different approaches to analysing eco-innovation in agriculture. Proposed study focuses on the specific features of supporting policy used to map interactions in agri-ecological innovation under the European Innovation Partnership as well as the linkages to the eco-innovative performance of practitioners and policy-makers. It is also important to identify the barriers that affect, reject and diffuse eco-innovations in agriculture. Using the factor and comparative analysises on data for special indicators, we estimated the effectiveness, opportunities and challenges of Polish support of agri-ecological innovation, and determined the directions eco-innovation policy in agriculture. At the same time, specific analyses was paid to deepening the understanding of certain areas of agri-ecological innovation, such as institutional linkages, financial support, the main constraints to the adoption of innovations in agriculture. The correlation analysis was used to find the relationships between the eco-innovative indicators and the level of support for farmers. The SWOT analysis allowed to identify the key factors determining the effectiveness of Polish support of eco-agricultural projects.

Data used for the analyses is taken from the database of the Central Statistical Office in Poland, the Ministry of Agriculture and Rural Development of the Republic of Poland,

and the Eurostat official statistics. Information base of paper is based on Polish laws and regulations in innovation, agricultural, and environmental policies, regulatory framework of the EU, scientific publications.

Specificities and barriers of eco-innovative activities in Polish agriculture

The reducing of negative impact of economic activities on the environment is the most important task for both government and farmers, and should include the implementation of environmental and resource-saving technologies in agriculture, provision of environmentally friendly rural development, adoption of eco-innovation projects, promotion of eco-innovative activities, and, consequently, the transition to sustainable development of agriculture as a whole.

A lot of studies indicate that the most significant barriers to eco-innovation in Poland are mainly of an economic nature, including high cost of implementation, difficult access to capital, uncertain return on investment and the weak system of economic and fiscal incentives encouraging eco-innovation (Eco-innovation in Poland, 2015; Rynek…, 2010; Klincewicz, 2013). No debt, eco-innovative development of agriculture and environmental projects adopted by the farmers require significant financial costs. The problem is that environmental innovation is a subject of fundamental uncertainty: only a part of eco-innovations will be successful in terms of solving the environmental problems as originally articulated (Buddelmeyer, 2010). However, farmers are finding it more difficult to get support from their government, especially to gain access to financial and credit support of their eco-innovation projects because of large-scale, long-term and high risks of implementation of eco-innovation projects in agriculture. Than farmers usually do not have free running costs to finance the expensive eco-innovation projects. In addition, they are reluctant to adopt new eco-innovations because of the lack of the motivation, especially financial motivation. Thus, virtually the only way out of this situation is to introduce a mechanism of the state support of eco-innovative activities based on existing instruments of financing the innovative development of agriculture. That is why it is advisable to reorient from the direct budget financing of eco-innovation projects to the indirect government and fund support of the eco-innovative development of agriculture. Moreover, the scientists point that if the model of intensive high production farming is supported, the result will be a deepening rift between the necessity to preserve sustainable agricultural production and the environmental consequences that result from high-income farming activities (Kassenberg, 2015).

The eco-innovative activities in Polish agriculture are connected with a meaningful group of administrative barriers. The study confirms the opinion presented in different sources (Kassenberg, 2015; Jasiński, 2013). that the insufficient cooperation between the administrative institutions supporting the development of agriculture, public entities responsible for achieving environmental protection goals, and the farmers leads to the avoiding the eco-innovative activities by farmers and to the reducing the number of the adopting eco-innovation projects. In addition, the continuous changes in legal regulations (several times during the 2004-2016) and poor integration of the objectives of agricultural and environmental policies are slowing down the eco-innovative development in agriculture.

In the case of Poland, the progress in the eco-innovative development of agriculture meets with some specific barriers, the biggest of which is the mentality and habits of the rural population (Popławski, 2015). But in addition to the mentioned problems it can be pointed also a problem of the ageing of the rural population, and, therefore, the opposition of it to the adoption of new technologies and new approaches to the farming.

Analysis of national and EU's support of eco-innovation in Polish agriculture

Institutional support of the eco-innovative development of Polish agriculture is carried out at EU's and national levels and is outlined in the strategic documents, which define the priorities of economic development for the coming decade. The EU's growth strategy Europe 2020 has set the ambitious objectives for Member states in the middle-term period. The innovation and environmental protection are among the most important goals to be reached by 2020 (Europe 2020…, 2010). Poland also has adopted its own national targets in the field of eco-innovation in agriculture. The medium-term National Development Strategy 2020 is based on the EU's strategy and foresees, firstly, the smart growth based on knowledge and innovation, secondly, the sustainable growth through the support for an effective, more competitive, resource-saving and environment-friendly agriculture (Strategia…, 2012).

It should be noticed that the main directions and instruments in state support policy were taken within the framework of the CAP and the EU now funds the most of the innovation projects in Polish agriculture toward ecologization, improving competitiveness and sustainability. Facing these challenges the EU pursues three objectives through the CAP (Agricultural...):
- Securing viable food production;
- Ensuring sustainable management of natural resources and climate action;
- Contributing to a balanced territorial development.

Now in Poland eco-innovation defined projects in agriculture are financed mainly by two funding streams: Research and innovation framework – Horizon 2020 (providing the research & innovation), and the Rural development policy (innovation).

Under the Horizon 2020 eco-innovation projects are expected to help with the following (Agricultural…):
- Improving production efficiency and coping with climate change, while ensuring sustainability and resilience;
- Providing ecosystem services and public goods;
- Empowering rural areas and supporting policies and rural innovation;
- Fostering sustainable;
- Developing a sustainable and competitive agri-food industry;
- Support market development for bio-based products and processes.

All of these directions foresee the implementation of eco-innovation projects in agriculture which will be co-financed from national funds and the EU funds available in this period.

It should be noticed that the EU nearly doubled its efforts with an unprecedented budget of nearly 4 billion euros allocated to Horizon 2020's Societal Challenge 2 "Food

security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy" (Agricultural…). Aside from Societal challenge 2, several parts of Horizon 2020 are of interest to eco-innovation in agriculture.

In synergy, the EU has set "Fostering knowledge transfer and innovation in agriculture, forestry and rural areas" as the first priority for Rural development policy 2014-2020. Rural Development Programmes will finance agricultural eco-innovation through several measures which can support the creation of operational groups, eco-innovation services, investments or other approaches. The sources of financing of eco-innovation projects in Poland consist of two groups on EU's and national levels and are presented in Table 1.

Table 1. Sources of financing of eco-innovative activities within the Rural development policy in Poland

Rural Development Programme for 2014-2020	Polish national sources of funding of eco-innovative activities
Cooperation	National Centre for Research and Development
Knowledge transfer and information actions	Polish Agency for Enterprise Development
Technical Support	Regional Operational Programmes
Other activities and operations within the Rural Development Programme 2014-2020	Operational Program Development of Knowledge Education
	PO Intelligent Development
	PO Eastern Poland

Source: author's own elaboration.

Currently, the evaluation of the effectiveness of the Rural Development Programme 2014-2020 is not possible, since the Programme now is still going on. Therefore the study is based on EU's rural development policy for the previous period. We investigate support measures under the Rural Development Programme for 2007-2013 and analyze their impact on the development of eco-innovative activities of Polish agricultural enterprises in the mentioned period. Figure 1 shows the proportion of funds shared between Polish voivodeships within the Rural Development Programme for 2007-2013. It is necessary to emphasise on the unequal distribution of funds, which was one of the major determinants of the eco-innovative development of agricultural sector in every voivodeship. A similar tendency is observed in the case of the Rural Development Programme for 2014-2020.

The greatest number of agricultural enterprises which adopted eco-innovations was concentrated in Western Pomerania and Warmian-Masurian voivodeship. Also, these voivodeships were occurred by the largest share of agri-environmental payments. In general, the Rural Development Programme for 2007-2013 foresaw about 2 mln 300 thousand euros to implement measures related to the environmental protection.

The preliminary visual analysis of the statistical databases suggests the positive relation between some economic indicators related with the eco-innovative activities of agricultural enterprises and the level of support for farmers under the Rural Development Programme for 2007-2013. The correlation analysis (with the correlation index of 0.65 as a result) confirmed the assumed hypothesis that there exists a significant positive relationship between the share of agri-environmental payments in Polish voivodeships and the number of agricultural enterprises which adopted the eco-innovations.

Thus, according to the analysis, the development of the environmentally friendly economic activities in Polish agriculture is more dependent on the level of payments within the framework of the EU Rural Development Programme, than on the funds under the

Polish national agriculture and rural development policy. This is not surprising because the results of previous evaluation of the realization of agri-ecological measures [Horin 2014] showed that just due to the implementation of the EU Rural Development Programme Poland was able to provide financial support for the environmental development of agriculture and rural areas as well as Polish farmers has received financial motivation for the implementation of eco-innovation projects into the business.
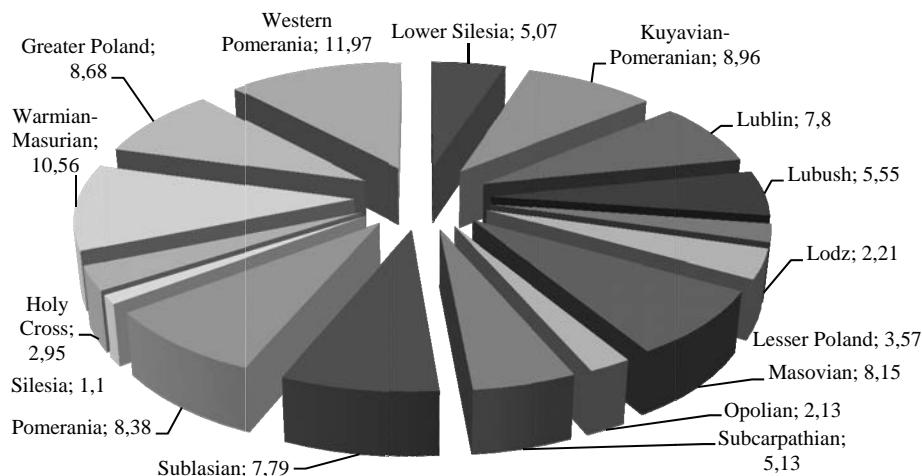
Fig.1. Allocation of funds provided by the Rural Development Programme for 2007-2013 for agri-environmental measures, %, per voivodeship of Poland

Source: own calculated on the basis of the official statistic data available from : http://www.minrol.gov.pl/pol/.

According to factor analysis, based on the data of Central Statistical Office of Poland, the main features of eco-innovative activities of agricultural enterprises are the following:

1) Most eco-innovative projects are introduced by the large enterprises which employing more people;

2) The participation of micro-enterprises in the adoption of eco-innovation projects is small but it slowly increases every year;

3) In the period of favourable economic conditions the farmers, being supported by the government, often decide to incur additional costs related to the adoption of new eco-innovation technology or product.

SWOT analysis was constructed to support the policy-makers in determining and strategic planning the goals, directions and methods of eco-innovative development and funding eco-innovation in Polish agriculture. The presented in table 2 analysis allows to evaluate the strengths, weaknesses, opportunities and threats of eco-innovative progress in Polish agriculture, and in future will help to identify the most effective policy instruments and investments to promote the innovative behaviour and practices in an agricultural sector of the Polish economy.

Table 2. SWOT analysis of eco-innovation in Polish agriculture

Strengths	Weaknesses
- Access to the funds within the framework of the EU programmes - The priorities of agri-ecological methods of farming in the state support programmes - Attraction of foreign direct investment for new eco-innovation projects; high investment attractiveness of particular sectors of agriculture - Great potential for organic food production - Wide range of higher educational and research institutions which work in the field of ecologization of agriculture and rural development	- Slow development of mechanisms for knowledge transfer and cooperation between farmers and scientific research and advisory services - Insufficient awareness of the needs of agri-ecological innovation and improvement of knowledge - Low level of farmers' income - Low level of eco-innovative motivation of farmers - Low shares of expenditure both on R&D and on eco-innovative activities of agricultural enterprises - Slow development of organic food market
Opportunities	**Threats**
- Increasing of the environmental awareness and knowledge of farmers - Organic farming - Reducing of gas emissions, among others, by promoting investments to reduce power consumption, increase production and use of renewable energy sources as the result of the rational use of fertilizers - Development of the innovative forms of cooperation and relationships between the farmers, the farmers and consumers, the farmers and supporting institutions - Cross-border cooperation with the neighbouring countries in the matters of realization of eco-innovation projects	- Increased competition, especially with agricultural producers from Eastern Europe - Non-sufficient professional competence of farmers - Low level of R&D expenditure - Reduction of the expenditure on eco-innovative projects in agriculture - Deepening of the economic inequality in the development of some voivodeships due to their uneven funding within the eco-innovation programs - The ageing of rural population, and, therefore, the opposition of it to new technologies

Source: author's own elaboration based on the materials of the Ministry of Agriculture and Rural Development of the Republic of Poland, Horizon 2020, the EU Rural Development Programme for 2014-2020, Rural Development Programme for 2007-2013, and on author's own study.

Conclusions

In this paper we examine the organizational and economic mechanism of Polish support the eco-innovation projects in agriculture. There is no doubt that the adoption of the environmental technologies in the agricultural sector, implementation of EU's and national laws in the field of ecologization, cooperation between the farmers and policy-makers will lead to sustainable development as well as the provision of international competitiveness of the economy as a whole. But the eco-innovation in Polish agriculture meets the number of constraints, which have mainly economic, administrative and mental character. The study indicated that the most significant barriers are the following: high cost of the adoption of eco-innovation projects; difficult access to capital for farmers; uncertain return on investment; weak system of economic and fiscal incentives; insufficient cooperation between the administrative institutions, public entities, and the farmers; continuous changes in legal regulations; poor integration of the objectives of agricultural and environmental policies; mentality, habits, and aging of rural population.

Evaluation of the institutional support of the eco-innovative development of Polish agriculture showed that supporting policy is carried out at EU's and national levels which both declared the innovation and environmental protection as the most important goal to be reached in the medium-term outlook. The sources of eco-innovation financing foresee the

joint financing from national and EU's funds mainly under the Horizon 2020 and the Rural development policy. The estimation of effectiveness of the Rural Development Programme showed the unequal share of funds between Polish voivodeships, that has determined the differences in the adoption of eco-innovation projects by the farmers from different regions of the country. Therefore, the analysis confirmed the positive relationship between the share of agri-environmental payments in Polish voivodeships and the number of agricultural enterprises which adopted the eco-innovations. Also, it was found that the development of the eco-innovation activities in Polish agriculture is more dependent on the payments within the framework of the UE's support programs than on the funds under the Polish national supporting policy. For the future implementation of more effectiveness supporting measures, we defined the strengths, weaknesses, opportunities and threats of eco-innovation in Polish agriculture.

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Tools and Mechanisms for Rural Area Development in the State Economic Security Policy System

Abstract. The article studies the regional-sectoral dimension of the correlation between the development of rural areas and the economic security of the state. The structural approaches are determined by the positioning of the economic mechanism of rural area development in the system of state economic security. The paper identifies key risks and describes their destabilizing impact on rural area development in the context of the economic, social and environmental spheres. A set of tools and mechanisms are worked out to stimulate the development of rural areas within the framework of the state policy of economic security; these the key mechanisms are administrative and management, organizational and economic, socio-humanitarian, logistics and infrastructural, and environmental protection.

Key words: rural areas, economic security, social and economic development, state economic security policy, economic mechanism, diversification .

Introduction

Transformation processes and incomplete structural changes cause the stagnation and decline of socio-economic development of rural areas. It hinders significantly the efficient use of natural resource potential, the increase in the volume of agricultural production, the organization of harmonious exploitation, improvement of the investment attractiveness of rural areas, the overcoming of imbalances of spatial and regional development, the employment of rural people and their well-being, the establishment of inter-regional and sectoral vertical and horizontal integration links, the formation of food security, and the modernization of socio-economic infrastructure in rural areas. Protecting the interests of the rural population enhances social and cultural development of the regions. These destabilizing trends have a negative impact on the formation of state economic security, violating the principles of consistency and balance in the process of ensuring the security. Considering this, the problem of creating effective mechanisms and tools to promote the socio-economic development of rural areas becomes critical in the framework of the implementation of applied foundations for the improvement of the state economic security policy.

At present, the study of theoretical and applied aspects of rural area development is concentrated mainly on the solution of socio-economic problems. Scholars and practitioners pay considerable attention to issues related to overcoming the periphery character of rural development, rural poverty, weak infrastructure support in rural areas,

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reduction of unemployment, improvement of social and living conditions of rural residents, increasing the level of the efficient use of agricultural land, harmonious exploitation, greening of the agricultural sector of the economy, and the development of business entities in rural areas (Pavlov, 2009). The studies, focused on the development of strategy and mechanisms for sustainable development of rural areas (economic, social and environmental spheres) in the context of sustainable development of society and the state as a whole, become a frequent practice, as modern United Nations program documents are oriented to achieve it. The strategic objective is to preserve the regional cultural customs and traditions, primary natural landscapes, ecosystems, etc, for future generations. (Popov, 2009). Much attention is paid to innovation in the formation of economic mechanism of rural area development. Scientists have processed theoretical and methodological foundations of institutional support for rural area development, drawn up adaptation mechanisms for the institutional environment with the demands and needs of business entities in rural areas and identified institutional barriers to the development of rural areas (Strategic priorities and mechanisms of..., 2014). Well-developed is the issue of harmonization of state and regional policy of socio-economic development of rural areas, fostering the development of local business and civic initiatives, information and analytical support for business entities in rural areas (Honcharenko, 2009). At the same time, elaborated ideas and hypotheses of the formation of economic mechanisms of rural area development do not provide clear mechanisms for financing and implementing the proposed measures that reduce the practical value of such developments. Moreover, the issues concerning correlation between rural area development and the economic security level remain unexplored. The place and role of the economic mechanism of rural area development in the system of economic security is not defined.

The main purpose of the study is to develop effective instruments and mechanisms to stimulate socio-economic development of rural areas in the framework of the implementation of applied foundations of state economic security policy in order to ensure economic security. This will allow the use of powerful uncommitted reserves to adjust space-regional disparities, diversify economic activity risks and create preventive countermeasures to threats in rural areas.

Research methods

The authors use the following methods of scientific knowledge: abstract-logical method (to establish the nature and the character of the correlation between the development of rural areas and the state economic security in regional and sectoral dimension); hierarchy method (to determine the conceptual approaches to the positioning of the economic mechanism of rural area development in the system of state economic security); analysis (to identify trends in the development of rural areas); structural and diagnostic method (to identify threats to rural area development in the context of the economic, social and environmental spheres); project-organizational method (to develop priority tools and mechanisms within the framework of the state policy to ensure economic security, including administrative and management, organizational and economic, socio-humanitarian, logistics and infrastructural, and environmental protection mechanisms). The methodology of the study has provided its systematic and comprehensive nature, which allowed us to obtain objective results and conclusions.

Results of the research

The multi-faceted nature of state economic security has ensured the formation of various conceptual positions regarding substantial and functional characteristics of this concept, including, in particular: stability and arranging for the state's ability to develop, optimal conditions of the national economy, countering internal and external threats, resource-functional approach, protection of national interests of the state. Based on an interdisciplinary approach, the authors define economic security as the resource and functional ability of the state to deal timely with threats under the condition of constant changes in the economic environment, protect national interests, pursue an independent internal and foreign policy, generate the preconditions for meeting basic human needs, improve the well-being of people and provide support for the processes of expanded reproduction on the basis of harmonious exploitation and effective management.

The complex nature of state economic security requires compliance with a systematic approach to solving the problem of its maintenance. The difference between the endogenous and exogenous factors of states' functioning allows us to differentiate the economic security system in countries with an industrial, transitive and post-industrial type of economic development, that forms a strategy, tactics and mechanisms of the security system, its resource and functional basis, priorities and objectives. Ukraine is at the transitive stage and provision of its economic security by means of activating the processes of socio-economic development of rural areas is strategically important because, according to official statistics, rural areas occupy more than 90% of the country, while the proportion of rural population comes up to 31.0%, at the same time in Zakarpattia, Ivano-Frankivsk, Rivne, Ternopil and Chernivtsi regions rural population consists more than 50.0% of the population (State statistics service of Ukraine).

It is worthwhile to determine the nature of the correlation between the development of rural areas and the level of state economic security, that allows to form the conceptual basis of the fundamental approach to the assessment of the security process parameters. The strength of the interconnection of the economic mechanism of rural area development and the state economic security depends on the degree of coherence and conformity of its functional elements with the strategic security priorities of space-regional and sectoral dimensions. A substantial and functional role of the economic mechanism in the process of providing economic security is to create safe conditions for rural area development on the basis of a balanced combination of harmonious exploitation tools, improvement of economic efficiency, development of preventive mechanisms to counter threats and protection of the interests of the rural population.

Positioning the economic security of rural area development through the prism of condition, that allows to create a basic framework for adjusting imbalances of spatial and regional development, increasing the resource potential of the state, protection of the interests of rural population and providing support for expanded reproduction is the most rational approach to assessing the effectiveness of security processes, given the specific character of hierarchical interconnections between the economic mechanism of rural area development and the state economic security system. The peculiarity of the economic security of rural area development lies in its two-dimensional interdependence (regional and sectoral) with the state economic security through intermediate hierarchical levels of its support system (Figure 1).
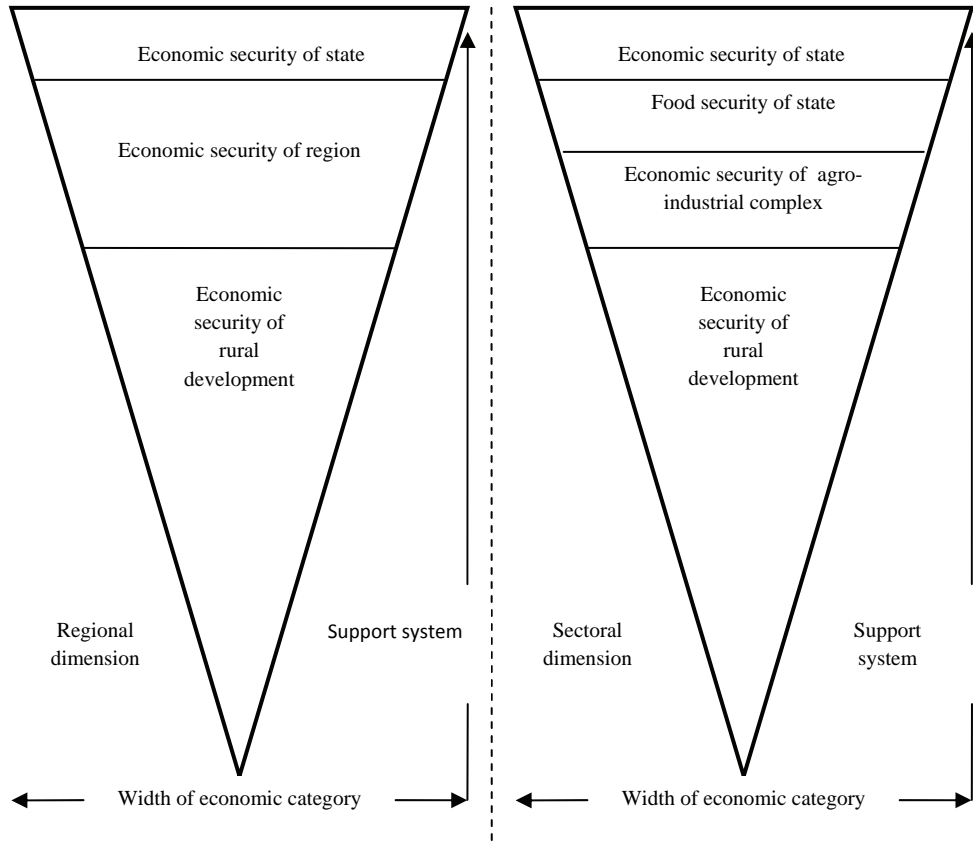
Fig. 1. Regional and sectoral dimension of the interdependence of economic security of rural area development and the levels of state economic security

Source: drawn up on the basis of the approach (Vasyltsiv, 2008, p. 21).

Thus, the economic mechanism of rural area development in the system of state economic security is positioned as: 1) an integral component of the creation of organizational support for the economic security system, aimed to ensure conformity of incentives of the different social groups, a fair distribution of public goods between them and protection of their strategic interests; 2) a source of the resource base for the provision of state food security under conditions of the aggravating of quality food shortage on world agricultural markets; 3) diversification tool of economic security risks in space-regional dimension that activates the network connections between the various hierarchical levels of the national economy. Given this, state policy should take into account regional and sectoral specificity of the provision of economic security of rural area development within the parameters of such two strategic vectors: the first is aimed at provision of regional security, based on levelling disproportions of spatial development and approaching the quality of life of the rural population to the urban level; the second is aimed at improving the sectoral and industrial tools to ensure food security and thereupon strengthening the economic security of the state. The combination of these two vectors will allow to ensure a

consistency and complexity of state policy of ensuring economic security and create objective preconditions for the development of effective organizational and economic mechanisms of security process management at various hierarchical levels.

The depressive nature of rural area development is caused by the lack of adequate infrastructure, making them uninhabitable and leads to a decrease in the number of rural settlements. Thus, in 2014 compared with 1991, the number of villages in Ukraine decreased by 641 units. The following changes have occurred in the western regions: in Volyn region decreased by 9 units, in Zakarapttia region – by 14, in Ivano-Frankivsk region – by 5, in Lviv region – by 21, in Rivne region – by 2, in Ternopil region – by 35 (Demographic passport of the territory). The imbalance of the system of administrative-territorial management of rural territories prevents the establishment of competent rural territorial communities, which hinders the participation of rural populations in the programming of rural development, hinders the solution of household problems, strengthens the passive behaviour of the villagers, generates risks of apparent discrepancy between local government priorities and the interests of local communities. For example, in Lviv region, where there is the biggest number of registered rural communities in Ukraine, 21 rural settlements have no population, but are not deregistered. Relatively competent is only the self-government of the cities of regional importance, since it is based on sufficient financial, infrastructural and personnel resource bases. Therefore, out of 710 local councils, only 72 are self-sufficient, and only 46 of those are rural councils. In 2012, 618 village councils received a government grant in the amount of UAH 179.4 million, in 2013 – 615 councils (UAH 186.3m), in 2014 – 613 councils (UAH 179.6m). Of 633 village councils in Lviv region only 65 councils have a population over 3 thousand people; 437 councils – over 1 000 people; 131 councils – less than 1 000 people. 186 village councils control one locality; 150 councils control 2 localities; 297 councils control 3 and more localities. Over the past 10 years the number of rural councils in Ukraine grew by 1,052 units, but at the same time the rural population decreased by more than 1.6m and the number of villages has decreased by 456 units. In Lviv region, in spite of the decrease in the rural population by 109.3 thousand people in the years of independence of Ukraine, the number of village councils increased by 150 units – up to 633 units (State Statistics Service of Ukraine).

Depopulation of villages and deep stagnation of socio-economic development of rural areas is caused by the destabilizing effects of threats in the economic, social and environmental spheres. Thus, in the economic sphere the development of rural areas is hindered by the low level of entrepreneurial and business infrastructure, which is caused by the imperfect institutional environment, which does not meet modern requirements and objective needs of economic entities. The economic sphere is characterized by negative aspects, among which are: incomplete legal framework that regulates economic activity; an excessive number of licensing and registration procedures; the imperfection of the taxation system; complicated access to financial resources; low level of information support to rural area development; unattractive investment climate; growing share of the transaction representation costs of businesses entities; frequent occurrence of settling production and economic relations with non-economic methods; breaching the conditions of treaty obligations. A typical problem for the creation of an adequate economic environment is the predominance of informal institutions over formal, which increase imbalances and differentiation between the development of rural areas of Ukraine.

In turn, the social sector has to play the role of a compensation factor for the rural population, as a result of a priori impossibility to meet such a range of interests and needs,

which is available in urban areas. A kind of balance control of this social injustice is a social sphere of rural areas, which potential and resource opportunities, especially in the segment of the cultural and spiritual development is qualitatively different than in urban areas. The destabilizing effects of the stagnation of the social sphere of rural areas go far beyond purely humanitarian aspects and are characterized by a range of negative phenomena: 1) increase in the disparity of class inequalities in society, which extension patterns have distinct regional features; 2) formation of a critical mass of public discontent, due to the inability to fully implement personal interests and needs; 3) strengthening of the social and psychological stimuli that activate the centrifugal motion caused by increasing level of distrust of the rural population to the central government bodies; 4) deterioration of the basic preconditions of base-spatial support of the educational and intellectual development of the rural population; 5) complication of management of public interest structuring and conflict resolution due to the destruction of the network of social relations of the rural population; 6) loss of cultural and ethnic characteristics of rural areas, the decline of the spiritual traditions; 7) undermining the authority of the rural school institution in the countryside, as a key centre of formation and development of a self-sufficient person and a patriot; 8) breach of cultural and spiritual relations between urban and rural population.

Destabilizing trends in the development of rural areas cause systemic poverty of the rural population, which, along with the destabilizing impact of the economic nature, also has deep social and psychological aspect, disregarding of which deforms the structure and etymology of threats' manifestation solely within the material and economic well-being. Deepening property stratification between urban and rural populations only exacerbates the class confrontations, which manifest themselves in various forms of social and economic conflicts and prevent the consolidation of society in achieving the strategic priorities of the state's national security. The situation is worsened by the scope of passive income in rural areas represented by different social payments (material aids, subsidies, benefits, etc.), the scale and scope of which negate the applied basis of the stimulation of active employment policy. In this regard, there is destruction of the framework of a motivational mechanism for the formation of active employment in rural areas and the suppression of the independence of self-employed farmers.

A significant problem is the deterioration of the ecological situation and imbalance in rational use of natural resources, which creates a threat to the development of rural areas and the preservation of their natural landscapes. Excessive human intervention in the ecosystems leads to irreversible processes, stabilization and elimination of the consequences of which requires significant cash costs and time. Imbalance in the "man-nature" relations system stimulates the worsening of ecological imbalances in rural areas. Natural ecosystems are on the verge of irreversible processes, which will significantly complicate overcoming the destabilizing consequences of environmental imbalances, both in time and financial terms. Long-term ecologically unbalanced use of land resources, incompleteness of land relations and ecologically unbalanced agriculture have led to a sharp deterioration of soil conditions: the loss of humus and nutrients; development of erosion; changes in the acid-base conditions; physical degradation; salination and alkalization; pollution, mainly related to air emissions of enterprises, violation of the rules of production, transportation and processing of minerals, fertilization and storage of agrochemicals and pesticides, disposal of drain water and sludge, household and industrial wastes, etc. (Yatsenko, 2014, p. 18). Environmental threats are amplified under the conditions of low capitalization of relations in this area, which provokes chaotic irresponsible consumption of

natural resources. Their use in the environment of rural development is characterized by its features, which complicate the process of monitoring and forecasting the parameters of potential environmental threats, such as the lack of effective control by the state and civic organizations; incomplete ecological passports of rural areas; passiveness of rural local communities in solving ecological problems; excessive dependence on natural and climatic factors and the territorial distribution of production capacities; specialization of business entities and their level of technical and technological equipment.

The destabilizing impact of threats is a consequence of the crisis in state management that is caused both by failures in state personnel policy and the predominance of the role of personal relations, while taking into account the determinants of professional experience and skills, in the process of appointment, staff turnover and career development of personnel in the system of key government posts. In cases where state regulation cannot prevent the threats, their negative impact not only increases, but also has a synergistic destabilizing effect on the functioning of economic mechanism (Yurkiv, 2015, p. 79). To overcome destabilizing tendencies in socio-economic development of rural areas the implementation of structural changes is necessary, as well as local government reform, and promotion of initiatives among rural residents, which asks for the development of rational decisions to improve the implementation of state economic security policy in order to increase the utilization efficiency of natural-resource potential of rural areas, improving level of prosperity of rural population and creation of preventive mechanisms to protect the state economic interests. Given that effective reform and development of rural areas is the basis for the development of the real sector of the economy, development and modernization of infrastructure, preservation of the environment and sustainable development of rural areas, the use of energy-saving and resource-saving technologies, the creation of human and intellectual potential of the state is extremely important.

Conclusions and suggestions

The destabilizing impact of threats on the socio-economic development of rural areas requires the development of preventive measures to counter them, which is primarily focused on structuring the security process by improving the level of protection for the rural population, quality of life and food security which altogether will strengthen state economic security. Having this in mind, within the framework of the state economic security policy a set of tools and mechanisms is developed to stimulate the rural areas development. Among them the key mechanisms are:

1) administration and management – involve conducting reform of local government, which provides for a system decentralization of power on the basis of delegation of authorities to rural territorial communities, the coordination of a strategy, tactics and operational tasks of the state, regional and local policies, reducing the uncertainty level of management decision-making based on stimulating initiatives of their adoption under the "bottom-up" principle, avoiding potential conflicts of interest between subjects of different hierarchical management levels, pluralism and deregulation of economic relations;

2) budget and finance – provide for a change of principles and approaches to the budgeting of rural territorial communities by diversifying their sources of income and decentralizing the distribution of the accumulated funds, increasing the share of productive expenditures aimed at overcoming disparities of regional development and the disparity

between the incomes of rural and urban populations, engaging design and grant support funds, observance of the balance in budgeting of rural territorial communities by taking into account the target indicators of socio-economic development of rural areas, the creation of mechanisms of protection of the basic interests of the most vulnerable groups of the rural population and a fair distribution of public goods;

3) organizational and economic – aimed at diversifying risks by moving to multifunctional rural area development and encouraging attractive types of economic activity for different territories, creation of innovative horizontal-vertical integrated regional and sub-regional clusters, provision of fair competition and equal market entry conditions for all agricultural producers, countering the emergence of monopolies on the agricultural market through the provision of state support for the development of farm enterprises, improving the marketability level of households and preventing the concentration of excessive amounts of agricultural land in the hands of one owner, ensuring food security through the provision of physical and economic access to food for all social groups, carrying out the adaptation of national rules and safety standards of food products with the requirements of the European Union, taking into account the provisions of the ratified Association Agreement between Ukraine and the European Union;

4) socio-humanitarian – involves creating safe conditions for human living in rural areas in the educational, medical and cultural spheres, which is necessary for ensuring the reproduction of the population, the improvement of human capital and the full-fledged development of personality, creating the preconditions for the solution of social contradictions arising from the specificity and differentiation of territorial location between rural and urban population, overcoming the negative migration trends in rural areas, provision of demographic security by improving the quality of life of the rural population, increase of life expectancy and lowering mortality rates, which will lead to a qualitative improvement of the age structure of the population to prevent the formation of desolate territories;

5) logistics and infrastructure – involves system upgrades, protection and development of critical infrastructure in rural areas, improving access of agricultural producers to commodity products markets through the development of an extensive network of facilities of agricultural market infrastructure support, the creation of purchase and procurement centres of agricultural products in rural areas, procedure simplification for small businesses to enter the stock trading floor, equipping trade places for small producers in local markets, creation of mechanisms for prosecuting large agricultural holdings for the destruction of transport and logistics infrastructure in rural areas;

6) environmental protection – aimed to ensure environmental management and protection of the natural environment in rural areas, preserving intact the rural landscapes, the optimal combination of crop and livestock sectors, the development of organic farming, the preservation of natural fertility based on cropping patterns management and compliance with scientifically based crop rotations for specific natural and climatic zone, use of advanced technology in the cultivation of crops, maximum permissible emission control.

Comprehensive implementation of the proposed tools and mechanisms for the development of rural areas within the state economic security policy will allow to create resource preconditions to counter targeted threats, level disparities in regional development, reduce poverty, bring the quality of life of rural population to urban levels, ensure food security, and diversify risks of running business which will ultimately strengthen state economic security.

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Comparative Analysis of Support to Agriculture in the QUAD Countries in 1986-2014

Abstract. The purpose of this paper is a comparative analysis of support provided to agriculture sector by the QUAD countries in 1986-2014. The authors examined the changes in levels and structures of this support and tried to assess it from the point of view of its impact on the QUAD economies and markets. In the analysis conducted there were used especially the OECD data and indexes measuring state support to agriculture including: Total Support Estimate, Producer Support Estimate, General Services Support Estimate and Consumer Support Estimate. In the last three decades in all the examined economies, there has been a reduction in agricultural support in relation to GDP, although no distinct change has occurred in terms of the amount of aid in absolute terms (in the US its value even increased almost twice). As regards the changes in structure of support, the most favorable tendencies took place in the European Union where the market price support (MPS), i.e. the most distorting aid to the functioning of the market mechanism, was significantly reduced. One can also positively assess the support structure in the United States where about half of the agricultural budget is earmarked to consumers. Canada has very good economic outcomes as regard the agriculture sector even though it allocates the least amount of financial resources to support agriculture in relation to GDP among all the QUAD economies. However, despite a large part of this support is in the form of general services (GSSE), the country is characterized by an unfavorable trend of increasing expenditure on price support. Throughout the period considered the most harmful support policy from the point of view of market competition was led by Japan though it has affected to a lesser extent the functioning of international agri-food markets due to the lower importance of Japanese agricultural production and exports in the world economy in comparison to the EU and the US.

Key words: subsidies, agriculture, European Union, United States , Japan, Canada

Introduction

Despite the global trend of a decreasing share of agriculture in GDP and employment compared to other sectors of economy in recent decades, many countries still regard this sector as a very special field which requires conducting an appropriate agricultural policy. One of the most important features of such a policy is providing state support to compensate for imperfections in the functioning of agri-food markets. Among these market failures one can distinguish (Czyżewski & Poczta-Wajda, 2011, p. 26): the rigidity of demand for agricultural products; a low elasticity of demand with respect to income under consumption pressure; a slower growth in demand for agri-food products in relation to supply which contributes to a decline in agricultural prices; as well as an extended period of return on capital invested in agricultural production. Production of many agricultural commodities is subject to forces that lie beyond the direct control of farmers. The real level

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of agri-food production can be much lower or higher than its planned volume due to natural disasters (like drought, floods or earthquakes) or exceptionally favourable conditions. A shortage in output as well as overproduction lead to fluctuations in agricultural prices and as a result to farmers' income disorders. Furthermore, agricultural price levels and incomes show a tendency to a relative decline with economic growth compared to prices and incomes in non-agricultural sectors. As people's income rises they tend to spend a smaller proportion of it on agri-food products (due to low income elasticity of demand) (El-Agraa, 2001, pp. 232-236 and Pelkmans, 2001, p. 203). Hence farm incomes usually lag behind the incomes of those employed in the non-farm sectors. The problem of agricultural incomes stems also from decreasing agricultural productivity in comparison to manufacturing. Other arguments for supporting farming arise from historical factors, strategic considerations and the strength of agricultural lobby (El-Agraa, 2001, p. 237).

Irrespective of various significance of agriculture across countries, they share a set of similar goals that drive their support for this sector of economy (Pelkmans, 2001, p. 205; Rieger, 2005, p. 169; Winters, 1988, p. 241; Wojtas, 2007, p. 45 and WTO, 2006, p. 120): income redistribution and stabilization (satisfactory and equitable standard of living for farmers); secure and sufficient food supplies; stabilization of domestic agricultural prices; enabling adjustment to exogenous shocks; rural development; preservation and encouragement of family farming; fair prices for consumers; protection of the environment; agricultural efficiency and competitiveness. However, some of these aims are very difficult to obtain at the same time as they can be mutually exclusive. The agricultural policy objectives tend to evolve over time and vary depending on the level of development of economies. The developing countries concentrate their efforts on providing food security, poverty alleviation, rural development, and stabilization of export revenues while the developed countries continue to focus on food self-sufficiency with the growing weigh being put on food safety and environmentally sustainable farming (WTO, 2006, p. 120).

Regardless of the undoubtedly justified goals of agricultural policy its economic outcomes are often quite different from the intended. Agricultural support (Edwards, 2009; Winters, 1987; Baldwin and Wyplosz, 2009): distorts market mechanisms which leads to substantial deadweight losses in economic welfare (due to wrong investment signals, avoiding cost cutting by farmers and discouraging innovation activity); wastes resources by over-expanding agricultural output in high-cost areas and limiting it in low-cost ones; diverts resources from more productive sectors of economy; transfers funds from taxpayers to a small group of large landowners instead of tenant farmers or farm workers; increases food prices to consumers; damages and contaminates the natural environment by fostering too intensive production and excessive use of fertilizers and pesticides; affects farmers' decisions and makes changes in the structure of agricultural production; constitutes a serious hurdle in multilateral trade liberalization process and discourages agriculture of the developing countries by reducing world prices and making them more volatile.

The paper concerns the QUAD countries - an informal group of highly industrialized economies including the United States, Canada, Japan and the EU member states – which are the main actors of the international trading system. This group has a significant share in the world agricultural production and trade and striving to realize its particular interests in the agricultural sector has a large influence on the results of multilateral trade negotiations at the forum of GATT/WTO shaping the rules of agricultural trade on a global scale. The aim of this paper is to compare the QUAD countries in terms of levels and structures of state support to agricultural sector as well as to assess the changes in support measures in

respect of their economic results as regards agricultural production, trade and prices in 1986-2014. The analysis conducted is based mainly on OECD data and indexes measuring state support for agriculture including: Total Support Estimate, Producer Support Estimate, General Services Support Estimate and Consumer Support Estimate. The FAO, WTO and World Bank databases also proved to be helpful. The state support and its impact on the QUAD economies is examined with distinction of three periods (1986-1994, 1995-2005, 2005-2014 or representative years) taking into account the fundamental changes in national agricultural policies as well as multilateral reforms.

Significance of agriculture sector in the QUAD countries

In 2014 the QUAD countries had over 21% share in world agriculture production and almost 25% share in world merchandise trade of agricultural products taking into account extra-EU28 exports and imports. However, considering extra- and intra- EU28 trade the share of QUAD group in world agriculture trade would increase to about 53% in exports and 51% in imports. Despite the growing importance of less developed countries in world agriculture production and trade in recent decades the QUAD countries still belong to the most important players in global markets for agricultural commodities. The European Union and the United States are the first largest exporters of agri-food products in the world and fall also under the group of largest importers.

Table 1. Selected economic indicators concerning agriculture sector in the QUAD countries in 1995 and 2013

Economic indicator	Japan		Canada		EU		US	
	1995	2013	1995	2013	1995	2013	1995	2013
GDP (bln USD)	5334	4901	590	1826	8838	17291	7338	16853
GDP per capita, PPP (USD)	22921	36069	22789	42748	21704	34305	28748	52985
Share of agriculture in GDP (%)	1.6	1.2	2.9	1.6	2.9	1.7	1.6	1.3
Share of agriculture in employment (%)	5.2	3.4	3.8	2	4.7	4.4	2.9	2.2
Agri-food exports (% of total exports)	0.4	0.5	6.8	9.9	8.3	6.7	10.9	9.6
Agri-food imports (% of total imports)	12.3	7.4	5.5	7.5	9.6	6.1	4.4	5
Agri-food trade balance (mln USD)	-39449	-58513	3817	10776	-8588	11319	29671	36255
Crop in total agricultural production (%)	76	68	51	58	53	56	61	59
Livestock in total agricultural production (%)	24	32	49	42	47	44	39	41
Share in world agricultural production (%)	7.14	1.82	0.88	1.05	19.5	10.59	9.59	7.97
Share in world merchandise exports of agricultural products (%)	0.79	0.6	5.47	3.86	40.55	38.06	13.66	10.32
Share in world merchandise imports of agricultural products (%)	12.04	4.37	1.96	2.14	42.36	35.77	8.55	8.38

Note: Data for 2013 or latest available year; EU(15) in 1995 and EU(28) in 2013; Agri-food exports and imports as % of total trade as well as agri-food trade balance for extra- EU flows; Share in world exports and imports of agricultural products for years 1995 and 2014 and for extra and intra - EU trade. Share of extra- EU flows in world exports and imports of agricultural products amounted to 10.1% in 1995 and 9.8% in 2014.

Source: Own elaboration based on: FAO (2016), OECD (2015a, pp. 97, 135, 179, 285), WTO (2015a, p. 77) and WTO (2015b).

Among the QUAD economies the agriculture sector is relatively most important in the EU and Canada in terms of share in GDP, and contributes most significantly to job creation in the EU and Japan. The United States and Canada are consistently large net exporters of agricultural commodities, with agri-food exports accounting for nearly 10% of their total exports in 2013, while the European Union's negative trade balance of agri-food products has reversed scarcely since 2012 and as a result the EU has joined the group of net exporters. The United States and the European Union have very big internal markets for agricultural products which helps farmers to take advantage of economies of scale and Canada benefits from an absorbing market of its closest neighbor destining more than half of its agri-food exports to the United States. Completely different is the situation of Japan, a country with relatively little land, where only 30% of its total area may be used for agriculture or urban development (OECD, 2015a, p. 179). This country is one of the largest net agri-food importers in the world with more than sevenfold predominance of share in world merchandise trade of agriculture imports over exports. Japan's lack of international competitiveness in agricultural product markets stems not only from its limitation in available land but it is also caused by many other reasons, e.g. improper agricultural policy measures such as a high rice price policy to increase farmers' income (Yamashita, 2006, p. 3). Moreover, this country has a very unfavorable agrarian structure with a majority of very small family farms, and many farmers move from the countryside to the cities. That is why the agricultural sector has experienced a decrease of nearly 30% of production, a decline in income of more than 40% as well as a rise in the average age of farmers by 7 years over the last two decades (OECD, 2015a, p. 179).

Analysis of support to agriculture in the QUAD countries

The broadest indicator of state support is Total Support Estimate (TSE). The TSE includes transfers to agricultural producers individually, measured by the Producer Support Estimate (PSE), policy expenditures that have agriculture as the main beneficiary but that do not go to individual farmers, measured by the General Services Support Estimate (GSSE) and budgetary support to consumers of agricultural commodities (as part of the Consumer Support Estimate, CSE). The financial aid of the European Union, Japan, the United States and Canada accounted for most of the total TSE for all OECD countries in the mid-1980s and their shares were 39.5%, 20.5%, 17% and 2.5% respectively, while in the most recent period their shares have decreased (except the US) and equaled 37.8%, 15.6%, 28,8% and 1.98% in 2014. This was mainly the result of the domestic reforms carried out by the QUAD countries in the 1990s as well as of the introduction of provisions of the Uruguay Round of GATT aimed at reducing support for agriculture.

The TSE expressed as a percentage of GDP (%TSE) measures the overall burden of support to agriculture on the economy. In the OECD countries the relative importance of total support to agriculture decreased on average from 2.8% of GDP in 1986-88 to around 0,8% in 2012-2014 (Table 2). The most significant reduction in that period occurred in the EU where %TSE was lowered by 1.9 percentage points but it also fell down in Canada and Japan (by 1.3 and 1.2 p.p.) and to a lesser extent in the US (by 0.5 p.p.). However, the total amount of aid measured in US dollars dropped only in Canada and Japan whereas in the EU it increased by 11% and in the US it almost doubled. Currently, the biggest burden on the economy resulting from supporting agriculture can be observed in Japan. The degree of

protection used to be and still remains higher in Japan than in countries at a comparable stage of development and the difference reflects the particularly difficult state of the Japanese agricultural sector (Hillman, 1985; Jones and Kimura, 2013).

When decomposing the aggregate TSE into its main elements it can be noticed that in the second half of the 1980s the total agricultural support was dominated by the aid to agricultural producers (PSE) which accounted for 86% of TSE in the EU, 85% in Japan, 84% in Canada and 72% in the US with the OECD average at the level of 83% (data for the years 1986-1988). During the analyzed period the share of PSE in TSE dropped significantly in the US and Canada (to 43% and 69% in 2014) whereas in the EU and Japan it was kept at a high level of 84% in 2014. In all the OECD countries it declined on average from 83% in 1986-88 to 72% in 2012-14. In the United States expenditure on supporting consumers (measured as transfers to consumers from taxpayers) constitutes most of the total support to agriculture (an increase from 20.7% in 1986-88 to 52.6% in 2012-14). A considerable share of TSE is allotted to the GSSE expenditures in Canada (27,9% of TSE in 2012-14 which was much above the OECD level accounting for 13.5% of TSE). In Japan and the EU the GSSE share in total support is close to the OECD average whereas in the US it is below that level (detailed information in Table 4).

Table 2. Total Support Estimate by the QUAD countries in 1986-2014

	1986-88	1995-97	2012-14	2012	2013	2014
Canada						
TSE (million USD)	7 198	4 781	8 089	9 757	7 902	6 607
Percentage TSE (% of GDP)	1.7	0.8	0.4	0.5	0.4	0.4
European Union[1]						
TSE (million USD)	112 734	134 095	131 353	126 848	141 291	125 920
Percentage TSE (% of GDP)	2.6	1.5	0.8	0.8	0.8	0.7
Japan						
TSE (million USD)	58 417	78 549	63 339	77 104	60 734	52 180
Percentage TSE (% of GDP)	2.3	1.6	1.2	1.3	1.2	1.1
United States						
TSE (million USD)	48 534	48 292	90 111	86 656	87 693	95 984
Percentage TSE (% of GDP)	1.0	0.6	0.5	0.5	0.5	0.5
OECD[2]						
TSE (million USD)	285 221	324 134	347 314	354 590	354 615	332 737
Percentage TSE (% of GDP)	2.8	1.5	0.8	0.8	0.8	0.7

Note: 1986-88, 1995-97 and 2012-14: unweighted averages; p: provisional. 1. EU12 for 1986-88; EU15 for 1995-97, EU27 for 2012-13 and EU28 from 2014 when available. 2. OECD EU countries are included individually in the OECD total for all years prior to their accession to the EU. Slovenia is only included from 1992. The OECD total does not include the non-OECD EU member states.

Source: OECD (2015c).

Producer Support Estimate represents transfers from taxpayers and consumers to producers individually. These transfers include (OECD, 2015a): 1) support based on commodity output (Market Price Support and payments based on output use); 2) payments based on input use (on variable input use, on fixed capital formation, on on-farm services); 3) payments based on current area planted, animal numbers, receipts, or incomes, with

production required; 4) payments based on non-current (i.e. historical or fixed) area, animal numbers, revenue, or income, with current production of any commodity required; 5) payments based on non-current area, animal numbers, revenue, or income, with current production of any commodity not required but optional; 6) payments based on non-commodity criteria (transfers for long-term retirement of factors of production from commodity production, transfers for the use of farm resources to produce specific non-commodity outputs of goods and services and transfers provided equally to all farmers, such as flat rate or lump sum payment; 7) miscellaneous payments.

A very problematic instrument of agricultural policy as regards its influence on market competition is Market Price Support (MPS). It can be defined as transfers from consumers and taxpayers to agricultural producers, arising from policy measures that create a gap between domestic market prices and border prices of specific agricultural commodities. They include trade policy instruments connected both with import (e.g. tariffs, tariff quotas and licensing requirements) and export (e.g. export subsidies, export credits and quantitative restrictions) as well as domestic price support measures (e.g. production quotas, administered prices and intervention purchases) (OECD, 2015b). Supporting domestic prices, stimulating production and raising farm incomes were the dominant features of agricultural policy strategies used by the QUAD countries in the 1980s. In 1986 the value of transfers associated with MPS reached 73642.4 mln USD in the EU, 41553.1 mln USD in Japan, 11070.8 mln USD in the US and 2976.1 mln USD in Canada. This accounted for 86.6% of PSE in the EU, 90.2% in Japan, 29.6% in the US and 49.4% in Canada (OECD; 2015c). This policy measure imposed significant costs on consumers and isolated farmers from market developments. MPS distorted farmers' production decisions and transfers often did not reach the intended beneficiaries. The MPS instrument caused a lot of problems in internal markets of the QUAD countries (overproduction, especially in the EU) as well as in international markets (pumping of agricultural products into the world market at dumped prices due to subsidies negatively affected incomes of the most competitive agri-food exporters). The Uruguay Round Agreement on Agriculture became an external incentive to change the character of agricultural policy support (especially in the EU) (Mucha-Leszko, 2004, pp. 35-39; Swinnen, 2015). The value of MPS transfers decreased in all the QUAD countries in 2014 compared to 1986, most significantly in the EU where it reached 18509.6 mln USD (17.3% PSE) but also in the US (9130.2 mln USD, 22% PSE) and in Japan (34716.4 mln USD, 78.4% PSE). In Japan price support programs cover majority of agricultural output, especially production of rice which is grown on about half of the arable land. In Canada, despite a decreasing value of MPS in absolute terms in 1986-2014 (to the level of 2742.9 mln USD), the share of MPS in PSE increased to 59.4%.

Reforms of support system that were introduced by the EU aimed at reducing intervention prices on wheat, beef and milk markets in combination with introducing Single Payment Scheme whereas in the US they focused on strengthening direct payments. These countries started to provide most of the support via tax-financed payments based on area, animal number, farm receipts or incomes. The share of such payments has increased most significantly in the EU (from 3% of PSE in 1986 to 64.7% of PSE in 2014)[3]. The US have a longer tradition of using this instrument of agricultural policy, in 1986 the share of direct payments in PSE was 37.6% and in 2014 this share rose to 49.2%. In both the EU and the US a marked shift can be observed - from payments based on current area/animal number

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[3] All the data on detailed structure of PSE, GSSE and CSE on the basis of: [OECD 2015c].

or farm receipts/incomes with production required towards the use of payments based on non-current area/animal number, farm receipts/incomes with production not required. Japan has also introduced, though to a lesser extent, some payments to farmers not connected with production, although one third of payments is still associated with production (the share in PSE of payments related and not related to production increased from 3.2% in 1986 to 12.8% in 2014). In Canada the importance of payments to farmers remained almost the same during the period analyzed (28.2% in 1986 and 30.6% in 2014) with the predominance of payments based on current area/animal number, farm receipts or incomes and with production required.

Table 3. Producer Support Estimate by the QUAD countries in 1986-2014

	1986-88	1995-97	2012-14	2012	2013	2014
Canada						
PSE (million USD)	6 058	3 576	5 862	7 411	5 559	4 618
Percentage PSE (%)	35.8	16.3	11.2	13.9	10.6	9.0
Producer NPC (coeff.)	1.39	1.10	1.08	1.10	1.08	1.06
Producer NAC (coeff.)	1.56	1.20	1.13	1.16	1.12	1.10
European Union[1]						
PSE (million USD)	97 318	116 732	111 988	107 760	121 301	106 902
Percentage PSE (%)	39.2	33.8	19.2	19.1	20.5	18.0
Producer NPC (coeff.)	1.70	1.33	1.05	1.05	1.07	1.04
Producer NAC (coeff.)	1.65	1.51	1.24	1.24	1.26	1.22
Japan						
PSE (million USD)	49 757	58 891	53 547	65 536	50 848	44 256
Percentage PSE (%)	64.0	58.1	52.3	55.1	52.6	49.2
Producer NPC (coeff.)	2.65	2.31	1.94	2.05	1.94	1.82
Producer NAC (coeff.)	2.78	2.40	2.10	2.23	2.11	1.97
United States						
PSE (million USD)	35 337	25 617	34 565	33 412	28 821	41 461
Percentage PSE (%)	21.2	11.9	8.2	7.9	6.9	9.8
Producer NPC (coeff.)	1.12	1.06	1.02	1.02	1.01	1.03
Producer NAC (coeff.)	1.27	1.14	1.09	1.09	1.07	1.11
OECD[2]						
PSE (million USD)	238 465	252 958	250 881	259 930	253 712	239 000
Percentage PSE (%)	36.9	29.6	17.9	18.4	18.0	17.3
Producer NPC (coeff.)	1.49	1.30	1.10	1.11	1.10	1.10
Producer NAC (coeff.)	1.58	1.42	1.22	1.23	1.22	1.21

Note: As in table 2. NPC: Nominal Protection Coefficient. NAC: Nominal Assistance Coefficient.

Source: OECD (2015c).

The OECD's key indicator to measure policy efforts to support agricultural producers is the Producer Support Estimate as a percentage of gross farm receipts (%PSE). Currently, in OECD countries about one-sixth of farm gross receipts depends on public policies. However, over the longer term, the level of such support has been following a downward trend. The producer support in relation to farm receipts remains below the OECD average

for the US and Canada and above that level for the EU and Japan. In the US %PSE was reduced by 13 percentage points between 1986-88 and 2012-14, in Canada by 24.6 p.p., in the EU by 20 p.p. and in Japan by only 11.7 p.p. In Japan the overall support remains high compared to the OECD average and to the other QUAD countries.

The Nominal Protection Coefficient (NPC) for the OECD countries at the level of 1.1 in 2012-14 suggests that farmers received prices that were 10% above international market levels (compared to 49% during the 1986-88 period). The highest prices for agricultural products occur in Japan. Prices obtained by Japanese farmers were 2.65 times higher than those in world markets in 1986-88, this ratio was reduced to 1.94 in 2012-14. The NPC value in Japan has resulted mainly from MPS for rice, Chinese cabbage and Welsh onion. In the EU producer prices were 70% higher than world prices in 1986-88 and only 5% higher in 2012-14 (still due to higher prices received by sugar, beef and poultry producers). In the US producer prices of commodities are mostly aligned with border prices, with the exception of sugar, dairy and sheep meat prices. In Canada higher prices than those on the world market are obtained by producers of milk, poultry and eggs.

The level of producer support can be measured by the Nominal Assistance Coefficient (NAC) which is a ratio that indicates by how much total gross farm receipts are higher than if they were generated at world market prices and without budgetary support. In 2012-14, in the OECD area NAC reached the level of 1.22 which means that in those countries total gross farm receipts were on average 22% higher than if they were only a result of market forces. The NAC index has narrowed significantly from 1986-88 when it accounted to 1.58. Price levels of agricultural products in the US and Canada are the closest to those in world markets among the QUAD countries and their agriculture would be able to survive without any budgetary support. The EU countries and Japan are less competitive and it seems that for the Japanese farmers it would be very difficult to survive with no state support.

Table 4. General Services Support Estimate by the QUAD countries in 1986-2014

	1986-88	1995-97	2012-14	2012	2013	2014
Canada						
GSSE (million USD)	1 109	1 201	2 225	2 345	2 342	1 988
Percentage GSSE (% of TSE)	15.5	25.2	27.9	24.0	29.6	30.1
European Union[1]						
GSSE (million USD)	10 504	12 600	18 051	17 338	18 822	17 993
Percentage GSSE (% of TSE)	9.3	9.4	13.8	13.7	13.3	14.3
Japan						
GSSE (million USD)	8 769	19 418	9 784	11 558	9 878	7 914
Percentage GSSE (% of TSE)	14.9	24.7	15.5	15.0	16.3	15.2
United States						
GSSE (million USD)	3 108	4 239	8 132	6 094	10 413	7 889
Percentage GSSE (% of TSE)	6.4	8.9	9.0	7.0	11.9	8.2
OECD[2]						
GSSE (million USD)	26 881	45 886	47 012	45 105	50 549	45 381
Percentage GSSE (% of TSE)	9.4	14.2	13.5	12.7	14.3	13.6

Note: As in table 2. A revised GSSE definition with new categories was introduced in 2014. When possible, the revision was implemented for the whole time series.

Source: OECD (2015c).

Table 5. Consumer Support Estimate by the QUAD countries in 1986-2014

	1986-88	1995-97	2012-14	2012	2013	2014
Canada						
CSE (million USD)	-2 860	-1 758	-3 938	-5 145	-4 134	-2 536
Percentage CSE (%)	-22.7	-11.2	-12.7	-15.8	-13.5	-8.8
Consumer NPC (coeff.)	1.33	1.13	1.15	1.19	1.16	1.10
Consumer NAC (coeff.)	1.30	1.13	1.15	1.19	1.16	1.10
European Union[1]						
CSE (million USD)	-72 556	-58 542	-22 220	-20 503	-28 973	-17 184
Percentage CSE (%)	-35.7	-20.9	-4.6	-4.3	-5.8	-3.6
Consumer NPC (coeff.)	1.70	1.30	1.05	1.05	1.07	1.04
Consumer NAC (coeff.)	1.56	1.26	1.05	1.05	1.06	1.04
Japan						
CSE (million USD)	-61 284	-76 199	-57 304	-70 865	-53 832	-47 214
Percentage CSE (%)	-62.3	-53.6	-44.3	-47.8	-43.1	-42.0
Consumer NPC (coeff.)	2.66	2.17	1.80	1.92	1.76	1.72
Consumer NAC (coeff.)	2.65	2.16	1.80	1.91	1.76	1.72
United States						
CSE (million USD)	-2 629	6 157	40 900	39 895	45 284	37 521
Percentage CSE (%)	-2.4	4.3	15.6	14.6	17.8	14.5
Consumer NPC (coeff.)	1.12	1.08	1.02	1.02	1.01	1.03
Consumer NAC (coeff.)	1.03	0.96	0.86	0.87	0.85	0.87
OECD[2]						
CSE (million USD)	-158 691	-169 553	-79 930	-93 692	-78 554	-67 544
Percentage CSE (%)	-30.1	-23.4	-7.3	-8.3	-7.1	-6.3
Consumer NPC (coeff.)	1.53	1.36	1.13	1.14	1.13	1.12
Consumer NAC (coeff.)	1.43	1.31	1.08	1.09	1.08	1.07

Note: as in table 2.

Source: OECD (2015c).

In addition to the support provided to producers individually (PSE), agriculture is assisted through public financing of services to this sector of economy (GSSE) such as: agricultural knowledge and innovation systems, inspection and control, development and maintenance of infrastructure, marketing and promotion, cost of public stockholding. The GSSE accounts for a much smaller share of total support to agriculture than the PSE in all the OECD countries as well as in the QUAD countries among which the biggest share allocated to the GSSE belongs to Canada. Priorities attached to different categories in the GSSE expenditures differ among the QUAD countries. In 2012-1014 the agricultural knowledge and innovation systems was the most supported category in the EU and the US, it was also important in Canada (second position). This kind of support is crucial for longer term sector development, especially budgetary expenditure financing research and development activities related to agriculture, agricultural programmes in high-level education, training and consulting services for farmers as well as information dissemination networks associated with agricultural production. Expenditures on development and maintenance of infrastructure were of most significance in Japan, and were also quite

important in the EU and the US (second position in both cases). This category of the GSSE classification consists of financing such investments like for example: irrigation and drainage networks, market facilities related to handling and marketing primary agricultural products (silos, docks, elevators, wholesales markets, futures markets), institutional infrastructure connected with the farming sector (machinery user groups, seed and species registries, development of rural finance networks, support to farm organizations). In recent years, Canada has allocated the largest share of the GSSE spending to inspection and control services including: expenditures financing activities related to agricultural product safety and inspection, pest and disease control of agricultural inputs and outputs as well as supporting institutions providing control activities and certification of industrial inputs used in agriculture. In all the QUAD countries (except Japan) there can be observed an increasing share of expenditures on marketing and promotion (e.g. promotion campaigns, participation in international fairs) and a declining share of expenditures covering the cost of public storage of agricultural products.

The Consumer Support Estimate (CSE) measures the annual monetary value of gross transfers from/to consumers of agricultural commodities (at the farm gate level) arising from policy measures aiming at supporting producer prices. In most of the OECD countries as well as in the QUAD countries, except the US, the CSE value is negative which means that the implicit tax on consumers through market price support more than offsets consumer subsidies that lower prices to consumers. The US is the only country where higher domestic prices are more than balanced by expenditures on food aid programmes for consumers. The expansion of such programmes led to a significant increase in %CSE (CSE transfers as a share of consumption expenditure on agricultural products) from -2.4 in 1986-88 to 15.6 in 2012-14. The US provide the highest consumer support (transfers to consumers from taxpayers) among all the OECD countries. On the contrary, Japan is among countries where %CSE is negative and still very substantial (-62.3 in 1986-88 and -44.3 in 2012-14). But the monetary value of consumer costs to support agricultural prices expressed in transfers to producers from consumers is the highest in the EU, although the consumer NPC (the ratio between the average price paid by consumers and the border price, both measured at farm gate) decreased in the EU significantly, from 1.7 in 1986-88 to 1.05 in 2012-14. The consumer NPC has decreased in all the QUAD countries as well as its average level in the OECD (Table 5). Similarly, the consumer NAC (the ratio between the value of consumption expenditure on agricultural commodities at farm gate and that valued at border prices) has decreased on average in the OECD and all the QUAD economies. The lowest level of this indicator - below 1 - is found in the US which means that transfers from taxpayers to consumers balance negative agricultural policy effects.

Economic outcomes of the QUAD countries from the perspective of changes in agriculture support

It is apparent from the data in Table 6 that until 2004 the growth rate of agricultural producer prices was much higher in the QUAD countries than in the world, while in 2005-2014 the trend has reversed. Before the end of the Uruguay Round Japan stood out as having the highest growth rate of producer prices in agriculture, in 1995-2004 the highest increase in prices occurred in Canada, and in the last decade in the United States. Throughout the entire period 1986-2014 the growth rate of world agricultural prices

measured by value added deflator was higher than the growth rate of the overall level of prices in the world economy measured by the GDP deflator. As for the QUAD countries in 1995-2004 Canada and the EU had a similar rate of growth in agricultural prices deflated by the value added to the world's pace (and the EU even slightly lower) while in Japan and in the United States prices were rising much faster. It is worth mentioning a significant decline in the price growth rate in the agricultural sector in the EU since the mid-1990s, that is after the MacSharry reform. In the last decade all the QUAD economies are characterized by a lower growth rate in agricultural prices deflated by value added than the world average which can be associated, among other things, with the decline of Market Price Support transfers in these countries. For many years, the lowest level of prices for agricultural products among the QUAD countries is characteristic for the United States (85% of the OECD average in 2011) which allocate relatively much of their agricultural support to consumers through various food aid programmes, and the highest one for Japan (176% of the OECD average) (OECD, 2016c). The changes of support in the QUAD countries have been significantly associated with the changes in global agricultural prices. In 2000 world prices of agricultural commodities were at the level of 1986, reaching the minimum in 2001 (World Bank, 2016a). Due to the completion of a long-term downward trend in agricultural prices in the nominal and real terms in the early 2000s and following increases in food prices, particularly in 2008 (during the recent global financial and economic crisis) and in 2010-2011 (World Bank, 2016; European Commission, 2015; OECD, 2016, p. 24), the need for price support in the QUAD countries has been reduced, which contributed in part to lower % PSE levels.

Table 6. Comparison of changes in production, trade and prices for agriculture sector in the QUAD countries and the world economy in 1986-2014 based on selected economic indicators

	Average Annual Growth Rate of Agricultural Production Value[1]			Average Annual Growth Rate of Agricultural Export Value[2]			Average Annual Growth Rate of Agricultural Import Value[2]		
	1992-94	1995-04	2005-14	1986-94	1995-04	2005-14	1986-94	1995-04	2005-14
Canada	99.74	104.44	112.79	106.08	106.49	109.71	106.97	105.90	109.32
Japan	111.28	96.24	100.82	109.00	103.56	106.18	109.35	101.51	105.29
US	105.24	103.16	107.14	106.52	102.36	110.67	103.33	106.99	107.72
EU	97.72	102.20	104.15	109.67	105.19	107.87	107.94	104.92	107.16
World	105.32	102.77	109.79	107.31	104.89	110.21	106.49	105.01	109.92
	Average Annual Producer Price Index for Agriculture[3]			Average Annual Value Added Deflator in Agriculture, forestry and fishery[4]			Average Annual GDP Deflator[4]		
	1991-94	1995-04	2005-14	1986-94	1995-04	2005-14	1986-94	1995-04	2005-14
Canada	90.10	104.06	127.42	86.78	92.60	121.00	69.89	73.70	125.00
Japan	118.47	102.26	98.74	102.56	108.80	102.70	89.89	103.70	107.30
US	85.11	89.58	134.94	112.67	107.40	124.60	72.22	88.60	109.60
EU	87.62	93.69	119.54	103.42	91.79	121.51	60.52	74.31	122.78
World	57.81	78.44	145.39	96.91	92.10	133.88	74.67	82.22	130.41

Note: [1] Gross Production Value (current US$), [2] Crops and livestock products (current US$), [3] (2004-2006 = 100), [4] Value in US$, 2005 prices (2005=100).

Source: FAO (2016) and own calculations.

In 1992-1994 the European Union and Canada were distinguished by relatively low growth rates of agricultural production as compared to the other QUAD economies and the world average, and from the mid-1990s this rate has been the highest in Canada which - what's interesting - has least supported agricultural production among the QUAD group. The reason for such good results in terms of increase in agricultural production in the case of Canada was a very high growth rate of labour productivity in agriculture in comparison with other QUAD countries. In 1986-1987, labour productivity in agriculture in the US and the EU accounted for respectively 60% and 47.5% of the level of productivity in Canada, and in Japan only for 40%. Whereas in the last three decades, the United States and Japan have significantly increased their levels of labour productivity in relation to Canada while in the European Union the opposite trend has occurred. In 2014 the US attained a comparable level of labour productivity with Canada, Japan raised its productivity to 78%, and the EU lowered it to only 35.5% of the Canadian level (own calculations based on World Bank, 2016b and FAO, 2016). The European Union and Japan which support to the greatest extent the agricultural sector in relation to GDP in the QUAD group have much lower growth rates of labour productivity in agriculture, which translates into lower growth rates of agricultural production in comparison to other QUAD countries. The comparison of economic efficiency of the QUAD countries in agriculture based on total factor productivity indicators - measuring the degree of organizational changes, technological progress and innovative capacity - falls out the worst for the European Union, where the level of TFP (measured by the TFP index, 1992=100) in 2013 compared to 1992 increased by only 28%, while in Japan by about 53%, in Canada by 45% and in the US by 43% (USDA, 2016 and own calculations). During the whole examined period 1986-2013 the average annual growth rate of TFP in the EU was 1.3%, while in Canada 2.3%, in Japan 1.8% and 1.6% in the US. While in 1986-1994 the highest average annual TFP growth occurred in Canada (3.1%) and the European Union (1.6%), in 2005-2013 the highest values of this indicator were reached by Japan (2.3%) and the United States (1.7%), and in the EU and Canada it amounted to only 1.4% and 1.3% respectively (USDA, 2016 and own calculations).

The analysis of export growth rates indicates that in 1986-1994 the best results in this field were achieved by the EU which applied the greatest export subsidies within the QUAD group. In the subsequent period (1995-2004) the pace of export growth in the world and in the QUAD countries has dropped significantly, except Canada which was characterized by a very high efficiency of agriculture. Whereas in 2005-2014 the growth rate of world exports increased considerably and the United States stood out with the highest growth of exports in the QUAD countries. A good performance in the US exports was favored by a developed policy of encouraging R&D and innovation in the agricultural sector, an integral part of which was the GSSE support. While in 1986-2007 innovation and productivity enhancing support (including agricultural knowledge systems, inspection and control, and infrastructure) accounted for about 50% of GSSE support in the United States, from 2008 to 2015 their share increased to approximately 70% (OECD, 2015c; OECD, 2016b, p. 194) which contributed to TFP growth in agriculture. The relatively high growth rate of exports is also specific for Canada which is currently the most open economy if we consider the growth rate of imports in the QUAD countries. The high level of labour productivity and good results in terms of TFP growth rates translate into the competitiveness of the country in international agricultural trade and taking initiatives in the form of free trade agreements, such as CETA.

Conclusions

In 1986-2014 in all the QUAD countries the share of expenditure on agriculture in relation to GDP decreased significantly. The best results in this regard were achieved by the European Union where state support for this sector was reduced from 2.6% of GDP in 1986 to 0.7% of GDP (equal to the OECD average) in 2014. In terms of value, support to agriculture provided by the United States nearly doubled in the examined period but in relation to GDP it remains one of the lowest in the QUAD group (0.5% of GDP in 2014) as well as in Canada where it currently accounts for only 0.4% of GDP. By contrast, Japanese economy has been characterized over the years by a relatively high share of agricultural spending in relation to GDP that amounted to 1.1% in 2014.

In the second half of 1980s transfers from consumers and taxpayers provided to agricultural producers individually (PSE) prevailed in all the QUAD economies while other types of support, like general services that create enabling conditions for the agriculture sector (GSSE) as well as transfers to consumers from taxpayers (constituting a part of CSE) were of little importance. Nowadays these countries differ to a larger extent in terms of the structure of support to agriculture. The European Union and Japan continue to allocate the majority of funds to individual farmers (their PSE accounted for 84% of TSE each in 2014). However, in Japan price support measures predominate while the EU prefers direct payments. Completely different policies of support to agriculture are carried out by the United States and Canada. The first of these economies devotes about half of its all financial resources supporting this sector to subsidize consumers (transfers to consumers from taxpayers) and only 43% of these funds as PSE. Whereas in Canada the expenditure on general services for agricultural sector is relatively important (30% of TSE in 2014). Except for the United States in other QUAD countries transfers to consumers from taxpayers do not practically function although there is a positive tendency of easing the burden on consumers arising from lowering their transfers to agricultural producers (in 1986-2014 the largest decrease of transfers to producers from consumers occurred in the EU). It is worth emphasizing the decreasing share in PSE of market price support, i.e. the policy measure that is very detrimental to competition and disrupts market functioning, in three QUAD economies (EU, US and Japan). It has fallen to the greatest extent in the European Union from about 87% to 17% over the past three decades. However, in Japan MPS still accounts for above 78% of PSE. In Canada, the share of such transfers within PSE declined in the mid-1990s while today it amounts to 59%, i.e. 10 percentage points more than in the second half of the 1980s.

Economic outcomes of the QUAD economies in terms of agricultural production, trade, prices and economic efficiency indices confirm that much more important than the amount of support for agriculture is an increase in technological progress and productivity which should be favored by a thoughtful agricultural policy and appropriate structure of financial transfers to agriculture. The best results among the QUAD countries in terms of labour productivity and TFP indices and as a result the rapid pace of growth in production and exports are reached by Canada and the United States which are also able to use its competitive advantage in the global market for agricultural commodities. The worst outcomes in respect of market performance in the agricultural sector are achieved by the EU and Japan in recent years despite the use of relatively high subsidies. The EU labour productivity and TFP growth in agriculture is relatively low, and Japan which has favorable rates of TFP growth in the agriculture sector due to natural constraints and the high level of

agricultural prices is not fully able to put them upon to improve the competitiveness of its food products on a global scale.

Changes in the size and structure of state support to agriculture in the QUAD countries reflect the new priorities of agricultural policy which should encourage greater efficiency and competitiveness of agriculture, cause less distortions of the market mechanism, promote economic growth and fight poverty in less developed countries, contribute to the protection of natural environment and biodiversity preservation as well as meet new challenges like climate change. In the context of the realization of these objectives the authors evaluate the policy pursued by the United States as the most appropriate as well as appreciate the positive changes in support policy that have been introduced in the European Union in recent years what is particularly important because of large shares of these two economies in the world's agricultural production and trade. The Canadian policy of support for agriculture can be also assessed as being well designed, even despite the high price support in recent years (which may cause some distortions of market signals), due to the fact that the amount of aid is small and overall economic outcomes are very good. The policy conducted by Japan is the least favorable in terms of competition intensity and free operation of the market mechanism but it has smaller impact on the destabilization of global markets due to the decreasing share of this country in the world's production and exports of agricultural products.

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Foreign Direct Investment in World Economy

Abstract. Some of the phenomena dynamically developing in global economy in recent years are capital flows in the form of foreign direct investment. The investment takes different forms and is a way of economic development desired by most countries in the world. The article aims to present tendencies occurring in global FDI flows and define their types and geographical structure.

Key words: foreign direct investment, world economy, European Union

Introduction

In the last decades, foreign direct investments have been the most dynamic streams of economic flows alongside goods and services. Processes of liberalisation and regionalisation taking place in the global economy have substantially contributed to the increasing flows of foreign direct investment in the world. In 1970, the value of world foreign direct investment reached USD 13.2 million and the amount of USD 1.76 trillion in 2015. The main creators of world foreign direct investment are developed countries, however, developing countries have joined this group in recent years and their share is continually growing. In recent years, we can observe changes both in the geographical structure and the type structure of foreign direct investment. Changes in the world market, especially fluctuation of prices, crises, but also processes of integration or international agreements are the reasons for changes in the flows.

The article is an attempt to assess international capital flows aimed at an analysis of foreign direct investment in the period 2000-2015. The paper aims to present trends in international flows of foreign direct investment. The analysis of foreign direct investment is based on data provided by World Investment Reports published by UNCTAD in the years 2000-2016, which are available on the organisation's website. In order to specify the importance of and trends in foreign direct investment, a descriptive and comparative analysis is used.

Foreign direct investment in the light of literature

Foreign direct investment (FDI) consists in (long-term) placement of capital in a company in another country in order to obtain a lasting influence on its operations and earn profits. A company transferring capital abroad in the form of fixed assets or cash can become the only owner or a co-owner of a company in the country of investment (Bożyk, Misala, Puławski, 2002). FDI is also a form of long-term deposit of capital abroad consisting in the creation of a new company and providing it with its own capital, or the

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purchase of the number of shares of a foreign company that ensures control over its operations (Słownik, 1993). Such investments are capital deposits aimed at obtaining direct influence on the operations of a company where capital is invested or at providing new resources for a company in which the investor already has substantial interest. The control motive, i.e. an intention to exert direct influence on foreign companies, is mentioned as an important criterion for foreign direct investment (Witkowska, 1996). Foreign direct investment is investment in a country other than the country of capital origin where, apart from capital, other assets, i.e. machinery, equipment and licences, are transferred, but also the movement of people takes place.

Foreign direct investment includes:
- purchase of shares of the existing foreign enterprises – *brownfield*,
- foundation of a new branch overseas, the so-called investment from scratch – *greenfield*,
  - creation of a joint venture – close cooperation of two entities from different countries,
  - acquisition of fixed assets abroad in order to extend operations.

From the point of view of ownership, foreign direct investment occurs in three forms:
- totally controlled foreign branches where usually 95% of capital or more is owned by a parent company;
- outstanding stock in overseas companies, in which situation 50%-95% of capital is owned by a parent company;
- outstanding stock where a parent company's stake in a foreign enterprise is below 50% (Jodkowski, 1995).

Due to the ties with the development strategy of a host country, FDI is divided into:
- one that is substitutionary for import,
- pro-export one and
- one that is initiated by the government of a host country (Puchalska, Barińska-Małajowicz, 2010).

In the literature on the subject, there are many theories, which try to explain the motives for and consequences of the flows of capital on an international scale. Starting with the orthodox theory through macroeconomic, microeconomic and mixed theories. The orthodox theory defined as the theory of differentiating interest rates indicates that particular countries are different with regard to the possession of capital and this results in differentiation of average interest rates and, thus, in flows until their levels equal (Harrod, 1939).

"Economic effects of capital flows overseas are as follows:
a) in countries exporting capital, its amount and production volume decrease but, in turn, the productivity of capital and interest rates increase;
b) in countries importing capital, the situation is exactly the opposite, i.e. there is an increase in the amount of capital and the volume of production and a decrease in capital productivity and interest rates;
c) in both countries, there is an increase in income: for exporters because of earning more interest or dividends; for importers because of the increase in production, which is usually higher than the cost of foreign capital management" (Nowara, 2007).

"On a global scale, migration of capital results in the increase in efficiency of financial markets functioning and the improvement in management efficiency" (Salvatore 1990; Misala, 2001).

Macroeconomic theories explaining capital flows on an international scale include (Misala, 2005):

- Theory of capital profitability – Salvatore,
- Theory of currency areas – R.Z. Aaliber,
- Theory of overseas production volume and foreign markets absorptiveness,
- Theory of relative movements of workforce and capital costs – K. Kojima,
- Theory of developing investment position in overseas markets, the so-called theory of the economic development level – J. H. Dunning.

Microeconomic theories of foreign direct investment are connected with the theories of international production and theories of internationalisation of company operations. They explain the phenomenon from the point of view of such entities as big transnational corporations. The theories explain what benefits result from the transfer of capital, the motives behind their operations etc. They include (Misala 2005):

- Theory of company behaviour – Y. Aharony,
- Theory of outstanding stock ownership – S. Hymar, R. Caves and F.T. Knickerbrocker, J.H. Dunning at al.,
- Theory of domestic transactions– P.J. Buckley and M. Casson, et al.,
- Appropriability theory.

The authors of mixed theories have linked microeconomic and macroeconomic aspects. This way, the theory of foreign direct investment localization and J.H. Dunning's eclectic theory of international production called OLI paradigm (*Ownership, Localization, Internationalization*) have been created. In 2006, Dunning modified and enriched his own theory introducing the so-called *J. H. Dunning's new development paradigm (NDP).* He based his considerations on the concept of transformation (J. Stigliz's approach), the concept of development objectives (A. Sen's approach) and the concept of institutional economics (D. North's approach). The model proposed by Dunning is "an expression of a complex, multidisciplinary and extremely broad approach both to final ends and to development means. Trying to closely relate development means to development ends, Dunning indicates the necessity for multicausal and multifaceted holistic analysis and use of comparative static and dynamic models" – compare Diagram 1. To ownership advantages he added specific institutional comparative advantages of TNC, i.e. incentives used by a company in order to optimally utilize its activities, resources and knowledge (ARK)" (Dunning, 2006; Puchalska, Barińska-Małajowicz, 2010).

According to literature, taking decisions on their investment location foreign investors most often have the following motives:

- to conquer the market,
- to obtain resources,
- to cut costs,
- to search for strategic assets (Nowara, 2007; Misala, 2001).

In the light of literature, foreign direct investment is seen as factors that revive and modernise economy, as factors improving management and supplies, increasing export capabilities, creating new workplaces, implementing new techniques and technologies (Rutkowski, 1993; Geldner, 1986). The influence of FDI on the economy is described as supplementation of domestic investment funds, which can constitute a method for modernising production apparatus, upgrading production technology, improving management methods and increasing products quality and management efficiency.
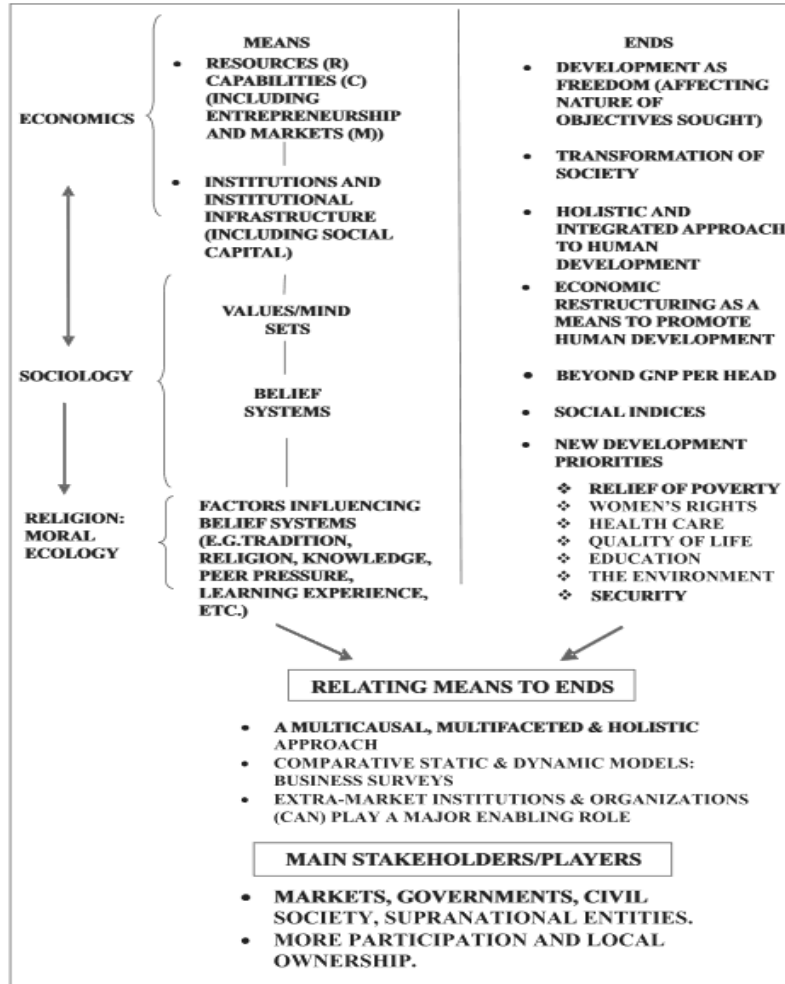
Diagram 1. J. H. Dunning's new development paradigm (NDP)

Source: J.H. Dunning (2006): Towards a new paradigm of development: implications for the determinants of international business https://pdfs.semanticscholar.org/ 9eda/6e68a8df536d656393e37eb01fbe59072424.pdf, 193.

FDI theories indicate positive and negative influence of FDI on the economy of the host country. Positive influence is expressed in the transfer of new technologies, employment, mobilisation and transfer of resources, trade balance and GNP. Benefits and negative consequences resulting from foreign direct investment for the host country are presented in Diagram 2 (Kacperska, 2001).
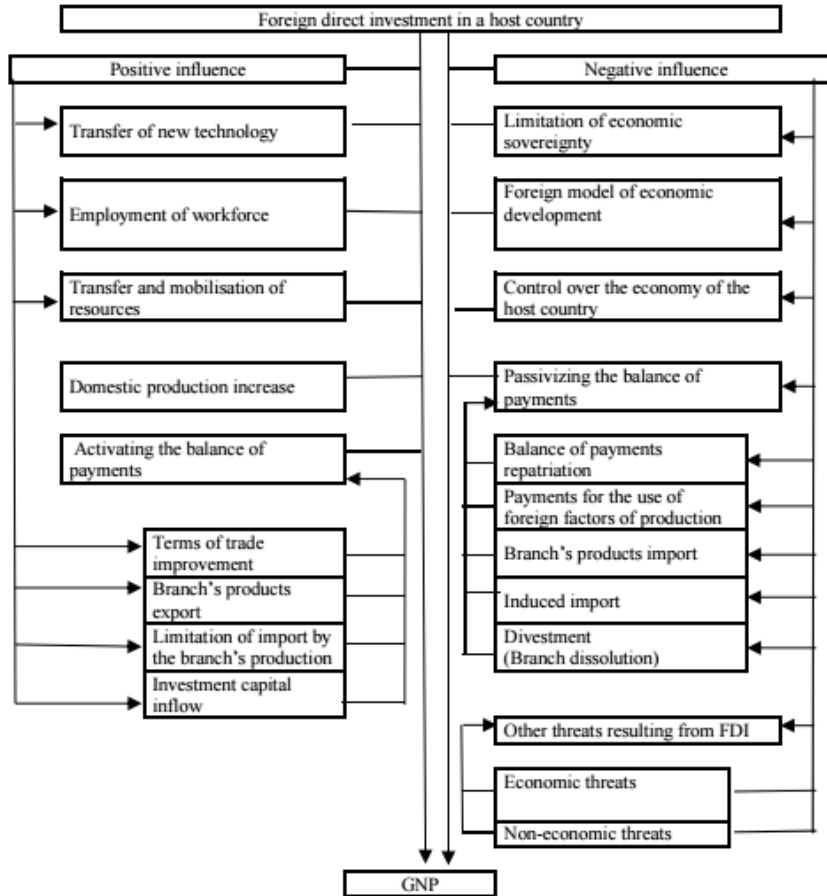
Diagram 2. Positive and negative influence of foreign direct investment on the economy of a host country

Source: Czerwieniec E.: Zagraniczne inwestycje bezpośrednie w gospodarce krajów wysoko rozwiniętych. Zeszyty Naukowe – SERiA II, No.105, Poznań 1990, 131.

Research outcomes

Value of world foreign direct investment

Foreign direct investment in 1970 reached the value of USD 13.2 million and from that time till 2000 its characteristic feature was a trend that multiplied the value. The analysis of data for the period 1970-2015 shows that the average yearly dynamic of FDI gained a threefold increase. The pace of investment growth was slow at first although the value doubled every five years. In the period 1985-1990, the value of investment rose 3.5 times, and in the successive period 1995-2000 almost four times (Table 1, Fig. 1 and 2).

In 2000, world FDI inflows reached the value of USD 1,358.8 billion, however, terrorist attacks of 11 September 2001 stopped the trend in the 2000s. Until 2007, the value of FDI increased slowly in the world. 2007 was a record year when world FDI turnover reached a high of USD 1,902.2 billion. The increase tendency did not continue because 2008 was when the global financial crisis broke out and investment fell to reach a low of USD 1,181.4 billion. Until 2015, FDI did not reach the value before the crisis. In the period 2009-2012, the value of FDI showed a growing trend but in 2013 and 2014, the world economy slowed down, there were difficulties in the euro zone, military conflicts and sanctions imposed on Russia, which reflected in the FDI value. In 2015, the value of FDI increased by 38% in comparison to the former year and reached USD 1.7 trillion (Table 1, Fig. 1 and 2). Forecasts for 2018 indicate a growth in investment to USD 1.8 trillion (World…, 2016).

Fig. 1. Value of global foreign direct investment in selected years 1970-2015 in million USD
Source: author's own development based on UNCTAD data.
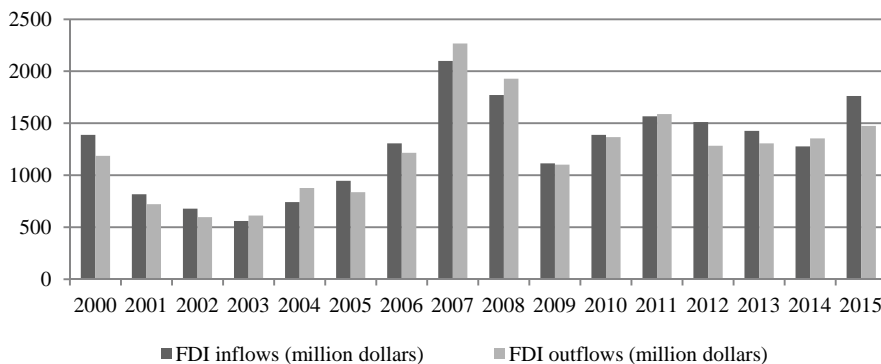
Fig. 2. World flows of foreign direct investment in the period 2000-2015 (in million dollars)
Source: author's own development based on UNCTAD data.

In the period 2000-2015, there were three evident breakdowns of the FDI growing trend:

- the period 2001-2003 – terrorist attacks on the WTC in the US,
- the period 2008-2009 – the global financial crisis,
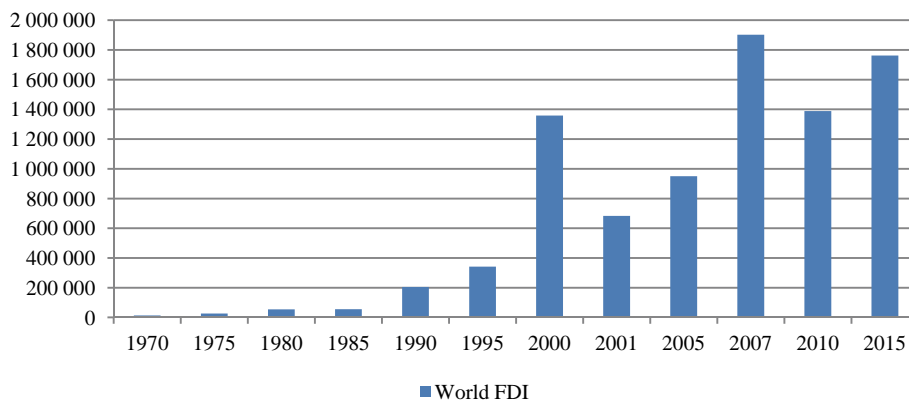- the period 2013-2014 – a slowdown in the world economy.

However, despite those breakdowns, capital flows are located in other geographical regions and their value is dynamically growing. Since 2000, we can observe identical tendencies both in the streams of FDI inflows and in the export streams (Fig. 2).

The most important factors in the FDI increase on an international scale include (see: Budnikowski, 2003; Dudziński, Nakonieczna Kisiel, 2005):

- technical progress, especially the possibility of sending data and remote controlling available thanks to the development of computerisation, the Internet and telecommunications;
- integration processes reflected in the elimination of barriers in the free trade zones and customs unions and integration within the European Union, which has created the common market of 28 European states;
- changes in the world economic policy reflected in trade liberalisation – agreements: GATT and WTO, TRIPS, GATS and deregulation and privatisation processes taking place in highly developed countries;
- dynamic development of transnational corporations and their expansion in the global market.

Foreign direct investment types structure

In the analysed period, there are evident geographical and structural changes in the FDI flows both in absolute and relative values. Within the structure of FDI, there are investments from scratch, the so-called greenfield ones, and mergers and acquisitions (cross-border M&As). In the examined period, the share of greenfield investment was overwhelming. It constituted 66.1% of FDI on average with the value of USD 765 billion in 2015. The highest value of greenfield investment was recorded in 2008. Mergers and acquisitions constituted 34% on average. Until 2007, one can see their dynamic growth, however, after the financial crisis of 2008, despite a few growths, their value did not exceed the level before the crisis (Fig. 3).
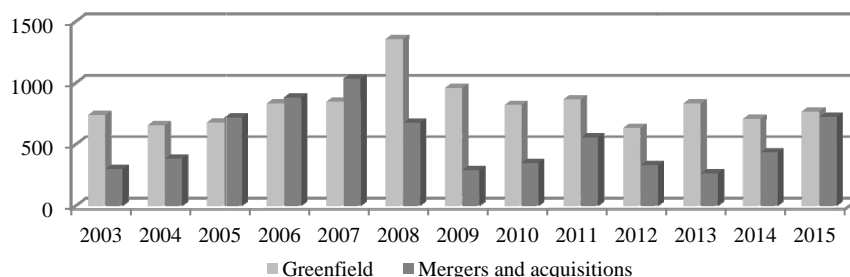
Fig. 3. Structure of foreign direct investment in the world in the period 2003-2015 in million USD

Source: author's own development based on: World Investment Report for 2004-2016 UNCTAD

Geographical structure of foreign direct investment inflow

From 2000, developed countries had the biggest share in the structure of FDI inflow. However, their share was systematically decreasing from 79.8% in 2000 to 54.6% in 2015 (it was lowest in 2014 and accounted for 40.9%). Among highly developed countries, Europe had the biggest share but with a falling trend (50% in 2000 to 28.6% in 2015) followed by North America with a falling trend (27.4% in 2000 to 12.9% in 2014). In 2007, investment located in Europe reached a record high of USD 988.4 billion, which meant a 47% share in the entire world investment at the time (Table 1 and 2, and Fig. 4).
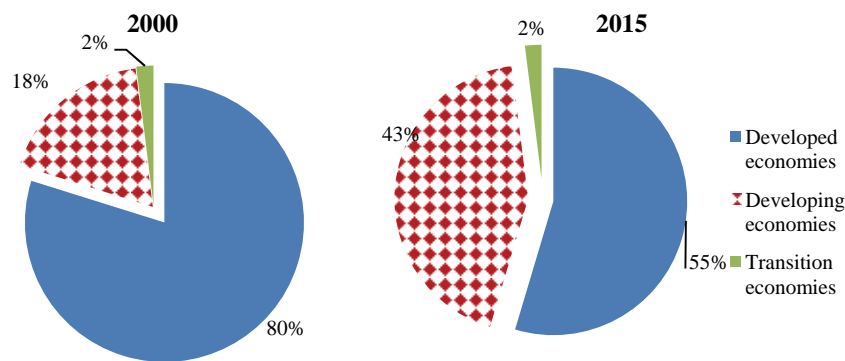
Fig 4. Share of particular regions in FDI inflows in 2000 and 2015

Source: author's own development based on Table 1.

In the analysed period, world direct investment increased its value by 27%, and the dynamic in developed countries decreased to the level of 86.9% of the value in 2000.

The share of developing countries in the inflow of FDI was dynamically increasing from 2000. The increasing trend in the share of entire FDI from 18.2% in 2000 to 54.7% in 2014 and 43.4% in 2015 indicates a clear change in the direction of capital flow. In 2000-2008, the absolute majority of investment was located in developed countries, and after 2008, there was a dynamic growth of investment share in developing countries. Until 2000, the value of investment inflow tripled (Table 1 and 2). In the structure of FDI inflow to developing countries, Asian countries had the biggest share with the increasing trend from 10.5% in 2000 to 36.6% in 2014 and 30.7% in 2015, and Latin American countries with the growing trend from 7% in 2000 to 13.3 in 2014 and 9.5% in 2015 (Table 1 and 2, Fig. 5).

The last group includes countries undergoing economic transformation, i.e. Southern Europe and CIS members. Their share in the structure is 4.5% on average in the analysed period with a tendency to rise slowly (Table 1 and 2, and Fig. 5).

The Unites States was the biggest host of investment in the analysed period. The share of the US in the entire FDI inflow was 22.6% in 2000 and 21.65% in 2015. The USA was third following China and Hong Kong only in 2014. In 2000, 69.7% of investment went to ten biggest receivers and the rate was 65.7% in 2015. In 2000, developed countries dominated the biggest receivers. Their share accounted for 60.5%. Germany with a share of 14.3% and the United Kingdom with a share of 8.8 % were among the ten biggest FDI hosts in 2000 but in 2015, they fell outside the first ten and were 12th and 13th with a share

of 2.3% and 1.8% respectively. Hong Kong (with a share of 4%), China (3%) and Brazil (2.4%) were the developing countries with a high FDI inflow.

■ Europe*   ⊡ North America   ■ Africa   ■ Latin America and Caribbean   ■ Asia   ■ Transition economies
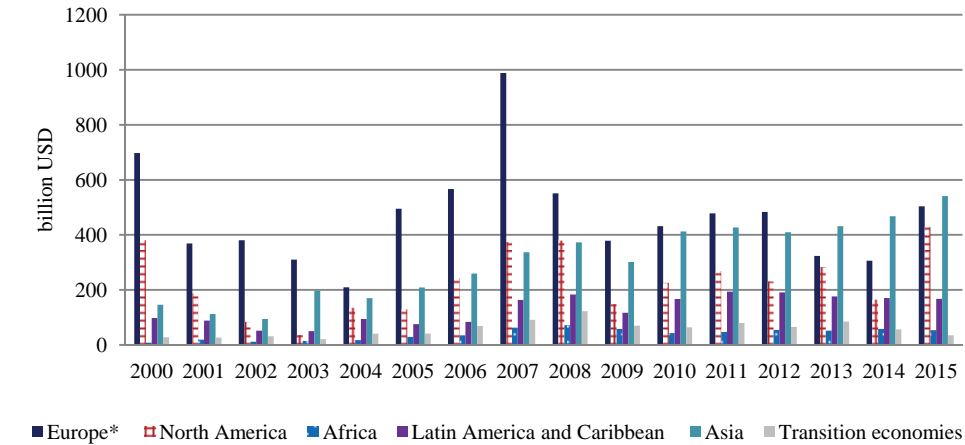
*Europe – until 2004 without stated that entered the EU

Fig 5. Geographical structure of FDI inflow in the period 2000-2015 in (billion USD)

Source: own calculation.

Table 1. Geographical structure of foreign direct investment inflow in the world in the period 2000-2015

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Value of FDI inflow (in billion dollars)															
World	1388	818	679	560	742	946	1306	2100	1771	1114	1389	1567	1511	1427	1277	1762
Developed countries:	1108	572	490	367	419	590	858	1444	1018	566	700	817	787	680	522	963
Europe*	697	369	380	310	209	495	566	988	551	378	432	478	483	323	306	504
North America	381	187	84	36	136	130	244	374	380	149	226	270	232	283	165	429
Developing countries:	253	220	158	172	283	314	379	565	630	478	625	670	659	662	699	765
Africa	8.7	19.6	11.8	15.0	18.0	29.6	35.5	63.1	72.2	58.6	43.5	47.8	55.1	52.2	58.3	54.1
Latin America and the Caribbean	98	88	51	50	94	76	84	164	183	117	167	193	191	176	170	168
Asia	146	112	94	197	170	209	259	337	373	301	412	427	410	431	468	541
Transition economies **:	27.5	26.4	31.2	20.9	40.3	41.2	69.3	90.9	122.6	69.9	63.6	79.3	64.8	84.5	56.5	35.0
Southern and Eastern Europe	-	-	-	-	13.4	15.1	26.3	12.8	12.7	7.6	4.6	7.8	3.6	4.7	4.6	4.8
CIS	-	-	-	-	26.9	26.0	42.9	781	109.9	62.4	58.2	70.3	60.3	78.8	50.1	28.8

* data concerning European states in the period 2000-2004 without the 10 states that entered the EU in 2004.
** until 2004 including the 10 states that entered the EU.
Source: author's own development based on: World Investment Report for 2000-2016 UNCTAD.

In 2015, the geographical structure of FDI host countries changed. The share of developed countries in the first ten hosts fell by 22.4 per cent in comparison to 2000 reaching the level of 38.1%, and the share of developing countries increased to 27.5%. In 2015, Hong Kong was second with a share of 9.9% and China was third with a share of 7.7% (Table 3).

Table 2. Share and dynamic of FDI inflow in the world in the period 2000-2015

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Share of particular regions in the FDI structure (%)															
World	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Developed countries	79	70	72	7	56	62	66	68.8	58	51	50	52	52	48	41	55
Developing countries	18	27	23	31	38	33	29	27	36	43	45	43	44	46	55	43
Transition economies*	2	3	5	4	5	4	5	4	7	6	5	5	4	6	4	2
	FDI inflow dynamic in the regions (2000 =100)															
World	100	59	49	40	54	68	94	151	128	80	100	113	109	103	92	127
Developed countries	100	52	44	33	38	53	77	130	92	51	63	74	71	61	47	87
Developing countries	100	87	62	68	112	125	150	224	250	189	248	265	261	262	277	303
Transition economies*	100	96	114	76	147	150	252	331	446	254	231	288	236	307	206	127
	FDI inflow dynamic in the regions (year to year)															
World		59	83	83	133	127	138	161	84	63	125	113	96	95	90	138
Developed countries		52	86	75	114	141	145	168	71	56	124	117	96	86	77	184
Developing countries		87	72	109	165	111	121	149	112	76	131	107	98	101	105	110
Transition economies*		96.0	118	67	193	102	168	131	135	57	91	125	82	130	67	62

* until 2004 including the 10 states that entered the EU.
Source: author's own development based on: World Investment Report 2000-2016 UNCTAD.

Table 3. Biggest FDI host countries according to its value and share in the inflow structure in 2000 and 2015 (billion USD and%)

	State	FDI in billion USD	State's share in the structure of inflow (%)		State	FDI in billion USD	State's share in the structure of inflow (%)
		2000				2015	
1.	United States	314	22.6	1.	United States	380	21.6
2.	Germany	198	14.3	2.	Hong Kong, China	175	9.9
3.	United Kingdom	122	8.8	3.	China	136	7.7
4.	Canada	67	4.8	4.	Ireland	101	5.7
5.	Netherlands	64	4.6	5.	Netherlands	73	4.1
6.	Hong Kong, China	55	4.0	6.	Switzerland	69	3.9
7.	China	41	3.0	7.	Singapore	65	3.7
8.	Spain	40	2.9	8.	Brazil	65	3.7
9.	Denmark	34	2.4	9.	Canada	49	2.8
10.	Brazil	33	2.4	10.	India	44	2.5

New York and Geneva 2001, World Investment Report 2004 - The Shift Towards Services, UNCTAD New York and Geneva 2004, World Investment Report 2016 - Investor Nationality: Policy Challenges UNCTAD New York and Geneva 2016, access http://unctad.org/en/pages/DIAE/World Investment Report/WIR.

Source: author's own development based on: World Investment Report 2001 - Promoting linkages. UNCTAD.

Geographical structure of foreign direct investment outflow

The structure of FDI outflows is still dominated by developed countries. However, there is a clear tendency to fall. In 2000, developed countries exported 91.3% of investment and the rate of their world investment was only 72.2% in 2015. In 2009, developing countries had a substantial share of over 20% with a growing trend to almost 33% in 2014. The share of countries undergoing transformation had the biggest dynamic of growth, almost 19-fold in 2013. As far as developed countries are concerned, the European Union states and the USA had the biggest share. Asian states and China dominated developing states' share (Table 4 and 5).

In 2000, over 80% of foreign direct investment flew out of ten countries (Table 6). Almost 20% of investment had come from the United Kingdom, about 15% from France and 12% from the USA; these three countries invested the amount of USD 553 billion, which accounted for 46.6% of the entire investment in the world. In 2015, almost USD 1.1 trillion (74% of all investment) flew out of the ten biggest foreign direct investment providers. In comparison to 2000, only the USA maintained the position of a leader with a share of 20.4% in the total world investment. France and the United Kingdom were behind the top ten. The analysis of the first three positions shows a total share of 38% in the world investment, where Japan and China followed the USA. In 2015, investment was fragmented and only the USA had a two-digit share while three countries had it in 2000. What deserves attention is the increasing share of developing countries: Hong Kong had a share of 5% (sixth position in the ranking) in 2000, and China joined with a share of 8.7% in 2015 (Table 6).

Table 4. Geographical structure of foreign direct investment outflow in the world in the period 2000-2015

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Value of FDI outflow (billion USD)															
World	1187	722	597	612	877	837	1216	2268	1929	1101	1366	1587	1284	1306	1354	1474
Developed countries:	1084	658	548	570	746	707	1023	1924	1572	821	963	1156	873	834	823	1065
Europe*	859	5	365	350	395	691	669	1368	992	821	586	559	411	320	311	576
North America	187	161	142	173	302	6	262	80	76	51	313	449	374	363	372	376
Developing countries:	99	60	44	36	117	116	174	292	296	229	358	374	358	409	446	378
Africa	1	-3	0.1	1	2	2	8	11	10	5	9	6	12	16	15	11
Latin America and the Caribbean	14	12	6	11	28	36	49	56	82	47	57	48	42	32	31	33
Asia	84	50	38	24	88	78	117	226	204	177	292	319	303	359	398	332
Transition economies**:	4	4	5	7	14	15	19	52	61	51	51	56	33	76	72	31
Southern and Eastern Europe	-	-	-	-	0.2	0.6	0.6	1.4	1.8	1.4	0.3	0.4	0.4	0.5	0.5	0.4
CIS	-	-	-	-	14	14	18	50	59	50	50	55	33	75	71	31

* data concerning European states in the period 2000-2004 without the 10 states that entered the EU in 2004
** until 2004 including the 10 states that entered the EU
Source: author's own development based on: World Investment Report 2000-2016 UNCTAD.

Table 5. Share and dynamic of foreign direct investment outflow in the world in the period 2000-2015

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Share of particular regions in the FDI outflow structure (%)																
World	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Developed countries:	91.3	91.2	91.8	93.0	85.0	84.4	84.1	84.8	81.5	74.5	70.5	72.8	68.0	63.8	60.8	72.2
Developing countries	8.3	8.3	7.4	5.8	13.4	13.8	14.3	12.9	15.4	20.8	26.2	23.6	27.9	31.3	32.9	25.6
Transition economies*	0.3	0.5	0.8	1.1	1.6	1.7	1.5	2.3	3.1	4.7	3.7	3.5	2.6	5.8	5.3	2.1
Dynamic of FDI outflow in the regions (2000 =100)																
World	100	61	50	52	74	72	102	191	163	93	115	134	108	110	114	124
Developed countries:	100	61	51	53	69	65	94	178	145	76	89	107	81	77	76	98
Developing countries	100	61	45	36	119	117	176	295	300	232	362	378	362	413	451	382
Transition economies*	100	88	123	175	350	365	468	1288	1515	1280	1263	1390	830	1895	1805	778
Dynamic of FDI outflow in regions (year to year)																
World		61	83	103	143	95	145	187	85	57	124	116	81	102	104	109
Developed countries:		52	82	96	113	175	97	205	73	83	71	95	74	78	97	185
Developing countries		61	74	81	330	99	151	168	101	77	156	104	96	114	109	85

* until 2004 including the 10 states that entered the EU
Source: author's own development based on: World Investment Report 2000-2016 UNCTAD.

Table 6. Biggest providers of foreign direct investment according to its value and share in the inflow structure in 2000 and 2015 (billion USD and %)

	State	FDI in billion USD	State's share in the structure of inflow (%)		State	FDI in billion USD	State's share in the structure of inflow (%)
		2000				2015	
1.	United Kingdom	233	19.6	1.	United States	300	20.4
2.	France	177	14.9	2.	Japan	129	8.8
3.	United States	143	12.0	3.	China	128	8.7
4.	Belgium and Luxemburg	86	7.2	4.	Netherlands	113	7.7
5.	Netherlands	76	6.4	5.	Ireland	102	6.9
6.	Hong Kong, China	59	5.0	6.	Germany	94	6.4
7.	Germany	56	4.7	7.	Switzerland	70	4.7
8.	Spain	55	4.6	8.	Canada	67	4.5
9.	Canada	45	3.8	9.	Hong Kong, China	55	3.7
10.	Switzerland	45	3.8	10.	Luxemburg	39	2.6

Source: author's own development based on: World Investment Report 2001 - Promoting linkages, UNCTAD New York and Geneva 2001, World Investment Report 2004 - The Shift Towards Services, UNCTAD New York and Geneva 2004, World Investment Report 2016 - Investor Nationality: Policy Challenges UNCTAD New York and Geneva 2016, access http://unctad.org/en/pages/DIAE/World Investment Report/WIR.

Mega-groups and foreign direct investment

International agreements, international organisations and integration groups play an important role in the international flows of capital. The flows within these mega-groups constitute from 15% to 54% of the entire FDI flows. The biggest share belongs to the G-20 countries: 53%, the APEC countries: 54% and the countries developing the TTIP agreement: 46% (Table 7).

Table 7. FDI inflows in selected mega-groups, 2014 and 2015 (billion dollars and per cent)

Mega-grouping	FDI inflows	Share in world FDI	FDI inflows	Share in world FDI
	2014		2015	
G20	652	51	926	53
TTIP	399	31	819	46
APEC	669	52	953	54
TPP	353	28	593	34
RCEP	341	27	330	19
BRICS	271	21	256	15

G20 = includes only the 19 member countries (excludes the European Union); TTIP = Transatlantic Trade and Investment Partnership (under negotiation); APEC = Asia-Pacific Economic Cooperation; TPP = Trans-Pacific Partnership; RCEP = Regional Comprehensive Economic Partnership (under negotiation); BRICS = Brazil, Russian Federation, India, China and South Africa
Source: author's own development based on: World Investment Report 2016 - Investor Nationality: Policy Challenges UNCTAD New York and Geneva, http://unctad.org/en/PublicationsLibrary/wir2016_en.pdf.

Conclusion

Foreign direct investment is deemed to be desired all over the world. It results in changes in the structure of economies, stimulates domestic entities to act and contributes to development in general. In the analysed period 2000-2015, there were changes in the structure of the world economy that had great importance for the flow of FDI. Despite a few breakdowns in the world market, direct investment tends to increase. Highly developed countries had the biggest share in the flows with a downward trend. The United States was the biggest FDI exporter and importer. Developing countries, especially Asia with China as a leader, dynamically increase their share in the FDI structure.

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Agroholdings as the Subjects of the Economy Globalization – the Example of Ukraine

Abstract. The objective of the paper is to define the factors that contribute to the development of the agricultural sector of Ukraine's economy, to analyze the places Ukraine takes in the world rankings of agricultural production and export and the share of the agricultural and food industry products in the total exports volume of Ukraine, to define the main markets for Ukrainian agricultural products, to identify the role agroholdings play in the functioning of the Ukrainian agricultural sector, to define the main factors that contributed to the emergence and development of the agroholdings in Ukraine and to make the list of the most profitable agroholdings in Ukraine.
The following general scientific and specific economic methods were used in the paper: the statistical analysis methods, the method of ratings, the information – computer methods, the critical analysis method, the monographic method, the case study method and the graphical method.

Keywords: agroholdings, globalization, agriculture, production, export, market, grain.

Introduction

The objective advantages of large commodity production known in the economic science and the economy globalization processes are realized through the creation of the so-called agroholdings nowadays. Since these enterprises are relatively new in Ukraine, their formation, development and its prospects require appropriate scientific research, so that they can take the adequate niche in the structure of the agricultural business of Ukraine as an equal and effective organizational form of agricultural management. Everything mentioned above is extremely important in the period of the transition to the market – oriented land relations as it has not only economic but also social and environmental value. The extent of land involved into the use by the agroholdings makes us to research the peculiarities of their activity and the opportunities to improve its regulation by the state.

Since the process of the development of agroholdings as a new form of management in the agricultural business of Ukraine began relatively recently, so the scientific thought of the Ukrainian economists about the said process became more active also only in recent years. Many Ukrainian and foreign scientists try to give their own definition of an agroholding taking into account different aspects of its activity. As, for example, according to the Law of Ukraine of 15.03.2006 р. №3528-1U "On holding companies in Ukraine" – "a holding company is a joint stock company, which owns, uses and disposes of holding corporate shares of two or more corporate businesses" (Law…, 2006). So, the creation of agroholdings can be considered a kind of response of Ukraine's agricultural economics to the market demands, aiming to restore the disturbed intersectoral ties and disparity in prices between the sold agricultural production and material and technical resources of industrial origin as well as recover the self-sufficient credit system (Dankevych, 2011). Consequently, from the juridical point of view, agroholdings are the association of business capitals under

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the supervision of the management company. From the organizational point of view, an agroholding is a „state within a state" with all its characteristic features. From the point of view of management, an agroholding is the symbiosis of the planned economy standards based on the new technological, innovation and organizational framework, with its fundamentals in the computerized management, accounting and auditing of the industrial activity system. From the economical point of view, an agroholding is an effective tool to improve the domestic production competitiveness and increase the working people social standards, arrange well rural territories and implement social programs (Dankevych, 2012). As a result of the capitalization process in Ukraine there appeared and function various forms of agro – industrial formations, which have not been identified in the official legal acts and have a different interpretation in the economic literature but in practice the said subjects are being treated freely. Everything mentioned above forms a wide field for research in the area mentioned above.

Material and Methods

The objective of the article is to define the factors that contribute to the development of the agricultural sector of Ukraine's economy, to determine the main directions of the Ukrainian agribusiness functioning, to analyze the places Ukraine takes in the world rankings of agricultural production and export and the share of the agricultural and food industry products in the total exports volume of Ukraine, to define the main markets for Ukrainian agricultural products, to identify the role agroholdings play in the functioning of the Ukrainian agricultural sector, to define the main factors that contributed to the emergence and development of the agroholdings in Ukraine and to make the list of the most powerful and profitable agroholdings in Ukraine.

The following general scientific and specific economic methods were used in the paper: the statistical analysis methods - to define the factors that contribute to the development of the agricultural sector of Ukraine's economy; the method of ratings – to determine the places Ukraine takes in the world rankings of agricultural production and export; the information – computer methods - to analyze the state and dynamics of the agricultural sector components; the critical analysis method - to define the main factors that contributed to the emergence and development of the agroholdings in Ukraine and to make the list of the most powerful and profitable agroholdings in the country; the monographic method - to synthesize of the scientists' viewpoints on the problems under research; the case study method - to study certain components of the Ukrainian agricultural sector development as a whole and some of its components in particular; the graphical method – to graphically represent the dynamics of the subjects under research and others.

The materials for the article presented were the legislative acts of the European countries, the official statistics of the State Statistics Committee of Ukraine and the European Union, the analytical reviews of the National Bank of Ukraine, Ministry of Finance of Ukraine, Ministry of Economic Development and Trade of Ukraine, the scientific literature on the topic under research and the personal research and observations of the author.

Results

Agriculture - is one of the leading sectors of Ukraine's economy, which has significant natural competitive advantages. The area of the agricultural land of Ukraine is the largest in Europe – 41.5 million hectares, that is 70 % of the country's territory. 32.5 million hectares of the said land is used for growing agricultural crops.

The following factors contribute to the development of the agricultural sector of Ukraine's economy:

- the proximity of major markets (as Ukraine is situated in the central part of Europe on the crossroads of the main logistic routes from different European countries);
- transport infrastructure (railways, highways, ports);
- the steady growth of the global demand for food products and alternative energy;
- the availability of relatively cheap workforce.

The main direction of Ukrainian agribusiness is plant growing – it takes approximately 70% of all the agricultural products of the country. Ukraine takes the first place in the world in terms of sunflower seeds production (Figure 1).

Fig. 1. Ukraine's Share in the Global Production of Sunflower Seeds, %

Source: State Statistics Service of Ukraine.

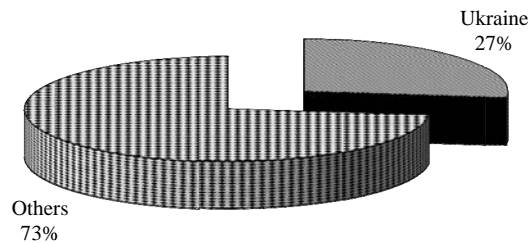Ukraine also takes the first place in the world in terms of the production and export of sunflower oil (Figure 2).
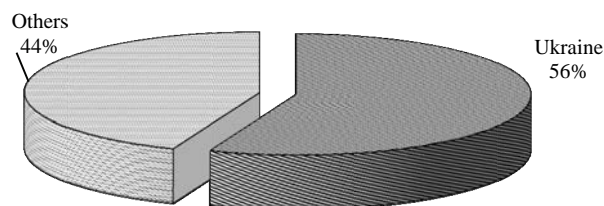

Fig. 2. Ukraine's Share in the Global Production and Export of Sunflower Oil, %

Source: State Statistics Service of Ukraine.

Ukraine has significantly increased its revenues from the agricultural exports over the last decade - they increased almost 4 times due to the increase of the world prices for

agricultural products and the increase of the agricultural exports volume from Ukraine (Figure 3).
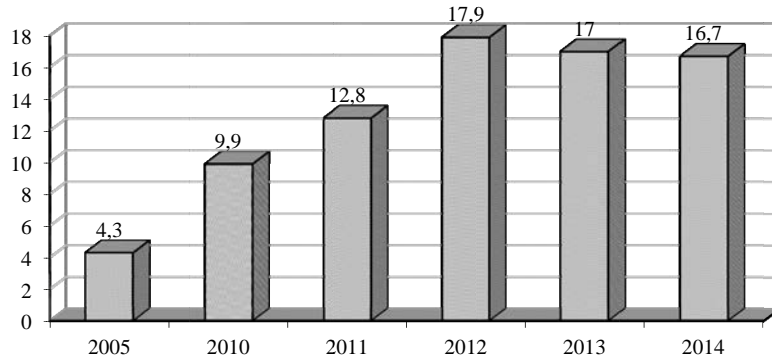
Fig. 3. The Agricultural Exports Volume from Ukraine, bln. USD
Source: State Statistics Service of Ukraine.

The role of the agricultural production in the total exports volume has also increased (Figure 4).
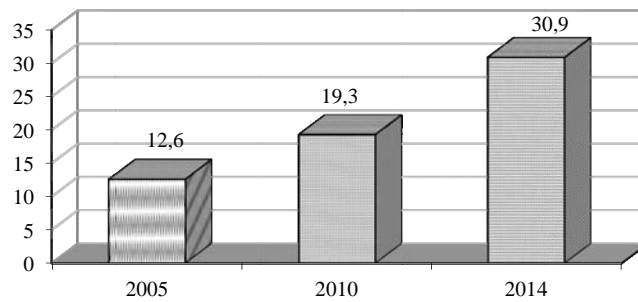
Fig. 4. The Share of the Agricultural and Food Industry Products in the Total Exports Volume of Ukraine, %
Source: State Statistics Service of Ukraine.

In 2014 the share of the agricultural and food industry products in the total exports volume was 30.9 %, while in 2010 it was 19.3% and in 2005 - 12.6%. In 2014 the agricultural sector became the leader in the exports volume of Ukraine for the first time.

The main product groups of agricultural exports from Ukraine traditionally include grain, oil plants seeds, fats and oils of animal or vegetable origin, ready food products, milk and dairy products, poultry eggs, natural honey (Figure 5).
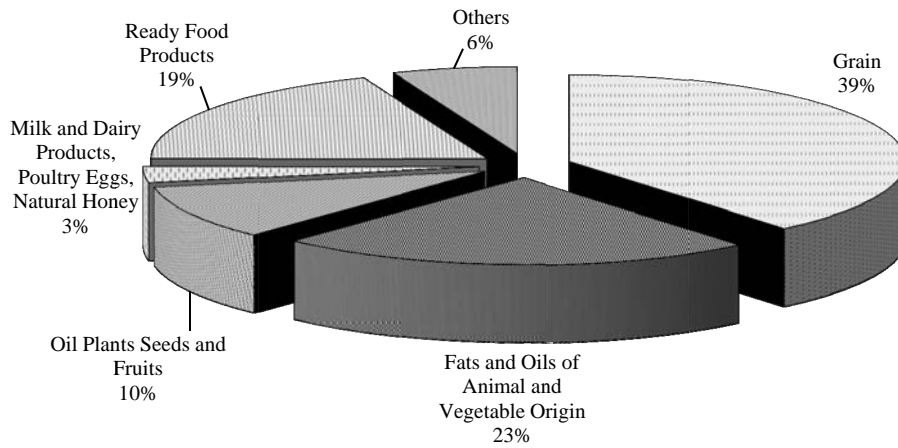
Fig. 5. The Structure of Agricultural Exports in 2014, % of Agricultural Exports Volume of Ukraine

Source: State Statistics Service of Ukraine.

The main markets for Ukrainian agricultural products nowadays are Asia countries (39 %), EU countries (29 %), CIS countries (15 %), Africa countries (16 %), other countries (1%) (Figure 6).
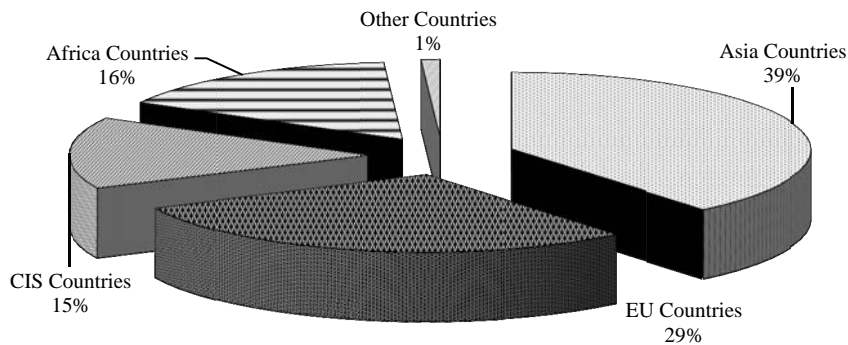
Fig. 6. The Main Markets for Ukrainian Agricultural Products in 2014, %

Source: http://businessviews.com.ua/ru/economy/id/20-grafikov-i-kart-kotorye-dostupno-objasnjajutagrobiznes-ukrainy-328/.

In 2014 the exports of the agricultural and food products from Ukraine into the EU increased by 6.7% if compared with that of 2013.

In the structure of the agricultural and food products exports from Ukraine into the EU the following items prevail: grain – 37.9%, oil plants seeds and fruits – 19.3 %, fats and oils of animal or vegetable origin – 16.6 % (sunflower oil – 14.2 %) (Figure 7).
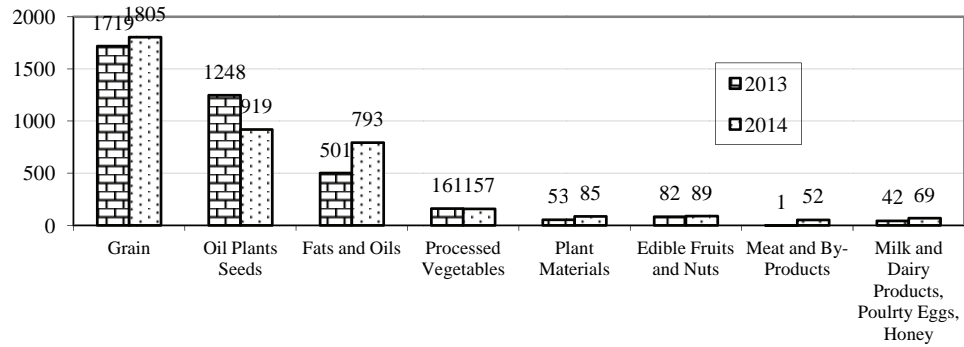
Fig. 7. The Main Commodity Positions of Agricultural Exports from Ukraine into the EU in 2013-2014, mln USD

Source: State Statistics Service of Ukraine.

In order to foster the cooperation between Ukraine and the EU, Ukrainian enterprises should adapt to the EU standards in such areas as sanitary and phytosanitary measures, certification and metrology, customs clearance, market surveillance and conformity assessment.

In Ukraine there are hundreds of agricultural companies nowadays. During the last decade there has been a clear tendency to increase the role and influence of the large agricultural enterprises in the total production of the said sector. In 2013 agroholdings produced 21.3 % of the total agricultural production of Ukraine, 46 % - by the households and 32.7 % - by the other agricultural producers (Figure 8).
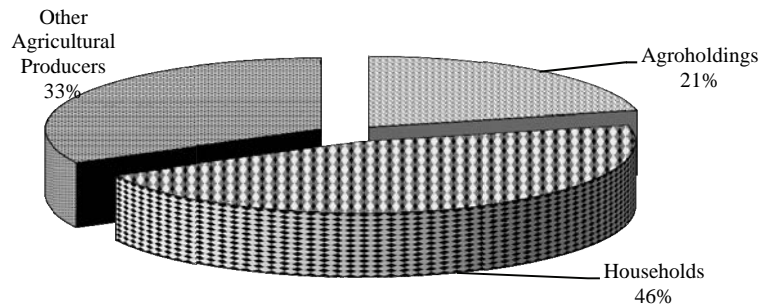
Fig. 8. The Structure of Agricultural Production of Ukraine in 2013, %

Source: http://expres.ua/main/2015/06/15/139585-milyardy-dolariv-ukrayinskogo-sela-dyvovyzhni-cyfry-malovidomi-geroyi.

Agroholdings play a very important role in both agricultural sector and the whole economy of Ukraine as they concentrate significant financial resources under their control, have access to the export markets and new technologies as well as political influence on the local and national levels. In addition, very often powerful international companies are

among the shareholders of such companies, that gives them additional advantages in the international lobbying.

Among the most powerful agroholdings (in terms of the area of land bank under their operational management), the following ones should be highlighted: "UkrLandFarming", NCH, "Kernel Group", "Mironivsky Hliboproduct", "Ukrainian Agrarian Investments (UAI)", "Astarta-Kyiv", "Mriya Agroholding", "HarvEast", "Agroton" (Figure 9).
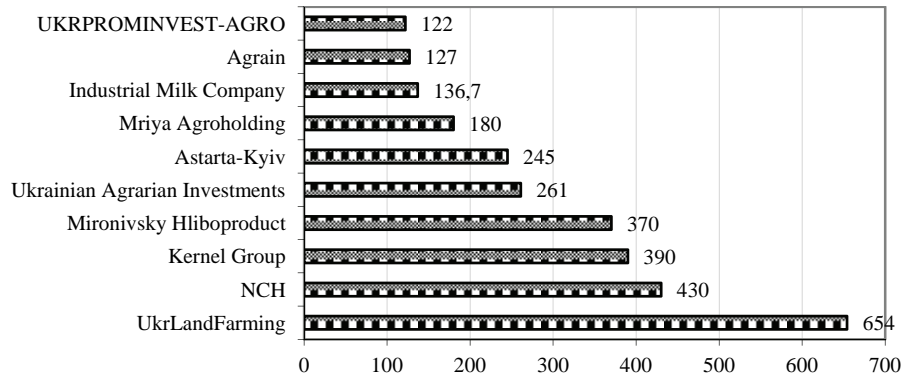
Fig. 9. Top 10 Agroholdings of Ukraine in Terms of Land Bank (on the 1st of January, 2015), thousands of hectares

Source: latifundist.com/rating/top100#88.

Under the management of the top 10 agricultural holdings of Ukraine there is about 7.5% of all the agricultural land in Ukraine. But the ranking of the agroholdings of Ukraine according to the revenue they received in the first half of 2014 is somewhat different from that of the size of their land bank. The said difference can be explained by the significant differences in the kinds of activities the holdings are engaged into as well as by the differences in their business models (Figure 10).
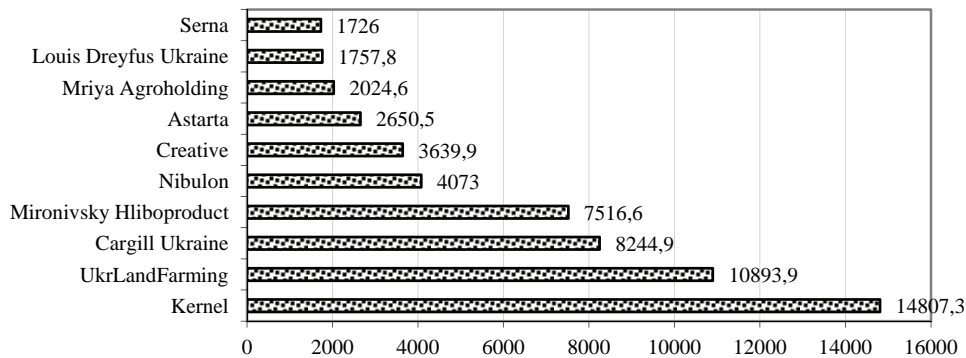
Exchange rate of Hryvnia to Euro – 1 – 16 (1.07.2014).

Fig. 10. Top 10 Agricultural Companies of Ukraine in Terms of the Revenues Received in the 1st half of 2014, bln. UAH

Source: http://forbes.net.ua/ratings/2.

If we consider the role of agroholdings in the exports of the agricultural production of Ukraine, the following grain exporters were among top 10 biggest ones in 2014 (Table 1).

Table 1. Top 10 biggest Ukrainian grain exporters in 2014

№	Company	Share in the Total Export
1	Nibulon	13.1 %
2	State Food and Grain Corporation of Ukraine	9.6 %
3	Louis Dreyfus Ukraine	9.3 %
4	Kernel	7.3 %
5	Cargill	4.8 %
6	Bunge	4.4 %
7	Alfred C.Toepfer International Ukraine (nowadays - Archer Daniels Midland Company)	4.0 %
8	Serna	3.2 %
9	Rise	2.3 %
10	Agrotrade Group	2.4 %

Source: Agrochart.

With the help of the data given in the table presented, you see that agroholdings together with intermediary trade companies, the so-called grain-traders, which are mostly often founded by the foreign companies, are the main exporters of the agricultural products of Ukraine.

Another important characteristic feature of the agricultural holdings is the power of the elevators, which they control.

The list of 10 largest companies – owners of private grain elevators is as follows:
1. Kernel;
2. Glencore;
3. Nibulon;
4. Mironivsky Hliboproduct;
5. UkrLandFarming;
6. Mriya;
7. Alfred C. Toepfer;
8. Bunge;
9. Agrotrade;
10. Astarta (Source: http://newukraineinstitute.org/media/news/549/file/Agro%202015.pdf.).

So, taking into consideration everything mentioned above, we can point out four main agroholdings in Ukraine, which take the first places according to the most indicators researched in the article. These are:
1. UkrLandFarming;
2. Kernel;
3. Mironivsky Hliboproduct;
4. Nibulon.

More than that, these companies are leaders in the specific market segments of agriculture, in which they specialize.

During the last decade we observe the rapid formation of large agricultural holdings, that is connected with the consolidation of the capital by some agricultural enterprises and the deterioration of the financial condition of a large number of small enterprises. In some cases, this process was a little bit chaotic as during the first phase of agricultural assets consolidation the agricultural enterprises of different profiles amalgamated.

So, the main factors that contributed to the emergence and development of the agricoholdings in Ukraine are:

1) the availability of the basic asset that has become the basis for the formation of the holding. That is, the following situation is meant, when the basis for the holding was a large asset that could be get into possession by the owner of the holding during the late 90's – early 2000's;

2) the consolidation of assets and land by the agricultural holdings within a short period of time – the owners of the agricultural holdings consolidated large agricultural assets and thanks to that got operational control over large land banks. More than that, the lack of the necessity to redeem the land from its owners allowed the agroholdings to rapidly increase their land banks;

3) the usage of advanced technologies – together with the consolidation of assets the agricultural holdings invested into infrastructure, accounting and quality management systems as well as into human capital. On the one hand, the implementation of advanced technologies made it possible to unite and increase the effectiveness of different agricultural enterprises that were integrated into the holding. And on the other hand – to achieve the quality level acceptable for the entering foreign markets, first of all, the EU market;

4) the availability of one's own production storage and exports facilities - the largest agricultural holdings actively invest into the development of their elevators, which they use for the storage of their own production and for rent. However, recently the agricultural holdings began to invest into the capacities of goods transshipment (ports, logistics centers, etc.);

5) access to the markets (for production sell) – the two following factors led to the demand creation for the agricultural production, that is: a) global economy growth in the pre-crisis period, which contributed to the increase of demand and food prices in the world, and b) the increase of the purchasing power of Ukraine's population in the pre-crisis period. During the said period, the most powerful Ukrainian agricultural holdings allocated on the external and internal markets and got the financial capacity for consolidation and development;

6) access to the capital markets – the access to the capital market of the agroholdings was preceded by the work for their transfer to the international standards of operation.

The entrance to the external capital markets took place by placing a certain percentage of their shares at international stock exchanges. After the said placement of shares, the foreign markets of credit financing opened in front of the agroholdings. So the holdings began to attract loans at low rates, getting another competitive advantage if compared with the other Ukrainian producers of agricultural products.

Conclusions

So, as you see from everything mentioned above, the agricultural sector of Ukraine has significant potential for further growth as it is one of the leading sectors of Ukraine's economy, which has significant natural competitive advantages.

As a result of the rapid growth of domestic and external demand for agricultural products, quite powerful agro-industrial complex was formed in Ukraine.The following factors contribute to the development of the agricultural sector of Ukraine's economy: the proximity of major markets, transport infrastructure, the steady growth of the global demand for food products and alternative energy and the availability of relatively cheap workforce. Thanks to that, the country occupies the first places on the amount of agricultural exports onto the world markets.

In Ukraine there are hundreds of agricultural companies nowadays. During the last decade there has been a clear tendency to increase the role and influence of the large agricultural enterprises in the total production of the said sector. In addition, the Ukrainian corporations are also presented in the world rankings of the producers and suppliers of agricultural products. The most powerful members of the agricultural market of Ukraine are agroholdings. Despite of some difficulties caused by the internal and external factors, they do not abandon their plans for the infrastructure development and their presence expansion in the foreign markets.

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Inequalities in Agricultural Subsidies in European Union

Abstract. The paper constitutes an attempt at comparison of subsidies level in relation to utilised agricultural area, labour force and value of production throughout EU-25 member states in years 2005 – 2013. The main objective of the paper was assessment of the level of inequalities in agricultural subsidies in European Union and evaluation of their potential trends. Using FADN data aggregated at country level the Gini coefficient was calculated for mentioned dimensions of subsidies level. Additionally sigma and beta convergence analysis were carried out for subsidies and productivity levels. The general conclusion from performed analysis was that famers in EU-10N should now perceive the subsidies level throughout EU quite fair in contrast to 2005, it is especially true in case subsidies per utilised agricultural area with drop of Gini coefficient from 0.23 to 0.15, that is by 35%. On the other hand the productivity levels are converging on much slower pace than subsidies level, for both measures of productivity the beta coefficients in convergence analysis where negative but not significant at standard 5% significance level.

Key words: agricultural subsidies, Gini coefficient, beta convergence, CAP

Introduction

The objectives of Common Agricultural Policy (CAP) have been changing from promoting increase of productivity in aim to provide food self-sufficiency 1962 to protection of environment in 2013. But for farmers CAP always meant additional money to support their income. Therefore farmers in new member states EU-10N, which joined the EU in 2004 were in the same time afraid of competition in enlarged market and hoping for the same conditions as farmers in EU-15. But in the first years after joining EU the subsidies level in EU-10N was much lower the in EU-15, starting at 25% of the EU-15 2004 level (Kelch and Normile, 2004), it was a cause for much complaining about unfair treatment of farmers in the "old" and "new" member states.

Comparison of famers income across EU member states seems to confirm that absolute level of income for the average farm greatly differ. But, according to (Hill and Bradley, 2015) report the main reason for that is the size of average farm and sometimes production type. When comparing farms of the same size of the profile of production performance is similar throughout the EU and quite often better in EU-10N. Also (Baráth and Fertő, 2016) confirm convergence of total factor productivity (TFP) in the EU, for both σ and β convergence. For years 2004 – 2013 the highest annual growth rate in TFP was observed for Finland, Poland and Latvia, while the lowest for Germany, Luxemburg and Belgium.

Probably at least some part of mentioned increase of farms performance in EU-10N in recent years could be result of changes in subsidies level. The inequalities of agricultural subsidies between countries could be tackled in various ways, in (Samman, 2005) the Gini coefficient was applied to measure concentration of agricultural subsidies for France, Great

Britain, the European Union and the United States in traditional way, that is comparing number of farm with amount of subsidies they receive. While this is formally correct in case of subsidies obtained results are actually in direct relation to inequalities of farms size. The more thorough analysis of mentioned inequalities requires comparison of subsidies at least in relation to utilised agricultural area, labour force and value of production.

This paper aims at assessment of the level of inequalities in agricultural subsidies in European Union and evaluation of their potential trends.

Data

This analysis uses data from the Farm Accountancy Data Network (FADN). Samples from years 2005 – 2013 were aggregated at country level. Although, the data for FADN is collected according to the same methodology across all EU member states the minimal economic size of a "commercial" farm is different in specific countries, starting from 2000 EUR of standard output in Bulgaria and Romania, by 4000 EUR in most EU10 countries up to 25000 EUR in most West Europe countries (plus Slovakia), to accommodate for the different farm structures across EU.

Observations of the following variables were selected for each member state:

X_1 – number of farms (SYS02);

X_2 – average total utilised agricultural area of holding (SE02) [ha];

X_3 – average total output (SE131) [EUR];

X_4 – average total labour (SE425D) [AWU[2]];

X_5 – average balance of subsidies and taxes (SE600) [EUR].

Table 1. Average levels of observed variables for EU 25

Year	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
2005	4044350	35.60	60734	1.66	10971	1972	34857	325	6408	18.55
2006	4064130	36.03	63226	1.63	12029	1982	36492	367	7069	20.56
2007	3858580	36.82	73494	1.65	12159	2314	41593	369	7006	17.53
2008	3816520	37.35	74173	1.65	12708	2279	42077	386	7364	18.69
2009	3660790	38.71	69122	1.64	13183	2017	38961	370	7573	21.49
2010	3704000	38.60	76799	1.61	13711	2184	43560	387	8077	20.73
2011	3703580	38.70	83219	1.61	13596	2313	47116	374	7986	18.75
2012	3782980	38.77	88238	1.60	13185	2439	49929	357	7712	17.10
2013	3770140	39.41	88232	1.58	13217	2384	50139	354	7785	17.44

Source: own calculations, based on FADN data.

Using the mentioned above variables five following variables used as a measures of productivity and subsidies level were calculated:

X_6 – average total output per total utilised agricultural area (X_3/ X_2) [EUR/ha];

X_7 – average total output per AWU (X_3/ X_4) [EUR/AWU];

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[2] AWU – annual work unit = full-time person equivalent.

X_8 – average balance of subsidies and taxes per total utilised agricultural area (X_5/ X_2) [EUR/ha];

X_9 – average balance of subsidies and taxes per AWU (X_5/ X_4) [EUR/AWU];

X_{10} – average balance of subsidies and taxes per total output (X_5/ X_3) [%].

During analysed time period 3 countries joined EU, that is Bulgaria, Romania and Croatia. Those countries were excluded from the analysis to avoid concealing of possible trends. The number of farms (X_1) and average values for all other variables of remaining 25 member states are presented in table 1. Through observed 9 years on average farms in EU become significantly bigger, that is total utilised agricultural area of holding increased by 11% and value of total output by 45%. At the same time total number of AWU decreased by 11% and average level of subsidies per hectare increased by 9%.

Methods

To evaluate the level of inequalities in agricultural subsidies following statistical measures were employed:

coefficient of variation: $c_v = \dfrac{s}{\overline{y}}$, where s stands for estimator of standard deviation and $\overline{y}$ for average.

Gini coefficient: $G = 1 - \sum_{i=1}^{k}(x_i - x_{i-1})(y_i + y_{i-1})$, where x_i – accumulated share of the values used as a denominator[3] and y_i – accumulated share of the values used as a numerator for the i country. Before calculation of Gini coefficient countries were arranged in ascending order according to quotient of shares used as nominator and denominator.

The evaluation of potential trends in subsidies inequality across EU member states the values of mentioned statistics were calculated for each year and additionally σ and β convergence was assessed. To estimate σ convergence estimator of standard deviation was calculated for each year. For and β convergence the modification of the original Baumol was used:

$$\frac{1}{T}\log\left(\frac{y_{i,T}}{y_{i,0}}\right) = \alpha + \beta \log\left(y_{i,0}\right) + \varepsilon_i ,^4 \qquad (1)$$

---

[3] Originally Gini coefficient was used for assessment of income inequalities where the x_i – was accumulated share of the population number and y_i – was accumulated share of total income. Consequently, the values used for the denominator calculation were just households numbers, and the values used for the numerator calculation were incomes.

[4] The formulation used in formula (1) is typical to standard notation for linear models. However, in literate on the subject of convergence it is quite common to find slightly different formulation for example in (Young et al.,

where: $y_{i,0}$ – value of subsidy in member state *i*, starting year of analysed period and $y_{i,T}$ – value of subsidy in member state *i*, ending year of analysed period, *T* – period length, *α* – intercept and *β* – regression coefficient. If the increase in subsidy is proportionally higher in member states with lower initial level of subsidies *β*<0 should be observed.

All calculations were performed in R, a statistical computing environment (R Core Team, 2016).

Results

Comparison of subsidies per total utilised agricultural area presented in figure 1. suggests, that the differences between countries are very high for both considered years. Nevertheless in 2013 the differences seem smaller, especially observing the level of subsidies in countries which joined EU in 2004.
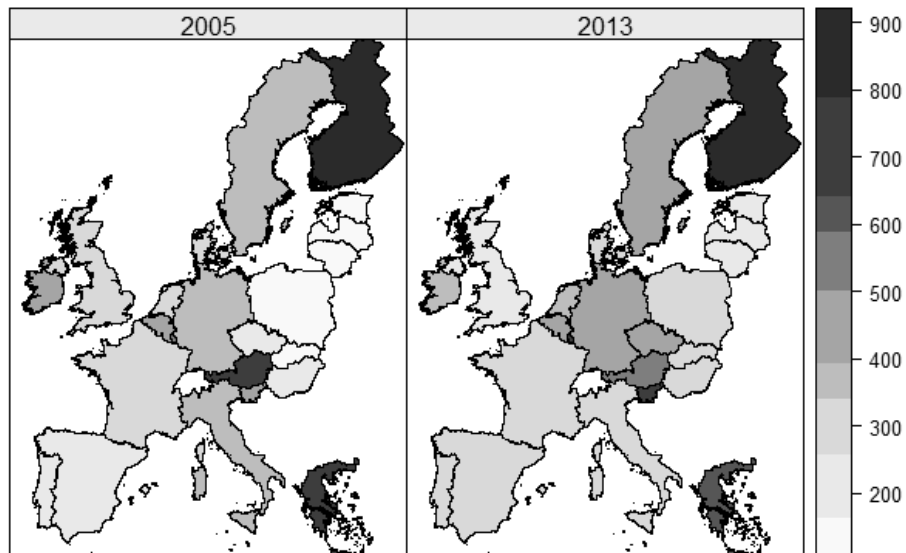
Fig. 1. Subsidies per total utilised agricultural area [EUR/ha]

Source: own calculations, based on FADN data.

On the other hand subsidies per total output presented in figure 2. show relatively high uniformity even in year 2005, except Finland, Ireland and Austria. And, what interesting, the countries which joined EU in 2004 display higher levels than Germany, France or Italy.

2008) following equation can be found: $\log\left(\dfrac{y_{i,t}}{y_{i,t-1}}\right) = \alpha - \beta\log\left(y_{i,t-1}\right) + u_i$. The main difference, besides using for estimation data from to consecutive years, is the minus sign before beta. Because of that in this formulation positive values of beta support convergence, while in the formulation used in this paper it negative beta.
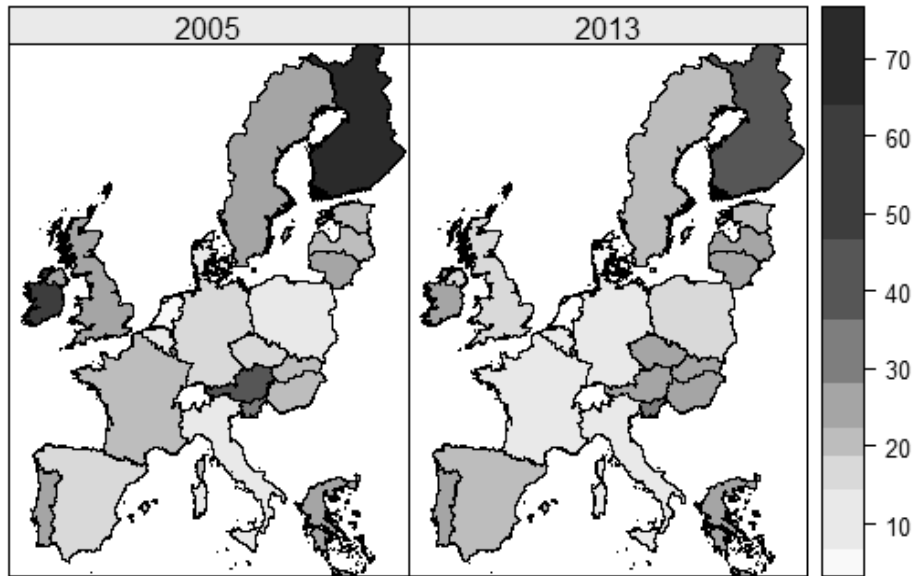
Fig. 2. Subsidies per total output [%]
Source: own calculations, based on FADN data.
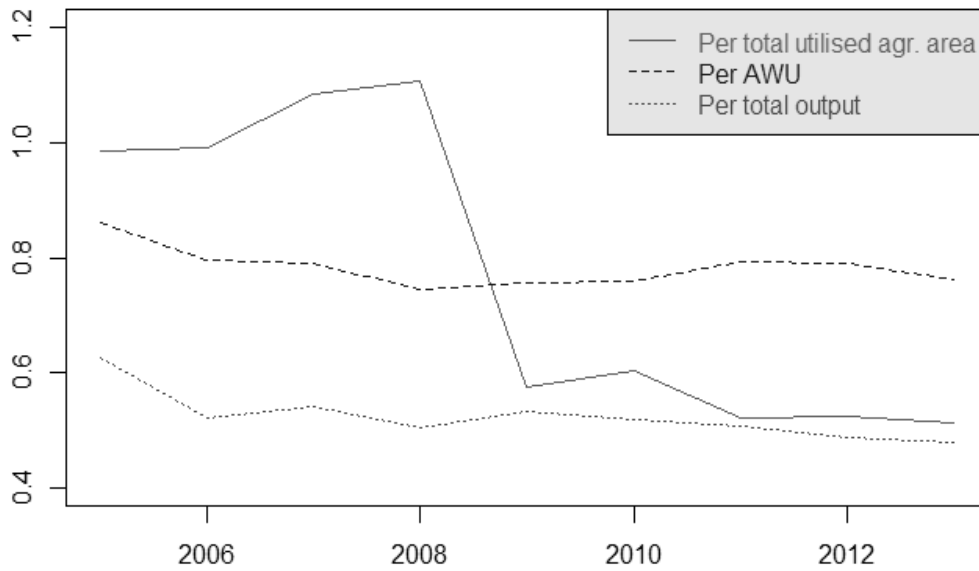
Fig. 3. Coefficient of variation of subsidies per total utilised agr. area, AWU and total output
Source: own calculations, based on FADN data.

Assessment of inequalities in the level of subsidies has been performed separately for the three variables, in which the nominal of level subsidies were divided, respectively by total utilised agricultural area, number of AWU and by total output. As could be expected all three variables show different level of inequality. Results for coefficient of variation presented in the figure 3 confirm, that for the whole period 2005–2013 subsidies per total output have the smallest variation, while for total utilised agricultural area the variability decreased to similar level only since year 2009. The variability of subsides level per AWU showed very small decrease and in year 2013 was still close 0.8.

The result showed in the figure 3. concerned variability of subsidies. It could be argued that in case of high uniformity of subsidies levels measures of variability should be low. Still, the traditional measure of inequalities is popular Gini coefficient. The calculation of it values for three variables representing different formulation of subsidies level allowed comparison of subsidies concentration in relation to utilised agricultural area, labour force and production. Surprisingly the lowest concentration was observed entire time for the utilised agricultural area. Such high difference between rankings produced by variation coefficient and Gini coefficient can be caused by some extreme values of observed variables with very low share in the sum of the denominator values. For example in 2005 subsidies per utilised agricultural area was close to 2200 EUR/ha on Malta when average for whole EU25 was just 325 EUR/ha, during the following years the subsidies for Malta were equal in EUR/ha: 2439, 2790, 3121, 1170, 1380, 1047, 1082, 1055. Consequently those extreme values greatly affected values of variation coefficient. In calculation of Gini coefficient the share of both subsidies and utilised agricultural area is taken into account. Those shares for Malta were in 2005 respectively: 0.0049% and 0.0347%, thus influencing value of Gini coefficient very little in contrast to variation coefficient where all observations had the same weight.

Summarizing the result for Gini coefficient, the inequalities of subsidies level across EU25 during years 2005–2013 were decreasing, with the deepest lessening of 35% observed for subsidies in relation to utilised agricultural area.
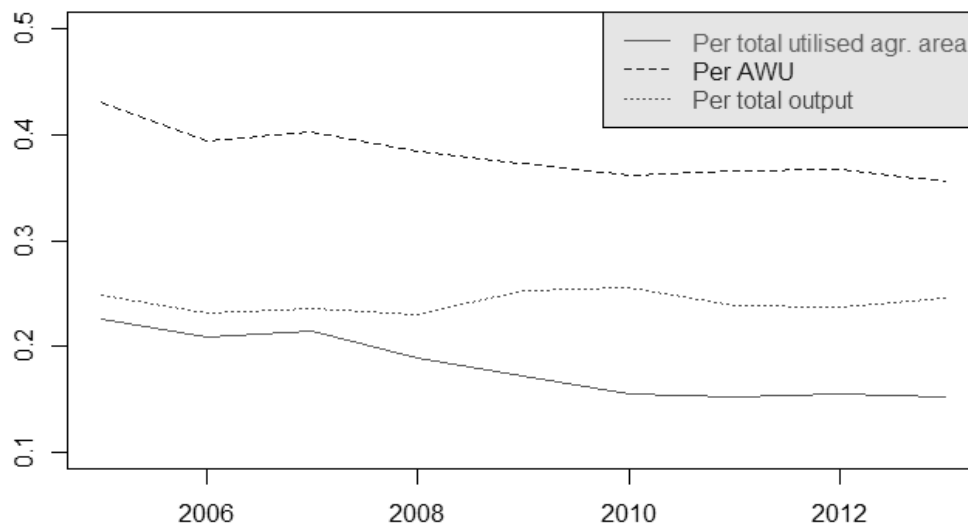
Fig. 4. Gini coefficient of subsidies per total utilised agricultural area, AWU and total output

Source: own calculations, based on FADN data

To compare trends in inequalities of subsidies level with changes in productivity tables 2 and 3 contain results for 5 variables, additional variables X_6 and X_7 are connected to productivity. Both measures of productivity show that during 9 analysed years there was practically no change in divergence level measured by variation coefficient. Conversely, subsidies level shows quite strong convergence. It is especially true for subsidies per hectare of utilised agricultural area where variation coefficient in year 2013 is almost twice lower than in 2005.

Table 2. Variation coefficients of productivity and subsidies level for EU 25

Year	X_6	X_7	X_8	X_9	X_{10}
2005	1.163	0.831	0.985	0.861	0.626
2006	1.189	0.858	0.991	0.796	0.520
2007	1.091	0.808	1.086	0.791	0.542
2008	1.140	0.801	1.108	0.745	0.504
2009	1.107	0.823	0.576	0.757	0.532
2010	1.130	0.862	0.604	0.759	0.519
2011	1.052	0.856	0.520	0.794	0.507
2012	1.111	0.853	0.524	0.790	0.488
2013	1.160	0.845	0.513	0.763	0.478

Source: own calculations, based on FADN data.

The negative values of β presented in table 3 indicate existence of β convergence for all variables. On the other hand the p-values show that at 5% significance level only subsidies per utilised agricultural area and per labour force size are significant. Furthermore only determination coefficient for X_8 has actually high value supporting claim of strong β convergence only for subsidies per utilised agricultural area.

Table 3. Estimated β convergence of productivity and subsidies level for EU 25

Year	X_6	X_7	X_8	X_9	X_{10}
β	-0.0081	-0.0113	-0.0518	-0.0311	-0.0177
p-value	0.1004423	0.1168155	0.0000003	0.0147030	0.2329500
R^2	11.3	10.35	68.98	23.23	6.13

Source: own calculations, based on FADN data.
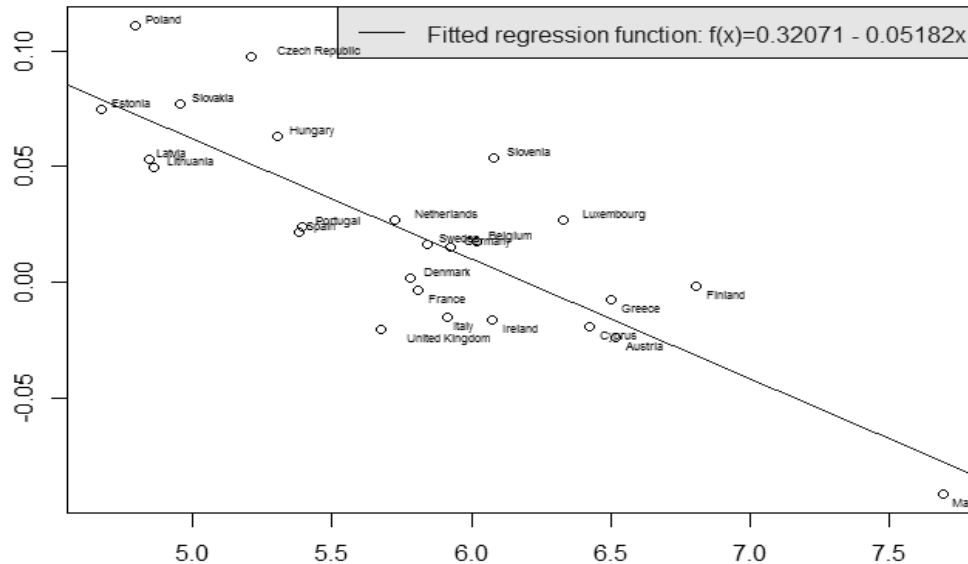
Fig. 5. Estimated β convergence model for subsidies per total utilised agr. area

Source: own calculations, based on FADN data.

Detailed data presented at Figure 5 prove, that relatively the highest increase of subsidies per total utilised agriculture area happens in Poland and other countries, which joined EU in 2004, except for Cyprus and Malta. In 2005, Poland was second to last in the level of subsidies per hectare, with lower level only Estonia, in 2013 Poland was 8 from the end, and among the countries with a lower level of subsidy was for the example the United Kingdom.

Conclusions

The comparisons of subsidies level across member states of the EU-25 in relation to utilised agricultural area, labour force and value of production show, that while for all those measures of subsidies level the reduction of inequalities level could be observed, the real decrease occurred in case of subsidies per utilised agricultural area. With drop of Gini coefficient from 0.23 to 0.15. The reason for the strongest reduction in this case could be attributed to two causes. First of them 2003 reform of the CAP, which introduced direct payments decoupled from current production, with implementation in 2005-07 at the discretion of its member states. The second reason was accession agreement for EU-10N new member states according to it single farm payments in the accession year 2004 for EU-10N started at 25% of the EU-15, with 5% increase each year until the new members receive 100% of EU payments (Cochrane, 2004).

For subsidies per labour force size the reduction of Gini coefficient was similar in absolute terms from 0.43 to 0.36, but in relative terms it was respectively: 35% and 16%. In case of subsidies per production value the changes were minimal, the reduction of Gini

coefficient from 0.25 to 0.245. Possibly the reason for this lack of inequalities reduction was change of productivity level proportional to change in subsidies per hectare.

The conclusions form analysis of Gini coefficient were confirmed by analysis of β convergence, where beta coefficient was not significant in case of subsidies per production value and strong relation with R^2 equal 69% in case of subsidies per utilised agricultural area.

Overall conclusion from performed analysis suggest, that although famers in EU-10N should now perceive the subsidies level throughout EU quite fair, in terms of subsidies per utilised agricultural area, in contrast to 2005 the productivity levels are converging on much slower pace.

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The Livestock Production in Norway

Abstract. A problem of the Norwegian agricultural policy, a description of the current types of subsidies for livestock farming, financial situation of this holdings and ongoing changes in a livestock production in the years 2000 – 2015 is presented in this paper. The main aim of the publication is to characterize these changes in the considered period. There is not too many publications about the Norwegian agriculture and livestock production. The data from Statistiska Sentralbyrå (Statistics Norway) were used in the analysis. The results indicate the slight changes in the livestock production in Norwegian agriculture i.e. the slight decrease of number of holdings with livestock and generally the slight decrease of population of livestock.

Key words: livestock production, subsidies, agriculture in Norway

Introduction

This publication is about an agricultural production in Norway, particularly livestock farming. This study is a part of researches which have been conducted in a framework of "Scholarship and Training Fund Mobility Projects In Higher Education. Individual Training Programme For Staff Training Mobility" in Østfold University College in Norway. It is a continuation of published discussions devoted to the Norwegian agriculture and Norwegian agricultural policy.

The total agricultural and forest area is 80 124 km^2, that is a 26% of land of the mainland part of Norway. The agricultural area in use covers 9 859 km^2 (3,2% of land) of which fully cultivated is 8 103 km^2 (2,7% of land). It is sufficient to ensure the supply of the population of Norway (the number of persons registered as living in Norway is equal 5 223 256 persons per second quarter of 2016) in the meat, dairy product, vegetables and grain products to a certain extent (www.ssb.no, 2016; Kozioł-Kaczorek, 2016). The share of agriculture in GDP was only 1.6% in 2015. The agriculture share in employment was 1.8%. The agro-food export was only 0.8% of total export while the agro-food import was around 9.1% of total import (Hemmings, 2016).

The structure of agriculture in Norway is measured by numbers of holdings. In 2015 the total number of holdings was 41 846 and around 68% of it were holdings keeping domestic animals. The share of livestock in total agricultural production was around 71% (OECD, 2016).

The spatial distribution of holdings in generally and the spatial distribution of holdings specialised in livestock farming is presented on a map on the Figure 1.

The largest number of holdings is located in the small county of Rogaland in western Norway, county of Hedmark and county of Oppland in the central part of Norway. While the largest number of holdings with livestock production is located also in the small county of Rogaland in western Norway and county of Hedmark in the central part of Norway.

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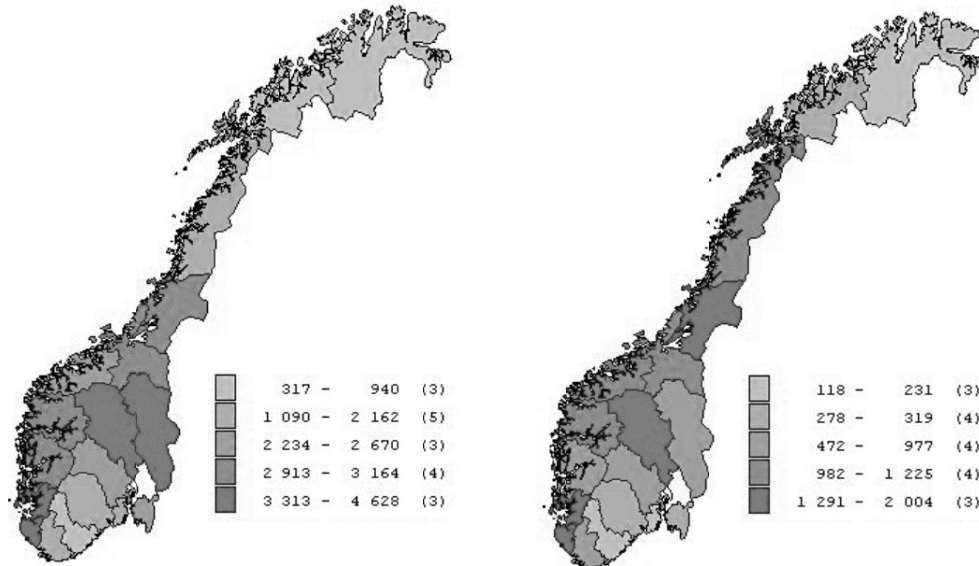
Fig. 1. The map of the spatial distribution holdings in generally (left map) and of the spatial distribution of holdings specialised in livestock farming (right map)

Source: Statistics Norway (www.sssb.no 2015).

The objective of the publication is to describe a background of the agricultural production in Norway. In particular, paper details structure of livestock farming in Norway, the situation in that sector of agriculture and also economic instruments that are the basis of Norwegian agricultural policy. It is important and also interesting because those aspects of human life and country reality are so different than in Poland.

The Norwegian agricultural policy

The agricultural production in Norway is strongly dependent on agricultural policy that is a major determinant of development of it. The agricultural policy is based on (among other) the White Paper No. 9 (2011 – 2012) "On Norwegian agriculture and food production" approved in April 2012. This document declares the most important aims and objectives of Norwegian agricultural policy: agricultural throughout all of Norway, creating more added-value, sustainable agriculture. Furthermore, the objective of Norwegian agricultural policy is also to ensure self-sufficiency and security in the field of agricultural production (especially food production). The problem is, that Norway is geographically large in relation to its population and has diverse habitats, many of which are rugged with harsh climates that present significant challenges for everyday life and economic activity, even with modern technology and conveniences. Much of arable farming is located in low-lying areas close to the main urban centres, while dairy farming is an important agricultural activity throughout the country. So, the Norwegian agricultural policy is realised in the rather unfavourable geographical and climatic conditions. It is a main reason for which the

Norwegian agricultural policy is still strongly state regulated through legislation and economic instruments (Kozioł-Kaczorek, 2016; Forbord et al., 2014; Dramstad et al., 2010). The key policy instruments supporting agriculture include domestic market regulation, budgetary payments, support measures, certain product price, welfare schemes and also border measures (OECD, 2016). The most important support for holdings comes via direct and indirect assistance for farmers. There is around one hundred individual mechanism. The key types of support comprises output-based support, transport subsidies, acreage-based payments and headage payments. The mentioned above core support mechanisms are augmented by a lot of other programmes that, for example, compensate farmers in the event of natural disasters or losses due to predators. Furthermore, farmers can also benefit from a special tax relief (OECD, 2016).

There are different kind of types of support for holdings with livestock. The first one is a output-based payments for certain meats, poultry and eggs. Another one type are transport subsidies i.e. various schemes supporting transport of meats or eggs. The next type are acreage-based payments. There are also headage payments for livestock i.e. payment per animal decreased with the number of animals for bovine animals, pigs, goats, hens, horses, rabbits and sheep. Another one are dairy-industry payment schemes. It is quota-limited price support. Comprises a structural income support and a regional payment per litre of milk for a limited output. It is "structural payment" based on numbers of animal. Further types of support are financial assistance with labour input and other national payment schemes include: organic farming support, natural disaster compensation, compensation programmes for losses due to predators and other losses. There are also regional environmental programme and income-tax deduction. Positive income balances are not taxed up to a maximum tax saving of NOK 44 900 (i.e. around EUR 4 900 at an exchange rate of 9.2) per farmer (Hemmings, 2016)

The basic information about the structure of livestock production are shortly described in this publication. Presented below results of analysis based on the data from Statistiska Sentralbyrå (Statistics Norway).

The changes in the Norwegian livestock production

The animal production in Norway covers certain meats (beef, mutton, pork, poultry), milk, butter and cheese and eggs, and fur skins. There is no fishes because the fishery is another branch of Norwegian economy and it does not belong to agriculture. The changes in the number of holdings keeping various kinds of domestic animals in the period from 2000 to 2015 are presented on the Figure 2. There are presented changes in number of holding keeping few main kinds of livestock i.e. cattle, cows (including dairy cows, beefs cows), pigs (including pigs for breeding, sows for breeding, boars for breeding and other pigs), hens, horses, sheep and goats.
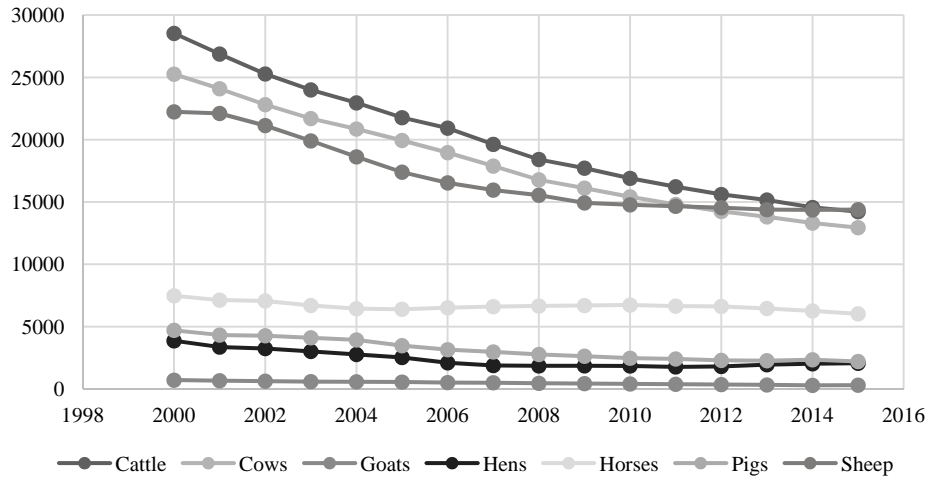
Fig. 2. The changes in the number of holdings keeping various kind of livestock

Source: own study based on Statistics Norway (www.sssb.no 2016).

Note that, the number of holdings specialised in livestock farming has systematically decreased during analysed period. Average annual rates of change of number of holdings in dependence on kind of livestock are presented in table 1.

Table 1. Average annual rates of change of number of holdings in dependence on kind of livestock

Livestock	Average annual rates of change
Cattle	-4,5%
Cows	-4,4%
Goats	-5,4%
Hens	-4,1%
Horses	-1,4%
Pigs	-4,9%
Sheep	-2,9%

Source: own calculations based on Statistics Norway (www.sssb.no 2016).

The biggest decline of number holdings is for holdings with goats (including also dairy goats). The lowest decline of number holdings is for holdings with horses. Almost the same decline of numbers holdings have holdings with cattle, cows, hens and pigs. This phenomenon is not confined to numbers of holdings livestock, the same situation is in general number of holdings and also size of agricultural area and cultivated area (Kozioł-Kaczorek, 2016).

Changes in the size of population of livestock in the analyzed period are shown on the Figure 3 and on the Figure 4. There are presented changes in number of horses, cattle, cows, goads and pigs on the Figure 3. Note that there are almost no changes in size of

populations. A slight decrease in the size of the population was observed for cattle, a slight increase in the size of the population was observed for hens.
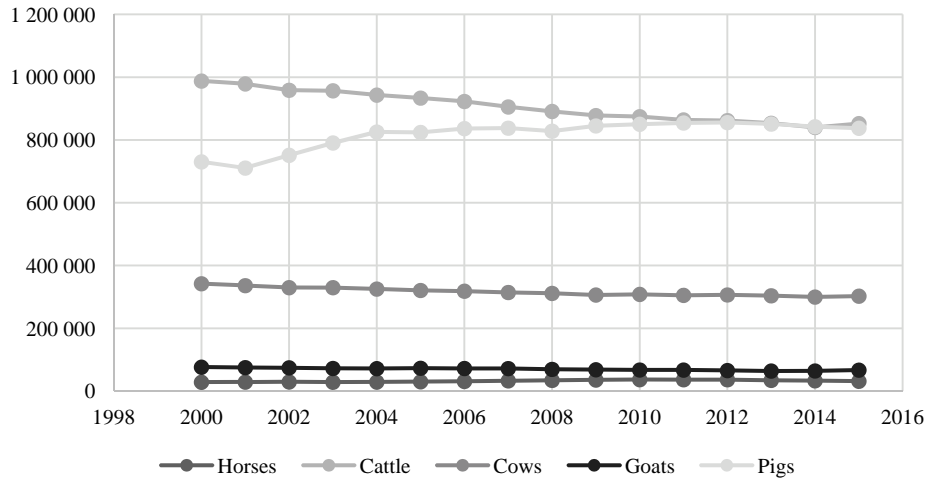
Fig. 3. The changes in the size of population of livestock (horses, cattle, cows, goats, pigs)

Source: own study based on Statistics Norway (www.sssb.no 2016).

The changes in size of population of hens and sheep are presented on the Figure 4. As is easily seen while the number of sheep remains almost unchanged, the number of hens increased steadily during this period.
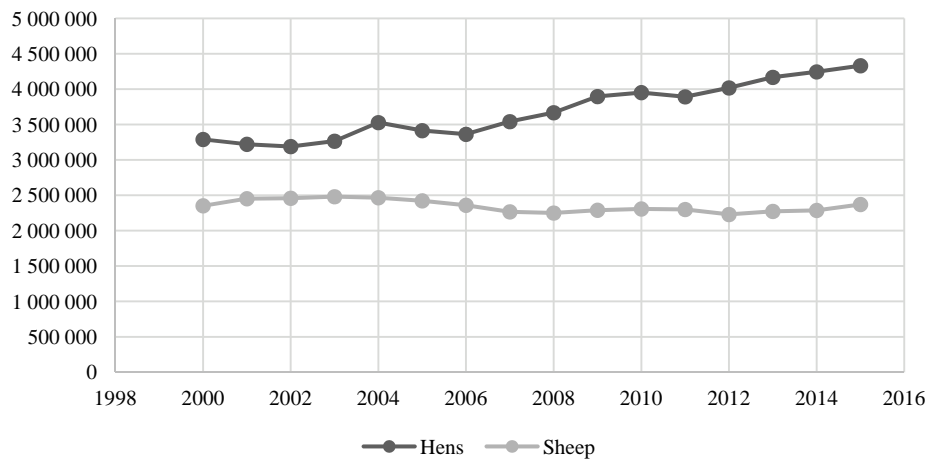
Fig. 4. The changes in the size of population of livestock (hens, sheep)

Source: own study based on Statistics Norway (www.sssb.no 2016).

Average annual rates of change of number of various kind of livestock are presented in Table 2. The increase in the size of the population of livestock is observed for horses, sheep, pigs and hens. The largest increase is observed for hens. The decrease in the size of the population is observed for cattle, cows, goats. The biggest decline of number of livestock is for cattle.

Table 2. Average annual rates of change of number of various kind of livestock

Livestock	Average annual rates of change
Horses	0,70%
Cattle	-0,98%
Cows	-0,82%
Sheep	0,05%
Goats	-0,87%
Pigs	0,92%
Hens	1,85%

Source: own calculations based on Statistics Norway (www.sssb.no 2016).

Financial situation of holdings with livestock will be described by entrepreneurial income form agriculture in 2014, and interest paid and debt for holders also in 2014. In both cases the holdings are grouped by type of farming: cattle – dairying, cattle – rearing and fattening, cattle – mixed, sheep, various grazing livestock, granivores, mixed livestock, mixed crops – livestock. The entrepreneurial income form agriculture in 2014 is presented in Table 3.

Table 3. The structure of the Norwegian holdings with livestock by the value of the agricultural income in 2014

Type of farming	Without positive income	1 - 49 999 NOK	50 000 - 99 999 NOK	100 000 - 249 999 NOK	250 000 - 399 999 NOK	400 000 and more NOK
Cattle - dairying	7%	4%	6%	21%	31%	32%
Cattle - rearing and fattening	32%	13%	18%	20%	11%	8%
Cattle - mixed	6%	2%	5%	17%	26%	44%
Sheep	35%	19%	19%	18%	6%	4%
Various grazing livestock	47%	14%	11%	13%	7%	7%
Granivores	10%	6%	8%	15%	18%	43%
Mixed livestock	14%	6%	7%	13%	16%	44%
Mixed crops - livestock	32%	14%	13%	13%	10%	19%

Source: Statistics Norway (www.sssb.no 2016).

Only around 6% of "cattle – mixed" farms and around 7% of "cattle – dairying" farms are the farms without positive income. The biggest proportion of farms without positive income was in group "various grazing livestock" farms. Therefore, it is most likely to finished the fiscal year without positive income from this type of livestock farm.

On the other side, around 44% of "cattle – mixed" farms, 44% of "mixed livestock" farms and 43% of "granivores" farms received at least the entrepreneurial income

of 400 000 NOK. The lowest proportion of farms with the entrepreneurial income of 400 000 NOK was in groups "sheep" farms, "various grazing livestock" farms and "cattle – rearing and fattening" farms. It is rather obvious that the entrepreneurial income depends on type of farm.

The interest paid and debt for holders in 2014 according to type of livestock farming are presented in the Table 4.

Table 4. The interest paid and debt for holders in 2014

Type of farming	Debt, total. NOK million	Debt per holder. NOK	Interest paid, total. NOK million	Interest paid per holder. NOK
Cattle - dairying	12 936	2 108 000	498	81 200
Cattle - rearing and fattening	6 666	1 784 000	265	70 800
Cattle - mixed	2 954	2 524 000	112	95 900
Sheep	10 562	1 113 000	430	45 300
Various grazing livestock	5 079	1 804 000	206	73 100
Granivores	10 685	4 855 000	415	188 600
Mixed livestock	2 740	4 910 000	111	199 400
Mixed crops - livestock	3 015	2 396 000	115	91 100

Source: Statistics Norway (www.sssb.no 2016).

The largest debt per owner is in group "mixed livestock" farms and in group "granivores". The debt per owner in these groups is at least twice higher than in the other groups. The largest total debt is in groups "cattle - dairying" farms, "sheep" and also in group "granivores". The total debt in these groups is also at least twice higher than in the other groups.

The lowest debt per owner is in group "sheep" farms, also in group "cattle – rearing and fattening" and in group "various grazing livestock". The lowest total debt is in groups "mixed livestock" farms, "cattle – mixed" farms and also in group "mixed crops – livestock" farms. The total debt in these groups is also at least twice higher than in the other groups.

Conclusions

Norway is a highly developed high economy and has the second highest GDP per capita in OECD region. Agricultural production constitutes only 1,5% of share of GDP and 1,8% of share in employment in the most recent years. The structure of farm area is dominated by small family farms with high cost of production. Some of them are also in remote locations operating under difficult conditions. These are main reasons for which the Norwegian livestock production is still strongly regulated by economic instruments. There is a lot of different kind of types of support for holdings with livestock as the output-based support, transport subsidies, acreage-based payments and headage payments.

With regard to decreased of number of livestock holdings, the situation is same as in the total number of holdings, and also size of agricultural area and cultivated area. During

last fifteen years can be noticed the decrease of number of agricultural holdings and the decrease of agricultural area.

But in regard to different types of livestock production, some of type of farm reported the increase of size population of livestock and the high entrepreneurial income form agriculture. Therefore agricultural policy objectives related to the provision of food seem to be carried out in the livestock sector.

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The Problems of Direct Support for Plant Production in the European Union and the United States

Abstract. The paper shows differences of opinions, on which side of Atlantic the level of support is higher. It reviews the shifts in the UE direct payments system. In the second part of the paper the American system of payments is analyzed. Some calculations of payments are added. Finally similarities and differences between the systems are being indicated.

Key words: agriculture, Common Agriculture Policy, USA, direct payment system,

Introduction

One of the issues which reappears on account of the negotiations regarding the TTIP agreement, are the methods of supporting agriculture in the EU countries and in the USA (Krzyżanowski, 2016). That's why concepts from both sides of Atlantic should be recalled.

Research carried out for the European Parliament has shed light on the degree of government support granted by the EU and US authorities to their agricultural sectors (Butault et al., 2012). The main conclusions of this work are that the EU has provided more support than the US to its farmers over recent years. Studies that find opposite results use questionable methodology implying that US welfare programs (e.g. 'food stamps') act as direct subsidies to US farmers. In reality, they actually benefit producers from other countries through indirect price effects (Risks, 2014). However since U.S. employs a multi-layer policy that protects US farmers against any possible adverse condition affecting either yields or prices, specific backup programs available to American farmers should be examined.

The basic tool of supporting agriculture in both systems, including in particular plant production, is direct payments, however the system is different. The aim of the study is to present the solutions applied on both sides of the Atlantic, to indicate the similarities and differences in the implemented instruments.

Evolution of direct payment within the Common Agricultural Policy

Direct payments were introduced in 1992, in the reform of MacSharry's Common Agricultural Policy, and as a result of subsequent reforms they became the main instrument of supporting agriculture. Initially, they were to compensate for the decrease in intervention prices, while in practice they became the additional means of increasing agricultural income or a compensation for its decrease (Krzyżanowski, 2015). The issue of level of payment rates and the whole further calculations may be presented on the example of payments for cereals.

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In the reform divided over 3 years, the target price of cereals, except for rice, was to amount to ECU 100 for 1t in the third year (ECU – European currency unit, exchange rate in 1992 – ECU 1 = USD 1.29). The proposed level of target price was to be at the level of prices of cereals in the global market, assuming it is stable. In 1992, the average market price of cereals in the countries of the EC was ECU 155. The farmers were to receive the compensation for loss in income, in the amount of ECU 55 for 1t. It constituted the difference between the actual market price of cereals – ECU 155 for 1t, and the target price of ECU100 for 1t. The amount of that payment could change with changes in crops, and in the general conditions in the EU and foreign markets. The rates of subsidies per unit of surface were specified regionally, depending on the amount of average crops achieved over the period of several years before the reform. For example, the average yields in the whole Community, calculated in the above manner, amounted to 4.6 t from 1 ha. Therefore, the payment amounted to ECU 253/ha (4.6t/ha • ECU 55/t).In the first year of the reform, the payment amounted to ECU 30/t, i.e. ECU 138 for 1 ha; in the second year – ECU 45/t, i.e. ECU 207 for 1 ha, and the target level was to be achieved in the third year. The change in the level of payment resulted from the respective decreases in the target price in the first year to ECU 125/t, and in the second – to ECU 110/t (Krzyżanowski, 1993).

In the system which is now called historical, classical or standard, the payment calculation formula was as follows:

Basic area x payment rate/t x yield x PLN/EUR exchange rate = so-called cereal envelope

The payment rate for 1 ha results from dividing the envelope by the number of hectares which are reported by the farmers who apply for payments.

Starting in 1993, the main support for the EU farmers has the form of payments to field crops, special bonuses for cattle and suckler cows, etc. These payments applied until the end of 2004, and, to a limited degree, they were made in certain member states even after the introduction of single area payments in 1 January 2005, as a result of the possibility of also applying partial decoupling.

The European Commission considered direct payments to be an instrument that was more explicit than market support and intervention mechanisms. The payments supplemented other support mechanisms, and replaced them over time. They were also perceived as a convenient transition mechanisms, to wean the farmers from the instruments disrupting the operation of the market and to ensure better use of public goods by supporting agricultural income. For example, such an instrument was the criterion of livestock density associated with aid for the producers of beef. This constituted a counterweight for the use of pastures that was too intensive.

However, on the other hand, there have appeared more and more deficiencies of the system applied. The European Commission assumed the position, expressed for years by numerous agricultural economists, that sector-based payments continue to distort the operation of the market, although to a smaller degree than market intervention, because they require the farmer to take specified line of production in order to receive the aid. This meant that in many cases the farmers were stimulated to maximize production, even if they were receiving signals from the market that production should be limited or discontinued.

The second important argument for applying direct payments is the fact that they were excluded from the "reduction obligations" resulting from the WTO Uruguay Round. That's

because they were included in the "Blue Box" category. Such a solution resulted from the compromise between the EU and the USA at the beginning of 1990s.[2]

After the beginning of the new WTO negotiations in 2000, it turned out that that solution was challenged by most members of WTO who demanded that the agreement be changed. If the so-called "Blue Box" ceases to exist, the only way of securing direct payments for farmers from EU countries in the future, will be to modify the payments so that they are classified as means from the "Green Box" group, i.e. payments decoupled from the size of production which, on the basis of the general understanding, are not subject to reduction.

For those reasons, in the plans of the Common Agricultural Policy reform (January 2003), the decoupling of payments from production size became the main element of proposed changes. As a result of arrangements, on 26 June 2003 it was determined that under EU regulation 1782/2003, on 29 October 2003 there would be created a new category of payments, so-called Single Payment Scheme (SPS).

The new system was introduced from 1 January 2005. The funds were paid to all the farmers qualifying to that solution, regardless of what they are going to produce. They may also produce nothing. However, obtaining the aid depends on meeting certain agronomic criteria as well as environmental protection criteria, so-called "cross-compliance". Member states could have decided to introduce the SPS within two years. However, the system had to start operating no later than on 1 January 2007 (Krzyżanowski, 2008).

In most cases, the level of payment is based on the actual amount of payments for each farmer, received in the reference period of 2000-2002. For each member state (including for the new members), from 2005 there were specified the maximum annual amounts of aid.

The payment rates for farmers resulting SPS are specified by dividing the amount of payments from three years by the surface area entitled to payment – also from three years. The entitled area also includes the fodder area.

Therefore, assuming that a farmer that only produces crops, cultivated 100 ha of wheat, getting the yields of 6 tons per hectare, its payment was: 100 ha x 6 tons x 63 EUR per 1 ton, i.e. EUR 37 800 - currently that is the amount it will receive for its farm, or, in other words, after dividing the amount by the size of the cultivated area, EUR 378 per each hectare.

The provisions of the reform of 2003 (Krzyżanowski, 2015) regarding the modifications of the existing instruments of the Common Agricultural Policy, included the provision on evaluation of that Policy (health check) in 2008.

The assessment also set the directions for future changes in the Policy (after 2013). The objectives of the Policy were supplemented with the "new challenges", associated with climate changes, renewable energy, water management, biological diversity, accompanying measures, restructuring of the milk industry, and innovativeness in the scope of the first four tasks. What was significant for the discussion of the future of the Common Agricultural Policy, was also the obligation of the European Commission and Council to analyze the problem of the high diversity of direct payments in the EU and to present the suggestions for suitable changes.

During the meeting of the EU Agriculture and Fisheries Council on 18-20 November 2008, there was adopted the final agreement following the discussions within the Health

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[2] Under the findings of the GATT Uruguay Round, the payments per hectare of crops or per animal, are eligible as "blue box" subsidies, and are conditionally not subject to reduction. The resources for the development of rural areas are excluded from the obligation to reduce them without any limitation, and are classified as the so-called "green box".

Check (Sprawozdanie, 2008). The result of the Health Check was the adoption of the legal documents modifying the basis of functioning of the Common Agricultural Policy:

The method of converging direct payments among the member states (when negotiating the Common Financial Framework) was also determined. In the member states with the direct payments per hectare below 90% of the average EU level, the difference between the current level of payments and 90% of the EU average is to be reduced by one third. That process will be conducted gradually, from the 2015 financial year until the 2020 financial year. Eventually, all the member states are to achieve the level of payments of at least EUR 196/ha (at current prices). The above convergence will be financed by the countries in which the direct payments are higher than the EU average.

Generally speaking, in the EU there are currently operating two payment systems: Basic Payment Scheme (**BPS** – the former name SPS) and Single Area Payment Scheme (**SAPS**).

The **Basic Payment Scheme (BPS)** is used in the EU-15 states and in Croatia, Malta and Slovenia. The new system consists of the mandatory elements that a member state must implement, as well as voluntary elements, the application of which depends on the decision of the given state.

The **Single Area Payment Scheme (SAPS)** is the simplified system of direct payments applied by all the states that joined the European Union in 2004 or later, except for Croatia, Malta and Slovenia. That system does not have entitlements to payments. The rate of the uniform area payment is calculated by dividing the annual domestic financial envelope, specified for each state, by the area of eligible lands. In the SAPS system, it is possible to apply the same types of payments that are applied in the basic payment system.

Direct aid for plant production in the USA

As regards the aid for plant production, the 2014 Farm Bill repeals the direct payment program, thus ending almost the period of almost 20 years of (annual) payments. Those payments were calculated on the basis of the eligible number of acres and output from 1 acre, so in the same manner as in the classical system of the European Union from the beginning of 1990s. The Bill also repeals two other programs associated with direct payments, i.e.: the previous countercyclical payments (CCP) which were also based on historical values (base acres and output), but their payments depended on the current pricing condition, and the ACRE instrument (Average Crop Revenue Election) which allowed payments to be paid to the agricultural producers after their revenues dropped below a certain reference level (average value of production from 5 years and the average value of prices from 2 years).

Instead of those, chapter I of the Bill includes two new programs supporting plant production (which, in fact, still operate on the basis of countercyclical payments, but with slightly different rules):

Price Loss Coverage (PLC) and the Agriculture Risk Coverage (ARC) which is going to operate together with the previous Marketing Assistance Loan Program.

The beneficiaries that want to make use of those programs, must be active agricultural producers, meet the specified limits of Adjusted Gross Income (AGI), i.e. USD 900,000 of revenues in total, from agricultural and non-agricultural operations, and may not receive the payments over the specified upper limit of USD 125,000 per farmer, but the spouse may receive the additional aid in the amount of USD 125,000 (that limitation applies to all the payments received).

Current aid instruments

Price Loss Coverage (PLC) – agricultural producers who possess the so-called base acres for the selected species of arable crops: wheat, fodder crops, rice, oleaginous plants, peanuts as well as selected species of high-protein plants are entitled to benefit from the program. The payments are made when the market prices drop below the reference price specified in the 2014 Farm Bill. As a rule, the payment rate is specified on the basis of the difference between the reference price and the annual domestic average market price. The rate is then multiplied by 85% of the number of base acres of the given crop. The reference period for calculating the base acres is 2009 – 2012, and for the reference prices 2008 – 2012. It is The arable species which were selected, apply during the whole period of effectiveness of the bill (5 years as a rule). Should the farmer also grow fruits, vegetables or wild rice, these areas are deducted from the surface area eligible for aid.

Example (Charakterystyka …, 2016):
The farm has 350 acres[3] of corn.
The reference price specified in the Farm Bill is 3.70/bushel[4]
Average price - business year (Marketing Year Average): USD 3.40/bushel
Yield: 160 bushels/acre
The difference between the reference price and the average price for the current business year
3.70 $ - 3.40 $ = 0.3 $/bushel
        0.3 $/bushel x 160 bushels from acre x (85% x 350 acres) = 14280 $
In the PLC system, the payment is then **14280 $**

Agriculture Risk Coverage (ARC) – that program has two different administrative levels: county level and individual farm level. The species eligible for aid are the same as in the above PLC program. Just like in the program above, a farmer chooses which of its products are to be covered by aid, and the decision made applies during the whole period, i.e. 5 years.

Table 1. Agricultural Risk Coverage at county level

Year	Corn	
	Yield in bushels per county	Average reference price for the given year
2009	183.0	3.70
2010	180.4	5.18
2011	165.7	6.22
2012	156.7	6.89
2013	185.0	4.50
5-year average	176.4	5.3
benchmark revenue	5.30 x 176.4 = 935 $/acre	
Guaranteed level of ARC-County	935 $ x 86% = 804 $/acre	

Source: (Charakterystyka …, 2016).

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[3] 1 acre = ca. 0.4 ha.
[4] 1 bushel of soy [bu] = 60 pounds[lb] = 27.22 [kg], 1 bushel of corn [bu] = 56 pounds[lb] = 25.40 [kg].

Aid at county level:

The aid is applied when the level of income from the given production (calculated as the product of the actual average yield per county and the domestic farm gate price) drops below 86% of the guaranteed reference point (calculated by multiplying the 5-year average yield a given county and the 5-year average of the domestic price or reference price in the given year, depending on which value is higher for each year; the borderline values are excluded from the calculations). Then, the level of aid for a farm is calculated as the difference between the above results and the current income per acre (but the level of payment from the given crop may not exceed 10% of the benchmark revenue), and is multiplied by **85%** of the area of eligible acres in the farm. Should the farmer also grow fruit, vegetables or wild rice, the payment is reduced on the basis of the acre-by-acre rule.

The projected price for the current year is 3.9 $/bushel, and the average yield in the county is 189 bushels/acre i.e. the current level of income in the County is 3.9 $ x 189 bushels/acre = 737 $ per acre.

Calculation of the level of payment within the ARC-County system

It is the difference between the guaranteed level of ARC- County and the current income in the county (804 $ - 737 $= 67 $/acre). However, it should be borne in mind that the aid may not exceed 10% of the benchmark revenue, i.e. 10% of 935 $, i.e. 93.5 $/acre. In this case the limit is not exceeded, so the result is 67 $/acre. The aid for a farm with 330 acres of corn is as follows:(area x 85%) x calculated payment level, so (85% x 330 acres) x 67 $ = 18 793.50 $.

Aid at farm level(ARC-IC):

That type of aid is provided in the case when the actual income from the crops covered by the aid system is lower than the reference income for that farm. The current income of a farm is calculated on an annual basis. The ARC-IC guarantee for an individual farm constitutes 86% of the individual ARC-IC benchmark revenue**.** The benchmark revenues is the 5-year average income obtained from each production in the farm, calculated as the ratio of the cultivated area to the total area of the farm covered by the aid system, and then added up (explanation in the example below). The actual revenue is determined, based on the farm yield, multiplied by the maximum domestic price for the given business year (specified in the 2014 Farm Bill). The individual aid level is calculated as the difference between the benchmark revenue and actual revenue (but its value may not exceed 10% of the individual guaranteed benchmark), and then multiplied by **65%** of the eligible base surface area of the farm. Should the farmer also grow fruit, vegetables or wild rice, the payment is reduced.

Example (Charakterystyka …, 2016):

The farm has 350 acres of corn and 235 acres of soy (585 acres in total).

The reference price of corn was specified in the bill at 3.50 $/bushel, and 8.40 $/bushel for soy.

Table 2. Calculation of the benchmark revenue and guaranteed level of ARC-IC

Year	Yield (in bushels)	Average price for business year	Revenue in $
		Corn	
2009	195.0	3.70	722
2010	184.7	5.18	957
2011	178.0	6.22	1179
2012	154.0	6.89	1015
2013	189.5	4.46	845
5-year average revenue			944 $
benchmark revenue	350:585 = 0.6 corn (944 $*0.6) + soy (572*0.4) = 795 $/acre		
guaranteed level of ARC-IC	795 $ x 86% = 683 $/acre		
		Soy	
2009	50.5	9.59	484
2010	42.6	11.30	481
2011	49.5	12.50	619
2012	46.4	14.40	668
2013	46.8	13.00	608
5-year average revenue			572 $
benchmark revenue	350:585 = 0.6 corn(944 $*0.6) + soy (572*0.4) = 795 $/acre		
guaranteed level of ARC-IC	795 $ x 86% = 683 $/acre		

Source: (Charakterystyka …, 2016).

Calculation of the level of payment within the ARC-IC system is as follows: is the difference between the guaranteed level of ARC-IC and the current revenue in the farm, i.e. 683 $ - 579 $ = 104 $/acre. However, it should be borne in mind that the aid may not exceed 10% of the benchmark revenue, i.e. 795 $/acre i.e. 80 $/acre. Therefore, in this case the maximum value of 80 $/acre must remain. That is why the calculation of the aid per farm is as follows:

(area x 65%) x calculated payment level, i.e. (65% x 585 acres) x 80 $/acre = 30420 $.

Table 3. Calculation of current revenue of a farm

Product	Area of crops in acres	YieldOutput in the farm	Current domestic price in the given business year	Revenue per acre
Corn	350	192	3.4	653
Soy	235	47	9.95	468
current revenue of the farm	(653*0.6) + (468*04) = 579 $/acre			

Source: (Charakterystyka …, 2016).

The **Marketing Assistance Loan Program** allows to obtain a loan on the basis of the non-recourse rule, addressed to the producers of wheat, corn, sorgo, barley, oats, cotton, long- and medium-grain rice, soy and other oleaginous plants, peanuts, wool, honey and other goods. Those loans apply in the postharvest period, when the market prices of agricultural products are usually lower. The eligible goods are submitted by the farmer as a collateral, and the loan may be granted for the whole period, until the moment of selling the goods. The repayment may occur at the moment when the price of the given goods rises appropriately, or, if the prices stay at a low level, the farmer may repay the loan at reduced price based on the quantitative equivalent at which the loan was obtained (so the current "low" market price will apply).

Similarities and differences between the systems. Conclusions

Both the previous and current payments systems in the USA, just like the system applied in the European Union, were based on the historical values of eligible areas and yields. In the EU, the third element taken into account in the calculations is the payment rate, while in the USA – the price differences.

Let's start from the crop level. The payment rate was specified for one produced ton, so it should be determined what is its amount for one unit of production area. In the first years of operation of McSharry's reform, the calculations took into account the average yields of cereals in the European Union. However, several years later the decision was made to reward higher production output in individual EU countries and, under Council Regulations 1251/99 and 2316/99, the European Union switched to application of the domestic yields from the years 1986/87 – 1990/91, i.e. from the so-called reference period (Kowalski 2001). That is why those yields were called "reference yields". After the 2003 reform, the so-called regional payments were introduced and regional yields were implemented into calculations. According to the Farm Bill, in the United States the yield in bushels per acre is determined both at the level of farm and county.

As stated above, the EU calculations of payments take into account their rates per 1 ton or 1 ha of cultivated area. In fact, that level results (it's initial level) from the price differences, just like in the USA. In the EU it constituted the difference between the target (global) price and the market price, but in the United States it was the difference between the reference price specified in the Farm Bill (so also a kind of target, preference price) and the market price.

Unlike in the USA, in the EU there is no maximum level of payment per farm, but the highest payments are subject to a 5% reduction; besides, a given country, e.g. Poland (limit of EUR 150,000 per 1 hectare) may introduce limitations on payments itself.

Furthermore, in the EU there is no limit of the surface area eligible for payments. In the USA, the yields are determined for a given county, which results in a much greater diversity of payments than in the European Union.

Generally speaking, the American system is more complicated than the "EU" system, but it may provide the farmers with funding from several programs. It means, which is presented in several publications (Momagri, 2012; Farm Bill, 2016) that an American farmer is not less subsidized than his European counterpart.

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The Role of Government in the Housing Market

Abstract. Nowadays one of the most intensely debated subjects in economics is government intervention in real estate market. Proponents of the free market system assert that government intervention should be strongly limited still others assert there are well-grounded reasons for government intervention. In this article the most common methods and forms of government intervention in real estate market such as legislation, subsidies, taxation, zoning, rent control, minimum and maximum price policies, licensing of market participants, transaction costs and procedures, banking system, restrictions on the involvement of financial institutions in real estate market have been observed.

In practice, each government uses these intervention methods with the choice of method depending on factors such as the political slant of the government, the levels of economic and institutional development, et cetera. Some countries even issue residence permit and citizenship foreigners who invest in the housing market. We find government intervention necessary, given the unique characteristics of real estate and the role that it plays in economic and social progress.

Key words: housing markets, government intervention, subsidy, taxation, renting, transaction costs and procedures

Introduction

Once something that is vital to everyone becomes expensive, people will complain. There are not many things, however, that are vital to everyone, yet people will complain both when they are becoming too expensive and too cheap.

Real Estate is probably one of those, with well-founded causes. On the one hand, homes are significant for everyone, so when they become unaffordable, people are starting complain. On the other hand, when home prices get cheap, those people who bought houses at the top of the market will be suffered.

Banking crises in Sweden, Spain, Finland and Japan in the early 1990s have been triggered by the problems risen in the housing markets of these countries. Moreover, in 2007, due to the problems risen in the USA mortgage market the four-year global financial and economic crisis rose with the consistent recession of real estate and financial assets. All these crises have been caused by the lack or inappropriate government intervention and regulation in the housing market.

Government policy and intervention is one of the key factors that drive the housing market. In general terms, there are four types of government intervention 'Market Shaping',

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'Market Regulation', 'Market Stimulation' and 'Capacity building' (Tiesdell and Allmendinger, 2005). Different types are used by different countries frequently unique-to-that-country to intervene and the housing market.

    The main aim of this research is to determine the role of government and the measures that they take, which affect the housing market. For that purpose, the following objectives have been set and resolved:

✓ Examine and state the role and importance of real estate in the economy, society and environment,

✓ Examine and analyze the existing methods and instruments through which governments regulate the housing market,

✓ Determine the role of government in the housing market.

    We find it needful to state the importance of real estate to the economy as well as society in this article, considering the unique economic and physical characteristics of real estate, which set its market apart from other markets and make government intervention and regulation a necessity.

    In this article have been used scientific works, scientific approaches and analysis of Polish and foreign researchers and authors, information materials and data published by various international organizations, as well as by central banks and national statistical offices.

The role of real estate in the economy, society and environment

    By studying real estate market of numerous developed countries, following tendencies can be drawn:

1. The work that has been done by previous generations piles up sequentially in the real estate objects (buildings, houses, built-up areas) providing a decent level of life nowadays as well as in the future. Eventually real estate is one of the few goods, which can meet also non-physical needs. For example The Great Pyramid of Giza (Egypt), The Coliseum (Italy), Leaning Tower of Pisa (Italy), The Taj Mahal (India) and so on. These man-made structures, besides meeting practical demands, apparently are exhibiting the level of development of a particular country. It is estimated that real estate with its different types constitutes approximately half the world's accumulated wealth,

2. Real estate market is a unique mechanism for stimulating economic growth of a country as initial investments of the main portion of means is made in real estate market which in turn generates qualitative changes of supply and demand and provides positive macroeconomic dynamics of development,

3. Being as the base of human and society's vital activity, real estate is a special object of market turnover, ownership and management,

4. Real estate has also a huge social role: normal activity of real estate market always gives a positive social outcome, especially the housing sector, which is primary in terms of consumption.

    The real estate sector's share in the GDP in the United States is around 11-12%, in Japan 8-10% and in Poland, it is estimated 6-8%. In terms of employment, the real estate sector engages about 8.1% of the labor force in the USA, in Great Britain 6-8% and in Poland 5-6% (Kucharska-Stasiak, 2006). Moreover, housing is not only creating jobs in the housing industry but also to the industries related to housing, such as industries producing building materials and housing equipment.

Table 1. Housing cost overburden rate by tenure status, 2014 (% of population)

	Total population	Owner occupied, with mortgage or loan	Owner occupied, no outstanding mortgage or housing loan	Tenant — rent at market price	Tenant — rent at reduced price or free
EU-28	*11.4*	*7.4*	*6.8*	*27.1*	*12.7*
Euro area (EA-18)	*11.4*	*7.5*	*5.6*	*26.2*	*11.7*
Belgium	10.4	3.1	1.8	38.1	13.3
Bulgaria	12.9	9.3	11.3	40.8	17.9
Czech Republic	10.5	8.3	6.2	29.9	7.0
Denmark (¹)	15.6	5.2	7.1	32.9	:
Germany	15.9	11.3	9.6	23.1	16.6
Estonia (²)	7.2	9.2	4.8	25.6	10.4
Ireland (²)	4.9	1.4	1.7	17.8	6.8
Greece	40.7	29.2	37.6	55.8	47.5
Spain	10.9	9.0	2.8	47.5	10.8
France	5.1	1.1	0.7	15.8	9.3
Croatia	7.5	21.0	6.2	41.3	7.7
Italy	*8.4*	*5.6*	*2.9*	*31.9*	*10.2*
Cyprus	4.0	6.0	0.7	19.3	1.3
Latvia	9.6	15.2	8.2	15.1	9.7
Lithuania	7.1	6.8	6.4	37.3	9.2
Luxembourg	6.8	0.7	0.9	26.3	8.2
Hungary	11.4	26.0	5.8	40.1	15.9
Malta	1.6	2.8	0.6	26.6	0.7
Netherlands	15.4	11.8	3.9	24.8	14.0
Austria	6.6	1.8	2.6	15.6	6.8
Poland	9.6	18.0	8.0	25.5	10.9
Portugal	9.2	7.4	3.8	33.8	6.7
Romania	14.9	31.2	14.4	31.6	37.3
Slovenia	6.4	9.7	3.6	27.4	8.2
Slovakia	9.0	26.2	6.1	14.9	6.5
Finland	5.1	2.3	2.6	16.8	9.6
Sweden (¹)	7.8	2.9	5.6	17.8	60.7
United Kingdom	12.1	6.3	4.3	33.2	15.7
Iceland (²)	8.8	6.8	7.0	17.9	14.4
Norway	8.2	5.1	4.0	34.2	16.8
Switzerland (²)	10.6	5.6	5.1	15.2	9.2
FYR of Macedonia (²)	17.6	10.3	17.1	62.4	20.2
Serbia (²)	28.0	33.4	25.2	62.4	33.1

(¹) Tenants- rent at reduced price or free: unreliable.
(²) 2013.

Source: Eurostat (online data codes: ilc_lvho07c and ilc_lvho07a).

It is estimated that in Greece 40.7% of the total population spent more than 40% of their equivalised disposable income on housing. In the same year, the proportion of the population whose housing costs exceeded 40% of their equivalised disposable income amounted to 15.9% in Germany, 15.6% in Denmark and 15.4% in the Netherlands. In Poland, the above-mentioned proportion amounted to 9.6% (Table 1).

Most common methods and instruments through which governments regulate the housing market

Nowadays there are numerous methods and instruments by which governments intervene and take regulatory actions in order to affect real estate market. In this respect, the most common methods and instruments are:

Legislation

In accordance with its historical impacts and economic trends, each national Civil Code prescribes the concept of property diversely. Regarding European countries, land property comprises, except of the surface of the earth, buildings and constructions that are steadily attached to it, and extends to the space above and below it. Such regulations can be found in the Civil Code of Germany, Belgium, France, Switzerland, and The Netherlands.

Provisions of similar concept are prescribed in the Civil Codes of Greece, Spain and Portugal (Dimitrios Kitsakis and Efi Dimopoulou, 2013).

In the Czech Republic, the maxim "*superficies solo cedit*" ("*whatever is attached to land is part of it*") did not apply, as buildings were not considered as components of the land. However, the New Civil Code (effective since 1 January 2014) returned to the principle of "*superficies solo cedit*", under which, structures firmly conected to a plot are considered as part of that plot. The Polish Civil Code is consistent with the other Central European Civil Codes although it prescribes some special rights in rem (Kucharska-Stasiak 2006).

According to the Chinese Constitution and land laws, Property Law provides that land belong to the State and to the collectives without mentioning of rights of accession or any limitations to the vertical extents of property (The Law Library of Congress, 2015).

In some countries (for example Germany and The Netherlands), the vertical limits of land ownership extend "as far as the owner has no interest in opposing against it'', in others (such as Norway, Sweden, and Switzerland) as far as" private ownership has any economic interest to the owner of the surface property''. In France, Spain, Poland and Hungary the vertical extents of real property are subject to the laws and regulations pertaining to mines, water and air space. In the USA, the vertical limits, according to the Subsurface and Air Rights, extend up to 50 000 feet below the surface of land and not more than 1500 feet above the surface (Epley and Rabianski, 1986).

As an instrument, legislation can have not only a sizable impact on property demand and prices but also on social protection. For example, the Act to protect the rights of purchasers of apartments or family homes (Ustawa o ochronie praw nabywcy lokalu mieszkalnego lub domu jednorodzinnego) commonly referred to as the Act on Developers came into force in 2012. The Act imposes duties on developers to provide information, unifies the terms and conditions of development agreements, regulates prepayments of prospective purchasers for homes or apartments under construction and introduces specific legal mechanisms in the case of a developer's bankruptcy through closed-end and open-end trust accounts. Due to the lack of such kind of act, many homebuyers suffered and left without both money and home in early 2000, when developers got money from home buyers during construction stages and went bankrupt because of unfavorable economic conditions.

Taxation

Many governments intensely use housing subsidies in the form of taxation because it not only affects demand but also affect the way the possession whether to buy or rent.

Very stimulating were tax breaks and deductions for the construction sector introduced by Polish government in 1991-2004, which pertained to the construction of a building for rent, as well as the construction of own homes or apartments**.** In 1997, more than 1,190,000 people benefited from these deductions (Kucharska-Stasiak, 2006). The United States has plenty of tax deduction types, namely, Property Tax deduction from Federal Taxable Income, Mortgage Interest Itemized deduction, Tax Deductions for Rental Property Owners and so on. Forms of property tax used vary among countries and jurisdictions. Real property is often taxed based on its classification (residential, commercial, industrial and vacant). In Israel, for example, the municipality property tax rates are set double for vacant apartments versus occupied in the struggle against Jerusalem's vacant apartments, which are owned mostly by foreigners. In Croatia**,** there was not any property tax until 2013. All of the property owners paid just monthly

communality fees. However, that fee was replaced with property tax. The biggest difference between them is that the communality fee was paid considering the size of the property and Property tax are charged considering the property value.

Subsidies

Government intervention in property sector implemented through subsidies is important in:

I.   Improving public health facilities;
II.   Improving fairness, quality and social balance;
III.   To overcome inefficiency in the housing market.

Nowadays in the USA, there are three subsidy programs Federal Housing Administration (FHA) loan, Rural Housing Services loan or the VA loan, which is a loan for veterans or their spouses (provided they don't remarry) without any downpayment.
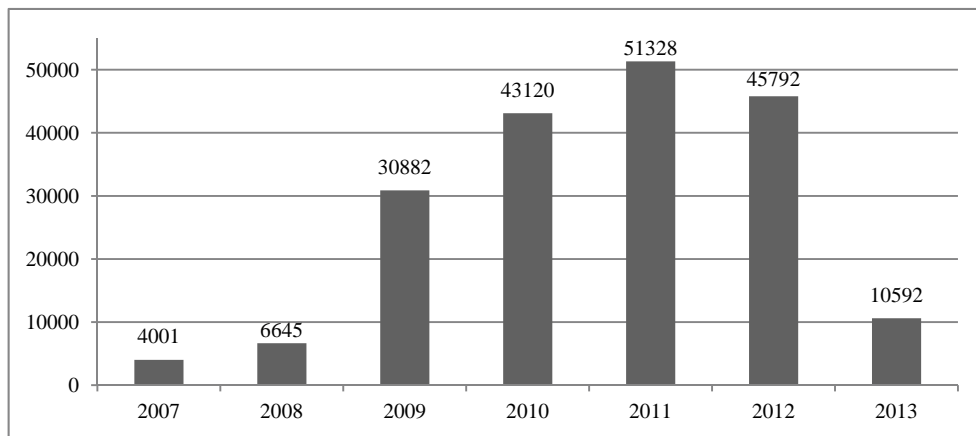
Fig. 1. Number of loans granted under Families on their Own program

Source: Bank Gospodarstwa Krajowego.

In 2006 Government subsidy program Families on their Own (Rodzina na Swoim) was introduced in Poland. Initially this program was not so effective, moreover it affected real estate market negatively (too low price limits per meter square disqualified the majority of new properties). However, later, by being subjected to continuous amendments in terms of price, cost, age and other parameters, the program boosted the real estate market (Trzebiński, 2015). In 2014, the program has been replaced by Apartments for Youth (Mieszkanie dla Młodych or MdM) program. This program aimed to help families by subsidizing home purchases particularly in the lower end market.

Banking system

Governments affect the housing market through quantitative and qualitative methods of control such as minimum reserve requirements and the refinancing rate. They also limit or expand the availability of mortgage loans by using two types of limit: loan-to-value (LTV) and loan-to-income (LTI). The first one based on the ratio of the loan to the price of the house and the other one based on the ratio of the loan to the income of the borrower.

Before 2008, In Poland the LTV ratio for natural persons almost in all banks was 100%. In 2008, the ratio has been reduced up to the level of 65-80% (Trzebiński, 2015). In 2014, 50.07% of new loans granted had LTVs over 80%, 36.87% between 50-80%, 9.32% between 30-50% and 3.74% below 30%.

In the same year in Italy and Sweden, the ratio on residential mortgage loans was 67%, 76% in Germany, 75% in the United Kingdom and 60% in Spain. The Dutch LTV-regime for mortgages was one of the most stringent in Europe. The maximum LTV was set –by law– at 104 percent (European Mortgage Federation, 2015). The average loan to value ratio in the United States in the fourth quarter of 2015 varied between 43.6% in Hawaii up to 71.6% in Arkansas (Statista, 2016).

Zoning

Generally, local governments designate diverse zones for different uses of land, such as agricultural, commercial, industrial and residential. In that regard, in terms of land-use planning systems in the United States and Europe there are many differences. In Europe, a greater mix of uses in residential zones can be found compared with the United States. For instance, in Germany, a residential zone can include offices, cafes, stores and apartment buildings. Yet, single-family residential zones in the United States in most cases forbid those uses. Zoning in Germany also occurs for smaller land areas (almost at the block level) than in U.S. cities, where zones are much larger. Governments also use zoning in order to designate the types of buildings that can be erected in a particular area through imposing restrictions on the maximum height, density and other parameters of buildings.

Imposing restrictions on the involvement of financial institutions or intermediaries in real estate market

The countries in which there was not adequate oversight of the flow of financial means to the real estate sector and where the banking system in an uncontrolled way got involved in the financing of real estate market ended up with banking crises. The vivid examples are banking crises in Sweden, Spain, Finland and Japan in 1990 (by the way Sweden crisis conditions were the same as in the USA in 2007) and 2 banking crises in Mexico (1982-1984 and 1994-1996). All these banking crises were caused by excessive involvement of this sector in real estate market. Nowadays most states impose quantitative or/and qualitative restrictions on investing abroad, in derivatives, in mutual funds, in private equity and in real estate for insurance companies and pension funds, taking into account that although they are private they have a key social role. In France, the share of real estate in the investment portfolio of an insurance company may not exceed 40%, In Germany 25%, in Poland in MBS (Mortgage-Backed Security) and real estate must not exceed 25%, wherein the share of investments in one property may not exceed 5% of an insurance fund (Kucharska-Stasiak, 2006). By contrast, UK and US rely on "prudent person rules" and do not impose any restrictions.

Licensing of market participants, transaction costs and procedures

It takes an average of 95 days to complete all the four procedures needed to register a property in Germany. Registration of real estate purchase in Poland usually takes 33 days and there are 6 procedures to complete, in France it takes up to 58 days and there are 8 procedures. In the USA, specific procedures vary from state to state, as well as between

cities. For example completing all the four procedures in New York City takes 12 days. In this respect, in the Nordic countries (Denmark, Finland, Iceland, Norway and Sweden), notaries do not exist, moreover, Sweden and Norway is the only countries with only one real estate registration procedure. It takes an average of one day to complete the single procedure needed to register property in Norway (Global Property Guide, 2015).

Rent control, minimum and maximum price policies

Some governments formed a common culture of renting for accessing accommodation, through making renting much more convenient and cheaper than buying. In this aspect, the best example is Germany, where homeownership rate is quite low (It was 52.4% in 2014) (Figure 2). However, Germany shows that owner occupancy is not a decisive factor to any healthy economy. In Spain, around 80% of people live in owner-occupied housing, but unemployment was 24.5% in 2014. While in Germany, it was 5% (Eurostat, 2016). Unlike high-homeownership countries like Spain, Ireland and the USA, Germany does not let homeowners deduct mortgage-interest payments from their taxes. German rental market is heavily regulated and these regulations are quite advantageous to renters. For example, German law, which allows state governments to cap rent increases at no more than 15% over a three-year period (Bloomberg, 2013).
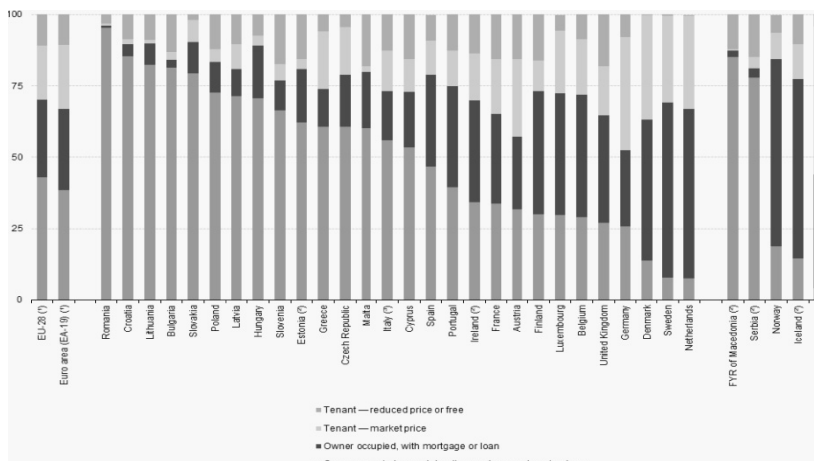
(¹) Estimates
(²) 2013
(³) Provisional data

Fig. 2. Distribution of population by tenure status, 2014 (percentage of population)

Source: Eurostat (online data code: ilc_lvho02).

Some countries, such as Malta, Spain, Greece, Cyprus, et cetera, even boost demand in the housing market through issuing residence permit and citizenship foreigners who invest in property (apartment or house). In this regard, the cheapest and easiest option offers Latvia. The minimum real estate investment is EUR 250,000 plus a 5% State fee on the purchase price (OECD, 2015).

Conclusion

Government plays a crucial role in stabilizing and developing the housing market. State intervention is necessary, taking into account the following factors:

➢ Real estate has a huge social role, especially the housing sector, which is primary in terms of consumption.

➢ Real estate is very capital-intensive.

➢ Disequilibrium is an intrinsic feature of real estate markets given the delay in supply response to demand and the relatively slow rate of change of demand.

➢ Continuous population growth and the limited availability of the land resources for human settlements, which require prudent and wise spatial planning and management by government.

Nevertheless, there does not exist a universal, ideal, accurate and standard method of real estate market regulation. Each state, taking intervention actions, should consider comprehensively the following:

▪ The unique economic and physical characteristics of real estate, that set its market apart from other markets.

▪ Socio-economic, Demographic and Geographical factors.

▪ The degree of economic interventionism (as huge doses of government intervention negatively affect the real estate market).

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Arrivals of Foreigners to Poland with Particular Emphasis on Visitors from Outside the Schengen Area – Characteristics and Prospects for the Future

Abstract. Poland is very popular among foreigners. Tourism is an important part of the Polish economy. The share of tourism in GDP remains at a level of 5-6%, with employment estimated at approx. 760 thousand. People (4.7% of the total workforce), with approx. 170-200 thousand. People are employed in activities related to accommodation and food service. Proceeds from the arrivals of foreigners goes back to the year 8-9 billion euros, of which about half is the proceeds of arrivals of foreign tourists. The aim of the article is to present the characteristics of arrivals of foreigners to Poland, with particular emphasis on visitors from outside the Schengen Area. On the basis of statistical data I analysed arrivals of foreign tourists to Poland and presented the changes in the structure of those arrivals. The article also shows the diversity of tourism revenue in the period considered. For this purpose a method of "Desk Research" based on data from Central Statistical Office, Institute of Tourism, Ministry of Sport and Tourism. The article also includes the perspective of the development of inbound tourism. The article presents the results of research conducted in October 2016 in Kiev among 152 respondents. The aim of the study was to collect the information on the attractiveness of Poland for Ukrainian visitors. Convenient sampling method was used to select the survey participants. Diagnostic survey method was used in the study and the direct technique was an interview without previously prepared questions. The results confirm that Ukrainians are willing to visit Poland.

Key words: arrival, Poland, Schengen, tourism

Introduction

Tourism is a key component of the development of every region in a given country. Globally, tourism is a very important, developing sector of the economy. In Poland it is still developing and becoming more and more valued. All changes in tourist movement, tourists' expectations and requirements regarding the type of the trip are undoubtedly consequences of the shift in lifestyle and consumption models. Such factors contribute to the change of the form and type of the tourist movement. Developing tourism is of great importance to the entire country. Tourism contribution to GDP rose from 4.7% in 2011, to 5.6% in 2015. Expenditures by foreign visitors also rose, from €7.6 billion in 2011 to €12.9 billion in 2015. (Turystyka 2016).

The market of tourist services is subject to constant change under the influence of various pulses from the international environment, as well as factors resulting from the specificities of national, regional and local. The impact of these factors is reflected both on the supply side, ie. The operation of companies in this sector, and demand, that is, the client or customer of tourism services (Zdon-Korzeniowska, Rachwał, 2011). Tourism

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development is a process whose effects can be observed in many areas: economic, social, political, ecological (Przecławski, 1996).

The World Tourism Organization (UNWTO) in relation to a given country distinguishes the following forms of tourism:
- National: travel residents of their own country;
- Inbound: arrivals to the country people constantly living abroad;
- Outbound trips of inhabitants of a country abroad (Cymańska-Garbowska, Steblik-Wlaźlak, 2014).

The potential of the tourism sector in Poland is not being used to its full potential. The reasons for this are, among others, poor (albeit improving) accommodation and dispersed tourist offer, concentrated on traditional products. What is more, an innovative approach to tourism and its products, manifesting itself in the implementation of innovation in the service provision system, the creation of new, innovative products, or utilising the results of cooperations and synergies in order provide tourist services is not sufficiently developed. The cooperation of the organisations and companies of this sector in the development of new products and services and in the implementation of developing projects is not sufficient. Tourism enterprises, which are mainly small and medium-sized, as most companies of this type that are suffering from insufficient qualifications of employees and limited possibilities of the development needs being financed. One effect of these weaknesses is a high level of seasonality of the sector. All mentioned factors restrict individual companies, institutions, and organisations, as well as entire regions, from becoming more efficient in the use of existing resources. These weaknesses are even more conspicuous in the light of changes occurring in tourism around the world. (Program 2015)

Despite the above problems, tourism in Poland has large potential for development. An important feature of the development of tourism is the activation of regional potentials and specialisations based on tourist services and sectors associated with tourism. When it comes to the competitiveness of tourism, Poland was ranked 42 (out of 140 countries) in "The Travel & Tourism Competitiveness Report 2013". It is 7 places higher than in 2011, when Poland ranked 49 (out of 139 countries). It was also a much better result than in 2009, when Poland ranked 58 (out of 130 countries). In the report, a synthetic indicator of the competitiveness of the tourism industry was analysed. It consisted of 14 components: the tourism policy, sustainable development, safety, healthcare and sanitation, tourism as a country's priority, air transport infrastructure, road transport infrastructure, telecommunication and tourist infrastructure, price competitiveness, human resources, approach to tourism, natural and cultural resources. The report clearly shows that Poland is competitive due to its tourism potential in the form of anthropogenic and natural attractiveness (respectively 18th and 66th place). Poland was also rated positively in terms of sustainable development of tourism (37th place), quality of human resources (32nd place), and telecommunication infrastructure (41st place). The authors of the concept and methodology of creating the tourism competitiveness index stress that the ranking of countries developed as a part of the index is positively (and pretty highly) correlated both with the number of tourist arrivals of tourists and tourism revenue of individual countries (Program 2015).

Poland thanks to its location is an attractive transit country between East and West and North-South. After the geopolitical changes that have occurred in Central and Eastern Europe in 1989-1991, increased rank axis linking in a latitudinal countries of Western and Central Europe with the countries of Eastern Europe. Special importance Poland's eastern

border, the more that since 1999 it has become the eastern border of NATO, and since May 2004. - Eastern border of the European Union. This leads to a much greater interest in the eastern Polish frontier by both state authorities and local government administration (Ruszkowski 2014).

Poland's entry into the Schengen Area in 2007 made it more difficult to travel to Poland from countries outside the European Union, especially from Russia, Belarus and Ukraine. After 2009 Poland again become a popular European tourist destination, noting a steady increase in the number of tourists. Because of Poland's entry into the Schengen Area, its eastern border has become the outside border of the European Union. In order to facilitate the movement of people in border areas, in 2009 and 2012 the agreement on local border traffic (MRG) between Poland and Ukraine and Russia entered into force. Between 2009 and 2013 local border traffic for Poland was about 23.6 million people.

According to the latest data of the World Tourism Organization (UNWTO) the international tourist movement in 2015 was 4.4% higher than a year before. Over 1.184 billion people travelled abroad - it is about 50 million more than in the previous year. It is the sixth consecutive year, with an increase in the number of international tourists above the average.

According to the organization's data, last year almost all the regions of the world experienced growth in the number of visiting tourists. The biggest growth (+ 5%) occurred in Europe, the Americas and in the countries of Asia and Pacific region.

In Europe, which is the most visited region with more than half of international tourists in the world, the number of travellers in 2015 stood at 609 million and was about 29 million higher than in 2014. Tourists prefer to visit Northern, as well as Central and Eastern Europe (+ 6%) which has achieved much better results than in 2014, when there has been a decline caused Russia and Ukraine conflict.

According to the UNWTO forecasts for 2016 are also optimistic. It is expected that the increase in the number of international tourists may be slightly smaller than in the two previous years and it will reach about 4%. The largest increase is expected in the countries of Asia and Pacific region, in the Americas (+ 4% to + 5%), and in Europe (+ 3.5% to + 4.5%) (Międzynarodowy…, 2015).

Data and methods

To perform the analysis data from the following sources were used:
- Central Statistical Office,
- Ministry of Sport and Tourism,
- National Bank of Poland- other available publications and analyses.
For this purpose a method of "Desk Research" based on data from the Central Statistical Office, the Institute of Tourism, the Ministry of Sport and Tourism.

As a result of the conducted analyses the perspectives associated with the development of tourist movement were presented. The results of personal research carried out in Kiev in October 2016 on the group of 152 people were also used. The aim of the study was to collect the information on the attractiveness of Poland for Ukrainian visitors. Convenient sampling method was used to select the survey participants. Diagnostic survey method was used in the study and the direct technique was an interview without previously prepared questions.

Purposes and motives for arrival of foreigners in Poland

According to the estimates of the Ministry of Sport and Tourism, 77,737 million foreigners arrived in Poland in 2015. It is about 5.4% more than in the previous year. The number of tourists was estimated at 16,722 million (about 4.5% more than in 2014). The data were presented in table 1.

Table 1. The number of arrivals between 2014 and 2015, according to the country/group of countries (in thousands)

Country/group of countries	Total arrivals		Dynamics 2015/2014 (%)	Including tourists		Dynamics 2015/2014 (%)
	2014	2015		2014	2015	
Total	73750	77737	105.4	1600	16722	104.5
27 EU countries	56013	58971	105.3	11379	12003	2015.5
The Old EU	34659	36385	105.0	9397	9951	105.9
Germany	30260	31681	104.7	5743	6012	104.7
United Kingdom	862	949	110.1	664	753	113.4
France	572	599	104.7	427	456	106.8
Italy	444	476	107.2	398	425	106.8
Netherlands	487	521	107.0	399	430	107.8
Austria	432	447	103.5	355	369	103.9
Sweden	297	333	112.1	257	287	111.7
Other countries of EU-15	1307	1379	105.5	1154	1220	105.7
The New EU	21354	22585	105.8	1982	2052	103.5
Czech Republic	11374	11911	104.7	266	283	106.4
Slovakia	5769	6242	108.2	159	169	106.3
Lithuania	2605	2789	107.1	605	632	104.5
Hungary	257	274	106.6	208	221	106.5
Latvia	742	743	100.1	363	356	98.1
Other countries of UE-12	607	626	103.1	381	391	102.6
Neighbours from outside the Schengen Area	15605	16479	105.6	2888	2872	99.4
Ukraine	8732	10533	120.6	1072	1198	111.8
Belarus	4066	3606	88.7	811	801	98.8
Russia	2807	2339	83.3	1003	873	87.0
Important overseas countries	780	806	103.3	616	631	102.4
USA	508	556	109.4	394	429	108.9
Other overseas countries*	271	251	92.6	223	203	91.0
The rest of the world	1352	1482	109.6	1117	1213	108.6

* Australia, Japan, Canada, South Korea.

Source: Department of Tourism of the Ministry of Sport and Tourism, Warsaw 2015.

Most people arriving in Poland come from Ukraine. From 2014 to 2015 their number increased by as much as 20.6%. The situation is different when it comes to Belarus. The number of arrivals of people from that country decreased by more than 10%. In the case of Russia the decrease is even more significant and amounts to 16.7%. In Table 2 was presented the purposes of a visit to Poland. The main purpose is paying a visit (over 40%) followed by business trip (over 25%) and tourist trip (about 20%).

Table 2. The purposes of a visit (%)

The main purpose of a visit	Total		Germany		EU-14		New EU countries		Russia Belarus Ukraine		Important overseas countries	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Business	28.7	24.3	12.5	10.3	22.8	19.7	54.9	47.4	49.8	42.0	20.9	19.7
Tourist trip	18.4	22.9	13.6	22.4	24.1	26.7	22.1	24.8	15.2	15.7	28.4	29.3
Paying a visit	40.7	40.5	66.0	60.7	42.5	44.4	13.6	16.8	11.9	13.1	44.6	44.7
Transit	2.1	2.8	1.6	1.2	1.6	2.0	2.7	4.6	4.3	8.0	0.8	0.4
Shopping	4.4	4.5	1.8	2.0	0.6	0.4	3.5	3.6	16.8	18.9	0.0	0.0
Other purpose	5.8	5.1	4.6	3.5	8.3	6.8	3.2	2.7	2.0	2.3	5.1	5.9

Source: Department of Tourism of the Ministry of Sport and Tourism, Warsaw 2015.

The situation is different in the case of foreigners from Russia, Belarus and Ukraine. For these countries, work (about 50%) and tourism (over 20%) are the main reasons for visit. The next reason was shopping. It means that this group of foreigners is a chance for the development of tourism in Poland. Tourism, which is becomes more and more important purpose of visit, may be combined with shopping.

Table 3. Length of stay (%)

Length of stay	Total		Germany		EU-14		New EU countries		Russia Belarus Ukraine		Important overseas countries	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
1 to 3 nights	55.9	52.5	42.3	40.5	44.3	41.4	90.8	87.9	88.1	85.1	20.4	15.8
4 to 7 nights	31.1	31.3	45.0	44.2	38.5	35.3	6.3	9.4	8.1	10.2	22.9	29.9
8 to 28 nights	11.6	14.5	12.2	14.5	16.1	21.6	2.7	2.4	3.3	4.1	45.5	40.4
More than 4 weeks	1.3	1.7	0.4	0.7	1.2	1.7	0.2	0.3	0.5	0.7	11.2	13.8
Average number of nights	5.1	5.5	5.1	5.5	5.5	6.3	2.1	2.3	2.5	2.9	15.8	15.9

Source: Department of Tourism of the Ministry of Sport and Tourism, Warsaw 2015.

Table 4. Accommodation (%)

Place of stay	Total		Germany		EU-14		New EU countries		Russia Belarus Ukraine		Important overseas countries	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Hotels, motels	27.9	32.3	17.0	23.7	37.9	38.6	23.5	27.7	25.8	31.8	50.6	51.0
Family or friends	46.5	44.1	74.5	65.4	47.3	46.0	17.6	20.3	15.6	18.4	46.6	47.0
Bed & breakfasts	3.8	4.8	3.8	4.7	5.6	7.0	1.1	3.9	3.8	3.4	1.4	1.1
Private accommodation	2.5	3.7	1.0	3.4	2.4	3.5	5.2	5.7	4.2	4.5	3.4	3.4
Other	20.5	16.8	4.2	4.7	8.5	6.6	52.7	42.5	52.7	43.2	1.9	3.0

Source: Department of Tourism of the Ministry of Sport and Tourism, Warsaw 2015.

Table 3 shows the length of stay. The length of stay from 1 to 3 nights (over 50%) is dominating, followed by 4 to 7 nights (over 30%) and 8 to 28 nights (about 15%). The situation is different in case of visitors from outside the Schengen Area, here the length of stay ranging from 1 to 3 nights is the most common (over 80%).

Table 4 shows types of accommodation used by travellers Stay with friends or family (more than 45%) is the most popular, then hotels or motels (about 30%). The situation is similar in case of foreigners from outside the Schengen Area.

The amount and type of the expenditure of foreigners visiting Poland

The research from 2015 shows that the average expenditure of tourists visiting Poland stood at $446 per person (about 2% less than in 2014) and $69 per day of stay, which is about 4.9% more than in the previous year.
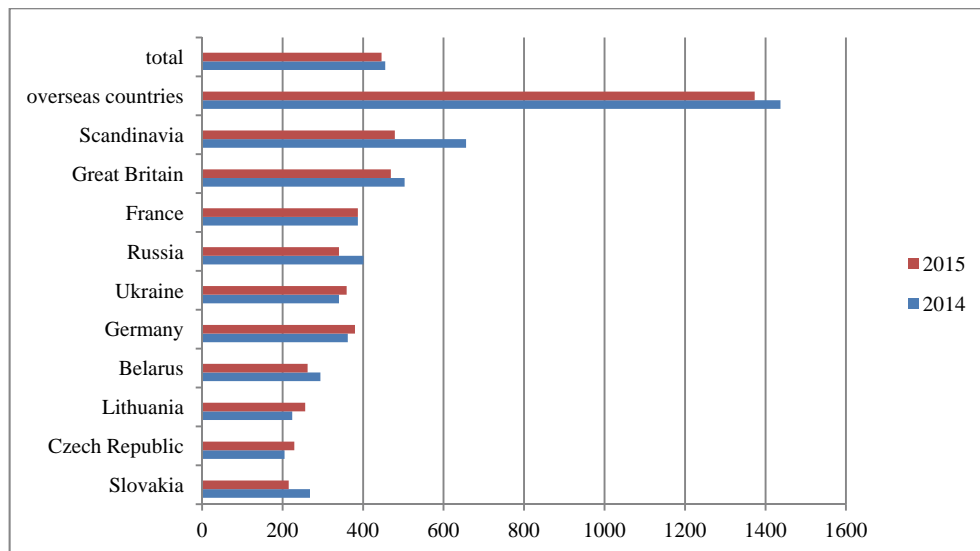
Fig. 1. The average expenditure per tourist in 2014 and 2015 in USD (by country)

Source: Department of Tourism, based on surveys conducted by GUS, MSiT, NBP.

Significant degree of variability is exhibited in the expenditure by country. It ranged from $215 (Slovakia) to $1373 (overseas countries). An increase in the average expenditure per person has been recorded in case of visitors from Lithuania (14.4%), the Czech Republic (11.6%), Ukraine (5.4%), and Germany (5.2%). There was a decrease in the expenditure of foreigners from Scandinavia (-26.9%), Slovakia (-19.7%), and Belarus (-10.8%).

Figure 2 shows the average expenditure of tourists per day of stay. In 2015 it ranged from about $41 (France) to $94 (Russia and Lithuania) and $88 (Belarus).

Since 2014 there has been a noticeable difference in the expenditure of visitors from certain countries. A significant increase in the expenditure per day of stay can be noted in

case of Germany and Lithuania (27%), and the opposite when it comes to France (decrease by over 10%) and visitors from outside the Schengen Area: Belarus, Russia and Ukraine.
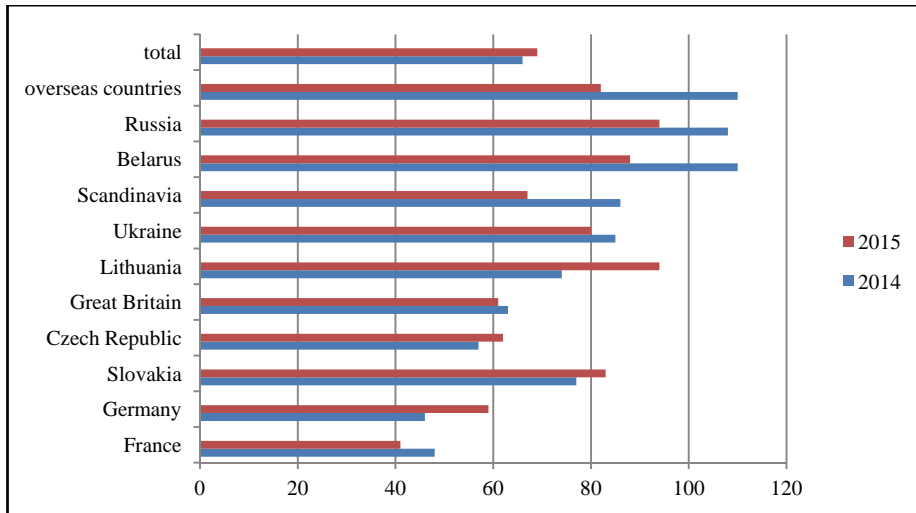
Fig. 2. The average expenditure of tourists per day of stay between 2014 and 2015 in USD (by country)
Source: see fig. 1.

The arrivals of foreigners in Poland have significant consequences for the country. These consequences can be studied from different angles: economic, logistic, sociocultural, ecological, demographic, political, aesthetic, psychological. (Rakowski, Teperek, 2009).

In the article mainly the economic consequences will be discussed. They come down to the following people crossing the border require the assistance of many different institutions in a given country (embassies, consulates, passport offices, tourist offices, hotels, guides).

In order to provide these services, it is necessary to train the staff which reduces the unemployment.

Another important element is broadly defined infrastructure (roads, motorways, etc.) and building of border crossings. Travellers require places to stay, eat and rest. For this purpose hotels, restaurants, swimming pools, and spas are build. New investments result in economic recovery and the demand for money appears. Visitors bring foreign currencies to our country and our citizens travelling abroad, take currency with them. It is important to keep the balance in our favour.

The results of personal research

The results of personal research carried out in Kiev in October 2016 on the group of 152 people were also used in this study. The study included 152 people who agreed to answer few questions regarding trips to Poland and their purpose, length of stay and accommodation. In this part I discuss the collected data. 89 (59%) respondents have visited Poland. The remaining rest (41%) have never been to Poland but say that they may visit Poland in future. Figure 3 shows the purpose of the Ukrainian visitor's trip to Poland.
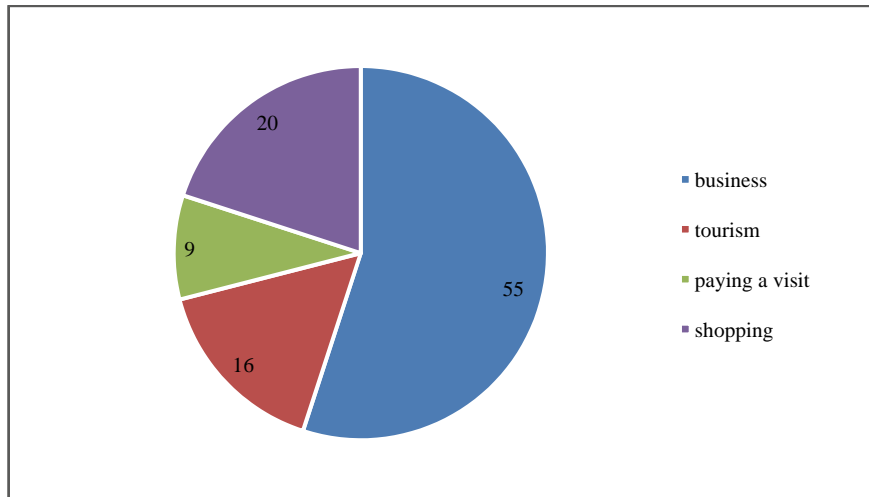
Fig. 3. The purpose of Ukrainians visiting Poland (%)

Source: Data collected personally.

Data presented in the chart shows that most visitors came to Poland to work (55%), next reason was shopping (20%), then tourism (16%), and paying a visit (9%). The collected data overlaps with a general trend in Polish inbound tourism. Among those who have not been to Poland so far (41%), 11 people (17%) stated that they already took steps to get a job in Poland.
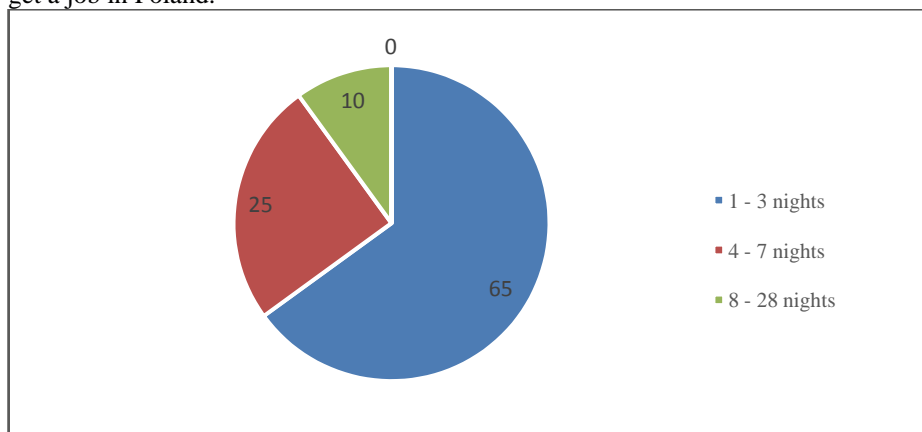
Fig. 4. The length of stay in Poland (%)

Source: Data collected personally

Most visitors stayed in Poland for a short time of 1 to 3 nights. The purpose of their visit was mostly business or shopping. A small group of visitors (25%) stayed for 4 to 7 nights and. These were mostly tourist trips with aim to visit cities such as: Warsaw, Krakow, Zakopane, or Tri-City. The smallest group of people (10%) came to Poland for a

longer period of time, ranging from 8 to 28 days. These were mostly were business trips. Those surveyed declared willingness to re-arrival to Polish. Most people indicated a desire to fulfill a tourist destination.

Future perspectives

Inbound tourism to Polish will develop. According to experts UNWTO in 2020, Europe will arrive 664 million tourists, the average annual growth in 2004-2020 is 3%, and the increase in 2004-2020 up to 60.4%. The largest increase in receipts from inbound tourism indicate countries: Latvia, Russia, Slovakia, Belgium, Sweden, Romania, Poland, Germany, Ireland, Ukraine and the Netherlands (UNWTO, 2006, 2007)

The development of travel and tourism according to the report Future Travelier tribes in 2020 will be determined by the following favorable trends (Bartoszewicz, Łopaciński, 2007):

1. The increase in world population to 8 billion in 2025 (1.5 billion over 20 years);
2. Increased global migration. Growing global migration increases the need for foreign travel. Many immigrants feel a strong connection with native countries, they have many reasons to return, visiting family or friends. The number of people who want to leave their country is increasing.
3. Globalization of business. The rapid growth in world trade leads to increased cross-border movement of goods, services and capital.
4. The globalization of travel and tourism. According to the WTO during the last fifty years, tourism has become one of the largest and most dynamic industries in the world.
5. The impact of the airlines on consumer behavior. The emergence of low-cost airlines has increased the opportunities to travel to these groups, which previously could not afford it because of the high costs.
6. Growing affluence. As satisfying the material needs of people begin to pay more attention to the very agreeable.
7. The development of technology will reduce the cost of travel.

Summary

In the article the characteristics of arrivals of foreigners to Poland were presented, with particular emphasis on non-Schengen.
The analysis shows that:
- In 2015 came to 5.4% Polish foreigners more than in the previous year, including in the case of the neighbors outside the Schengen 5.6% more;
- The main objectives of the arrivals were visits, business trips and tourism, in the case of the neighbors outside the Schengen business trips, tourism, shopping;
- Foreigners visited Poland mainly from 1 to 3 days (over 50%), from 4 to 7 days (over 30%); in the case of the neighbors outside the Schengen most (over 80%) decided to stay 1-3 days;
- Most people used for accommodation in motels and hotels and with family or friends.
As part of the study received their similar values.

The increase in the number of arrivals to the Polish in the coming time will depend on:
- A relatively good economic situation in countries that generate tourist traffic to Polish;
- Polish favorable image in the international arena;
- The availability of communication;
- Promotion of Polish arrivals to showing the magnitude of changes in the Polish tourist offer;
- Qualified staff who will implement innovative and modern management methods.

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Position of Polish Agricultural Production Cooperatives on the International and Domestic Market

Abstract. The historical as well as recent experiences show that in some countries and sectors cooperatives play a key role. The agricultural cooperatives are the organizations where farmers pool their resources in certain areas of activity. A fundamental differences between the agricultural cooperatives in develop countries and the CEEC exist. To add insight to the understanding these differences the paper presents some relevant, secondary data. Precisely, the purpose of the article is to investigate the position of Polish agricultural production cooperatives (APCs) on the domestic market and in comparison to cooperatives in developed countries. A main finding is that there is observed a phenomenon of decreasing number of APCs, poorly recognized brands, a relative small turnovers and market shares in comparison to agricultural cooperatives in developed countries.

Key words: agricultural cooperatives, turnover, market share

Introduction

Cooperatives play a prominent role in the agricultural sector, both in developed and developing countries (Tortia et al., 2013). The agricultural cooperatives, also known as a farmers' cooperatives, are the cooperatives where farmers pool their resources in certain areas of activity (Smith, 2011). Similarly to co-operatives in other sectors, they are organized according to fundamental principles and values, which are the following: voluntary and open membership; democratic member control; member economic participation; autonomy and independence; education, training, and information; cooperation among cooperatives; and concern for community (Majee & Hoyt, 2011). In addition, they are based on the values of self-help, self-responsibility, democracy, equality, equity, and solidarity. The benefits to members and to the community are both tangible and intangible (Zeuli & Cropp, 2004). Tangible benefits may be seen immediately in improved services, more product availability and better prices, whereas it may be some time before the intangible value from organizing cooperatives becomes apparent. Through governing their cooperatives members develop leadership and problem-solving skills and confidence in their ability to help themselves. Agricultural cooperatives play an important role in supporting small agricultural producers and marginalized groups (Agricultural cooperatives…, 2012). They:
- empower their members economically and socially;
- create sustainable rural employment through business models that are resilient to economic and environmental shocks;
- offer small agricultural producers opportunities and a wide range of services, including improved access to markets, natural resources, information, communications, technologies, credit, training and warehouses;
- facilitate smallholder producers' participation in decision-making at all levels;

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- support members in securing land-use rights;
- negotiate better terms for engagement in contract farming and lower prices for agricultural inputs such as seeds, fertilizer and equipment.

The political, demographic, social, economic and technological changes have brought about the development of new forms, roles and fields of activity for agricultural and rural co-operatives both for spread of innovations and for poverty reduction (Munkner, 2012). There are huge differences of productivity, income and co-operative structures, between small farmers operating near subsistence level and large, professionally managed agribusinesses. This is because agricultural cooperatives help farmers gain market power by joining together to market their crops, increase their bargaining power by achieving economies of scale and by processing their commodity to add value, and/or purchase supplies and services. Benefits and profits gained from the cooperative are distributed equitably to members-farmers on the basis of use of the cooperative (Agricultural Cooperative…, 2013, p. 12).

The historical as well as recent experiences show that in some countries in the world cooperatives play a key role on the market (Chloupkova, 2003). In Europe, for example, there are two different models for developing agricultural cooperative entities, namely (Popescu, 2014):

- in the Nordic countries (Scandinavia, Germany, Belgium, United Kingdom) there are a relatively small number of cooperatives, but with a greater economic value and specialized on different channels;
- in Southern Europe the cooperatives are more numerous, but generally lower economic size.

However, in Central and Eastern Europe (CEEC), including also Poland, the agricultural cooperatives formerly remained strongly influenced by the idea of communist. This has led to a peculiar, deformed model of so called "production cooperative" usually composed of landowners and employees. As a consequence such cooperatives nowadays do not use their potential and cannot grow. Based on the positive experiences from a number of cooperatives that exists in the EU countries and wider in the world, many sources advocate that cooperatives should be reintroduced in the postcommunist European countries in order to iron out problems inherited from transforming their agricultural sectors (Chloupkova, 2003).

To add insight to the understanding the differences between agricultural cooperatives in developed and post-communist countries the paper presents some relevant market data. Precisely, the purpose of the article is to investigate the position of Polish agricultural production cooperatives (APCs) on the domestic market and in comparison to cooperatives in developed countries.

Data and methods

The basic methods used in the paper were the analysis and critique of literature and writing, as well as logical conclusion. The lack of current and comparative data on the cooperative sector makes definitive conclusions about its global size and scope difficult (Shaw, 2007, p. 6). It is not easy to classify and quantify such heterogeneous and changing cooperative sector. However, there are some statistics in this field, conducted mainly by

institutions related to cooperatives. The statistical data sources in the article were the following:

- annual reports of the National Auditing Association of Agricultural Production Cooperatives, published in "Biuletyn Informacyjny" (Sprawozdanie…, 2011, 2012, 2013, 2014, 2015);
- the "List of the 300 best agricultural enterprises" prepared annually by the Institute of Agricultural and Food Economics – the National Research Institute in Poland (Lista…, 2013);
- "Measuring the Size and Scope of the Cooperative Economy" – the recent report of United Nations (Measuring…, 2014);
- the "World Co-operative Monitor" – a robust and comprehensive report published annually by the International Co-operative Alliance and the European Research Institute on Cooperative and Social Enterprises (World…, 2015);
- "Development of Agricultural Cooperatives in the EU 2014" – the report of Copa-Cogeca (Development…, 2015);
- Support for Farmer's Cooperatives – the report prepared for European Commission (Bijman et al., 2012).

The collected data included such aspects as: number of cooperatives, number of members and employees, scope of activity, turnover and market share. To develop, organize, present and segregate the data tabular and graphical methods were used.

Research results

Polish agricultural production cooperatives – key facts

The long history of Polish cooperativeness in rural areas begins basically with the activity of Stanisław Staszic in the early nineteenth century. But first "truly" agricultural cooperatives were organized spontaneously after the end of the Second World War, mainly by former employees of the manor and the farmers themselves (Bajan, 1988). They were parceling-settlement in nature, and they appeared in order to improve the land use by means of the deficient amount of livestock and farm equipment (Matyja, 2012). During the period 1949 – 56 their number increased remarkably from 243 to 10 452 (Rocznik Statystyczny GUS, 1957). Unfortunately, over the next thirty years APCs became a tool in the hands of political and administrative authorities of that socialist time in Poland. This led to dramatic decrease not only of their number to 2 177 in 1989 (Guzewicz et al, 2001), but also to their negative image, because they were associated with the forced collectivization of agriculture. This image have remained until today and APCs are still perceived as a relic of a previous system (Dzun, 2009). This may be the one of important reasons of continuously declining number of APCs.

During the period analyzed in this paper the general number of APCs in Poland fell by 7% from 1 083 to 1 007. Moreover, there is observed a relatively huge, almost 15-percent drop in the number of actively operating APCs over the last five years. In the light of well doing agriculture in Poland (Agriculture…, 2015) this downward trend seems to be

disturbing and confirms that there are some obstacles, probably of an internal nature, that inhibit the development of Polish APCs.

Table 1. Number of APCs in period 2010 – 2014

Year	2010	2011	2012	2013	2014	2010/2014 (%)
General	1 083	1 065	1 055	1 024	1 007	-7.0
Actively working	818	785	774	708	696	-14.9
In liquidation, bankruptcy or suspended operations	265	280	281	316	311	17.4

Source: (Sprawozdanie…, 2011, 2012, 2013, 2014, 2015).

Nowadays, agricultural production cooperatives in Poland cultivate over 245 thousand of UAA (utilised agricultural area). They focus on plant production (mainly cereals, oilseed rape, sugar beet) and livestock (mainly pigs and poultry) (Brodziński, 2014). In 2012 the structure of sales consisted in 61.1% of crop products, in 35.5% of livestock products, in 1.7% of food processing and in 1.7% of production and services of mechanical workshops, wood departments, building materials departments and others (Brodziński, 2014). However, in previous years the APCs were more diversified. The share of sales of processed products and services in total revenues was higher and achieved even the level of 13% in 2006. It is worth mentioning, that the larger cooperatives organize their sales network, both wholesale and retail. Some APCs develop the tourist infrastructure, combining fruit, vegetable and meat processing with gastronomy, hotel services, medicinal treatments, horse riding, etc.

Almost 70% of APCs have signed long-term contracts with customers, through which they sell approx. 53 – 65% of their agricultural production. In this field they also cooperate with individual farmers. The prices obtained by the APCs are generally lower than the average in agriculture, but thanks to contracts cooperatives obtain higher prices during periods of oversupply. By participating in the market exchange APCs are under pressure towards acquiring the competitive advantage and rationalizing the use of resources by increasing their economic efficiency (Brodziński, 2014). They compete with agricultural enterprises on national and foreign market, however in terms of their organizational and legal form they could be compared more with their analogues in other countries.

Agricultural cooperatives in the world

Cooperatives are known worldwide. They are found in sectors like agriculture, housing, insurance, wholesale and retail trade, industry and utilities, banking, health and social care and many others (World…, 2015). The recent report of United Nations stated that the most common type of cooperative is an agricultural cooperative (Measuring, 2014). This is influenced by large numbers of cooperatives in India and China where the small size of land holdings fosters working together to gain economies of scale and scope. As such, both of these markets have large numbers of agricultural cooperatives and control significant market share in certain sectors. For example, Indian cooperatives have 36% market share of the fertilizer market. Chinese cooperative have 60% market share in cotton, 68% in agri-processing, 70-80% market share in tea production and more than 80% market

share in fertilizer. According to the same report over 1.2 million agricultural cooperatives associate over 122 million of members, hire 1.2 million people, have over 35 thousand offices/outlets and dispose of assets worth almost USD 134 billion.

The World Co-operative Monitor presents, among others, the 30 largest cooperatives in the agriculture and food industries. The top three of them are characterized in table 2.

Table 2. The three largest agricultural cooperatives in the world by turnover

Cooperative	Country	Members	Personnel	Turnover (billion USD)			
				2013	2012	2011	2010
NH NONGHYUP (NACF)	Republic of Korea	2 431 353	almost 80 000	55.05	50.71	31.27	na*
ZEN-NOH	Japan	1 032	over 8 000	48.37	56.85	62.44	60.88
CHS INC.	USA	625 000	over 11 000	44.48	40.60	36.92	25.27

* na – data not available

Source: own study on the basis of (World…, 2015).

Table 3. Top-ten meat, cereals supply and horticulture cooperatives in Europe (by turnover in 2013)

Sector	Nº	Cooperative	Country	Turnover (m EUR)
Meat	1	Danish Crown	DK	7 844
	2	Vion Food	NL	7 033
	3	Agricola Tre Valli SCA	IT	3 135
	4	Westfleisch	DE	2 507
	5	HKScan	FI	2 100
	6	Cooperl Arc Atlantique	FR	2 100
	7	Atria	FI	1 411
	8	Gesco Consorzio Cooperativo SCA	IT	1 352
	9	Coren	ES	982
	10	Grandi Salumifici Italiani	IT	675
Cereals	1	VIVESCIA	FR	4 209
	2	Limagrain	FR	1 938
	3	CAP Seine	FR	900
	4	SCAEL	FR	798
	5	CAVAC	FR	798
	6	Arterris	FR	778
	7	EMC₂	FR	602
	8	AVEBE	NL	591
	9	ACOLYANCE	FR	525
	10	Noriap	FR	518
Horticulture	1	FloraHolland	NL	4 350
	2	Landgard	DE	2 035
	3	Coforta (The Greenery)	NL	1 293
	4	Conserve Italia	IT	980
	5	Apo Conerpo	IT	723
	6	Anecoop	ES	593
	7	ZON fruit & vegetables	NL	362
	8	BELORTA	BE	350
	9	CONSORZIO MELINDA	IT	286
	10	AGRIINTESA	IT	274

Source: own study on the basis of (Development…, 2015).

The world largest agricultural cooperatives are located in Asia and North America. NH Nonghyup (NACF) is a Korean cooperative that associates almost 2.5 million members and hires almost 80 thousand employees. Its turnover reached over USD 55 billion in 2013. Japanese ZEN-NOH (National Federation Of Agricultural Co-Operative Associations) associates 1 032 co-operative unions (including 156 secondary unions) and provides employment for over 8 000 people. Its turnover varies between USD 48.37 billion in 2013 and USD 60.88 billion in 2010. The third world largest agricultural cooperative – CHS INC. – is a US enterprise joining over 600 thousand producers and employing over 11 000 people. Each year it increases its turnover from USD 25.27 billion in 2010 to USD 44.48 billion in 2013. These numbers are impressive especially when compared to the above global summaries of UN report.

European agricultural cooperatives also are doing quite well. They maintain a strong market presence in the food supply chain (Development…, 2015). In particular, in 2013 the total turnover of all agricultural cooperatives was in the range of some EUR 347 billion. Such enterprises as Arla Foods, Danish Crown and DMK Deutsches Milchkontor GmbH are the ones of the largest and well-known agricultural cooperatives in Europe, with annual revenues of EUR 5-10 billion (Development…, 2015). European agricultural cooperatives are present in different sectors of agriculture, including farm supply, dairy or even olive and wine, especially in southern countries. In order to enable the reference to Polish conditions the table 3 contains the list of top-ten European cooperatives operating in such branches of agriculture as: meat, cereals and horticulture. Indeed, as stated above, Polish agricultural production cooperatives also operate in these areas.

Comparison of Polish and European agricultural cooperatives

It turns out, that the largest Polish APCs (table 4) do not perform so well as their analogues in other European countries. Their turnover in 2013 was significantly small in comparison to the cooperatives listed in table 3. They are rather known on the domestic market, but they do not have international brands.

Table 4. Top-ten agricultural production cooperatives in Poland (by turnover in 2013)

N°	Cooperative	The type of production	Turnover (m EUR)
1.	RSP Rzecko	Non-agricultural, some plant and livestock	14,53
2.	RKS Bądecz	Mainly livestock	7,96
3.	RSP Wydrowice	Mainly plant	4,88
4.	RKS Czempiń	Plant, livestock	3,90
5.	RSP Hopkie	Mainly plant	3,43
6.	SGR Baszewice	Mainly plant	2,83
7.	RSP ZJEDNOCZENIE Janocin	Plant, livestock	2,61
8.	SPR DIAMENT Otfinów	Mainly livestock	2,45
9.	RSP PRZEŁOM Linowo	Plant, livestock	2,41
10.	RSP NOWE POLE Górzno	Mainly plant	2,27

Source: own study on the basis of (Lista…, 2013).

Generally in Poland, cooperatives have a significant (in fact – dominant) position only in the diary sector (Development…, 2015). In other sectors, the role of cooperatives is much smaller. Figure 1 shows a relative importance of cooperatives in European countries, based on the estimated market share of all cooperatives at farm gate sales level weighted for eight agricultural sectors: dairy, pig meat, sheep meat, wine, olive, fruit and vegetables, cereals. Poland is in the second half of this summary, with the market share slightly more than 20%. The strongest cooperatives, having over 60-70% of the agricultural market, are located in Finland, Netherlands and Denmark.
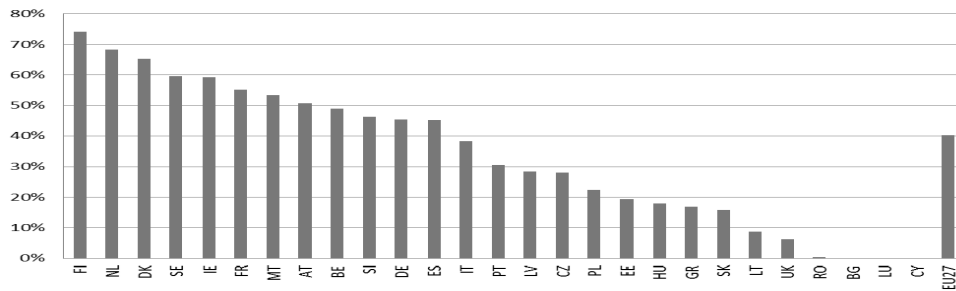
Fig. 1. Market share of cooperatives, per country, 2010

Source: (Bijman et al., 2012).

Market shares of cooperatives differ substantially across sectors and countries. Figure 2 presents the share for the EU as a whole, per sector, and for all sector together (weighted for the relative importance of the sector in total EU agriculture). European cooperatives are most important in dairy. Other sectors with an important role for cooperatives are olives, wine, cereals, and fruit and vegetables (Bijman et al., 2012).
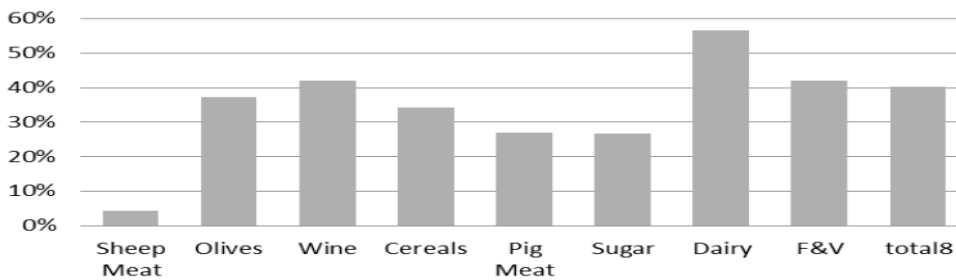
Fig. 2. Market share of cooperatives, per sector and total EU, 2010

Source: (Bijman et al., 2012).

In discussing market share of European cooperatives by sectors in which Polish agricultural production are operating (cereals, pig meat, fruit and vegetables), one can easily notice, that Poland is the country where cooperatives do not have a significant role. Table 5 confirms this statement. Polish APCs occupy the first quarter of cooperatives' market shares. Precisely, in crop production their market share is around 6-7% (Development…, 2015). In production of pig meat, where cooperatives are usually associated in producers groups, it amounts to 7%. In production of fruit and vegetables 90

cooperatives, 150 producers groups and 20 other producers organizations have around 10-12% of the market. In comparison to Scandinavian countries, France, Belgium and Netherlands, in which cooperatives' market share exceeds 50% and even 75%, the agricultural production cooperatives in Poland are far away from achieving the market advantage.

Table 5. Market share of cooperatives in European countries*, per selected sectors, 2010

Sector	1 – 25%	25 – 50%	50 – 75%	>75%
Cereals	Belgium, Estonia, **Poland**, Slovakia, Hungary	Finland, Germany, Italy, Latvia, Slovenia, Spain	Austria, France, Netherlands	
Pig meat	Belgium, Czech Republic, Hungary, Germany, **Poland**, Slovakia, Spain		Sweden	Denmark, Finland, France
Fruit & vegetables	Estonia, Hungary, Latvia, **Poland**, Portugal, Spain	Austria, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Greece, Italy, Spain	Slovenia, Sweden	Belgium, Netherlands

* table does not include all of European countries due to the lack of the relevant data

Source: own study on the basis of (Bijman et al., 2012).

Conclusion

A fundamental differences between the cooperatives in EU countries and the CEEC exist (Chloupkova, 2003). The paper investigated these differences on the example of Polish agricultural production cooperatives. A main finding is that there is observed a phenomenon of decreasing number of APCs, poorly recognized brands, a relative small turnovers and market shares in comparison to agricultural cooperatives in developed countries. The above, together with the atmosphere of hostility around cooperatives (both from the outdoor environments, as well as cooperative members), the crisis of identity and management and the scarcity of research cause that in Poland the cooperative movement in agriculture does not use its potential and, instead of develop, successively ceases its activities. It seems disturbing because the cooperative movement has a role to play in countering the economic and social inequalities. The author believes that this article has helped to draw attention to the discrepancy between the strong, well-organized and cost-effective agricultural cooperatives in developed Western countries and forgotten and fading agricultural cooperatives in Poland.

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Farmer's Perception of Soil and Water Conservation Practices in Eastern Hararghe, Ethiopia

Abstract. The perception of farmers is an important part of their decision-making. Therefore, it is imperative to understand the perception of farmers towards soil and water conservation and the socio-economic determinants. The knowledge would help understand farmers decision whether to adopt soil and water conservation practices or not. This paper analyses the perception of farmers towards SWC by taking a sample of 240 farmers from Eastern Hararghe, Ethiopia. Descriptive statistics and generalized linear model are used to describe the data and identify the important factors influencing farmer's perception respectively. On average, Sample farmers are found to have a good understanding of soil and water conservation with standard deviations ranging from 0.615 to 1.551. The factors that positively determined the perception of farmers in the study area are; training, plot size and number of ploughing. Manure application and plot distance affected perception negatively. Following the results, we recommend extension agents in the area to provide continuous trainings and advice farmers to follow up on their land, especially to those who are far from their plots.

Keywords: perception, soil and water conservation, generalized linear model, Ethiopia

Introduction

Recent development in the field of behavioural economics stresses the importance of perception of economic agents in adjusting their choices of scarce resources (Weber, 2003). Perception of farmers towards soil and water conservation (SWC) is, therefore, an important factor in their adoption decision of different SWC practices. The agriculture of developing countries is characterised by unsatisfactory productivity which is attributed to, mainly, environmental degradation and low adoption of improved practices (Graaff *et al*., 2008; Nin *et al*., 2002; Fulginiti and Perri, 1997; Feder *et al*., 1985).

Resource depletion and degradation poses a serious problem in a country where more than 90 million people have to dwell. To make matters worse, most of the population of Ethiopia resides in the highland areas where land is sloppy and prone to erosion. Awareness of the farmers, constituting about 85% of the total population, on sustainable agriculture is unsatisfactory. For example, a research conducted by Tessema *et al*., (2015) on the Ethiopian farmer's decision to adopt conservation tillage, found farmers opting for the traditional multiple ploughing over conservation tillage. This could be the result of farmer's poor perception of soil degradation and its consequences on their production and productivity.

Although adoption of agricultural technologies is rigorously researched, the perception component seems to be ignored. It is the perception of the decision makers, that plays an important role in their final economic decision; such as whether to adopt a certain technology/ SWC practice or not. The attention given by researchers, in the area of risk and

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climate change, towards perception may be due to this fact (Fosu-Mensah *et al.*, 2012; Deressa *et al.*, 2010; Weber, 2010; Slovic *et al.*, 1982).

Proper utilization and conservation of resources should be at the heart of any development intervention. How much do resource users know about resource degradation? Do they know how their activities are affecting natural resources and the environment? How well aware are farmers about sustainable resource utilization? This article analyzes the awareness of farmers towards SWC practices and the factors that affect their perception.

Research Methodology

The Study Area

This research is conducted on sample households from three districts of Estern Haraghe zone, Ethiopia, namely, Meta, Gurawa and Haramaya. The three districts are similar in their farming system which is dominated by maize, sorghum and *chat*[2] cultivation. Meta district consists of 47 *kebeles*[3] distributed over three agro-ecological zones. It is home to 252,269 people out of which 93% are Muslims. In addition, the district is known for its coffee production, covering about 50 square km of land. Gurawa district comprises of 46 *kebeles* in three agro-ecological zones and hosts 81,310 people, with more than half of them relying on aid. Haramaya district has 271,018 people living in it; out of which 96% are Muslims.

Data Type, Source and Sampling

The research uses a quantitative data obtained from a survey conducted on 240 respondents from nine *kebeles* of the three districts of Eastern Hararghe. Multi-stage sampling is used to purposively select three districts based on their farming system. The 9 *kebeles* and 240 sample households are then selected randomly.

Method of Data Analysis

To address the objective of this research, both descriptive and econometric methods are employed. Measures of central tendency, frequency and percentages are used to describe the data. A generalised linear model (GLM) is employed to identify the factors that affect the perception of farmers towards SWC.

In order to capture the perception of farmers' we ask ten different questions (Table 3) related to the SWC and are evaluated by the respondents on a five scale likert. We then transformed the questions into an index by assigning equal weight. The index value is between zero and one, making the OLS estimation incompetent as it results in biased and inconsistent estimates. As a result, following Papke and Wooldrige (1996) we implement the Generalized Linear Model (GLM), which allows the modelling of a fractional dependent variable. Although some researchers use the Tobit model for such type of data, it

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[2] Chat (*Catha edulis)* is a drug chewed for stimulant effect**.**
[3] Kebele is the smalles administrative unit in Ethiopia.

is not appropriate since all values are observed – not censored—leading to estimated values that are out of the range of the observed values. The GLM is specified as:

$$G\,(E(Y)) = \alpha + \sum \beta k \; Xik$$

Where G (E(Y)) is some function of the expected value of Y and Y~ F, F representing the distributional *family*. If Y has a normal distribution, the family is normal/Gaussian, which is the case for our variable (Table 3). G is the *identity* link function which shows how the expected value of the response relates to the linear predictor of explanatory variables; i.e. G (E(Y)) = E(Y) for linear regression, which is the case for our data.

The Explanatory Variables and Hypothesis

Household and Institutional Characteristics of Respondents

Age: older farmers, because of their longer experience, could have a higher perception compared to their less experienced counterparts. Soil erosion and yield reduction as a result of it takes longer time to be visible to farmers making it difficult for younger farmers to have as good understanding and perception as the older and more experienced farmers.

Education: The education level of household heads as a dummy variable. Our sample respondents did not have a significant difference in their education level—which is why we gave zero to respondents who can't read and write and one for those who can read and write wheather from formal or religious education.

Cooperative membership: members of cooperative are expected to have a higher perception than non-members because they have more access to discussions with fellow farmers and might learn from one another. Farmer to farmer discussions could be more powerful than top down government policy interventions in shaping perception and decision making farmers.

Extension Duration: This variable shows the number of years the respondent farmer started using extension service. We chose this variable instead of do you have access to extension service because a farmer who just started to get the service and a farmer who started using the service for a relatively longer time would fall into the same category, making it difficult to capture the correct contribution of the service. The frequency of extension contact could have been a better proxy. However, farmers usually respond to how many times do you meet with development agents in one year by considering every social contact such as *chewing chat*. Therefore, we choose to use the duration to capture the positive contribution it might have in enhancing farmer's perception towards SWC.

Training: This variable shows if the farmer has received any training pertaining to SWC (1 if received training and 0 if not). Farmers who have received training are expected to have a higher perception towards SWC.

Plot characteristics of respondents

Plot Size: Measured by qoxi[4] is the size of one of the plots of farm lands that the respondents own. Sample farmers own, on average, more than two plots of land. However, we are taking the first plot's characteristics to capture the farmer's perception towards SWC. We expect a positive relationship.

Plot distance: Measured in minitues of walking is also the distance of the first plot from home of the respondent. The farther the plot, the lower the perception; this could be due to fewer visits to the plot to understand its SWC status.

Plot slope: **Measured categorically** is the respondent's perception of the steepness of their first plot. We expect a positive relationship because attributed the fact that a good understanding of the slop of plots is associated with a better perception. Meaning, farmers with steep slope might easily recognize the damage of their land due to erosion and water runoff.

Number of trees: farmers may plant trees on their farm-land to protect soil erosion. Therefore, the more trees are present on the farmland, the better the perception of the farmer on SWC.

Number of ploughing: measures the amount of ploughing farmers use before plantation. The more they plough the higher their perception. We assume that if farmers plough more, it is becase they are trying to get the more fertile soil underneath because the topsoil has been eroded.

Manure application: is a dummy variable, 1 if the respondent applies manure 0 otherwise. A negative relationship is expected between the perception of farmers and manure application. This is because farmers that apply manure to their field might take them a longer time to perceive the decline in fertility of their land than those who do not apply manure to their field.

Inorganic fertilizer application: also a dummy variable, 1 if the respondent uses inorganic fertilizer 0 otherwise. Farmers who use fertilizer might not be able to observe the decline of harvest due to loss of soil fertility of their land, making us assume a negative relationship between fertilizer application and their perception towards SWC.

Results and Discussions

Description of the data

The following table displays the mean, standard deviation, minimum and maximum values of our data along with the number of observations.

The average age of our sample respondents is 40 years. Around 33% of sample respondents are members of cooperatives and 54.5% have some form of formal education. Our respondents have an average of about 8 years of extension service and 88.3% have received some training regarding SWC. Respondents have at least one plot with an average of 1.744 *qoxi* land, an average walking distance of 12 minutes, and plough their field 2.3

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[4] Qoxi is a local measurement of land which is equivalen to 1/8th of a Hectare

times on average. 61.7% and 73.3% of sample farmers use manure and chemical fertilizer respectively.

Table 1. Data Description

Variable	No. of Observations	Mean	Std. Dev.	Min.	Max.
age	236	39.322	10.090	20	80
cooperative membership	240	0.333	.472	0	1
school	240	0.545	.498	0	1
extension duration	240	7.775	3.642	1	30
training SWC	240	0.883	.321	0	1
p1size	238	1.744	1.511	0	15
p1distance	228	12.618	17.000	0	120
p1slope	239	1.694	.567	1	3
p1trees	240	.533	.499	0	1
p1plow	240	2.273	.583	1	4
dummymanure	240	0.617	.487	0	1
fertp1	240	0.733	.443	0	1

Source: own calculation using own survey data.

Farmer's knowledge and perception of the slope of their field plays an important role in shaping their perception towards SWC. Majority of sample farmers (59%) perceive that their land has a medium slop. Farmers with a steep slope, according to their perception, are only around 5% of our respondents.

Table 2. categorization of slope of plots by respective farmers

Slope of plot1	Freq.	Percent	Cum.
Plain	86	35.98	35.98
Medium	140	58.58	94.56
steep	13	5.44	100
Total	239	100.00	

Source: own calculation using own survey data.

The sample respondents are presented with the questions and a five scale likert; 1. strongly agree, 2. disagree, 3. neutral or undecided, 4. agree and 5. strongly agree. Table 3. provides overall information as to where an average respondent belongs based on their perception of SWC. The average response for the negative statements is below 3 whereas for the positive it is well above 3. The response for "Soil fertility and crop productivity can be managed to a large extent by applying mineral fertilizers only" is around 2, which could mean that farmers have a lower faith in the power of chemical fertilizer in improving soil fertility. From the discussions we had with farmers, many held inorganic fertilizer responsible for the decline of their soil fertility.

Table 3. Descriptive statistics of the ten questions used to measure perception

Variable	No. of Obs.	Mean	Std. Dev.	Min	Max
Soil erosion is the leading cause that results decline in soil fertility	240	4.825	0.615	1	5
Soil fertility and crop productivity can be managed to a large extent by applying mineral fertilizers only	240	2.345	1.268	1	5
Applying compost and farm yard manure to soil has no impact on soil property rather a waste of labor and time	240	2.808	1.551	1	5
Applying cow dung and leaving crop residue on the field has little impact on soil fertility improvement, so it is better to use these as fuel for cooking	240	2.983	1.472	1	5
Cultivation of mixed crops (intercropping) not only increase total production but also reduces soil erosion	240	4.000	0.976	1	5
Constructing and maintaining physical SWC measures (terracing, soil bunds, stone bunds, cut off drains and mulching) on farm plots decrease surface water runoff	240	4.633	0.796	1	5
Physical SWC measures for crop production are costly and labour-intensive activity that has little contribution to improve and maintain soil fertility	240	3.425	1.501	1	5
Physical SWC measures maintain soil fertility and also enhance crop yields in the long-run	240	4.262	1.015	1	5
I do not have the knowhow to construct and maintain Physical SWC measures on my plots	240	1.467	0.775	1	5
I have no intention to construct physical SWC measures on my plots because it will bring me no benefit in resulting increase in my agricultural production	240	1.425	0.819	1	5

Source: own calculation based on own survey data.

Econometric result

The following table presents the factors that affect farmer's perception towards SWC. The result of the GLM regression shows a positive correlation among training on SWC, plot size and the number of times farmers plough their field and their perception of SWC, the dependent variable. On the other hand, plot distance and manure application are negatively related with sample respondents' perception of SWC. The findings of the econometric regression match our hypothesis.

Training, especially when it focuses on a specific area, has a significant impact in improving perception and understanding of people (Delaney et.al., 1996). Training can also create motivation and improve productivity of workers (Khan *et.al.*, 2015). That could be why farmers who took training on SWC have a better perception than those who didn't. Obtaining training improves the perception of farmers by about 3.9% compared to farmers who do not obtain any training regarding SWC.

The other significant variable is land size. Farmers with larger farm size have a better perception towards SWC than those farmers with smaller land size. Farmers might give less emphasis to their lands if they are smaller and might not attribute the reduction in yield to soil degradation as much as they do for the size. Also the SWC practices occupy some

space on farm land, which could indirectly influence farmers' perception towards using any SWC on smaller plots. A one *qoxi* increase in land increases perception by 0.7%.

Table 4. Results of parameter estimation of the GLM model for farmers' perception of SWC

Variables	Coef.	OIM Std. Err.
age	0.000	.000
cooperative membership	-0.010	.011
school	0.0104	.011
extension duration	-0.002	.001
training SWC	0.039**	.017
plot size	0.007*	.003
plot distance	-0.001***	.000
plot slope	0.008	.009
Plot trees	0.013	.011
No of ploughing	0.025**	.010
Manure application	-0.023*	.011
Chemical fertilizer	-0.000	.000
Constant	0.465	.040

***, ** and * significant at 1%, 5% and 10% probability level, respectively

Source: own calculation based on own survey data.

Plot distance has an inverse relationship with perception. Plots farther from home might not be visited often and receive attention that could enable farmers to observe changes on its fertility. An increase in one minute of walking distance is found to decrease farmers' perception by 0.1%. Maro *et al.* (2013) also have found similar result.

Farmers plough their land to obtain the fertile soil underneath in addition to controlling weed and mixing organic matter with the soil. The more farmers understand the decline of fertility the more they plough to increase their harvest. This is why we have found a positive relationship between the number of ploughing and SWC perception. One additional ploughing indicates a 2.5% increase in perception of farmers.

Manure application is found to have a negative interaction with perception. This could be attributed to the potential of manure application in improving fertility and water retention of the soil (Wortmann and Walters, 2007). Farmers who apply manure to their field are found to have a 2.3% reduction in their perception.

Conclusions and Recommendations

Based on our sample data, we have come to learn the importance of training in improving farmers' perception towards SWC. It is, therefore, very important for the district agricultural office to provide continuous educational programs on SWC practices. Providing innovative SWC options, which do not consume much of smallholding farm lands, should be at the heart of policy making to create a sustainable agricultural production. This will especially help farmers with relatively smaller holdings.

Introducing and promoting minimum tillage could be very helpful. Farmers tend to plough more when they perceive declining fertility which can lead to a vicious cycle of more erosion—more loss of fertility—more ploughing. Educating farmers is also necessary on the use of manure. Manure application can improve fertility of the soil and its moisture retention. Some farmers use manure as an energy source for their household than use it on the farm. A strong work is required by all stakeholders to strengthen the perception of farmers towards SWC and improve their production and productivity.

Acknowledgements

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Causes and Consequences of Deindustrialization in the Euro Area

Abstract. The post-industrial stage of development reached in developed countries is characterized by an increase in services' share and the progressive decline of the manufacturing share in their economies. The intensification of deindustrialization process heated up the discussion pertaining to its impact on the weakening of investment, technological progress, innovation, and a decline in labour productivity and GDP growth. The aim of the paper is to present the scale and consequences of deindustrialization in the euro area based on analysis of manufacturing and other sectors shares in the gross value added and employment in the euro area. The indicators used for the assessment of deindustrialization consequences are: labour productivity and total factor productivity (TFP) growth rates. As the outcome of conducted analysis, the author has drawn two main conclusions: 1) the decreasing importance of manufacturing limits the possibility of carrying out research projects and creating technological progress, 2) the negative TFP growth rate, declining of labour productivity growth rate in 2008-2015 and the decrease of GDP testifies to the threat of secular stagnation in the euro area.

Key words: euro area, deindustrialization, labour productivity, total factor productivity

Introduction

The process of structural changes is a consequence of technological progress and economic development. Since the 1980s the growing importance of services has been a typical feature of this process in the developed economies, which testifies to the dominance of post-industrial changes. Their intensification has been occurring since the mid-1990s as the result of stimulating influence of several factors: the development of ICT (information and communication technologies), higher intensity of globalization processes, rapid industrialization of the emerging economies and growth of their competitive advantage in the labour-intensive and resource-intensive manufacturing as well as outsourcing production to those countries by companies from developed economies and multinational corporations. We must not overlook the matter of deindustrialization effects of the crisis (2008-2009), when falling demand and exports of industrial products led to production cuts and the fall of sectors which were the core of export specialization in the southern countries (Greece, Italy, Portugal, Spain).

Deindustrialization and its effects justified conducting analysis allowing to assess the scale of reduction in the importance of manufacturing in the euro area as well as evaluate macroeconomic effects of deindustrialization. The indicators used for the assessment of structural changes and their consequences are: the main sectors' shares in GDP and in total employment as well as changes in labour productivity and total factor productivity, which illustrate impact of declining share of manufacturing in economies on labour productivity and on total factor productivity (TFP).

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Introduction to empirical analysis consists of an overview of theoretical concepts relating to determinants of structural changes and the importance of industrial policy in achieving optimum results in socioeconomic development. Structural changes that allow to divide socioeconomic development of countries into distinct stages have been properly reflected in economic theory, appropriately to the gravity of the problem. However, the traditional approach to the structural changes from the 1980s was dominated by the belief in the effectiveness of the market regulatory mechanism, which leads to the optimal allocation of production factors between sectors of the economy. Financial and economic crisis of 2008-2009 has caused large losses in GDP and what's worse, there is still no sign of a sustainable recovery. Therefore, the proponents of economic liberalism can no longer stick to the schematic thinking, because the contemporary economic situation requires a new interpretation of processes. Thus, the literature review focuses on theories developed in recent years.

Depending on the subject of the empirical analysis the two different timeframes have been adopted: 1995-2015 and 1990-2015. First part of the analysis (in 1995-2015) is aimed at interpreting indicators that reveal the declining share of manufacturing in euro area economy. Shares of manufacturing in value added and total employment in 2000 and 2015 are compared to the base year of 1995, which is considered a starting point intensifying significant structural changes in domestic economies as well as world economy.

Second part of the analysis of deindustrialization includes all countries currently functioning in the common currency area, but it was limited to the years 2000-2015 as this was the period of particularly intensified growth in the share of service sector in most of the analyzed economies which as a consequence contributed to the decline of manufacturing. Data on the share of manufacturing in those economies in 2010 and 2015 was presented in order to observe the impact of 2009 recession on the speeding up of the deindustrialization process.

Empirical analysis on the impact of IC technologies and deindustrialisation on labour productivity and total factor productivity (TFP) encompasses 1990 - 2015, divided into five sub-periods: 1990-1995, 1996-1999, 2000-2007 and 2008-2015. The reasoning behind this division was based on the following goals of the analysis: 1) assessment of effects of reduction of the euro area development gap to the United States; 2) assessment of impact of intensive investment in IC technologies, growth of labour productivity and TFP in the US on the widening of euro area development gap; 3) presentation of results of structural changes due to the new wave of technological progress, including deindustrialization as well as consequences of 2008-2009 crisis, based on fluctuations in labour productivity and TFP in the euro area and in the United States.

Structural changes, the importance of manufacturing and industrial policy - theoretical framework

The literature devoted to the patterns of socioeconomic development is rich and the research in this field has been growing as the economies went through the subsequent stages of industrialization, which was from the nineteenth century. Economic theorists interest in structural changes, supported by new concepts, increased in the 50s and 60s of the twentieth century, when industrial development entered the peak phase in Europe and Japan, and service sector become increasingly important in the United States. The most

famous theorists of structural changes are: D. Bell, C. Clark, A. Fisher, J. Galbraith, W. Rostow and A. Toffler. They assumed the flow of production factors from declining into rising sectors of the economy as the determinant of socioeconomic development. While as the main triggers of changes in the movement of production factors they recognized technological progress and changes in the structure of demand (more: Gawlikowska-Hueckel, 2014, p. 55-57). Aforementioned authors predicted an increase in share and importance of services in the economy as the higher post-industrial stage of development.

The development of industry contributed to structural changes, labour productivity growth, income growth, changes in the structure of demand and the prosperity growth in the various stages of its advancement. In fact, no country, except for a few oil exporters, has reached a high level of development without industrialization (Lin and Monga, 2013, p. 21). The deindustrialization process results in lowering the economic dynamics and reduces technological progress. The strength of the market as an economic mechanism in the knowledge-based economy is not sufficient to encourage the development of research undertaken by private entities in order to introduce new, more efficient technologies.

The economists attitude to the role of the market depends on their belonging to two main schools - neoclassical and neokeynesian. The first accept state intervention, such as taking corrective action on the market only in case of market failures, when the market is not capable of efficient allocation of resources, but others justify the need to increase the activity of the state. The high costs of the recent crisis resulted in the economists no longer disputing the need for industrial policy. The controversy is over defining it, pointing out its objectives, scope, instruments and the role of the state. Definitions of industrial policy differ depending on the objectives that the national authorities want to achieve, how they perform, and what instruments they use. Semantic aspects of definitional disputes often obscure the substantive meaning of the definition, which should be clearly expressed. Assuming established in industrial policy objectives as a criterion for arranging the definitions, the following approaches can be specified: sectoral, called vertical and horizontal, in which obtaining the effects throughout the economy is assumed.

Policy of promoting the development of selected industries or favoring a particular group of investors is considered as a selective policy pursued in order to protect the national independence, technological autonomy, to support declining sectors, and in cases of other economic problems (Harrison and Rodriguez-Clare, 2009; Cohen, 2006, p. 85-106). Due to the fact that industrial policy has a wider range of influence than only on the selected areas of the economy or specific targets, and its effects are not limited to the industrial sector, some authors emphasize its structural effects, which may involve agriculture and services (Rodrik, 2004, p. 2; Lin and Monga, 2013, p. 21). Horizontal policy is defined as functional and in accordance with that approach, which has recently been preferred in the European Union, it has to create favourable conditions for economic development, productivity and competitiveness growth, which means resulting in greater pro-development effects in business environment. The European Commission (2002; Warwick, 2013, p. 14) defined the horizontal policy in 2002, stressing that its aim was to create general conditions for enterprises that contribute to the growth of business activity, which requires taking into account the specific needs of particular sectors and the features of the products and their utility. In conclusion, the European Commission's attitude was characterized by a combination of horizontal orientation of industrial policy with selective, sectoral adjustment in its implementation.

The crisis heated up the discussion on the role of industrial policy and on its redefinition in terms of objectives, instruments and performance. Theorists do not question the important role of the state in infrastructure development, financial contribution to research and development activities, coordinating functions, in particular enhancing the institutional basis of the market mechanism to ensure greater security of doing business in the terms of growing economic openness, as well as stimulating the activity of businesses through the development of joint projects with state. Theorists devote most attention to cooperation between the state and private companies, which aims at accumulating research and development funds as a result of pooling financial resources and competences for upgrading innovation processes (Katz, 1986, p. 527-543; Lin and Monga, 2013, p. 23; Spence, 1984, p. 101-122). The development of R&D sector in the knowledge-based economy is a condition for the growing importance of sectors and branches that create technical progress, increase productivity and reduce unit production costs. The risk of high cost of basic and applied research is reduced by spreading the cost on many partners and the financial contribution from the state.

In widely regarded Warwick's (2013) work we can find a comprehensive, multidimensional literature analysis of the traditional approach to the role of industry and industrial policy as well as presentation of the new trends that appeared earlier as a reaction to the industrialization of developing countries. In recent years they have re-appeared in developed countries because of the growing problems caused by the crisis of 2008-2009 and the extended sluggish economic situation. The author (Warwick, 2013, p. 47) presents arguments justifying the need for re-industrialization, because the decline of manufacturing share in GDP and employment results in a decline in the GDP growth rate and the deterioration in the labour market conditions. The increasing competition from fast-growing emerging economies also poses a threat for developed countries.

It is crucial to give a sharper focus on the role of combining horizontal with selective policy, so the implementation of horizontal objectives as a result of adequately established priorities in the sectors, technologies or tasks development (stages in the value chain), and to indicate the advantage of strategic policy over defensive/reactive policy.

Of the already rich recent literature, in which authors support the need for smart industrial policy development, it is worth to distinguish an extensive joint publication edited by J.E. Stiglitz and J.Y. Lin (2013) 'The Industrial Revolution and Policy I', that consists of two main parts, theoretical and empirical, based on the experiences of Latin American and Asian countries. Lin and Monga (2013, p. 19-38) defined the conditions that have a significant impact on the efficiency of industrial policy and stressed that its strategic goals should be adjusted to the level of economic development, the structure of resources and achieved comparative advantage. Greenwald and Stiglitz (2013, p. 43-71) focused their attention on those elements of the market environment, which have the greatest impact on the results of industrial policies, and their proactive impact depends on the involvement of the state, in particular through the institutions and law development. The role of the state is also enabling the creation and diffusion of knowledge, because the markets on their own are not effective enough in that area. If knowledge is a public good, then the access to it is open, except for the cost of transmission. The aforementioned authors believe that the main determinant of countries' development strategies in order to achieve long-term competitive advantage under conditions of high mobility of production factors is the ability to learn and create a learning society. Lerner (2013, p. 118-133) assesses the long-term effects of public policy of stimulating innovative entrepreneurship and creating a favourable climate for the

further development of effective entrepreneurship and claims that state involvement can contribute to the revitalization of the venture-capital sector. Alfaro and Charlton (2013, p. 162-208), on the basis of empirical research involving 29 countries, assessed the impact of FDI on economic growth in the years 1985-2000 and found that the relationship between investment and growth is stronger in the case of sectors with higher requirements of labour quality and those more dependent on foreign capital. Industrial policy allows to attract foreign capital maximizing the use of FDI for accelerating economic growth. Monga (2013, p. 209-224) analysed the benefits of production concentration in specific geographic areas, which are the result of knowledge spillover, pooling labour and nearness of specialized suppliers. However, he believes that the production concentration is the effect of government promotion policy, but the traditional theories of agglomeration can lead to incorrect conclusions. Nowadays, an instrument of industrial policy which creates the possibility of achieving economies of scale are clusters. They result in better specialization, and development of economic activity of small enterprises. Moreover closer internal linkages between enterprises associated in a cluster reduce the transaction risk. Local authorities can play a major role by providing necessary public goods and coordinating collective projects.

The literature shows that the declining share of manufacturing in GDP of developed countries is considered a determinant limiting technological progress, innovation, labour productivity growth and economic growth. Among theorists there is a broad consensus on the role of the state in organizing and coordinating cooperation and collective research and development activities of private sector and public-private partnership as a condition for knowledge spillover and the creation of a learning society.

The scale of deindustrialization and its consequences in the euro area

Theorists, engaged in research of socio-economic development rules, agree that the decline of manufacturing share in GDP in developed countries confirms the previously observed patterns of stage changes and the transition to a post-industrial stage. It is a consequence of rapid development of the market and non-market services – intensified by a number of factors, which include (Mucha-Leszko, 2016, p. 184): GDP per capita and population income growth, 2) commercialization of services for households, 3) growing services outsourcing by manufacturing companies, 4) increasing importance of educational services, 5) growing demand for services directly related to aging, 6) increasing importance of commercial services as well as accommodation and food and beverage serving services.

Figures 1 and 2 and the data in table 1 show that the pace of deindustrialization in the euro area increased in 2000-2015, but varied between countries. The share of manufacturing in gross value added in the euro area (19 countries) in 1995 was 19.9%, in 2000 decreased to 19.4% and in 2015 fell to 16.3%. A similar downturn occurred in the share of manufacturing in total employment (Fig. 2). The data on changes in the share of manufacturing in gross value added and total employment in euro area countries in 2000, 2010 and 2015 are presented in table 1. The deindustrialization process occurred mainly in the period of 2000-2010, which was influenced by the crisis, but in the next five years deindustrialization slowed down in most countries. Moreover, it is possible to notice an increase in the share of manufacturing in GDP. During the first of these periods, deindustrialization process measured by decrease in the share of manufacturing in the gross

value added has not occurred only in two of the nineteen euro area members: Germany and Lithuania. However, after the economic collapse in 2009, manufacturing share increased in 2015 compared to 2010 (so after the recession) in Slovenia, Greece, Lithuania, Germany, Portugal and Austria, and remained at the same level or decreased slightly in Slovakia, Italy, Spain, the Netherlands and France. Nevertheless, only seven out of those eleven countries had the manufacturing share in the gross value added higher than the average for euro area-19 (16.3%).
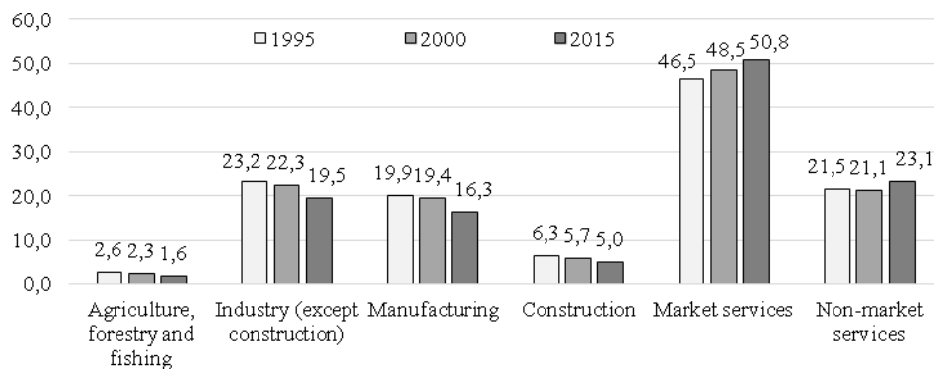
Note: The data include share of manufacturing twice: as a component of the category "Industry (except construction)" and as the separate category "Manufacturing".

Fig. 1. Shares of major sectors in gross value added (GVA) in the euro area (19 countries) in 1995, 2000 and 2015 (% of total GVA)

Source: own calculations based on: (EUROSTAT Database, 2016).
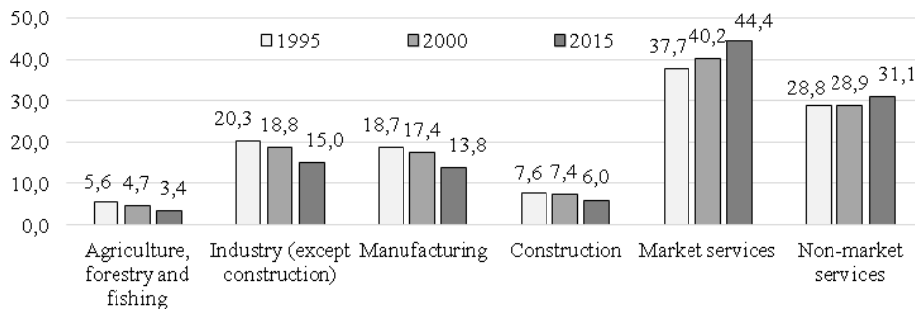
Note: The data include share of manufacturing twice: as a component of the category "Industry (except construction)" and as the separate category "Manufacturing".

Fig. 2. Shares of major sectors in employment in the euro area (19 countries) in 1995, 2000 and 2015 (% of total)

Source: own calculations based on: (EUROSTAT Database, 2016).
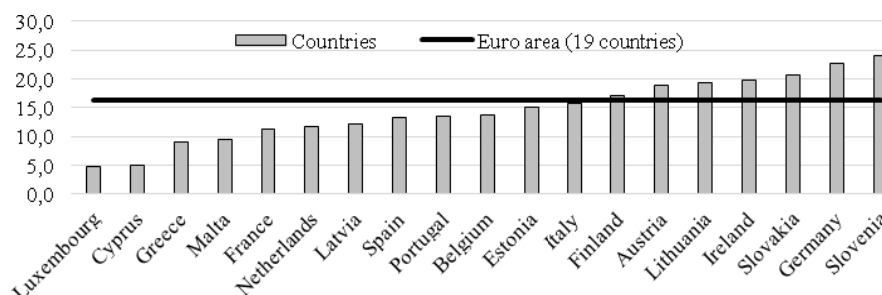
Fig. 3. Shares of manufacturing in gross value added (GVA) in the euro area countries in 2015 (% of total GVA)

Source: own calculations based on: (EUROSTAT Database, 2016).

Table 1. Shares of manufacturing in gross value added (GVA) and in employment in the euro area countries in 2000, 2010 and 2015 (% of total)

Countries	Shares of manufacturing in GVA (% of total)			Shares of manufacturing in employment (% of total)		
	2000	2010	2015	2000	2010	2015
Euro area (19 countries)	19,4	16,0	16,3	17,4	14,2	13,8
Belgium	19,6	14,7	13,7	15,9	12,1	11,0
Germany	23,0	22,2	22,6	19,6	17,4	17,4
Estonia	17,3	15,7	15,1	22,2	19,0	18,9
Ireland	26,0	21,6	19,7	17,4	11,5	10,2
Greece	10,6	8,2	9,1	10,4	9,2	8,7
Spain	17,8	13,3	13,3	17,3	11,8	11,1
France	15,7	11,3	11,2	13,6	10,4	9,7
Italy	19,5	15,8	15,8	19,9	16,8	15,8
Cyprus	8,9	5,7	5,1	11,4	9,1	7,8
Latvia	15,4	13,4	12,2	16,0	13,8	13,4
Lithuania	18,9	18,8	19,4	17,3	15,4	15,2
Luxembourg	10,8	5,9	4,7	12,9	9,2	8,0
Malta	21,4	12,9	9,5	21,6	13,4	11,6
Netherlands	15,3	11,8	11,7	11,6	9,1	8,7
Austria	20,5	18,7	18,9	17,4	14,9	14,7
Portugal	17,2	13,2	13,5	20,4	14,9	15,6
Slovenia	24,9	20,2	24,0	27,2	20,3	20,3
Slovakia	23,9	20,8	20,8	24,5	21,3	21,6
Finland	27,6	19,5	17,0	19,2	14,7	13,6

Source: own calculations based on: (EUROSTAT Database, 2016).

The impact of IC technologies and deindustrialization on labour productivity and total factor productivity in the euro area and the US

Labour productivity depends on many factors, but primarily on capital expenditures per employee and total factor productivity, that includes the structural changes and shares in the economy of sectors which create technical progress, the quality of labour, new methods of work organization, working time and pro-efficient incentives. The measure of multifactor productivity is TFP (Total Factor Productivity). The research of indirect factors contribution to real GDP growth using TFP is common in economic analysis, especially pertaining to labour productivity. Total factor productivity is defined as real output per unit of inputs (all production factors) (Mucha-Leszko, 2007, p. 252). Gomez-Salvador, Musso, Stocker and Turunen (2006, p. 9) believe, that in order to understand correctly what factors affect labour productivity growth, it is useful to divide them into two groups: 1) the direct factors (capital expenditures and labour quality growth), 2) the factors affecting the labour productivity indirectly, but essentially affecting the rate of change, such as research and development activities (R&D), innovation and new technologies dissemination.

The highest labour productivity growth rate in the current euro area countries occured in the 50s and 60s of the twentieth century, when European economies were at the stage of intensive post-war industrialization, and the average annual growth rate of labour productivity was about 6%. In the following three decades of the previous century, labour productivity in Europe was rising, but the growth rate went towards a strong downward trend (from 4.0% average in the 70s, 2.5% in the 80s to 2.0% in the 90s) (Gomez-Salvador et al., 2006, p. 10-11). At the same time, the growth rate of labour productivity in the United States averaged near the long-term trend of 2%, with periodic fluctuations. In that long-term analysis, the changes that occurred in the mid-90s cannot be ignored, when the decline of labour productivity growth rate deepened in the euro area, and in the United States the rate was increasing. The average level of labour productivity in the euro area was comparable with the US in the mid-90s, but in the second half of the decade the gap in relation to the United States has started to increase.

Until the mid-90s it was believed that human resources and capital reallocation from manufacturing to service sector leads to a decline in labour productivity growth, because the industry was regarded as a sector, which creates technological progress. The latest technological revolution (ICT- information and communication technologies), the center of which was the United States, led to fundamental structural changes which stemmed from the impact of ICT on labour productivity growth and total factor productivity. Investments providing growth in production of ICT's devices and their application in other sectors were made extensively in the United States, but in the euro area investing in ICT sector was modest, which resulted in the growing technological gap. ICT contributed to labour productivity and total factor productivity growth by removing technical barriers to doing business on a global scale and achieving economies of scale and due the dynamic development of financial services. The deterioration of the euro area economic position compared to the United States during the stage of intensive development of ICT investment is reflected in the changes in labour productivity and TFP presented in table 2 and figures 4 and 5.
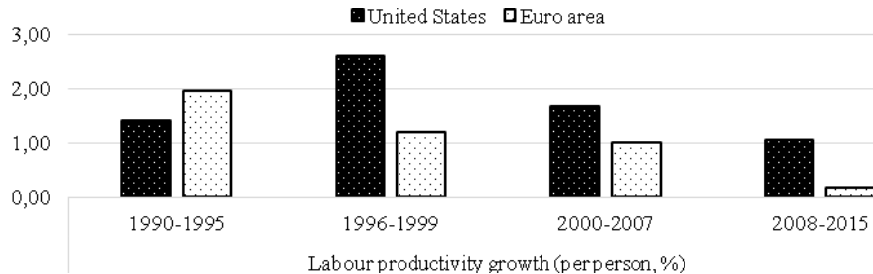
Fig. 4. Growth of labour productivity per person employed in the euro area and the United States in 1990-2015 (percent change)

Source: own calculations based on: (The Conference Board, 2016).
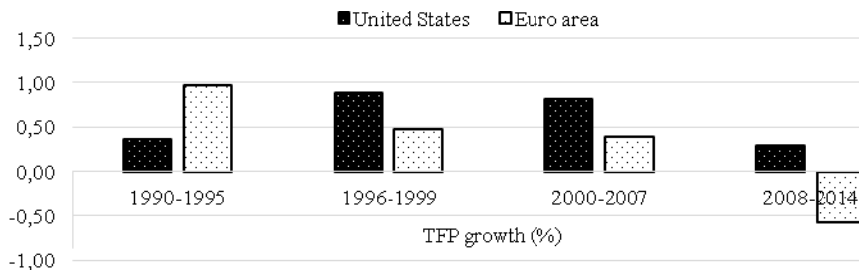
Fig. 5. Growth of total factor productivity in the euro area and the United States in 1990-2015 (percent change)

Source: own calculations based on: (The Conference Board, 2015).

The data for years 1990-2015 indicates that the euro area in two of the four defined periods reduced its development gap to the United States and the gap increased in the remaining two periods. The labour productivity growth rate (yearly average) in 1990-1995 in the euro area was higher than in the US by 0.53 percentage points and the TFP growth rate was higher by 0.61 percentage points. In the following period (1996-1999), during the peak of ICT development, there has been a fundamental change and the difference in labour productivity growth was 1.41 pp in favor of the United States and in TFP growth the US' advantage was 0.42 pp. During third period (2000-2007), there was a large decline in labour productivity growth in US by 0.93 pp. and smaller in the euro zone - by 0.19 pp. In the case of total factor productivity the decline was comparable in US and euro area.

In 2000-2007 the euro area began to make up the gap towards the US, which arose in the late 90s, however the reduction was not only the effect of labour productivity improvement in the euro area, but also because of the decline in labour productivity growth in the United States. The deterioration of the economic situation in the United States began with the bursting of speculative bubble in ICT market (Mucha-Leszko and Kąkol, 2009, p. 52-54). Another factor destabilizing the economy was the terrorist attack on the World Trade Center on September 11th, 2001. The increasing risk limited investment activity and weakened economic situation, which led to the global economic slowdown. The recovery started in the US in 2002, but in the euro area it was delayed until 2004. Economic performance, including labour productivity improvement occurred in the euro area in 2006-2007.

Table 2. Growth of labour productivity (GDP per person employed) and growth of total factor productivity in the euro area, chosen countries and the United States 1990-2014/2015

Countries	Labour productivity growth (per person, %)			
	1990-1995	1996-1999	2000-2007	2008-2015
United States	1,42	2,60	1,67	1,04
Euro area*	1,95	1,19	1,00	0,18
Austria	2,14	2,01	1,40	-0,26
Belgium	1,53	1,68	1,28	0,12
Finland	2,93	2,58	2,08	-0,47
France	1,34	1,26	1,13	0,28
Germany	3,07	0,95	1,18	0,07
Greece	0,50	2,73	2,63	-1,62
Ireland	2,98	3,81	2,43	2,28
Italy	1,77	0,81	0,06	-0,66
Netherlands	0,96	1,71	1,20	0,23
Portugal	1,60	1,95	1,19	0,56
Spain	2,01	0,26	0,06	1,35
Slovak Republic	2,36	4,30	4,96	1,61
Countries	TFP growth (%)			
	1990-1995	1996-1999	2000-2007	2008-2014
United States	0,37	0,90	0,82	0,29
Euro area*	0,98	0,48	0,39	-0,57
Austria	0,83	0,57	0,95	-0,23
Belgium	0,24	0,37	0,07	-1,09
Finland	1,16	2,52	1,38	-2,10
France	0,18	0,35	0,43	-0,57
Germany	1,98	0,93	0,96	-0,19
Greece	-0,93	0,49	0,02	-4,03
Ireland	2,70	3,29	-0,02	-0,93
Italy	0,80	-0,19	-0,42	-0,84
Netherlands	0,40	0,93	0,81	-0,48
Portugal	-0,05	0,68	-1,14	-1,45
Spain	-0,03	-0,85	-0,82	-0,63
Slovak Republic	-0,86	1,69	3,15	-0,31

* Includes all current members of the common currency area.

Source: own calculations based on: (The Conference Board, 2015; The Conference Board, 2016).

Increase in the euro area development gap to the United States was caused once again by the crisis of 2008-2009. The average annual growth rate of labour productivity in euro area in 2008-2015 fell to 0.18%, and in the US remained at 1.04%. Technological gap deepened even faster, what was reflected in the TFP growth showing technical progress in the US and regression in the euro area.

The average annual growth rate of labour productivity and other macroeconomic indicators in the euro area are the results of the economic situation in member states and their potential, but do not reflect the real situation fully, because of the large diversity of indicators among countries. Therefore, table 2 contains data on labour productivity and TFP growth rates of chosen most significant euro area countries (twelve) in order to make direct comparison with the United States.

In the first period (1990-1995) the following countries had labour productivity growth rate significantly higher than the average of the euro area: Germany 3.07%, Ireland 2.98%, Finland 2.93%, Slovakia 2.36% and Austria 2.14%. These were the countries with the largest share of manufacturing in the economy. The growth rate of labour productivity was lowest in: Greece 0.50%, Netherlands 0.96%, France 1.34%, Belgium 1.53% and 1.60% in Portugal (countries with lower manufacturing share in the economy). TFP confirmed the technological advantage of developed economies with higher industry share in GDP: Germany, Ireland, Finland and Austria.

In the second half of the 90s (the second period) the economic dynamics depended primarily on the development of investment in the ICT sector and the labour productivity growth rate increased significantly in the US and in the euro area productivity growth weakened, so the development gap between the US and the euro area deepened. However, it does not mean, that this process took place in all analyzed euro area member states. In 1996-1999 the average labour productivity growth rate similar or higher than in the US (2.60%) was reached in: Slovakia 4.30%, Ireland 3.81%, Greece 2.73%, Finland 2.58% and Austria 2,01%. The same group of countries (except Greece) also had significantly higher TFP growth rates than the US (table 2). Moreover, Germany and the Netherlands had slightly higher TFP growth rate compared to the US, while in Greece TFP growth rate was at average euro area level. To sum up, it should be emphasized that there was a large diversity in labour productivity and TFP growth in the euro area and investment in ICT sector in Finland and Ireland had a major impact on TFP and labour productivity in both countries. High labour productivity growth rates in Slovakia and Greece were the irrefutable proof of striking development and economic convergence achieved due to inflow of foreign direct investment.

In 2000-2007 (the third period) the average labour productivity growth rates in the US and the euro area came close, and the group of countries, where labour productivity growth was higher than in the US included: Slovakia, Greece, Ireland and Finland. Austria had only slightly lower labour productivity growth rate. A group of countries with the highest TFP growth rate is quite interesting. Besides Slovakia, Finland and Austria the group was joined by Germany and the Netherlands, but did not include Ireland and Greece, where economic problems had already started, whereas adjustment processes in Germany and the Netherlands have contributed to growth in economic efficiency.

The crisis of 2008-2009 has caused the greatest economic effects and sustained economic recovery in the euro area and the EU has not occured until 2015. The average annual GDP growth rate in 2008- 2014 was 0.2% in the EU-27, 0% in the EU-15, in the euro area the rate was negative (-0.2%) and in the United States it was 1.1% (Van Ark, 2015, p. 9). One of the factors that reduced the ability to economic growth in the euro area countries was deindustrialization, which has deepened during the crisis. By the end of 2013 developed countries had not reached the level of production in manufacturing from the first quarter of 2008, only Germany and the United States managed to catch up the pre-crisis level (Sinn, 2014, p. 111). The biggest fall in manufacturing occurred in Spain, Italy, Cyprus and Greece as well as in France and Portugal (Sinn, 2014, p. 111).

The average annual TFP decline in 2008-2014 in the euro area was 0.57% and all analyzed countries also had negative TFP rates, including -4.03% in Greece, -2.10% in Finland, -1.45% in Portugal, -1.09% in Belgium, -0.93% in Ireland and -0.84% in Italy (table 2). The smallest TFP loss was sustained in Germany (-0.19%), Austria (-0.23%) and Slovakia (-0.31%).

Conclusion

1. The declining role of manufacturing in developed economies, called de-industrialization, is a consequence of reaching the advanced post-industrial stage of development. The services' share in the economies has been increasing steadily since the 1980s and that process has intensified in the second half of the 90s as a result of robust development of information and communication technologies (ICT). Simultaneously, liberalization and deregulation of economies have opened up new possibilities for production factors flows and ICT have created technical and organizational conditions facilitating internationalization of production. Cheap labour and raw materials abundant in least developed countries have attracted capital and investments have created demand for production and consumption goods. The developing countries' competitive advantage led to relocation of manufacturing and decrease in its importance in developed countries. The increasing specialization within the production process allowed to divide it into more and more narrow technological phases and led to further intensification of internationalization process.

2. The decreasing importance of real economy, including manufacturing, in developed countries is also a consequence of developing modern financial and business services, especially computer and information technologies. Specialization in services since the mid-90s had the significant impact on labour productivity growth and service sector's ability to achieve technological progress. The remarkable development of services in which ICTs are widely used occurred in the United States and that contributed to the growth of labor productivity in the whole economy. While in the euro area, investment and employment expansion were concentrated in traditional economic sectors. In the fastest growing commercial services, such as trade and financial and business services, the use of ICT was lower compared to the US. It created technological gap in the service sector in the euro area, that was leading to a decline in labour productivity growth.

3. Another factor that had intensified the deindustrialization process of less competitive European countries was the last crisis of 2008-2009. The decrease in internal and external demand caused production cuts and increased competition on foreign markets in segments of labour-intensive products from emerging economies. Export specialization in labour-intensive products in the southern euro area countries resulted in deep economic losses as a consequence of collapsing industry.

4. The total factor productivity decrease in the euro area, expressed in negative rates of TFP, and a strong slowdown in the labour productivity growth rate: 0.18% average in 2008-2014 in euro area and 1.04% in the United States, and a GDP decline of 0.2%, confirms that euro area suffers from secular stagnation, which is an economic stagnation resulting from low investment, decline in innovation and slow technological progress. The market mechanism in the knowledge-based economy, especially in terms of low demand, does not have sufficient strength to stimulate innovative investment and technological progress. The decline of manufacturing further limits this process, thus also hindering the growth of labour productivity. Nevertheless, technological progress can contribute to the development of new business services that create more technological progress and can in turn add to the growth of labour productivity throughout the economy. IC technologies and investment in that sector in the US since the mid-1990 can be a proof of that. However, the recent financial and economic crisis has led to such a deep deindustrialization that

reindustrialization of euro area economies becomes the necessary condition for recovering ability to economic growth and innovation as well as labour productivity.

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Evaluation of Human Capital in Selected EU Countries Using Cluster Analysis

Abstract. The study evaluates the quality of human capital on the basis of the Eurostat data. There was also prepared a short bibliography review of the previous research which indicates various definitions of the term human capital. To evaluate its quality in selected EU countries. There was used cluster analysis – the k-medoid method. The analysis was performed for three periods: 2008, 2011 and 2014. The selected states were divided into 4 clusters, and Norway constitute a single-element group. In the other cases, it may be stated that the quality of capital may be determined through the joint economic past or historical traditions.

Keywords: human capital, cluster analysis, k-medoid method

Introduction

One of the most important tasks of the European Economic Community is to continuously improve the quality of human capital, in compliance with the requirements of competitive knowledge-based economy. The respective EU countries conduct activities in that regard in compliance with their individual development strategies. The improvement in the quality of human capital, understood as the resources in the form of knowledge, skills, health, strength, as well as vital energy, guarantees long-lasting economic growth which is conducive to the improvement of the well-being of the society (Becker, 1975). Many discussions are conducted regarding human resources and their role in the development of the economic development of different countries. As a result, there exist multiple methods for comparing them among different states, and to group them by degree of probability.

This article assesses the quality of human capital in selected EU countries, with the use of cluster analysis. Cluster analysis has the main aim of classifying and dividing the collection of elements on the basis of the similarities among the selected properties, into the specified number of groups (Parlińska, Wasilewska, 2016). The result of the analysis will be separation of the groups that are most homogenous in terms of the selected characteristics of the countries according the quality of human capital.

Description of data and applied grouping method

The subject literature contains numerous definitions of human capital and its numerous interpretations, resulting from the application of different research assumptions by the

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persons handling that subject. The definition of that term often depends on the level of research conducted on a macro scale or at the level of an organization.

An example of such deliberations is the study by Stanisław R. Domański entitled "Kapitał ludzki i wzrost gospodarczy" ("Human capital and economic growth"). He characterized that term as "the resources in the form of knowledge and skills, health, vital energy, included in the society or nation as a whole". He also believed that human capital guarantees the ability to work, satisfaction and sufficient salaries.

In turn, Nobel Prize winners, such as G.S. Becker (1975) and T.W. Schulz (1981) mentioned the significance of that term as an investment into people for the benefit of development of a country. Schultz emphasized that the well-being of a society depends on the quality of human resources, such as education, experience and health, and the factor that is decisive for economic growth, is an acting person, through such investments as gaining education and experience, developing its skills and looking after its health. Additionally, G. Becker indicated the need to educate the unemployed, thus introducing, in economy, the notion of investing in people.

After a brief analysis of the above studies, there may be differentiated 4 groups of indices that are decisive for the quality of human capital which will be used in the cluster analysis below. These are: labour market, education, health and investments in people.

The source of data for the analysis was the Statistical Office of the European Union – Eurostat. The following 17 states were selected on the basis of the criteria of availability of data of European countries: Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Spain, France, Latvia, Lithuania, Hungary, Poland, Portugal, Romania, Slovenia and Norway. For comparison purposes, the analysis was performed for the years 2008, 2011 and 2014. The year 2015 was omitted due to the large amount of missing data in the form of the variables being the indices of quality of human capital for the respective states. In the selection of variables representing the above-mentioned groups of indices, there was applied the amount of information provided by the given variable, as well as the access to its levels in the respective countries in the researched years.

Table 1 contains all the variables used for characterizing the quality of human capital in the selected states. The following variables characterizing the labour market were selected: GDP adjusted for purchasing power per one citizen and unemployment rate calculated as the proportion of the unemployed persons in comparison with the professionally active population. Those measures reflect quite well the labour market and the quality of the human capital in that market, and they are easily accessible. Education was characterized with the use of the variables depicting the level of education in the society, such as the percentage of people leaving the education system at the age of 18-24, the percentage of people aged 15-64 with primary or lower secondary education, and the percentage of people aged 15-64 with higher secondary education but without higher education. Those characteristics are to depict the resources of knowledge represented by the given society. Another factor determining the quality of human capital is healthcare. It was characterized on the basis of the life expectancy of women and men, as well as the number of physicians per 100,000 citizens. These characteristics may have different impact on the quality of human capital, because it might result from higher awareness of healthy lifestyle or from the higher availability of qualified labour in hospitals. The last group of indices of quality of human capital, called investment in people, includes the amounts of money spent by the state on development per one citizen, the number of inventions reported in the patent

office per one million citizens and the percentage of people aged 15-24 and 65-74 employed in the areas of science and technology.

All of the above variables help to characterize the human capital of the given society and are available for most states in the respective years. In the case of lack of the value of any variable for the given country, it is filled in with the value that is the arithmetic mean of the two adjacent values (one year before and later) for the given country. In some situations, this required filling in with the use of the value from several years (like in Latvia, where the variable "number of physicians" for 2008 was filled in with the value from 2011).

Table 1.Selected diagnostic variables for analysing the human capital in selected EU countries.

Variable symbol	Diagnostic variables
X_1	GDP *per capita* by purchasing power parity
X_2	Percentage of unemployed person in the professionally active population
X_3	Percentage of the population aged 18-24 who left the education system early
X_4	Percentage of the people aged 15-64 with primary or lower secondary education
X_5	Percentage of the people aged 15-64 with lower or higher secondary education, but without higher education
X_6	Life expectancy for women
X_7	Life expectancy for men
X_8	Number of physicians per 100,000 citizens
X_9	Expenditure on research and development *per capita*
X_{10}	Number of patents submitted in the EPO per one million of citizens
X_{11}	Percentage of the population aged 15-24 and 64-74 employed in areas of science and technology

Source: own study.

The research into human capital may be conducted with the use of various methods, but one can also come across the studies where that subject was presented with the method of grouping.

A good example is the joint study by Małgorzata Stec, Agata Janas and Artur Kuliński entitled "Grupowania państw Unii Europejskiej ze względu na zasoby kapitału ludzkiego i intelektualnego" ("Grouping of European Union states based on their human and intellectual capital resources"), in which the condition of human capital was presented using Ward's method (Stec, Janas, Kuliński, 2005).

Another study worth mentioning is one by Gabriela Wronowska, entitled: "Kapitał ludzki w krajach Unii Europejskiej – analiza porównawcza" ("Human capital in the states of the European Union – a comparative analysis"), in which the author also grouped the states with the use of the same method as used by the above-mentioned authors. Additionally, she classified human capital in the respective EU countries on the basis of the control indices, using the data for 2006. In her work she demonstrated that Denmark was the leader, while Poland had the lowest level of development of human capital at that time (Wronowska, 2009).

The study presented in our article for verifying the quality of human capital in the respective states uses cluster analysis. Cluster analysis is a method of classifying, aimed at

dividing the collection of elements on the basis of the similarities among the selected properties, into the specified number of groups. The aim of that method is to separate the groups that are most homogenous in terms of the selected characteristics of the elements included in them. The popular algorithms for the above task include the k-means algorithm and k-medoid algorithm. The k-means method is used most frequently due to its simplicity and low computational complexity, but it is encumbered with numerous flaws. These include the need to declare the number of clusters and low resistance to noisy data. One of the alternative methods not resistant to diverging observations, applied in cluster analysis, is the k-medoid method. The difference between the operation of those algorithms consists that in the case of k-means, the centre of a cluster is the "centre of gravity of the group", the so-called centroid, while in the other method, it is the so-called medoid, i.e. a representative element of the group that lies closest to its centre. Therefore, in the former method the central point of the group is determined with the use of an algebraic method, and it does not constitute an element, unlike in the latter method, where medoid is an element belonging to the group. That is why the k-medoid method was applied in this study.

The general steps in the grouping algorithm may be defined as:
1. Draw the initial k number of medoids as the example central points of clusters
2. Assign an element to the group in which the distance between the element and the centre of the group is smallest
3. Select new central points of clusters among the elements not being medoids
4. Go back to point 2 and perform steps 2-4 until a new grouping of the elements no longer improves the value of the criterion function.

As regards the listed methods, the notion of criterial function which constitutes the criterion of stopping the grouping algorithms, should be explained. That function determines whether the next grouping of elements is better than the previous grouping. An example of such a function may be the average distance of all the elements in the group from the centre of the group, or the sum of squares of deviations[3]. Attention should also be paid to selection of the optimum number of clusters. One of the criteria found in literature is the Caliński-Harabasz index. A detailed mathematical description of that index is presented in the article issued by Caliński and Harabasz in 1974. For an optimum number of clusters, that index assumes the maximum value.

For the purposes of this article, the calculations make use of the R software as well as the packages used for cluster analysis: "cluster" and "ClusterSim" (Nowak-Brzezińska, 2012). The next chapter presents the results of the research.

Presentation and analysis of results

In the cluster analysis method, the most important aim is to determine the optimum number of clusters. In order to do that, there was applied the Caliński-Harabasz index which assumes the maximum value for the optimum number of clusters for the given group and its characteristics. In order to compare the migration of states between the clusters more easily, the decision was made to assume the same number of elements for all the periods studied. The figure demonstrates that the Caliński-Harabasz index achieves the local maximum for the number of clusters of 4, except for the data for 2008.

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[3] Function used in Ward's method.

Index Calinski-Harabasz
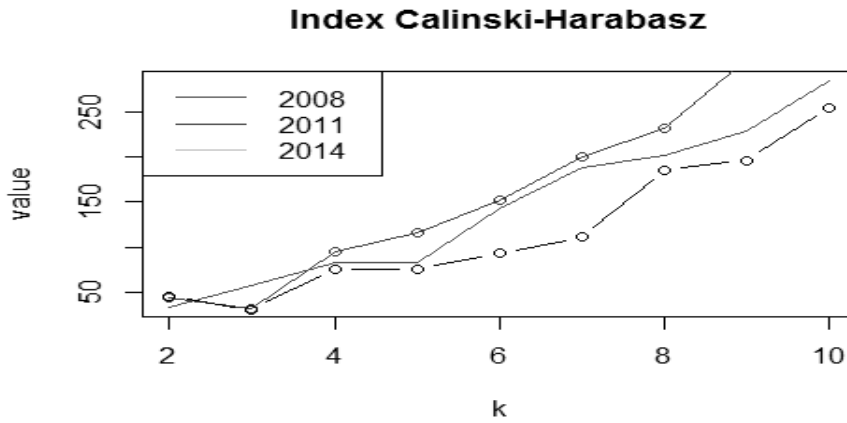
Fig. 1. The Caliński-Harabasz index

Source: own study on the basis of the *Eurostat* statistical data in the R software.

Despite that, it was assumed that the optimum number of clusters was 4, and the states were divided based on the variables reflecting the quality of the human capital of their residents. Below please find the results obtained using the k-medoid method.
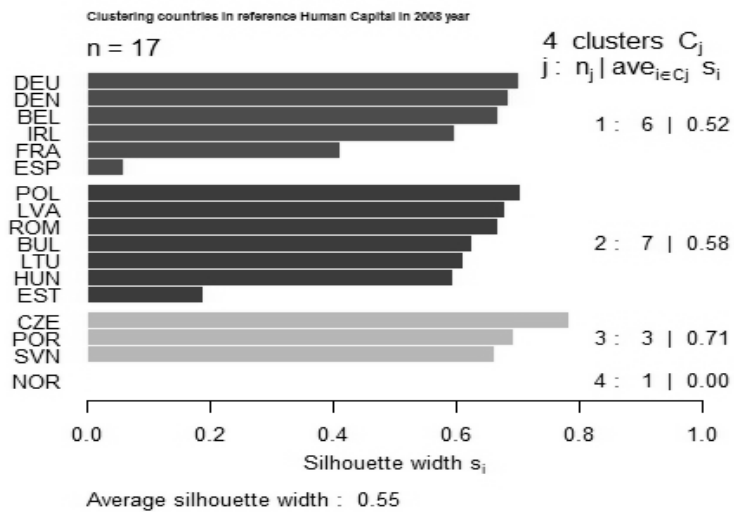
Fig. 2. Cluster analysis for 2008

Source: own study on the basis of the *Eurostat* statistical data in the R software.
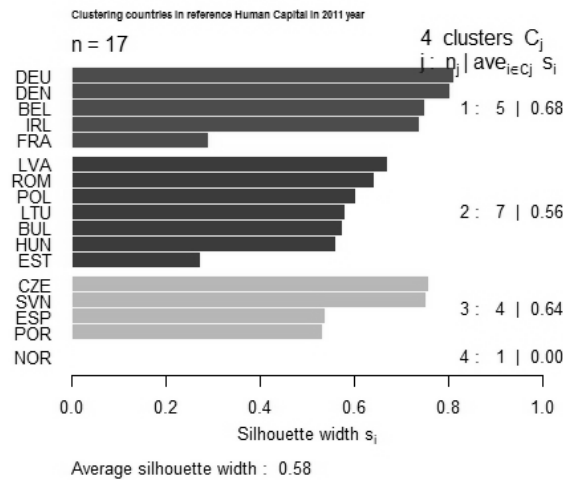
Fig. 3. Cluster analysis for 2011

Source: own study on the basis of the *Eurostat* statistical data in the R software.

It follows from the figure analysis that the first cluster comprises the states of the "old" EU, such as: Germany, Denmark, Belgium, France, Ireland and Spain only for the year 2008. In 2011, Spain found itself in the third group, together with such states as: Czech Republic, Slovakia, Portugal. The second, largest cluster comprised the Central and Eastern European countries (except for the Czech Republic): Poland, Latvia, Romania, Bulgaria, Lithuania, Hungary and Estonia. In both cases Norway constituted a separate cluster.
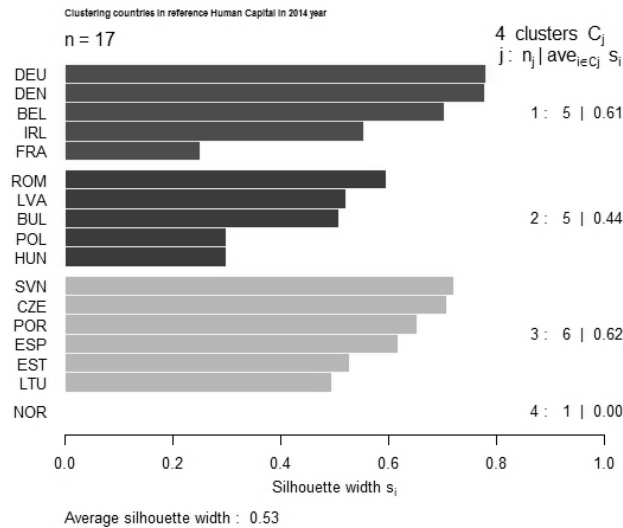
Fig. 4. Cluster analysis for 2014

Source: own study on the basis of the *Eurostat* statistical data in the R software.

For 2014, the first and last cluster did not change in comparison with 2011. The changes resulting from the division based on quality of capital were recorded in the second and third groups. As a result of grouping, Estonia and Lithuania moved to the third group, with states such as Spain, Slovenia, Portugal and Czech Republic.

Conclusions

After conducting the above analyses for the three periods of 2008, 2011 and 2014, it may be stated that the states being the first members of the EU demonstrate high similarity of capital, and the lowest fluctuations in recent years. It should be noted that these countries present high quality of capital due to the presence of Germany in that group, which country is exceptional in terms of economic growth and development in comparison with other states. The core of the second concentration between 2008 and 2011 comprised the states with common past, as well as historical and economic tradition. These are the countries of the former Soviet Union, the legacy of which is visible in certain areas of life until this day. The Czech Republic is the only country from Central and Eastern Europe that did not belong to that group. In 2014, Estonia and Lithuania migrated from the second to the third cluster. It may result from the change in quality of capital, which may, in turn, stem from the beneficial development of those states, as a result of which they adopted the joint currency – EURO. In all the periods, Norway constitute a separate group in terms of quality of capital. That country is not a member of the EU, but has agreements with the community. Norway as a state is characterized by highly developed economy which may result from the high quality of the possessed human capital, and it is not subject to the EU policies.

The above analysis demonstrates that the joint past and geographical location may determine the quality of capital in the selected countries.

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Consumer Safety Awareness – How the Labelling Can Protect Health of Gluten-Intolerant People

Abstract. Recent years have witnessed a growing number of people who are gluten-intolerant and whose diet cannot contain gluten (celiac disease, allergy to gluten and gluten-intolerance). Consequently, the consumers' interest in non-gluten diet is progressively increasing. Gluten is a mixture of prolamins and glutelins, present in the cereal grains: wheat (gliadin), rye (secalin) and barley (hordein). Wide use of gluten in the food industry results from its positive influence on products' consistency, taste and moisture preserving. Since the only effective method of gluten-related diseases treatment is a strict gluten-free diet, this study examines the market of the gluten-free carbohydrate products. A growing desire to avoid gluten is changing the whole food industry. The task was to analyze the labelling correctness of selected nutriments suitable for gluten-intolerant people. The analysis was based on the current EU and national regulations. Besides of common EU regulations and directives dedicated to food production sector and food safety, we can find specified law regulating the composition and labelling of foodstuffs suitable for people intolerant to gluten. In total, 100 food products were subjected to the analysis, divided into 5 groups of gluten-free carbohydrate products (flours, groats and rice, pastas, snacks and sweets, breads).
Summarizing our research the correct labelling of analysed products was present in all examined groups. 97% of the items were labelled by a text stating they were gluten-free products. Also, the composition of the assortment did not give rise to objections to their gluten-free characteristics. 86% of the analysed gluten-free food was produced from natural free-gluten ingredients, whereas 14% was made of low-gluten wheat ingredients. 78% of the examined items were gluten-free products, bearing both text and graphic labelling as gluten-free products. 63% out of this group were products with the AOECS (Association of European Celiac Societies) certificate for safe gluten-free foodstuff.

Keywords: gluten, celiac disease, gluten-free nutrition, gluten-free diet

Introduction

One of the key measures to ensure the safety and quality of food is the monitoring and detection of ingredients harmful to consumers. As an example of such ingredients, we can mention gluten, which can be dangerous for gluten -intolerant people. The subject of gluten-free or restricted gluten food is a huge economical task currently. There are prognoses, that production of meat-free products would no longer be profitable (e.g. sales of meat alternative have flattened in US since 2008). However consumers are presenting rapidly growing demand for products without gluten. Also American people, as health-conscious, were first in significant increase of sale of this type of products. In recent years sale have surged from 5.4 billion dollars to 8.8 billion, Europe is quickly catching up. In most countries there is double-digit sales growth (leading country is Great Britain). US forecasts for 2017 showing further, 61% of sales growth (2018, 38.5% up – after The Economist data). It is not only food manufacturing market change, also restaurants are beginning to offer gluten-free versions/substitutes of their popular foods, to accommodate

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growing consumer base. In recent years, a massive interest in the gluten-free diet has been noticed. The reason for the growing interest is the increasing frequency of diagnosing gluten sensitivity and celiac disease. It is estimated that one out of 100 individuals in Europe suffers from the celiac disease (Cheng et al., 2010; Czerwińska, 2009; Malekzadeh, et al. 2005). Celiac disease is characterized by the intolerance to gluten. Gluten is a spare protein in cereals such as wheat, rye, triticale and barley (Matsuo et al., 2004). The diet of a gluten-intolerant person cannot contain many of very popular food products, such as bread, corn flakes or pastas. The cereals are used as the source of fibre, and gluten as a condiments' carrier, therefore, the gluten-free diet must also exclude many types of meat-products (sausages, ham, mortadella, etc.) and milk products (cheese, yoghurts, creams etc.) (Dziuba et al., 2009; Matsuo et al., 2004). In addition, gluten is frequently present in a great number of ready to use soups and sauces (Wojtasik et al., 2010).

Celiac disease is an incurable disease that may be diagnosed at every age. Currently, 60% of lately diagnosed cases affect adults, 15-20% of whom are aged 60 and more (Dziuba et al., 2009). The pathogenesis of this illness results from the interaction between environmental factors (consumed gluten), genetically based and immunological factors. The only efficient method to counteract the celiac disease is a strict gluten-free diet that must be applied lifelong. The symptoms of the disease might be very characteristic: diarrhea, flatulence or loss of weight. Children might suffer from various disorders in physical development, mainly growth dysfunction (short stature) (Cheng et al., 2010, Sategna-Guidetti et al., 1998). However, the celiac disease might also give very untypical symptoms, not related to the digestive tract, a feature that is delaying the correct diagnosis. It can be i.e. anemia, hemorrhages (bleeding), weakness, depression, constant tiredness, skin symptoms, neurological or endocrinological symptoms, and osteopenia – all of them related to the disruptions of vitamins and mineral nutrients absorption. If not treated, the disease may lead to serious complications, such as life-threatening malnutrition, osteoporosis, pathological fractures, fertility disruptions, neurological disruptions, primary cirrhosis, fatty liver, anemia. An increased risk of gastrointestinal tract tumors (colon lymphoma) can be noticed (Hu et al., 2006; Malekzadeh et al., 2005; Sapone, 2012). Celiac disease often co-exists with such illnesses as type 1 diabetes, or the Hashimoto disease (Hill et al., 2005).

There are also diseases not considered as gluten-dependent, in which the non-gluten diet is recommended: Inflammatory Bowel Diseases (IBD), type 1 diabetes, Hashimoto disease, child autism spectrum disorder (i.e. Asperger syndrome) or child ADHD (Currie et al., 2012; Sapone, 2012; Zali et al., 2011). The Food Law in Poland is regulated by the national legislation, i.e. law acts and corresponding regulations, as well as by the EU laws, obligatory in all countries of the European Union. The EU laws take the form of directives (must be implemented in every member state) and regulations (are directly binding for all EU countries). The national legislation in the area of interest is: The Act on the Food and Nutrition Safety, The Act on the State Sanitary Inspection and corresponding regulations.

Among the EU acquis, which are worth mentioning are the regulations of the European Parliament and the European Council, forming the so-called "Hygiene Package", i.e.: Regulation No 178/2002 on the general principles and requirements of food law, establishing the European Food Safety Authority and procedures for food safety; Regulation 852/2004 on the hygiene of foodstuffs; Regulation no. 882 ensuring proper checks on food and animal feed; Regulation no. 853/2004, laying down specific hygiene rules for food of animal origin for food business operators; Regulation no. 854/2004 on the

organisation of official checks on products of animal origin intended for human consumption.

The following regulations on the food for gluten-intolerant people are in use: Regulation no. 41/2009 on the composition and labelling of foodstuffs suitable for people intolerant to gluten; Regulation no. 828/2014 on the requirements for the provision of information to consumers on the absence or reduced presence of gluten in food; Regulation no. 1169/2011 on the provision of food information to consumers; changes in the Regulations no. 1924/2006 and no. 1925/2006; annulment of the Directives: 87/250/EWG, 90/496/EWG, 1999/10/UE, 2000/13/UE, 2002/67/UE and, 2008/5/UE, of the Regulation no. 608/2004.

The food labelling is defined in the Regulation no. 1169/2011 as any tag, logo, trademark, illustration or other description in the form of print, illustration, stamp, press or other, applied on the packaging or wrapping surface, or attached to the food container. The label must be clear to support the customers in the conscious choice of their food and diet. The basic criteria for the correctness of the labelling are the accuracy and readability of information on the packaging. The producer must not give misleading information or imply product's extraordinary characteristics. Thus, the information about the ingredients that might cause allergies or reactions of intolerance must be duly indicated, apart from such information as: product's name, producer's name, country of origin, ingredients list, net amounts of ingredients, "best before" indication, storage conditions, nutrition values and list of supplements. The information on allergy risks is vital since some of allergies or intolerance reactions might become for some people health - or even life - threatening. Therefore, in order to ensure the legal consistency and approximation in all EU member countries, voluntary food and nutrition declarations on the labels should be effectuated according to the Regulation no. WE/1924/2006 laying down the provisions on nutrition and health claims made on foods.

The Regulation UE/41/2009 considers the Council Directive 89/398 as of 3 May 1989 on the approximation of the laws of the Member States relating to foodstuffs intended for particular nutritional uses. Hereto, gluten free products for celiac disease patients (people with permanent gluten intolerance) were included. The provisions contained in the Regulation mentioned above are intended to unify the rules on the use of terms referring to the absence of gluten in products sold in the EU countries and to ensure a high level of consumer protection. Gluten, as a substance harmful to gluten-intolerant consumers, was scientifically identified in the following cereals: wheat (and its various sorts, such as durum, spelt or kamut), rye, barley, oat and their sorts. It should be remembered that removing gluten from food products is technologically very difficult. Many special foodstuffs were approved for sales, containing small, secure amounts of gluten (UE no. 41/2009). Special nutrition products, meeting the requirements set for celiac disease patients, should be labelled as "gluten-free products" or "gluten low-content products". Such products, in order to achieve compliance with the provisions of the Regulation, have been subjected to technological processes such as the use of specially processed foods, which reduced the content of one or more ingredients containing gluten or, where such components were replaced with others, naturally gluten-free substances.

National and EU law defines three categories of special nutrition products for people with gluten-intolerance:

1. gluten-free food, where the total amount of gluten must not exceed 20 mg kg^{-1};

2. food with a low-level of gluten - the total amount of gluten must not exceed 100 mg kg^{-1} (Codex Alimentarius Commission (2015);

3. general nutrition products not containing natural gluten, that can be consumed by people suffering from celiac disease (COMMISSION REGULATION (EC) No 41/2009).

The correct identification of food that can be safe for consumers on a gluten-free diet requires a very good knowledge of the gluten-free products' market and has to be built on the consumer's trust toward the producer. Now, the only method recommended by Codex Alimentarius to examine the presence of gluten in food is the Enzyme-Linked Immunosorbent Assay ELISA R5 Mendez, which applies the R5 monoclonal antibodies. This method can be applied only in laboratories. The test detection limit should not exceed 10 mg gluten kg^{-1} in dry mass (Kupper, 2005). The identification of the gluten-free food products available on the Polish market is largely enhanced by the „List of gluten-free products" publication. It is published and annually reviewed by the Polish Association of People with Celiac Disease and on Gluten-Free Diet (Polskie Stowarzyszenie Osób z Celiakią i na Diecie Bezglutenowej). This association grants licences to use the international symbol of a strikethrough grain ear of the safe gluten-free food AOECS (Association of European Celiac Societies) in Poland. This licence labeled on the product gives the full consumption safety, since it certifies that the producer strictly co-operates with the association and checks regularly the whole product range in terms of gluten content.

Among the wide range of non-gluten products available on the market, natural gluten-free products are very important, e.g.:
- Gluten-free cereal products, the seeds of which serve to obtain flour, white rice, brown rice, corn, buckwheat, millet, almonds, quinoa, amaranth, millet flour, edible chestnuts, edible acorns;
- Starch: potato starch, corn starch, rice starch, cassava starch;
- Grits: millet, buckwheat and maize;
- Fresh meat, fish, seafood, eggs;
- milk and milk products: fresh milk, natural yoghurt, kefir and other naturally fermented drinks, unprocessed cheese and white cheese;
- Fats: butter, lard, margarine, vegetable oils, i.e. grape seeds oil;
- Fresh food and vegetables;
- Sugar and sweets: white sugar, cane sugar, honey, sweets made of non-gluten ingredients, i.e. fruit drops;
- Non-alcoholic drinks: tea, natural coffee, fruit juices, mineral water, compotes, herbal infusions;
- Alcoholic drinks: potato vodka, rum, wine, grappa, cognac, brandy, tequila, calvados, malibu, kahlúa, campari, gluten – free beer, ciders;
- Spices: salt, pepper, fresh herbs, wine vinegar, apple vinegar, gluten - free soy sauce Tamari.

The products listed above do not contain gluten in their natural form; however, when stored in wrong conditions, processed or spiced, they can lose their gluten-free characteristics. Bearing in mind that possibility, a gluten-intolerant consumer should always additionally verify the purchased products in respect of the applied supplements or allergens, as indicated on the product's label (celiakia.pl).

Apart from the mentioned above natural gluten-free products, the following food supplements can be applied for the manufacturing of food for people with gluten-intolerance (celiakia.pl):

E410 – carob meal (thickener, stabilizer, gelling agent, emulsifying agent);
E412 – guar gum (thickener, stabilizer);
E415 – xanthan gum (thickener, stabilizer);
E406 – agarwood (thickener, gelling agent);
E407 – carrageenan (thickener, stabilizer, gelling agent, emulsifying agent);
E440 – pectin;
E1401 – modified starch (corn), (thickener, stabilizer);
glucose-fructose syrup,
maltodextrin,
E466 – carboxymethylcellulose (emulsifying agent);
Egg' albumin.

Data and methodology

The aim of the project was to verify whether gluten-free and low- gluten content products available on the Polish market are properly labelled regarding gluten content, according to the current law.

The work methodology was based on the analysis of the labelling content and of the correctness of labelling of selected food products dedicated to gluten-intolerant people. Between October 2015 and January 2016, 100 products were subject to analysis, all of them coming from various eco shops offering special food products, located in Warsaw and Józefów, as well as one internet shop specialized in gluten-free food. The examined products for people on a gluten-free diet were divided into 5 groups: 1. flours, 2. groats, rice and grains, 3. pastas, 4. sweets and snacks, 5. bread and pastries.

The evaluation criteria of the gluten-free product labelling correctness were based on the verification of the consistency of the applied labelling with national and EU law, in particular: Regulation no. UE/41/2009 of 20 January 2009, Regulation no. UE/828/2014 of 30 July 2014, Regulation no. UE/1169/2011 as of 25 October 2011, the Act of Law as of 26 August 2006 on the food and nutrition safety, the Codex Standard for Foods for Special Dietary Use for Persons Intolerant to Gluten from 2008. The first task was to examine whether the product for special dietary use is labelled as a gluten-free foodstuff or a gluten low-level foodstuff. Then, the labelling graphics "gluten free" was examined, as it was important, to verify if the product helds the AOECS certification. The analysis considered both information placed on the label, as well as on the packaging of the product. Additionally, other graphic labelling was examined, which might have indicated other characteristics of the analysed product. At the next stage the product composition examination was performed. The final evaluation was dependent upon the application of the gluten-free wheat products and upon the application of the natural gluten-free ingredients. Preservatives and additional substances present in the examined products underwent the analysis, as well.

Results

The first analysed group of products comprised flours for gluten-intolerant persons. Products of the most common gluten-free food manufacturers were selected, i.e. Schär, Bezgluten, NutriFree, Balviten, Le Venezine, JizerskePekamy, BauckHof, Glutenex and Incola Gluten Free.

The results of the products' analysis from the 1st group revealed that the labelling of gluten-free flours was in line with the law. The products were labelled as gluten-free both in text and graphically. Regrettably, not all of them held the AOECS symbol of safe gluten-free food. 14 out of 20 samples had that commonly acknowledged symbol. In the rest of the cases, there were various versions of pictograms of the strikethrough ear designed by the particular manufacturers. In this product group no low-level gluten products were noticed.

Six products were partly composed of wheat ingredients, technologically deprived of gluten. They are particularly common as ingredients in gluten-free flour mixtures for pastries, cakes and bread. Nonetheless, the basic components of all examined flours labelled as "gluten-free" were natural gluten-free compounds such as corn starch (14/20), potato starch (8/20), corn flour (7/20), rice flour (4/20), cassava starch, lupine flour (3/20). The market offers encompasses also flours labelled as gluten-free that are of natural origin only, such as corn, rice, amaranth or buckwheat. The main thickener applied in the manufacturing of gluten-free flours is the guar gum. Its presence was detected in 12 out of 20 products. A very common technological ingredient applied as raising agent is sodium bicarbonate. There were 7 products among the examined group that had this substance in their composition. Due to their characteristics, the supplements listed above replaced gluten that does not appear in gluten-free flours (Figure 1.).
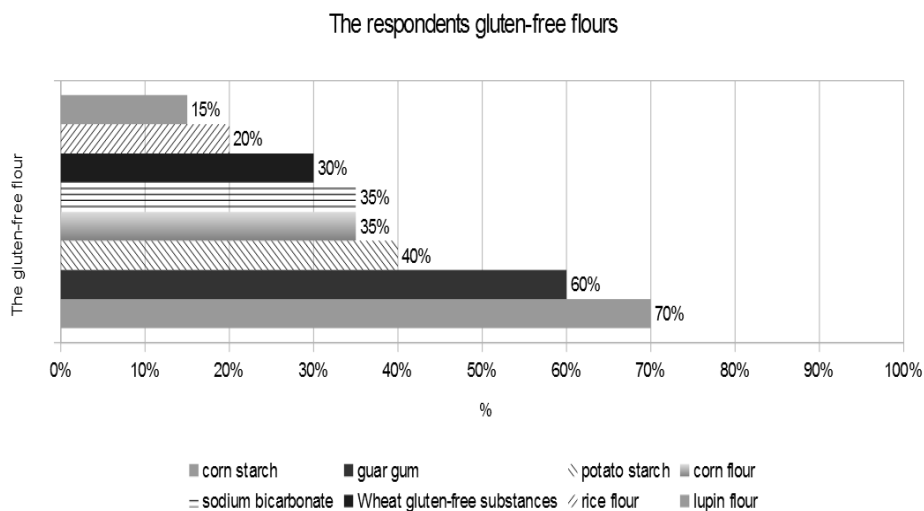
Fig. 1. The results of analysis of gluten – free flours. The evaluation of flour types most popularly present on the market (on the base of raw material) (%)

Source: own data.

The second analysed group of products consisted of groats, rice and cereals, designated for consumers who are gluten-intolerant. Products from big brands of gluten-free food producers were selected, along with products of smaller suppliers of groats, rice and natural gluten-free cereals. The assortment of groats, rice and cereals for gluten-intolerant consumers can be divided into two subgroups. First, there are products of natural gluten-free origin for a special nutrition purpose, having a producer's declaration that they are completely gluten-free. Second, there are natural gluten-free products, widely accessible, bearing no indication of a gluten-free product. The first subgroup consists mainly of groats and cereals offered by companies producing safe nutrition products for gluten-intolerant people. These are products classified as special nutrition products, suitable for people that do not tolerate gluten.

The second subgroup consists of nutrition products based on natural gluten-free products that are widely common on the market.

In most cases groats, rice and cereals were labelled as gluten-free products, both in text and graphically. The analysis did not reveal any low-gluten products. Unfortunately, only in 3 cases, the product was certified by the AOECS symbol. 8 out of 20 products were labelled by a non-certified graphic symbol of the strikethrough ear. A significant group (9 items) of nutritional products did not have any graphic symbols which would indicate their gluten-free composition. Three products showed no indication that they were gluten-free, and one product was marked with the English information „gluten free" (the original transcription, with no Polish translation). The rest of the products from this subgroup had some kind of indication in their names that they were gluten-free.

According to the observations, often the location of the product on the particular shelf in the shop was supposed to indicate that it was a gluten-free product. Sometimes, this role was played by the gluten-free origin, or the name of the product. The majority of the examined assortments (13 out of 20 items) were ecological products. Despite such labelling is expected to increase the consumers' trust level, in fact it presents no guarantee of the gluten-free food quality. This finding has been confirmed by the analysis of the gluten content in food products that is available on the website www.celiakia.pl, e.g. from May 2014, showing an example of the ecological buckwheat flour "BIO Babalscy", which contained over 400 mg of gluten per 1 kg of the product.

It is important that the consumer possesses the right amount of knowledge on products which can be suitable for him while choosing groats and cereals, as in most cases, he deals with a one-ingredient assortment. However, it must be clear that the gluten-free characteristic of a product results not only from the raw material, but also from the conditions of growth, storage and processing. As the analysis reveals, not all groats and cereals that are naturally gluten-free bear the information "gluten-free". Gluten-intolerant people are advised to consume products such as: quinoa, millet, buckwheat, white rice or brown rice. The gluten-free nutrition is defined in the domestic and EU laws that make the producer responsible for a careful examination of the gluten-free food in respect of the gluten content. In order to follow those requirements, the producer needs to obtain an adequate gluten-free raw material. Then, he must process it and store it in conditions that limit to the minimum the contamination of the final product by gluten. For many companies, such an investment appears unprofitable, thus they decide not to label their products as gluten-free.

Figure 2. Buckwheat, labelled as an ecological product. The white circle indicates a gluten grain, contaminating the buckwheat, theoretically a natural gluten-free product

Source: own data.

The third group of the analysed products contained pastas for gluten-intolerant consumers. Currently there is already a wide range of various gluten-free pastas on the market. They, however, differ in respect of their composition and shape. Traditional pastas, such as: spaghetti, lasagne – all of them can be purchased in a big variety. Their basic component that commonly replaces the wheat flour is the corn flour (13 out of 20 cases), rice flour (13 out of 20 cases) and their mixtures. Such ingredients as potato starch, corn starch (4/20) or buckwheat flour (3/20) are also added. Two cases reported the addition of gluten-free wheat starch.

Fig. 3. The results of labels analysis of gluten –free pasta. The diagram presents the most common ingredients and food additives used in the manufacturing process of different kinds of pasta (%)

Source: own data.

The most common supplements applied in gluten-free pastas were: E 471 (i.e. mono and diglycerides of fatty acids, performing as emulsifying agent (8 out of 20 cases). E 575, i.e. glucon acid lactones, performs the acidity control (2/20). The analysis of the

composition revealed that beta carotene was used as a dye (2 cases), and hydroxypropyl methylcellulose (E 464), was added as a thickener (also 2 cases). Those data indicate that application of additional substances in the production of gluten-free pastas was a scarce (Figure 3).

To sum up, it can be stated that the labels of the gluten-free pastas available on the Warsaw area market indicate that producers apply the domestic and EU regulations. In the group of the examined products, again, only the gluten-free products were observed; no low-level gluten products could be noticed. In 18 cases, apart from the text information, also graphic signs were applied, out of them 10 had the certified symbols of safe gluten-free food AOECS. The absence of such symbol was reported in two cases.

The fourth analysed group comprised snacks and sweets for gluten-intolerant consumers. Snacks and sweets is a group with a wide variety of assortment, including e.g. cakes, candy bars, salt sticks and chips. The examined products were classified to gluten-free products (no products with a low-level of gluten). More than a half of the sweets and snacks (12/20) exhibited both text and graphic information on their gluten-free characteristics. The AOECS certification for safe gluten-free food was present with 10 items from the entire group of products. In 8 cases, no graphic information was available. The composition of the examined products was fairly varied. Their common denominator was the application of natural gluten-free substances such as: rice flour, buckwheat flour, potato flour, potato starch, rice starch, cassava starch, corn starch, corn flakes, and expanded amaranth or millet grains. In 3 cases, there were wheat gluten-free products on stock. Those substances presented a kind of basis for gluten-free snack and sweets. The rest of the components depended on the product's character. As fatty substances, hardened palm or rapeseed oil, sunflower oil, vegetable margarines, or mono and diglycerols were applied. The producers of sweets and snacks warned of allergens like eggs, peanuts, almonds and soy. In the examined group of products, no traces of gluten containing supplements were observed.

The fifth group of analysed products consisted of bread for gluten-intolerant people. For persons who not tolerate gluten, one of the biggest challenges in their gluten-free diet is the necessity to avoid consuming of traditional bread. The problem pose even those natural gluten-free products that are prepared in a traditional bakery, since during the gluten and gluten-free production process, cross-contaminations often occur. On the Polish market, there is already a wide range of gluten-free bakery products. Twenty examined items were all classified as gluten-free food. The great majority of them (17 items) had text and graphic symbols, informing about the absence of gluten in the product composition. More than half of this group (12 items) was labelled by the AOECS certificate. Only three products exhibited no additional graphic symbol, signifying the gluten-free food.

The basis for the gluten-free bakery products was corn starch, present in 19 out of 20 products, as well as rice flour (15 out of 20). Yet, other key ingredients were unsaturated vegetable fats, present in their various forms in 18 out of 20 items. One of the most commonly used fats is olive oil. 80% of the examined products showed yeast in their composition. 16 products contained the addition of natural roughage from apples or potatoes.

In the examined assortment, the presence of the following substances was noted: buckwheat flour (7/20), rice starch (6/20), potato starch (4/20), corn flour (4/20) and cassava starch (2/20). Only in 3 items, gluten-free wheat starch was used. Technological supplements applied in the production of gluten-free bread that were present most

frequently in the composition of the examined products were: E 471 i.e., mono and diglycerides of fatty acids performing as emulsifying agent (18/20), hydroxypropyl methylcellulose (E 464) applied as thickener (9/20), acidity regulator E 575, tartaric acid (4/20), citric acid, guar gum and E 330, E450, E 282 (Figure 4).

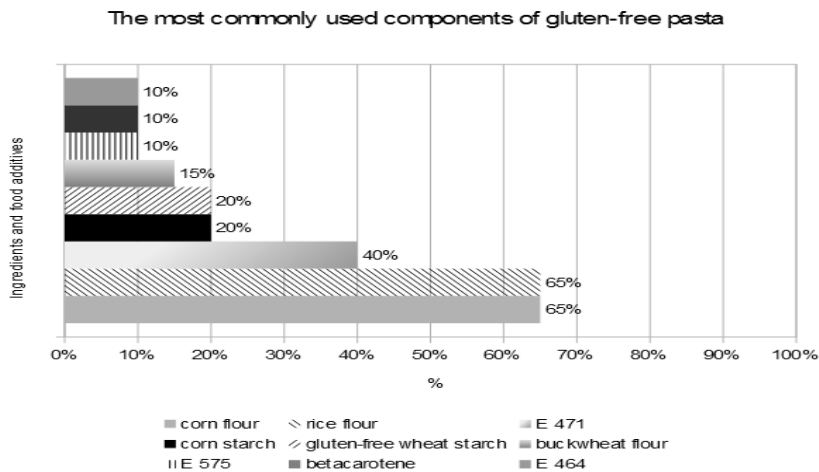The most commonly used ingredients in the production of gluten-free bread
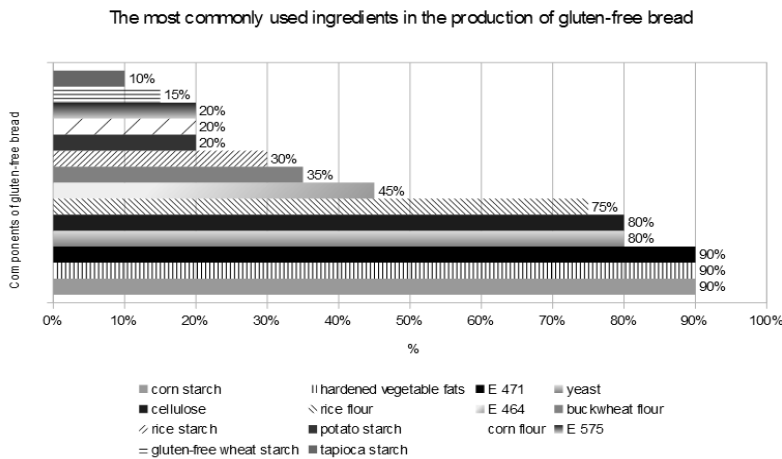
Fig. 4. The results of labels analysis of gluten – free bread. The diagram presents the most common ingredients used in the manufacturing process of different types of bread (%)

Source: own data.

Summary

On the basis of the present analysis of the composition and the labelling correctness of selected foodstuffs such as: groats, flours, rice, corns, pastas, snacks, sweets and bakery products suitable for gluten-intolerant people, it can be summarized that the correct labelling of those analysed products was present in all examined groups. 97% of the items were labelled by a text stating they were gluten-free products. Also, the composition of the assortment in question did not give rise to objections to their gluten-free characteristics. 86% of the analysed gluten-free food was produced from natural free-gluten ingredients, whereas 14% was made of low-gluten wheat ingredients.

To sum up, 78% of the examined items were gluten-free products, bearing both text and graphic labelling as gluten-free products. 63% out of this group were products with the AOECS certificate for safe gluten-free foodstuff. Products holding such certificate are particularly recommended for people suffering from the celiac disease, as they guarantee the full safety of the production conditions and application of all required standards regarding the gluten content limits in the final product.

However, it must be stated that the biggest problem on the national gluten-free market is the insufficient observance of the production quality standards by the manufacturers. The condition of the gluten-free assortment offered on the Polish market is examined by means

of random checks performed by the Polish Association of People with Celiac Diseases and on Gluten-Free Diet (Polskie Stowarzyszenie Osób z Celiakią i na Diecie Bezglutenowej) that assigns laboratories with the task of marking the gluten content in gluten-free nutrition products. The results of the tests are published online on the association's website www.celiakia.pl.

The text-labelled products with no additional graphic labelling amounted to 33% of the tested group. 33,3% were one-ingredient products, prepared from natural gluten-free materials. Manufacturers often do not place information on the packaging of gluten-free nature of the product because although it is a naturally gluten-free product there is no guarantee that there had not been any contamination during the production process. As a matter of fact, companies that do not specialize in the production of gluten-free products often do not have safe, "gluten-free" production lines or storage houses.

The study revealed that apart from the graphic illustration informing that the given product is gluten-free, there are also pictograms informing about the absence of other potentially allergenic ingredients, mainly wheat ingredients (12%), milk – lactose (30%), eggs (24%), sugar (1%), soy (3%) and genetically modified GMO products (4%). In the composition of the examined products, no additional ingredients were detected that might have contained gluten. The great majority, i.e. 86% of the total number of analysed foodstuffs, were based only on natural gluten-free ingredients. The rest, i.e. 14% of the total number, exhibited the addition of wheat ingredients that were deprived of gluten.

Buying a gluten-free product requires a fair amount of trust towards the producer as in home conditions no customer is able to detect potential contamination with gluten of groats, flours, rice, corns, pastas, sweets, snacks or bread. Thus, it gives much rise to optimism that 40% of products had the AOECS certification for safe gluten-free food, issued in Poland by the by the Polish Association of People with Celiac Diseases and on Gluten-Free Diet (Polskie Stowarzyszenie Osób z Celiakią i na Diecie Bezglutenowej). Only AOECS-labelled gluten-free nutrition products guarantee the highest consumption safety.

The presented study examined the compatibility of the labelling with the law and the declared composition of gluten-free products. Even though, both aspects seemed to be correct, the daily practice defies such optimism. As the market analyses reveal, the gluten-free food is frequently contaminated by gluten. For example: gluten-free bread "Białobrzeski" from a bakery exceeded twice the gluten content limit (www.celiakia.pl). Regrettably, such cases are not rare. Along with the recognition of the necessity to eat gluten-free food, there is an increasing number of theoretically gluten-free products. They are customarily processed in the same place (production line) as traditional products containing gluten, therefore, they may easily become contaminated. Same silos, self-sown gluten cereal grains, same transport, grinding and processing on the same premises – all of these factors contribute towards the enhanced contamination danger. Those observations also used to be confirmed by the consumers' own experience, i.e. finding fragmented grains of wheat while cooking groats (fig.2), or noticing flour layer on groats. The examples mentioned above show that despite the wide range of manufactured gluten-free products and natural gluten-free products on the market, not all of them fulfil the quality criteria. On the other hand, the health of the gluten-intolerant people largely depends on the credibility of the manufacturers and distributors of the gluten-free food.

The aim of the next study will be the examination of the food samples, from products not labelled as gluten-free, in which the list of composition did not contain information

about the presence of gluten derivatives; hence, no gluten presence is assumed. The study will be conduct with the use of Enzyme-Linked Immunosorbent Assay R5 Mendez ELISA.

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Considerations Regarding a Comparative Economic Approach on Corn and Wheat Crops on a Representative Soil in Romania

Abstract. The research refers on the production results obtained on corn crops (Turda STAR Variety) and wheat crops (Dumbrava variety) (cultivated following corn crops) conducted on an argyle chernozem soil in Cluj County, Romania. The study exhibits the differentiated fertilization systems (the effect of the nitrogen-phosphorous interaction) involved in obtaining high productions of wheat and corn in the reference area. For corn crops the rate of return, as a mean of all the values that derive from all nitrogen-phosphorous combinations was at a very high level, 80%, with a maximum of the individual values reached at the fertilizing combination N200P160, at which the value of the production increase due to the applied dose, reached the maximum value (6041kg/ha).. For wheat crops the rate of return, as a mean of all the values that derive from all nitrogen-phosphorous combinations was at a medium level, 58%, with a maximum of the individual values reached at the fertilizing combination N200P80, at which the value of the production increase due to the applied dose, reached the maximum value (2658kg/ha). Corn is not as sensitive as wheat to an imbalanced nitrogen-phosphorous (NP) ratio and responds to this through high productions even for nitrogen (N) overdoses that can sustain high and economic corn grain productions per surface unit.

Key words: corn crops, economic optimization, fertilization systems, nitrogen-phosphorous interaction, wheat crops.

Introduction

Sustainable agriculture attracts the application of principles that lead to agriculture technologies which are both technically and economically productive, providing effective solutions for protecting the environment and the consumers. They also insure the productivity of the factors involved and also an optimization of the production components. The production data are obtained from these experiments that target the economic efficiency of differentiated fertilizations on corn and wheat productions and their quality. In this study was tracked the effect of the nitrogen-phosphorous interaction in achieving corn and wheat productions. The production data are obtained from experiments, framed in the "long term experiments system" from ASAS-ICDCPT Fundulea network, which target both the effect and efficiency of differentiated fertilizations on productions and also the impact of fertilizers on the soil fertility evolution, on the quality of the productions obtained (Poruţiu et al., 2013). Economic approaches dedicated to ensure real management of

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fertilizing resources on agricultural crops are going through stages of scientific evidence on the economic efficiency of fertilizer application and then developing a substantiation framework for the optimization of fertilization. These approaches involve first of all defining the concepts and objectives of establishing relevant indicators expressing fertilization efficiency and optimization in order to disseminate the results obtained in the delimitation of differentiated fertilization systems (Otiman, 1979; Otiman, 1987; Toader et al., 2013). In the context of the optimization of soil-plant system, an important scientific and practical role is played by the agrochemical optimization alternatives that harmonize the fertilizing components of the soil with the demands of the vegetal species that can exploit better the production capacity of the soil and genotypes cultivated in order to obtain high vegetal productions that are consumable in large quantities, having superior quality indices, in terms of maintaining an equilibrium in the environment and determining food safety and security (Rusu et al., 2005, Borlan et al., 1994; Hera, 2008). Economic and fertilization optimization objectives were related to investigating by economic analysis, the efficiency indicators in experimental variants, which, based on net revenues (of the increase of production) and their unitary costs assess the rates of return of the technical effect and also on researching on economic efficiency research results supported the appropriateness of performing further studies regarding programming technologies of fertilizer application, that includes based on maximizing net income, detailing specific indicators for the optimization of calculating the NP doses, of their programming the establishment of fertilizer assortment and relevant recommendations related to the rational application of fertilizers (Poruțiu, 2014).

Material and methods

The experimental approaches were performed under SCDA-Agricultural Research and Development Station Turda conditions, using the experimental protocol of long term experiences, first located in the agricultural year 1966/1967, for wheat-corn-soy rotation (Haş, 2006).

The varieties of wheat and corn used for the experiments were Dumbrava wheat variety and corn hybrid Turda STAR.

The field experience which underpins the achievement of objectives is a bi-factorial structure that tracks the effect of the NP interaction on wheat: A factor - phosphorus doses (kg P_2O_5/ha): 0; 40; 80; 120; 160, with annual application to wheat; B factor - nitrogen doses (kg N/ha): 0; 50; 100; 150; 200, with annual application to wheat after corn;

Soil from the nutrient experiences: according to soil mapping, pedological and agrochemical study and from the soil quality monitoring results, this soil fits the argic chernozem type, in the pedological class of cernisoils.

Fertilizer used in the experiments: complex fertilizer 20-20-0 is a solid, granulated nitrophosphate, which holds when applied, the effect of the interaction of the two elements from its composition (N·P), here in balanced concentrations and reports (1:1:0) (Hera, 2008).

When harvesting the wheat, production results were collected and for these the absolute increases due to phosphorus application as a fertilizer were calculated.

The processing and interpretation of the data was conducted using the production curves according to polynomial models and they were graphically represented in this study.

When harvesting the corn and wheat, production results were collected and for these the absolute increases due to phosphorus application as a fertilizer were calculated. The economic indicators tracked and studied were economic efficiency indicators: Production increase per surface unit (ha) (ΔQ); Value of the production increase per surface unit (ha) (V_S); Additional costs per surface unit (ha) (Cs); Value of the production increase per 1 leu additional costs (V_S/1 leu Cs) (Otiman, 1987; Chiş and Merce, 1999).

RESULTS

Wheat crops respond positively to the NP levels applied to the soil in the experience, the production effects are at the level of 3-6 tons grains per surface unit (ha) with production differences (increases) that are very distinctly significant for all nitrogen-phosphorous combinations applied (Figure 1, Figure 2).

P 40: y = -312.5x² + 2853.7x - 145.2 $R^2 = 0.9994$
P 80: y = -312.14x² + 2901.5x - 93.8 $R^2 = 0.9995$
P 160: y = -348.93x² + 3191.1x - 577.8 $R^2 = 0.9966$
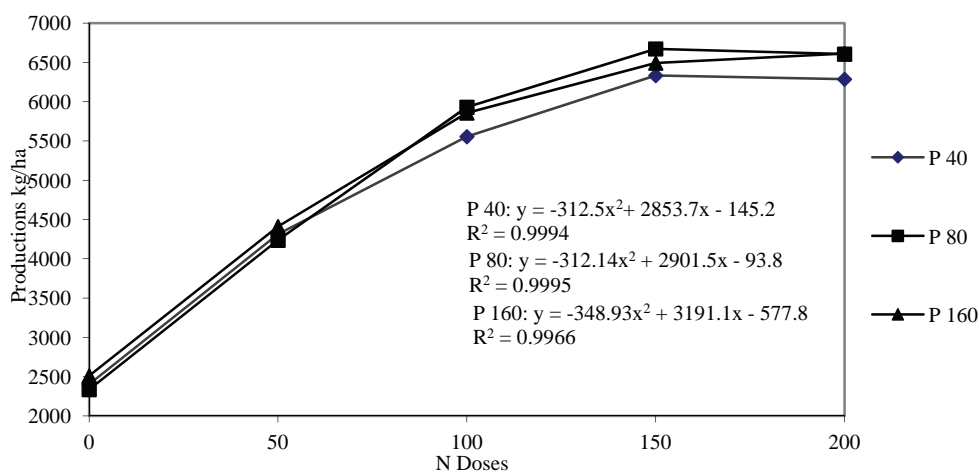
Fig. 1. Effect of differentiated fertilization (NP) on the production of grain (kg/ha) obtained from wheat grown after corn in 2011

Source: own calculation.

The results obtained during 2011 exhibit Dumbrava wheat's variety feature to harness well the nutrients applied, from the small to the medium and to the high NP doses, with capping tendencies of the grain production and of fertilizing increases, at over 100 – 150 kg N/ha for wheat grown after corn.

P 40: y = -309.43x2 + 2516.6x + 100.4
R2 = 0.8917

P 80: y = -395.21x2 + 3064.6x - 419.8
R2 = 0.9962

P 160: y = -340.57x2 + 2800.2x - 181.2
R2 = 0.9814
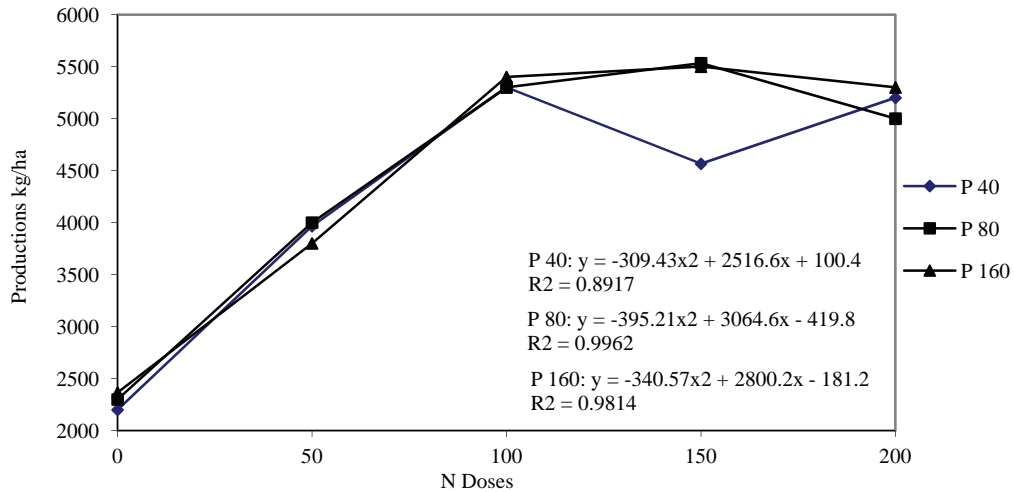
Fig. 2. Effect of differentiated fertilization (NP) on the production of grain (kg/ha) obtained from wheat grown after corn in 2013

Source: own calculation.

The complex application of the NP combinations exhibits multiple possibilities of obtaining productions of 5,5 - 7 t grains/ha for wheat grown after corn, at 100 – 200 kg N/ha and 40 – 160 kg P/ha insured at the same time.

Wheat production results in the experimental years 2011 and 2013 allow a synthesis of their analysis regarding some production effective approaches through differential fertilizing systems based on the NP complex effect, a high priority and often used technology (Table 1).

Table 1. Report on production and maximum increases to the content of a. s./hectare (N+P)

Year	Crop	Maximum production (kg/ha)	NP Dose	Dose sum N+P	Production/NP dose	Prod. Dif. (M)/NP dose
2011	Wheat after corn	5533	N150P80	230	24	6,1
2013	Wheat after corn	6945	N150P120	270	26	5,2
Mean	Wheat after corn	6239	N150P100	250	25	5,6

Source: own calculation.

Technical results obtained as the mean of the years 2011 and 2013 prove the possibility of obtaining maximum yields of wheat, Dumbrava variety, of 6945 kg/ha using N150P106 fertilizer effort (crop after corn). Corn crops have a much differentiated response to the effect of applying fertilizers than wheat. First, only the results in 2011 confirm regularities in the influence of NP factor on the grain production or significant influences of the N and P factors (Figure 3, Figure 4).
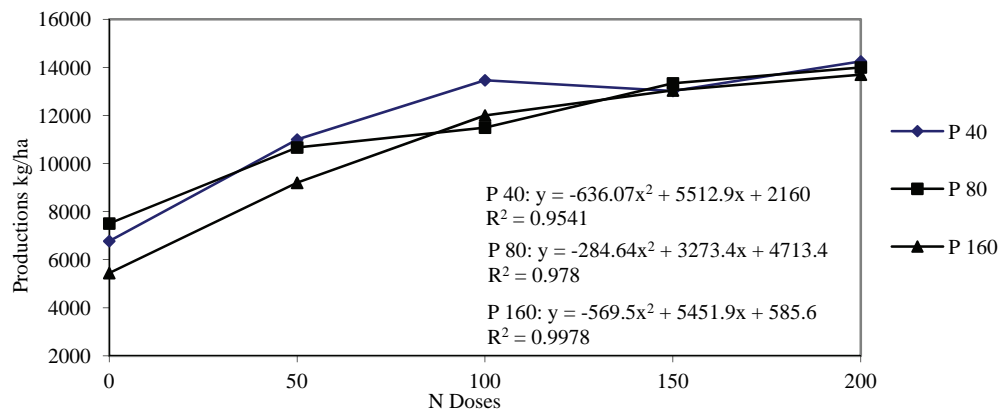
Fig. 3. Effect of differentiated fertilization (NP) on the production of grain (kg/ha) obtained from corn grown after wheat in 2011

Source: own calculation.
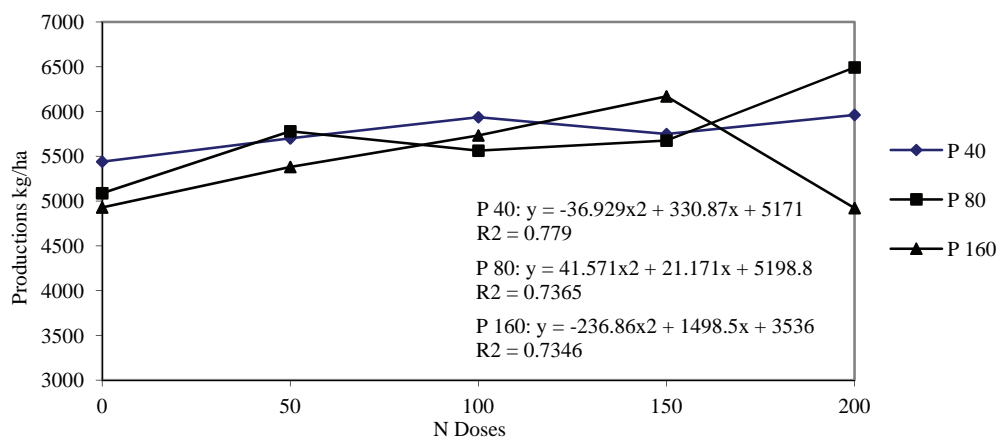
Fig. 4. Effect of differentiated fertilization (NP) on the production of grain (kg/ha) obtained from corn grown after wheat in 2013

Source: own calculation.

Table 2. Report on production and maximum increases to the content of a. s./hectare (N+P)

Year	Crop	Maximum production (kg/ha)	NP Dose	Dose sum N+P	Production/NP dose	Prod. Dif./NP dose
2011	Corn	13696	N200P160	360	38	2,0
2013	Corn	6493	N200P80	280	23	2,5
Mean	Corn	10093	N200P120	320	31	2,2

Source: own calculation.

Table 3. Economic efficiency indicators for wheat grown after corn in 2011(Vs; Cs; Vs/1 leu Cs) (lei)

N	Economic efficiency indicators	P →	0	40	80	120	160	Mean
0	Vs Cs Vs/1 leu	–	–	–	–	–	–	–
50	Vs		900	1766	1700	1300	1433	1420
	Cs		644	943	1100	1752	1390	1166
	Vs/1 leu		1.39	1.87	1.54	0.74	1.02	1.31
100	Vs		1500	3100	3000	2700	3033	2667
	Cs		920	1235	1424	1571	1759	1382
	Vs/1 leu		1.63	2.51	2.1	1.71	1.72	1.93
150	Vs		1800	2366	3233	2700	3133	2646
	Cs		1158	1414	1660	1801	2034	1613
	Vs/1 leu		1.65	1.67	1.94	1.49	1.54	1.66
200	Vs		2166	3000	2700	2166	2933	2593
	Cs		1402	1663	1844	1987	2252	1829
	Vs/1 leu		1.72	1.8	1.46	1.09	1.3	1.47
Mean	Vs		1592	2558	2658	2217	2633	2332
	Cs		1031	1314	1507	1778	1859	1498
	Vs/1 leu		1.6	1.96	1.76	1.26	1.39	1.59
	Rate of return (Vn; Rr) (lei; %)							
0	Vn Rr	–	–	–	–	–	–	–
50	Vn		256	823	600	- 452	43	254
	Rr		40	87	54	- 26	3	32
100	Vn		580	1865	1576	1129	1274	1285
	Rr		63	151	110	71	72	93
150	Vn		642	952	1573	899	1099	1033
	Rr		55	67	95	49	54	64
200	Vn		764	1337	856	179	681	763
	Rr		54	80	46	9	30	44
Mean	Vn		561	1244	1151	439	774	834
	Rr		53	96	76	26	40	58

Source: own calculation.

Actually, corn grain production (Turda STAR hybrid) are very variable from year to year, the quantitative results in 2013 are less than half of the productions obtained in 2011. Climate disorders slashed the production of those years. The synthesis of the production results obtained for corn linked to the NP fertilization proves specificity due to this crop and especially a real dependency to the favorable climatic condition of that agricultural year (Table 2).

Based on technical analysis, consistent with the average production results obtained in 2011 and 2013, with all the high variability of the grain production, it is possible to obtain maximum yields of 8128 kg/ha at a complex dose of N183P93. Large differences in production from year to year and the production increases per active substance unit prove the influence of the years (with climatic effects) on the effectiveness of applying fertilizers to corn. From this point of view, only the results in 2011 can be conclusive for a correct technical and economic analysis. For wheat crops efficiency indicators calculated for 2011 and 2013 show levels that prove a higher efficiency of the NP doses (Table 3, Table 4).

Table 4. Economic efficiency indicators for wheat grown after corn in 2013 (Vs; Cs; Vs/1 leu Cs) (lei)

N	Economic efficiency indicators	P →	0	40	80	120	160	Mean
0	Vs Cs Vs/1 leu	–	–	–	–	–	–	–
50	Vs		1053	1373	1368	1231	1368	1279
	Cs		703	840	1111	1244	1416	1063
	Vs/1 leu		1.49	1.63	1.23	0.99	0.97	1.26
100	Vs		1794	2268	2587	2448	2408	2301
	Cs		967	1224	1444	1605	1762	1400
	Vs/1 leu		1.85	1.85	1.79	1.52	1.37	1.68
150	Vs		2337	2828	3121	3154	2867	2861
	Cs		1242	1468	1685	1875	2056	1665
	Vs/1 leu		1.88	1.92	1.85	1.68	1.39	1.74
200	Vs		2541	2795	3074	3026	2952	2878
	Cs		1469	1683	1900	2086	2287	1885
	Vs/1 leu		1.72	1.66	1.61	1.45	1.29	1.55
Mean	Vs		1931	2316	2538	2465	2399	2330
	Cs		1095	1304	1535	1703	1880	1503
	Vs/1 leu		1.74	1.77	1.62	1.41	1.26	1.56
	Rate of return (Vn; Rr) (lei; %)							
0	Vn Rr		–	–	–	–	–	–
50	Vn		350	533	257	- 13	- 48	216
	Rr		49	63	23	- 1	- 3	26
100	Vn		827	1044	1143	843	646	901
	Rr		85	85	79	52	37	68
150	Vn		1095	1360	1436	1279	811	1196
	Rr		88	92	85	68	39	74
200	Vn		1072	1112	1174	940	665	993
	Rr		72	66	61	45	29	55
Mean	Vn		836	1012	1003	762	530	827
	Rr		74	77	62	41	26	56

Source: own calculation.

For corn crops were taken into consideration the efficiency parameters and indicators for 2011 when the productions were constantly of 12-14 tons of grains/ha and annual production increases of 3-7,5 tons grains/ha. For corn, the quantification of the economic efficiency indicators was developed with reference to the framework technology parameters for this crop (according to data from SCDA-Agricultural Reasearch and Development Station Turda) (Tab. 5).

Table 5. Economic efficiency indicators for corn grown in 2011 (Vs; Cs; Vs/1 leu Cs) (lei)

N	Economic efficiency indicators	P →	0	40	80	120	160	Mean
0	Vs Cs Vs/1 leu	–	–	–	–	–	–	–
50	Vs		3653	4014	3004	3695	3571	3587
	Cs		3068	3068	3068	3068	3068	3068

	Vs/1 leu	1.19	1.3	0.97	1.2	1.16	1.16
100	Vs	5289	6357	3786	6407	6232	5614
	Cs	3068	3068	3068	3068	3068	3068
	Vs/1 leu	1.72	2.07	1.23	2.08	2.03	1.83
150	Vs	4813	5929	5540	6049	7220	5910
	Cs	3068	3068	3068	3068	3068	3068
	Vs/1 leu	1.57	1.71	1.8	1.97	2.35	1.88
200	Vs	6275	7099	6167	7579	7141	6853
	Cs	3068	3068	3068	3068	3068	3068
	Vs/1 leu	2.04	2.31	2.01	2.47	2.55	2.28
Mean	Vs	5008	5850	4624	5933	6041	5491
	Cs	3068	3068	3068	3068	3068	3068
	Vs/1 leu	1.63	1.85	1.5	1.93	2.02	1.43
	Rate of return (Vn; Rr) (lei; %)						
0	Vn	–	–	–	–	–	–
	Rr						
50	Vn	585	946	- 64	627	503	519
	Rr	19	30	- 2	20	16	17
100	Vn	2221	3289	718	3339	3164	3546
	Rr	72	107	23	108	103	83
150	Vn	1568	2861	2472	2981	4152	2807
	Rr	51	93	80	97	135	91
200	Vn	3207	4031	3099	4511	4773	3924
	Rr	105	131	101	147	155	128
Mean	Vn	1895	2782	1556	2865	3148	2449
	Rr	62	90	40	93	102	80

Source: own calculation.

Production and economic results for corn crops from 2011 are reference for the ones obtained in 2013 (climatically unfavorable) stating that due to thermic excess the results from 2013 were not significant regarding the fertilization effect. Corn grain production obtained in 2013 did not even represent 50% of the ones registered in 2011.

The research on the situation of optimum doses show that on an argic chernozem type of soil, the essential and recommended element is nitrogen. Corn crops responded to the application and even overdosage of nitrogen – which can sustain high and economical productions per surface unit.

Summary

It was proven to be essential the effect of nitrogen-phosphorous interaction for corn and wheat crops, followed by the individual action of nitrogen and less of the phosphorus. The variation and variability of the effect of the factors (x_1-P and x_2-N) were at a high level, production results being much different between 2011 and 2013. The most favorable year in terms of climate was 2011, and in 2013 excess heat (during the decisive pheno-phases of crops) caused lower results. In the set of the mentioned alternatives of fertilization with the mentioned doses, grain yields can be obtained of 5,5-6,5 t/ha for wheat crops, Dumbrava

variety, on an argic chernozem. In 2011, Turda STAR hybrid responded with grain yields of 12-14 t/ha, with increases in NP interaction accounted for only ½ and over half of the grain production. This hybrid harnessed the NP interaction, at average and high doses of both nutrients. In 2013 were reported some effects of fertilizers, but exhibited erratically and without statistical support. Economic analysis of the results of differentiated fertilization highlights high economic variability of the combinations of x_1 (P doses) and x_2 (doses of N). This variability occurs based on the level of production, the level and value of production increases obtained, equally important and essential, from the amount of additional costs due to fertilization. The rates of return of fertilization on corn and wheat crops in 2011, show a high efficiency of complex measures of NP and even of the primarily application of nitrogen. With high levels of production of 12-14 t grains/ha and increases of 4-6 t/ha due to the application of some NP combinations, the rates of return are very high and positive feedback justifies such activities. Optimum doses insure and forecast the production levels that stood of the productions that have derived from the results and technical analysis of corn productions. The economic analysis, in which some calculations that show numerical and percentage indicators of this field were made, is capable of also differentiating the technologies that can be applied to prevent fertilization formulas, such as „widespread formulas" and can bind technological efforts, by costs and results, to the rational technical and economic feature.

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The Possibility of Food Consumption Improvement by Reducing Food Wastage in the Households in Poland

Abstract. The primary challenge of global food system is to provide food for nearly 800 million starving people and the next generations of constantly growing population. One of the solutions to this challenge is to reduce food wastage, which is especially high in the households of developed countries. Considering this fact, the analysis of a questionnaire study among WULS students determines their knowledge and awareness of food waste issues, and most often wasted food products. The study also tests the attitudes of respondents towards food waste and its consequences. Results showed that baker's good, fruit and vegetables were the most often wasted food while these products are recommended to consume in largest amounts. Respondents wrongly indicated that food service is the food chain sector with the highest food waste in Poland. The reduction of respondent's disposable income was recognized as the most important effect of food waste. In conclusion, it can be stated that the higher knowledge and awareness of food wastage issues can contribute to reduction of the scale of the problem and improvement of food consumption.

Key words: food wastage, food product, consumption, household

Introduction

Food wastage is a global issue with solely negative consequences. The effects of food wastage can be summed in the following three categories: environmental, economic and social/humanitarian. The third category concerns the perception of food wastage as a barrier for achieving the state of food security in starving regions of the world. A total of 795 million are estimated to be suffering from chronic hunger, regularly not getting enough food to conduct an active life in 2014-2016 (FAO et al., 2015). Over 2 billion people suffer from micronutrient deficiencies, in particular iron, vitamin A, iodine, folate and zinc, among others (CDC, 2015).

Professional literature mainly examines food wastage within the context of starvation and malnutrition in the global scale. Yet, there is still little evidence regarding the determinants of consumers' food waste behaviour in the households (Stancu et al., 2016). In developed countries the food waste generated at the household level represents about half of the total food wastage, making consumers the biggest contributor to food waste. The largest food waste concerns primarily bread/baked goods, fruit and vegetables (WRAP, 2009; European Commission DG ENV – Directorate C, 2011; Gustavsson et al., 2011). It should be added that the term food wastage covers food losses and food waste. Food losses

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occur in agricultural production, post-harvest and processing stages, while the term food waste refers to the end of the food supply chain: distribution and retail, restaurants and consumption in the households (Gustavsson et al., 2011).

Food waste in the final stage of food chain – that is in consumption at households – is much higher in developed regions and industrialised Asian countries than in developing regions. On average each European and North American consumer generates about 95-115 kg of food waste annually, whereas in least developed regions – sub-Saharan Africa and South and Southeast Asia, this number amounts to 6-11 kg (Gustavsson et al., 2011).

Table 1. Feasible food waste reasons in the household

Domestic food handling stages and consumer character traits	Reasons for food waste
Shopping	- Shopping beyond need, impulsive and/or while hungry - Unplanned, inconsiderate shopping - Inability to buy less, lack of smaller packaging available - Stockpiling - Shopping disappointment (unsavoury from producers fault, partly spoilt – especially when buying in bulk)
Food storage	- Inappropriate conditions - Inability to use food stores - Kept too long/forgotten - Wrong packaging
Meal preparation	- Preparing too much food - Wrong processing of ingredients (pretreatment/thermal) - Wrong cooking processes - Failed recipes - Insufficient cooking skills - Lack of time for preparation of planned meals - Lack of skills to manage surplus of products and meals
Meal consumption	- Too large servings - Leftovers - Take away food (to work/school) not eaten
Knowledge and awareness	- Unawareness of scale of food waste in own household - Unawareness of money lost for wasted food - Unawareness of the need to manage food efficiently - Ignorance of other consequences of food wastage - Lack of understanding and differentiation of 'best before' and 'use by' labels
Character traits	- Attitudes: lack of respect for food, cultural standards - Preferences: disposal of edible components of food - Socio-economic aspects: smaller households and of younger people generate more waste and dispose more packaging

Source: own study.

According to European Commission report, EU member states annually waste 89 million tonnes of food, whereupon this estimate does not include food losses in food production and management in agriculture (European Commission DG ENV - Directorate

C, 2011). This equals to an average value of 179 kg per capita, with its largest shares attributed to the households – 76 kg per capita (42%), manufacturing – 70 kg (39%), food service/catering – 25 kg (14%) and retail/wholesale – 8 kg per capita (5%). The estimation made in the frame of European research project FUSIONS (Stenmarck et al., 2016) showed that total food waste in the EU-28 amounted to 88 million tonnes in 2012 (both edible and inedible parts associated with food). This equates to 173 kg per person and constitutes 20% of the total food production. FUSIONS calculation indicated that the share of food waste in the households is higher than it was stated in EC report and equals 53%. Moreover 60% of total food waste in the households is edible.

Costs of food waste accumulates in the whole food supply chain, however it is important to note, that one tonne of food wasted on the consumption stage is more expensive, for the economy as a whole, than one tonne wasted during agricultural production. Cost per tonne of edible food waste in primary production in the EU-28 was estimated at 399 Euro, in food processing – 1490, in wholesale and retail – 2768, in food service – 3148, and in the households – 3529 euro (Stenmarck et al., 2016). British study showed that the average value of food wasted by a household per year, amounts to 250 – 400 GBP (WRAP, 2009). This number is almost twice as high in US – 936 USD (Buzby & Hyman, 2012). In addition to that, household food waste contributes to further costs linked with its collecting, transporting, sorting and utilization (Priefer et al., 2013).

Household food waste generation on such a large scale is determined by a variety of factors which can be identified on all stages of domestic food handling, and also include character traits of consumers (Table 1).

Aim and methods

The purpose of this paper was to identify and recognize different aspects of food waste, including awareness of its consequences, types of food wasted and basic knowledge of the issue of selected group of consumers. The data were acquired using CAWI method (Computer Assisted Web Interview) and original Google Docs (https://docs.google.com) questionnaire as a research tool. The study was carried out between January and April 2015 and during this time 132 questionnaires were collected from the students aged 18-29 years of 18 fields of study at Warsaw University of Life Sciences (WULS – SGGW).

Among all respondents 82% were women. The same share lived in cities. Twenty five - 26% respondents lived each in 2, 3 and 4 person households, 9% lived in 1 person households and 13% in 5 and more person households. Monthly household income was classified in 6 groups. Exactly 58% of respondents chose the first three income ranges, while 42% declared the three latter. Almost all (95%) stated that their households waste food. From those, 57% acknowledged that they waste food at least once a week.

Awareness of food waste

The level of waste varies between respective links of food supply chain. According to 42% of respondents, most food waste should be attributed to catering services. One-third of the tested population indicated retail/wholesale and transport, and only 16% selected households as their answer (Table 2).

Table 2. Food supply chain links with highest food wastage in Poland in the opinion of respondents, %

Food chain link	% respondents
Agriculture	1,7
Food processing	6,7
Retail (shops, markets), wholesale, and transport	33,6
Food service	42,0
Households	16,0

Source: own study.

Those results entirely contrast with the outcomes of FUSIONS project (Stenmarck et al., 2016) and estimates of European Commission (European Commission DG ENV - Directorate C, 2011). According to EC estimation, food waste in Poland occurs primarily in the food processing sector (73% of total waste) and households (23% of waste).

Regarding possible actions that reduce food waste, the majority of respondents were of opinion that those should be implemented by consumers themselves (89%), then in catering services (79%) and in retail/wholesale (75%) (Fig. 1). Those results are consistent with responses presented in Table 1 (at least in terms of the actual stages not their percentage order). In the survey of Federation of Polish Food Banks [FPBŻ 2012] on random sample of Polish adults, the majority (57%) also indicated that households should be responsible for food waste. Next results were slightly different: retail (35%), food producers (34%), government/self-government (29%), NGO's (21%) and food service (15%). Remaining options were indicated by 4-7% of respondents.
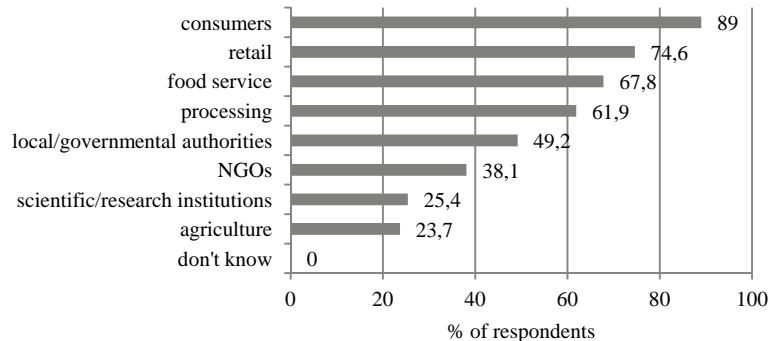
Fig. 1. Food supply chain links and its macro environment where, according to the survey respondents, actions reducing food waste should be undertaken, % of respondents

Source: own study.

The sphere of consumption, as a place where food waste reducing actions should be taken, was also the most popular survey choice in Canada – 74% (Parizeau et al., 2015) and Denmark – 59% (DA&FC, 2009). However, the multitude of determinants of food waste occurrence throughout the whole supply chain demands multidimensional solutions, implemented in parallel on micro, mezzo and macro levels. For instance: private investment in agriculture and crop management, good practices for businesses and consumers on micro level and financial

mechanisms, public investment, activities in the frame of Corporate Social Responsibility (CSR), indexation of food surplus and by-products on mezzo level, should be enabled, supported and reinforced by actions on the macro level (HLPE, 2014). Those solutions require a national scope and inclusion of food waste issues on relevant policy levels.

Wasted products and food handling stages critical in terms of food waste in the household

For a more complete portrait of food wastage, respondents were asked about all products types wasted in the month preceding the survey and top three most wasted products in their households. The percentage of declarations concerning last month's waste was higher than the percentage of total food wasted. This observation may suggest that the scale of total food waste is underestimated.

In both of those objectionable rankings first place was taken by bread/baked goods (around 60% of responses), second – vegetables (respectively 58 and 48%) and third – fruit (respectively 44 and 35%) (Fig. 2). Every third respondent indicated that last month he wasted already prepared meals (38%) and cold cuts or other meat products (34%). The same products, but in alternate order, were specified to be wasted most in general. Within the context of proposed consumption pattern change to a more sustainable one, it is worth noting that 10-30% of respondents declared wastage of milk, fermented milk-based beverages, cheese and meat. With reference to food of animal origin, the environmental consequences of food waste are especially severe and proliferated. This is due to the fact that life cycle stages of animal origin food include conversion of plant resources to animal ones, breeding time and more complex and material-consuming processing technologies, than their plant origin counterparts.

The obtained results are consistent with outcomes of Federation of Polish Food Banks studies, carried out on random samples of consumers (FPBŻ, 2012; 2013; 2014; 2015; 2016). Baked goods, vegetables, cold cuts, fruit and yogurts are in the forefront of those ranking. It is worth noting that both in 2013 and 2016, cold cuts were wasted most frequently. The cause of this declaration can be sought in incorrect storage of cold cuts in the final stages of food supply chain – that is: retail and households, as well as in low quality of parts of those products. Inspections of quality of food offered in the retail market show a large percentage of irregularities of meat products labelling, sensory characteristics and physical and chemical parameters triggered by errors occurring in production processes (for example: non-compliance with recipes, sub-standard base resources etc.) or by counterfeiting products (IJHAR-S, 2012; 2016).

In the survey of inhabitants of Warsaw and Olsztyn, the largest percentage of respondent also indicated baked goods (64%) as most wasted, followed by milk and milk-products (56%), fruit, vegetables and potatoes (Rejman & Wrońska, 2014). In a study of Swedish consumers (Williams et al., 2012) most instances of food wasted concerned prepared meals, vegetables, fruit and dairy products. Respondents from Germany and Italy most commonly discarded vegetables, fruit and baked goods (Jörissen et al., 2015). In Netherlands, surveys specified significant wastage of milk and milk-products, baked goods, vegetables, fruit, sauces and fats (Ministry of Economic Affairs, 2014). Finnish study showed that vegetables (including potatoes), prepared meals and dairy products are wasted substantially (Koivupuro, 2011).
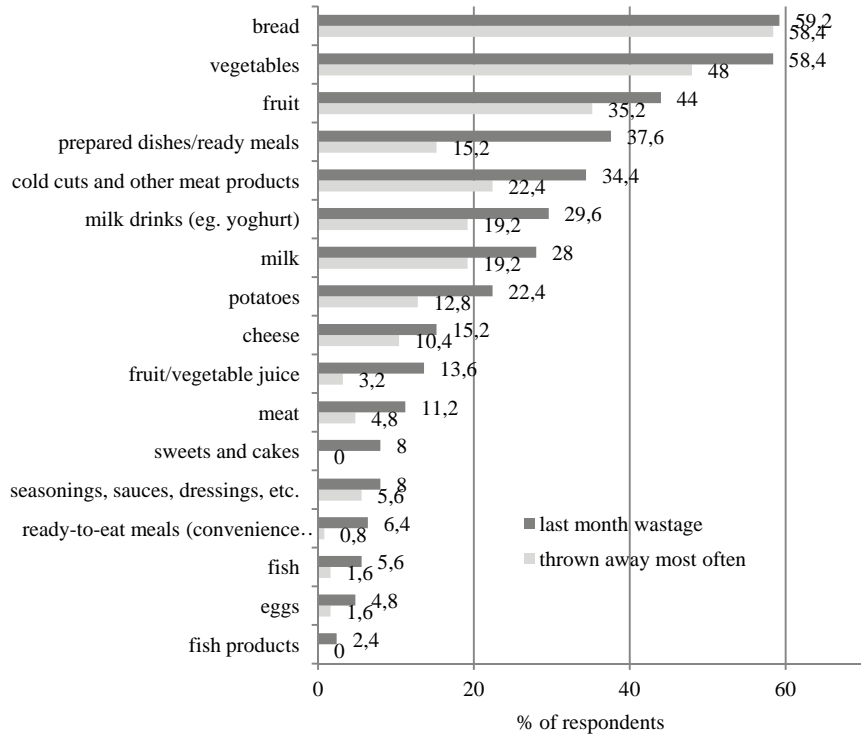
Fig. 2. Food products wasted/discarded last month (preceding the survey) and wasted most often presented in % of respondents

Source: own study.

It is worth to notice that food waste surveys commissioned by FPBŻ (2012; 2013; 2014; 2015; 2016) displayed much lower scope of the problem in comparison to the own study results. In subsequent studies of years 2012-2016, only 30 to 39% of respondents admitted that they waste food. It was observed that food is wasted more by employed people and big cities inhabitants.

The completed survey enabled to assess the distribution of food waste during food management stages in the household. Most respondents (almost 40%) ranked storage of acquired food as the stage of highest wastage. Nearly 30% indicated meal/plate leftovers and remnants of food, and last 17% showed prepared meal storage and meal preparation processes (Fig. 3).

Calculation of weighted means of respondents declarations, allowed to recognise, that in the opinion of total tested population, the most significant stage of food waste is in leftovers and remnants of food (mean = 2.70). In a study referenced above, households in Warsaw also declared leftovers and remnants as the largest share of food waste (Rejman & Wrońska, 2014). Reasons for selecting this stage may include difficulties in evaluation of household members' food needs and preparation of meals for future, in order to limit the time needed in kitchen.

leftovers and remnants of food/2.70*	16,7	25	28,8	28,8
storage of prepared dishes/2.38	24,2	30,3	28,8	16,7
storage of obtained food/2.68	28,8	13,6	18,2	39,4
meal preperation/2.26	30,3	30,3	22,7	16,7
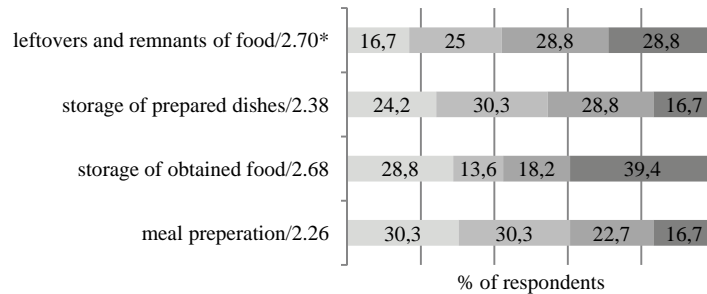
% of respondents

*weighted mean of declarations

Fig. 3. Assessment of food waste volume in respective stages of household food management, % of respondents and weighted means

Source: own study.

Food wastage in a household can also be evaluated by examining the content of household waste containers. More than half of respondents declared that majority of their waste bins contained peelings, peels, rinds, and other potentially edible elements of potatoes, fruit and vegetables (Fig. 4). Remaining categories of food waste in waste containers as the highest ones were selected by only 7-15% or respondents. As a result, the first category – peelings and other edible elements – obtained the highest weighted mean of 3.97 of a total population. Meals leftovers in waste bins were the second, with 15% of respondents declaring its highest share in the amount of wasted food and a mean of 3.24.

expired imperishable food products/1.93*	58		14,8	10,2	10,2 6,8
bread (slices, peels etc.)/2.67	21,6	30,7	18,2	18,2	11,3
expired perishable food products, eg. dairy products, cold meats, salads/3.22	9,1	17	31,8	27,3	14,8
peelings, peels and other edible waste from potatoes, fruit and vegetables/3.97	8	11,4 9,1	19,3	52,2	
food/meal leftovers/3.24	3,4	26,1	28,4	27,3	14,8

% of respondents

■ 1 - the least   ■ 2   ■ 3   ■ 4   ■ 5 - the most
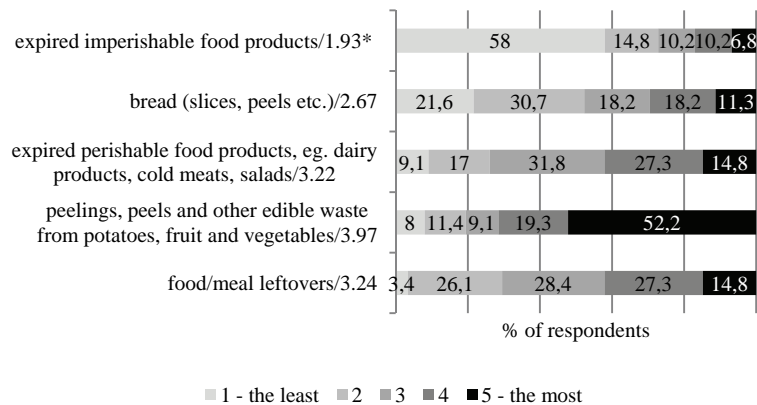
*weighted mean of declarations

Fig. 4. Visual assessment of particular food waste categories in waste containers, on 5 point ascending scale, where 1 – the least, 5 – the most, % of respondents and weighted means

Source: own study.

Taking into account this data, and previous indications (Fig. 3), it seems that British distinction between avoidable, possibly avoidable and unavoidable food waste is justifiable (WRAP, 2009). Food leftovers constitute the majority of food waste in many European countries, for example in Austria (Schneider ,2008), Finland (Silvennoinen et al., 2012) and Netherlands (van Westerhoven & Steenhuisen, 2010).

Expired non-perishable food products in waste containers was the least popular choice in the survey (with average rank of 1.93). This can signify a rational food management behaviour or knowledge about expiry date labelling systems. Vast majority of respondents (90%) correctly assigned 'best before' and 'use by' labels to categories of respectively lasting and perishable products. Lasting products such as flour, groats, canned vegetables, coffee etc. can usually still be consu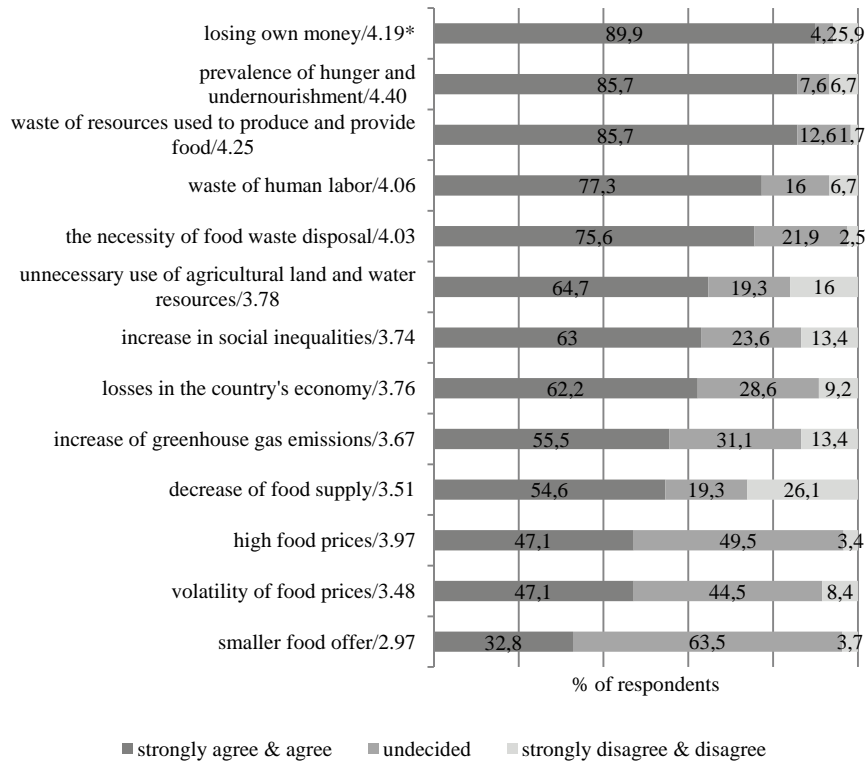med beyond their 'best before' date. After this date, the product quality may become less, however without any increased risk regarding food safety, if the conditions mentioned on the label have been regarded (Bartels et al., 2010). So this term does not mean that the product is unsafe automatically. Currently on the EU forum is a discussion on the issue of non-discrimination of 'best before' and 'use by' labels by consumers, as the cause of food waste – especially with regards to wasted food with past 'best before' date. The ongoing discussion also concerns on whether such food can be freely redistributed to most deprived persons through NGOs, eg. food banks.

Assessment of food waste consequences

The need to limit food waste on global, regional and national scale, results from solely negative consequences of this issue on the environment, global population and economies. That is why in the next part of the survey respondent attitudes towards 13 listed consequences of food waste were identified by using 5-points Likert scale. Consequences where ranked on the basis of weighted means with the following rank ranges and assessment categories: 1.0-1.5 unimportant, >1.5-2.5 rather unimportant, >2.5-3.5 medium importance, >3.5-4.5 rather important, and >4.5-5.0 very important.

Majority of respondents rank the consequences of food waste by a perspective of their own disposable budget (total 90% of agree and strongly agree responses) (Fig. 5).

Consequence	strongly agree & agree	undecided	strongly disagree & disagree
losing own money/4.19*	89,9	4,2	5,9
prevalence of hunger and undernourishment/4.40	85,7	7,6	6,7
waste of resources used to produce and provide food/4.25	85,7	12,6	1,7
waste of human labor/4.06	77,3	16	6,7
the necessity of food waste disposal/4.03	75,6	21,9	2,5
unnecessary use of agricultural land and water resources/3.78	64,7	19,3	16
increase in social inequalities/3.74	63	23,6	13,4
losses in the country's economy/3.76	62,2	28,6	9,2
increase of greenhouse gas emissions/3.67	55,5	31,1	13,4
decrease of food supply/3.51	54,6	19,3	26,1
high food prices/3.97	47,1	49,5	3,4
volatility of food prices/3.48	47,1	44,5	8,4
smaller food offer/2.97	32,8	63,5	3,7

% of respondents

■ strongly agree & agree ■ undecided ■ strongly disagree & disagree

*weighted mean, with assumption: 5 – strongly agree, 4 – agree, 3 – undecided, 2 – disagree, 1 – strongly disagree

Fig. 5. Consequences of food waste according to respondents in 5-point Likert scale (% of respondents), and weighted means listed after each consequence

Source: own study.

Slightly less (86%) believed that food waste causes hunger/undernourishment and needless waste of resources used to produce and provide food. Next three consequences were also of economic nature: waste of human labour, necessity of food waste disposal and unnecessary use of agricultural land and water resources (77, 76 and 65%, respectively). Respondents were, therefore, aware of economic consequences of food waste. Even so, only 56% of respondents understood that economic wastage is directly correlated to environmental consequences in form of greenhouse gases emissions. Least respondents viewed the consequences of food waste in decrease of food supply and market offer of food, and in high and volatile food prices. Based on values of weighted means, one can also deduce that respondents valued no consequence to be very important, 10 to be important and 3 to be of medium importance. It is also interesting to note that weighted means scores had different importance order than percentage based scores. Most important consequence was the prevalence of hunger and undernourishment (with mean of 4.4), and disposable budget considerations fell to the third position (with mean of 4.19).

Survey results of categories of most undesirable food wastage consequences serve as confirmation of abovementioned ranking. According to over a half of respondents (52.1%), social/humanitarian consequences are most undesirable. Almost a quarter ranked economic and environmental consequences (23.5 and 22.7%, respectively. Respondents from Canada were of similar opinion – they viewed food waste as primarily a social issue (83%), followed by economic (72%) and environmental (68%) (Parizeau et al., 2015). This, in all probability, can be linked with favourable geo-environmental condition of Canada, and attentiveness towards environmental issues. On the other hand, British respondents considered food waste as primarily a negative environmental issue (70%) (WRAP, 2013).

Conclusions

Questionnaire survey conducted on a population of students from different fields of study at WULS demonstrates that ¾ wrongly regard food service and retail as the main food chain sectors where food waste is the largest. Only 16% recognised that the principal guilty party are consumers in households. Even so, the majority (almost 90%) was of opinion that consumers in households should undertake actions that limit food waste. Respondents stated that largest food waste in their households occurs during storage and in form of meal/plate leftovers and remnants of food. Second declaration was confirmed by observation of contents of waste bins. Respondents' households mainly waste: baked goods, vegetables, fruit, cold cuts and milk based beverages. Baked goods, fruit and vegetables are wasted most frequently according to many surveys and studies from different organisations, countries and regions. This signifies, that consumers waste most valuable food. Those products should be consumed in largest amounts, due to their dietary and pro-health properties. In the new Healthy Nutrition and Physical Activity Pyramid for the Polish population fruit and vegetables form its basis, as they should be consumed most frequently and in most quantity (IŻŻ, 2016). Baked goods are on the second stage of the pyramid, with whole grain products being recommended most. Those three categories of food are also featured as the foundation of food consumption patterns in dietary guidelines of majority of other countries. Meanwhile the consumption of fruit and vegetables is in general too low, especially with respect to daily intake recommendations. That is why WHO population dietary goals (WHO & FAO, 2003), which advises pro-healthy structure of dietary energy supply and amounts of intake of nutrients being recognised as risk factors of diet-related chronic diseases, list among them fruit and vegetables as a solely food product category. Recommended daily goal for fruit and vegetables is at least 400 g for adult.

Therefore, respondents waste those products, which are essential for prevention or for treatment of diet-related diseases, including overweight and obesity, type II diabetes and different types of tumours. In Great Britain, it is estimated that British consumers waste 22% of fibre, 18% of carbohydrates, 17% of proteins, and 16% of energy included in purchased and then wasted food (DEFRA, 2010).

Own study also indicated that almost all respondents are aware that food waste equates to financial loses. According to authors' estimation using data from EU (European Commission DG ENV – Directorate C, 2011) and GUS (Central Statistical Office of Poland) (GUS, 2016) Polish consumers in households annually lose on average 185 PLN on wasted food. In households of employees in non-manual labour positions, the cost of

wasted food equals to 223 PLN. This means that 4-person household loses about 740 – 890 PLN annually.

Results of study display that limiting food waste in households can impact the improvement of food consumption and nutritional value of the diet. For this reason, widespread propagating of food waste issues and using all means necessary to promote the reduction of food waste shall be very much advocated.

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Problems of Water Management in Agriculture in the World

Abstract. In connection with the frequent occurrence of water deficit in Central Poland and the growth of the phenomena of droughts and stepping formation (and desertification in southern Europe), the studies undertaken by hydrologists and representatives of agricultural scientists should be extended and stepping formation and desertification economics should be separated in these studies. Therefore, the evaluation of the management strategies in the conditions of water deficit, undertaken in agriculture, power engineering and other sectors of the economy as well as the search of suitable sources of water management financing should be brought to the forefront as they are specific in Poland due to functioning of ecological funds.

Key words: crisis of water supply, water deficit, retention of rainwater, irrigation of agricultural areas, overexploitation of water resources, risk of food crisis

Introduction

Water has always been, is and will be the most precious natural resource. Its lack, shortage of water resources, results in serious economic and social problems. Water resources include all rainwaters suitable for the use in the form of the annually renewable amount of water and its elementary element is *the permanent runoff*, which amounts to 36-39% of the total runoff of the rivers in the world (about 31% in Poland). It is the so-called blue water which can be used in the economy before it evaporates or flows to seas and oceans. However, 61-64% of precipitation is "green" water, which evaporates from plants and the surface of soil, i.e. evapotranspiration (Mioduszewski, Szymczak, Kowalewski, 2011). Water resources mean the total amount of water circulating in the environment in the given area and fed with the retention processes which is storing rainwater. While it is true that there is a lot of water in the world, and none of other resources exists in such abundance, but as much as 97% of water resources is salty water in seas and oceans, and 2/3 of fresh water is accumulated in icecaps. Thus, only 0.5% of the world's resources of water in the form of underground and deep waters as well as rivers and lakes. These waters, similarly to precipitation, are not distributed evenly due to the localization of lands, their relief and the differentiation of temperatures. The condition of water engineering infrastructure as well as water and sewage one has a big influence, which is connected with the level of the social and economic development of countries and regions. This factor prejudges that in practice the deficit of water resources does not occur more often but the crisis of water supply (Their, 2016). This especially refers to the developing countries with the high percentage of rural population.

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Water and its resources are, apart from the so-called the agricultural culture, the fundamental factor conditioning the agricultural and livestock production. The aim of the article is to present the significance of water management for the development of agriculture, and next the identification of the factors stimulating and hindering the use of water in the processes of irrigation of agricultural areas. This article is part of the unpublished in English A. Thier`s dissertation. The originator of this article and its concept is the second author because of the importance of issues.

Water resources in the world

The average annual world's precipitation is 710 mm, 470 mm of which returns to the atmosphere as vapour and 240 mm makes up surface, ground and deep runoff. The average time of water retention in the atmosphere is 9 days, 1-2 months in soil (as humidity), 2-6 months in rivers, 50-100 years in lakes, 20-100 years in icecaps (20,000 years in Antarctica), 3,200 years in oceans, 10-100 thousands of years in ground waters. Thus, ground waters and icecaps in Greenland and Antarctica are a kind of reserve and strategic water resources, and their circulation in the nature is significantly slower.

Table 1. Renewability of water resources in the world per continents

Continent	Area million km^2	Population million 2005 and 2012	Renewable water resources (runoff from the surface in km^3/year)			Water resources per 1 inhabitant in thousands m^3/year in 2005 and 2012	Resources per 1 km^2 of the area in thousands m^3
			average	max	min		
Europe	10.46	730 742	2900	3410	2254	3.97 3.91	277.2
Poland	0.31	38.5	61.9	86.9	49.7	1.60	198
North America (with Mexico)	21.8	392 466	7890	8917	6895	23.98 16.93	361.9
Africa	30.1	906 1084	4050	5082	3073	4.47 3.74	134.6
Asia	43.5	3921 4255	13510	15008	11800	3.45 3.18	310.6
South and Central America	20.5	373 496	12030	14350	10320	32.25 24.25	586.8
Australia and Oceania	8.95	33 38	2404	28080	1891	72.85 63.26	268.6
World	136	6470 7080	42785	44751	39775	6.61 5.42	314.6

Source: Kowalczak 2007; Poskrobko, Poskrobko, Skiba 2007 and own calculations.

Europe is inhabited by 11% of the world's population but it only has access to 8% of the global water resources. It amounts to 4-4,600 m^3 per 1 inhabitant (almost 1,600 m^3 in Poland) in comparison with the world's average 7,400 m^3. Yet, this indicator is only about 1,000 m^3/1 inhabitant in Northern Africa and in the Middle East. North America is the richest in water as its population amounts only to 5% of the population and the share in water resources is 26%. It is illustrated by Table 1.

According to *the World Water Development Report,* for 180 countries, the poorest water resources characterize such counties and areas as Kuwait (where 10 m^3 of water is per 1 inhabitant annually), next the Gaza Strip, Palestine (52 m^3), the United Arab Emirates (58 m^3), the Bahama Islands (66 m^3), Qatar (94 m^3), the Maldives (103 m^3), Libya (113 m^3), Saudi Arabia (118 m^3), Malta (129 m^3) and Singapore (149 m^3). The following countries belong to the richest in water resources (excluding Greenland and Alaska): French Guiana (812 thousands m^3), Island (609 thousands m^3), Guyana (316 thousands m^3), Suriname (292 thousands m^3), Congo (275 thousands m^3), Papua New Guinea (166 thousands m^3), Gabon (133 thousands m^3), the Salomon Islands (100 thousands m^3), Canada (94 thousands m^3) and New Zealand (86 thousands m^3). According to the predictions in this report, these indicators may worsen until 2050[3].

The presented data prove the known opinion that the distribution of water resources is uneven. It was influenced by the factors which played the central role in the evolutionary formation process of the current surface of our planet, including especially the hydrological and meteorological cycle. This cycle is present everywhere in the nature and decides on the incessant water circulation in the atmosphere, nevertheless it does not lead to the balance of its resources and streams.

Share of agriculture in water consumption

According to *the World Water Development Report* and other UN reports, agriculture is the biggest user of water in the world, which makes up 67-69% of the world's consumption, 40% in Europe, and only 10% in Poland. The water consumption for communal needs in the developed countries amount to 20%, in the less developed ones below 10%, and the world's average is12% (The millennium…, 2015). It is recommended to consider where the consumption of water should be limited in Europe or where additional sources of fresh water should be provided. Although nowadays water resources seem to be abundant, one should realize the fact that the sources of clean water are definitely limited. The level of water is lowering every year and additionally the surface waters, among the others due to contamination, are more and more difficult to be recycled so that they could be used by a man and even for irrigation in agriculture.

There are special and specific difficulties in Africa and Asia since the percentage of water used in agriculture is generally even higher and amounts to over 85%. While the consumption of water for the living in the households in these countries is only 5-8%. The daily amount of water consumed by the inhabitants of the richest countries equals the monthly amount of water consumed by the inhabitants of the poorest countries (therefore, the first ones live beyond their means in terms of water). The use of water in some regions

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[3] *World Water Development Report* published by UNESCO, http://www.unesco.org.2003; the UN Information Centre published the discussion in the translation into Polish in: http://www.unic.un.org.pl/iyfw/raport_gwns.php

of Africa is below the minimum 25 litres/inhabitant/day which was defined by the WHO. The recommended indicator is 80-100 litres. Therefore, it is concluded that most of the countries in Africa die owing to the lack of access to fresh, clean water.

The main sector of the economy consuming water resources in Asia is agriculture. Table 2 depicts the exemplary comparison of water consumption in India, the USA and in Poland. Now, in India, the relatively poor country of the low industrialization, almost all the water is used in agriculture, and only its little part in the industry and the urban economy. In the USA the proportions are much more even due to the higher degree of industrialization of the country as well as owing to the bigger access to water and the well-developed urban economy. The structure of water consumption in Poland is similar.

Table 2. Structure of water consumption in the USA, India and Poland as well as in the world, in %

Items	Industry	Agriculture and forestry	Urban economy
USA	45	32	23
India	4	94	2
Poland	69	10	21
World	16	67	17

Source: UN Statistical Yearbook. The UN, New York 2015.

According to the report of the WDDR of 2003, the share of agriculture in the intake of water amounted to as much as 69%, and it exceeded 70% in some countries. It is concluded from the latest estimates that the share of agriculture in water consumption in the world amounted to as much as 71% in 2013, including over 90% in Afghanistan, India, Pakistan, Sudan and Turkmenia and ebout 70% in Saudi Arabia, Australia, Chile, Chad, Egypt, Indonesia[4]. Yet, this situation is changing. The biggest decrease in the share of agriculture can be observed in South America from 82% in 1950 to the predicted figure of 44% in 2025. Generally, it happens on all the continents in favour of the industry and the needs of the urban economy. For instance, the share of industry in water consumption in Asia in the studied period is increasing from 2.3% to about 10%. Europe is an exception where the share of industry in this structure is high, but it is decreasing. Besides, Europe (and also the USA and Canada), including especially Poland, is characterised by the different structure of water consumption than the world economy as in most European countries the share of the urban economy (fresh water) in the use in total amounts, according to the author's estimate, to 12-18% and the share of agriculture 3-12%, with the exception of Spain and Turkey where this indicator distinctly amounts to over 60% (Table 3). Therefore, competition in water consumption between the sectors of the economy has been increasing over time as so far its delivery for agriculture has been undisputed although often wrongly used, but – after the period of the increase in the urban economy and the industry - in the light of the needs for irrigation of crops, this issue requires the new strategy.

The development of agriculture, industry and services also contributes to the increase in water consumption as it is a resource needed in the production and service processes, and some of them are very water-inefficient. While it is true that the technological development results in the decrease in water consumption per unit in the production processes, but in

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[4]http://wdi.worldbank.org/table/3.3 and http://data.worldbank.org/indicator/SH.H2O.SAFE.ZS

spite of this fact the development of the economy influences the increase in the total demand for this resource in the developing countries.

Table 3. Water intake for the use in agriculture in the chosen European countries

Countries	Water intake in total m³ per inhabitant		Share of agriculture in the intake in total in % from 2012 to 2013[b]
	2010	2013	
Belgium	580	462.0	0.6-0.8
Bulgaria	805	750.7	16
Czech Republic	186	157.0[a]	2.1-2.7
France	495	457.7	about 12
Spain	710	797.7	about 60-70
Holland	645	641.0	0.7-1.1
Germany	390	310.1	0.5-0.8
Poland	300	293.9[a]	9.7-10.1
Rumania	320	320.6	17.8
Slovakia	146	103.3[a]	3.2-4.1
Slovenia	460	609.4[a]	0.5
Switzerland	333	252.0	about 3
Sweden	290	287.9	about 4
Turkey	625	676.0	about 70-80
Hungary	540	508.6	7-13

a) Year 2014   b) Estimated data owing to the differences in the classification

Source: Eurostat database. Environmental protection. GUS, Warsaw 2016, 471-472 and own calculations.

Agriculture and industry in numerous countries suffer from the more and more difficult hydrological conditions. The shortage of water is a frequent problem, but it does not concern everybody. For example, in these parts of India which are affected by the lack of access to water, irrigation pumps pump water from water-bearing layers to the farms of rich farmers all the time, whereas small farmers depend on changeable precipitation. Here, the reason of the shortage of water in most cases is not its quantitative lack but the wrong policy of the authorities. The shortage is the consequence of the economic policy of the state in a lot of countries which led to the excessive consumption of water with subsidies and the decrease in prices. However, the poor are constantly devoid of access to water owing to the limited rights and the underestimation of the issue of access to the sanitary and water infrastructure by the state. Therefore, the shortage of water results from the different actions discriminating poor people, which has already been, or at last, criticised.

Social aspects of water management

If water is to be the cause and the main engine of development of the social and economic life, one should change the political and economic structures, and first of all, the way of thinking of the man. One should realize in the first place that the right to water is an

indispensable condition of social security in the rural areas. The sudden loss of water or the limitation to the entitlement to water can threaten the human life and effectively contribute to the increase in poverty, which consequently leads to the loss of security. The right to water is more important for the poor than for the rich for the obvious reason, poor people do not have sufficient resources or political influences in order to defend their position sufficiently enough. The reforms of the hydrological economy teach us how essential is justice in the field of the rational management of water resources. Contrary to the reforms of the land use, the fair division is not paid such attention to in the plans of the reform of the water management. It is a serious mistake of the structural character, which contributes to the non-sustainable social and economic development. The good example of the influence of the water management on wealth or poverty is the irrigation system. The research showed that the degree of the poverty distribution is by 20%-40% lower in the areas with the irrigation network, however, there are big fluctuations here (Sen, 1982). Irrigation favours the decrease in poverty to a large extent in some countries, but in others does not help so much anymore. The uneven access to soil is a vital factor here. The countries where big inequalities exist (among others India, China, the Philippines) are less effective and fair than the countries with less significant inequalities.

The shortage of water is the reason of the lack of possibility of the agricultural production in the dry and semi-dry zones, which is often the effect of the unfair division of water resources when the poor are generally losers. The polarization of the social classes exists especially in the developing countries. The bigger percentage, as much as over 65% of the poor population, is in the areas with the deficit of water resources in such countries as China or India. The consequences of such a division of society are surprising. Namely, in the 1970s and the 1980s there was famine owing to the long drought in the countries of the Sahara Dessert in Western Africa, but in spite of that there were sufficient amounts of water to cultivate cotton, vegetables, peanuts intended for the export to Europe and the USA. These products were transported to Dakar by the same vessels which brought food aid for starving people. The similar situation occurred in Ethiopia in 1985 where a large part of the country was affected by the drought, causing the death of 300,000 people, but at the same time the satisfactory crops of sugar cane and cotton were obtained in the state farms in other regions of the country, intended for export. These facts illustrate that the polarization of the society pushes one group into poverty and leads to the disaster through the failure to help.

According to the reports, water consumption has already tripled in the last 50 years together with the increase in the population in some regions of the globe (Water…, 2003). This tendency will still be intensifying because the research shows that the population growing by about 80 million every year is increasing the demand for water by 12 billion m^3. The demand for agricultural products is increasing together with the fast population growth, and 67% of water consumed in the world is used in various forms of agriculture. Currently, a lot of countries maximally use their water resources, which is caused by the natural increase and the needs generated by it, especially concerning irrigation. The growing demand for water increases the risk of food crisis. The best example is again Africa where the droughts and the decrease in water resources bring about constant problems with famine. As a consequence, every year millions of people's health deteriorates and they even die. Thus, access to water will be one of the key problems of security in the future.

According to the predictions of the UN, in 2025 about 8 billion people will live on the Earth which is about 38% more than nowadays. Therefore, it is estimated that the increase in the cereal yield by 40% will be necessary. This will in turn be connected with the

development of agriculture and the acquisition of new water resources. It is estimated that the irrigated area will have to be enlarged by about 30%, which is connected with the growth of the demand for water by 17%. It is evaluated that overexploitation of water resources both surface and underground ones already exists in India, Pakistan and even the USA (Spring, Brauch, 2011).

Fight against droughts

Due to the increasing global warming, the phenomenon of drought is more and more common in numerous states. In some regions, such as Syria (2006-2011), Australia ("the drought of the millennium" 1995-2009), India (54% of the area of the country suffers from water stress and in Punjab and Rajasthan there is a threat of the collapse of the agricultural production), northern China (due to the drought people emigrate to Siberia), California, south-eastern Brazil, Spain, the drought has been there for several years. The depletion of deep water resources has been noticed in Saudi Arabia. The processes of steppe formation and desertification are recorded also in Europe, especially in its southern part where there are permanent periods of drought. In 2003 the drought affected 53% of the area of the European Union and brought about the losses in agriculture at the amount of 12.5 billion Euro (then there were violent floods). The steppe formation affects especially the regions of Wielkopolska (Great Poland) and Kujawy (Kuyavia) in Poland, where the indicator of *the climatic water balance*, as a difference between the amount of precipitation and the amount of evaporation from the air, soil and plants, is very unfavourable and amounts to minus 200-250 mm. The use of the potential possibilities of crop productivity of arable crops is evaluated in Poland as only about 62% - from 30% in the south-eastern part to 80% in Western Pomerania owing to the shortage of water (Jankowiak, Bieńkowski, 2011).

The influence of the drought on the yield in agriculture is still insufficiently examined in Poland and more work in this field was undertaken after 2000, and since 2007 this system has been run by the Institute of Soil Science and Plant Cultivation in Pulawy. Since 2009 the European Union has been assessing the range and the consequences of the water shortage and drought every year. The European Union has established the Centre of Drought Management entitled *Drought Management Centre for South-Eastern Europe* and *European Drought Centre* (the virtual centre of knowledge and coordination operating in Holland). Five research centres were created in this filed in Great Britain. Since 1999 the National Oceanic and Atmospheric Administration has been functioning, using the satellite data on vegetation, climate and geophysics. Next, the Global Drought Monitoring at the University College London offer monthly reports on the spacious composition of weather phenomena, etc. (Kręgiel, Jarosińska, 2006). Similar climatic centres were opened in Australia, China and other countries and such reports for Africa are prepared, among others, by the Princeton University (New Jersey, USA).

A lot of actions have already been taken to fight against drought apart from the monitoring of climatic and weather changes, enumerating for instance, retention of rainwater and water from rivers, modernization of irrigation systems (losses in water transport and distribution often amount to 40-60%), the use of recycled sewage to irrigate arable farming (in Cyprus and the Canary Islands it is 20% of water to irrigate the fields), the changes of the financial aid system for the projects concerning water management.

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Changes in the Structure of Agricultural Production in the European Union with Particular Emphasis on Poland and Latvia

Abstract. Many of phenomena, their growth or trend, are dependent on the interactions between neighboring areas. Model of shift-share analysis represent a growth rate (rate of change) of the different options phenomenon by taking into account the phenomenon of increase in the neighbouring area. The aim of the study is to analyze the changes in the commodity structure of agricultural production in the European Union according to the selected types of agricultural products using of shifts share analysis. The study assesses the rate of change the size of the phenomenon and identified and estimated the share of structural, sectoral and regional (local spatial) in the size of the effect of the global (agricultural production in the European Union overall) in the EU countries.

Key words: structure of agricultural production, European Union

Introduction

Agriculture of EU member states is characterized by diverse natural conditions, which largely determines the nature of agricultural production. A common feature for most countries is that agricultural production is mechanized, modern and agricultural producers use of industrial means of production. Another and perhaps the most important common characteristic of EU agriculture is the fact that it is the subject to the common political-legal regulation which are strictly and clearly defined within the framework of the Common Agricultural Policy (Nowak, Wójcik, 2013; Wilkin, 2009; Tłuczak, 2016). Diversification of nature and relatively high level of development of agriculture has contributed to the fact that in most EU countries is dominated by specialized farms, with directions appropriate for the conditions of the natural of the country (Adamowicz, 2008; Poczta et all 2009).

In those countries where is dominated by permanent grassland, the farms rearing of animals grazing are very important, this applies primarily in countries such as Austria, Belgium, the Netherlands, Ireland, Hungary and the United Kingdom. In the Mediterranean area (Cyprus, Greece, Spain, Italy) countries are specializing in permanent crops. Field crops are this type of agricultural production, which has a large share in total agricultural production, but in any country is not in the advantage. The largest share of field crops are in Sweden, where they account for more than 40%).

Differences in the level of development of agriculture between the EU-15 and EU-12 can be seen, among other things by the fact that in the first case, a greater proportion are farms belonging to different types of specialist. In the old countries, their share is a total of more than 87% are very important, while in the new countries is less than 65% (although the highest percentage of entities specializing exists in Hungary and in Slovenia, reaching more than 90%).

In Poland, farms specializing in field crops are very important, in 2010 was about 40%, and the share of multi-stakeholders is at a level similar to the average for all EU-12

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(Tłuczak, 2106). Agricultural land of Latvia occupy 27% of the country area (of which 14% of arable land, meadows and pastures 13%), including approx. 2 million hectares are swamp. Dominates breeding cattle milk type, pigs, fur animals. Cereal crops mainly include barley, wheat, rye, oats.

Today's economic conditions which are related to the operation and regional development within the European Union make it necessary to take on new diagnostic tests for the prospects of economic development of regions (Rozpędowska-Matraszek, 2010; Tłuczak 2015).

The main aim of this article is to analyse the changes in the structure of agricultural production in the European Union in the period 2005-2014, according to the selected agricultural products (wheat, rye, potatoes, pork, beef) using the method of shifts-share analysis. The study evaluated the rate of growth of the size of the phenomenon. In addition, the author identified the share of structural and competitiveness effect of global cross-section of countries.

Materials and Methods

The subject of this research is structure of agricultural production, which was divided into wheat, rye, potatoes, beef and veal meat, and pork meat. The adopted time range of research covers the period 2005–2014. The analysis covers 26 EU countries. The necessary statistical information was obtained from Eurostat database. Structural and geographic analysis of agricultural production was conducted by using classical shift-share analysis.

Methods and models of shift share analysis (*Shift-Share Analysis* − SSA) belong to the group of structural and geographical analyzes (Tłuczak, 2016). Dunn and Perloff, Lampard and Muth (1960) were the first who describe classic shift – share analysis. This method was modified since the 60s of the XIX century, the spatial factor was included to the research. Doing research the spatial distribution/intensity/changes in the level of the studied phenomenon the fact that each unit/region/country does not exist as a separate geographic area must be taken into consideration. The development of many phenomena depends on the spatial interaction with neighbouring areas. Observing the spatial relationship and interaction we should remember the first law of geography (spatial econometrics) formulated in 1970 by W. Tobler: "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970).

SSA method allows testing and assess the level of development of the region (province) on the background the level of development of the reference area (country). Changes of regional growth of the analyzed phenomena are assessed in the context of the analysis of changes in the structure of phenomena (Antczak, 2014; Grzybowska, 2013; Mayor, Lopez, 2008).

The variable TX quantified in the form of a complex of absolute growth or the rate of change is tested in the classic shift-share analysis (Trzpiot et all, 2013). The use in research the shift share analysis is based on the decomposition of the total change in the variable for the three components (Szewczyk, Zygmunt, 2011):

$$tx_{ri} = tx_{..} + \sum_i w_{r.(i)}\left(tx_{.i} - tx_{..}\right) + \sum_i w_{r.(i)}\left(tx_{ri} - tx_{.i}\right) \tag{1}$$

where:

$$m = tx_{..} = \frac{\sum\limits_{r=1}^{R}\sum\limits_{i=1}^{S}\left(x_{ri}^{*} - x_{ri}\right)}{\sum\limits_{r=1}^{R}\sum\limits_{i=1}^{S} x_{ri}} \quad - \text{national (global) share effect;}$$

$$e_i = tx_{.i} - tx_{..} = \frac{\sum\limits_{r=1}^{R}\left(x_{ri}^{*} - x_{ri}\right)}{\sum\limits_{r=1}^{R} x_{ri}} - \frac{\sum\limits_{r=1}^{R}\sum\limits_{i=1}^{S}\left(x_{ri}^{*} - x_{ri}\right)}{\sum\limits_{r=1}^{R}\sum\limits_{i=1}^{S} x_{ri}} \quad - \text{structural share effect;}$$

$$u_{ri} = tx_{ri} - tx_{.i} = \frac{x_{ri}^{*} - x_{ri}}{x_{ri}} - \frac{\sum\limits_{r=1}^{R}\left(x_{ri}^{*} - x_{ri}\right)}{\sum\limits_{r=1}^{R} x_{ri}} \quad - \text{regional competitiveness share effect;}$$

$$w_{r.(i)} = \frac{x_{ri}}{x_{r.}} \quad - \text{regional weight;}$$

x_{ri} – the value of the variable in the *r*-th region of the *i*-th group of the cross-sectional distribution of the initial period;

x_{ri}^{*} – the value of the variable in the *r*-th region of the *i*-th group of the cross-sectional distribution of the final period.

Transforming the equation (1) to formula (Szewczyk, Zygmunt, 2011):

$$tx_{ri} - tx_{..} = \sum_{i} w_{r.(i)}\left(tx_{.i} - tx_{..}\right) + \sum_{i} w_{r.(i)}\left(tx_{ri} - tx_{.i}\right) \tag{2}$$

we received the regional growth ($tx_{ri} - t_{..}$) defined as the difference between regional and national growth rate. The relation described by equation (2) is called structural and geographical equation where geographic diversity of the regional average growth rate is decomposed into two effects:

- structural: $s_r = \sum\limits_{i} w_{r.(i)}\left(tx_{.i} - tx_{..}\right)$ – which is the weighted arithmetic mean deviations of the average tempos of growth in the sector and the growth rate of national and indicates that the regions are differentiated by variations in the location;

- regional: $g_r = \sum\limits_{i} w_{r.(i)}\left(tx_{ri} - tx_{.i}\right)$ – defined as the weighted arithmetic mean of regional variations prescribing categories of cross-cutting qualitative criterion to the respective regions.

Results and discussion

Analysing the changes in the structure of agricultural production according to the regarding agricultural products it must be stated that the biggest changes have occurred on the rye market, production growth reached 33%. This was due primarily by large increase in rye production in Denmark, Spain and Germany (in the case of this the country area an increase of over 150%). The decrease in agricultural production it's can be noted on the potato and beef markets. Despite the increase in potato production in France by 150%, in the EU there was a decline in production by 9%.

Meat production depends largely on the size of number of livestock and the price level, which should provide profitability. On the beef market, in the years 2005-2014, it was recorded 9% decrease in production but on the market in pigmeat 3% increase. Bulgaria and Romania are the countries where the production of beef decreased the most (by 36% in Bulgaria and 49% in Romania), while in Germany over the period considered the biggest increase in pork production (22%).

Table 1. Structure of changes in agricultural production in EU 2005-2014 (%).

wheat	rye	potatoes	beef and veal meat	pork meat
6	33	-9	-9	3

Source: author's own calculation based on Eurostat database.

Table 2. Structure of agricultural production in EU, Latvia and Poland in 2005-2014 (%)

Countries	EU		Latvia		Poland	
Year	2005	2014	2005	2014	2005	2014
wheat	58	60	46	80	35	43
rye	3	4	6	4	14	15
potatoes	27	24	44	13	42	32
beef and veal meat	3	3	1	1	1	2
pork meat	9	9	3	2	8	8

Source: author's own calculation based on Eurostat database.

The structure of agricultural production in Latvian and Poland are similar, but there are some differences. In Latvia, the largest share of agricultural production is wheat, in 2014 it's 80% of the total agricultural production, while beef production is marginal (barely 1%). Agricultural production in Poland has changed in the years 2005-2014. In 2005, the largest share in agricultural production were the potatoes while in 2014 it was wheat. Comparing the production of pork in Poland the share of this species in agricultural production total was four times higher than in Latvia.

Comparing the period 2005-2014 the rate of growth of the regional individual member countries with an average, EU growth of 1.8%. We can specify the countries with the growth of agricultural production higher by more than 30% of the EU (Bulgaria, Lithuania, Spain) and a group of countries with production growth agricultural much lower than the average for the EU (Slovenia, Greece, Sweden). These changes may have resulted from changes in both the structure of production according to the endpoint of agricultural

products in particular countries (structural effects), as well as from changes in the internal situation of the competitiveness of a given area (competitiveness effects).

Table 3. The results of the shift-share analysis of changes in agricultural production in the EU by countries and types of agricultural products in the years 2005-2014.

Country	Total effects	Structural effects	Competitiveness effects
Austria	0.0143	0.0021	0.0122
Belgium	0.1250	-0.0437	0.1688
Bulgaria	0.3378	0.0227	0.3151
Croatia	0.2503	-0.0080	0.2583
Czech Republic	-0.0346	0.0173	-0.0518
Denmark	-0.0828	0.0068	-0.0896
Estonia	0.1098	-0.0146	0.1244
Finland	-0.0479	-0.0260	-0.0219
France	0.0770	0.0118	0.0652
Greece	-0.1656	-0.0033	-0.1623
Spain	0.3208	-0.0120	0.3328
Netherlands	-0.0040	-0.0750	0.0710
Ireland	-0.1461	-0.0352	-0.1110
Lithuania	0.3484	-0.0072	0.3556
Luxembourg	0.1036	0.0121	0.0915
Latvia	0.1917	-0.0147	0.2064
Germany	0.0319	0.0093	0.0225
Poland	-0.1270	0.0096	-0.1366
Portugal	-0.0977	-0.0558	-0.0419
Romania	-0.0740	-0.0117	-0.0622
Slovakia	-0.0800	0.0220	-0.1020
Slovenia	-0.3477	-0.0335	-0.3142
Sweden	-0.1648	0.0010	-0.1657
Hungary	-0.0660	0.0241	-0.0901
United Kingdom	-0.1587	-0.0073	-0.1514
Italy	-0.1006	0.0000	-0.1007

Source: author's own calculation based on Eurostat database.

The biggest changes in the size of agricultural production was recorded in Lithuania (34.8%), Bulgaria (33.8%) and Spain (32%). In the case of these three countries, this increase was caused primarily by internal changes related to competitiveness with other regions.

These changes amounted to 35.5% - Lithuania, 31.5% - Bulgaria, 33.2% - Spain. Changes in the structure of agricultural production marginally influenced the growth of total agricultural production in those countries. In countries where the growth in agricultural production was positive (total effect greater than zero) it was mainly due to

changes in the internal changes in these countries and their competitive position in the international arena.

The largest decrease in agricultural production was recorded in Slovenia, Greece and Sweden. As previously, so in these cases, these decreases were due to the negative internal changes related to the competitiveness of these countries.
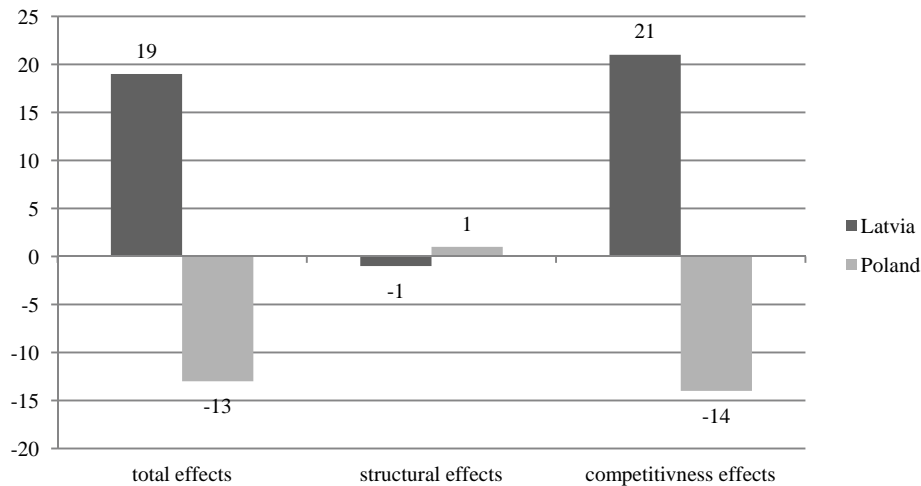

Fig. 1. Structural and competitiveness effects of shift share analysis in Latvia and Poland (%).

Source: author's own calculation based on Eurostat database.

In Poland and in Latvia, the situation is different in the years 2005-2014 in Poland decreased agricultural production by 13%, while in Latvia increased by 19%. In Latvia these changes were due to the positive internal changes related to the competitiveness of other regions (+ 21% - the effect of geographical). In the case of Poland but by unfavorable changes in the structure of regional agricultural production (- 14% - the effect of geographical). The results indicate a better competitive position Latvia's, then Poland, on the European Union arena.

Conclusions

Since 2005 EU countries recorded an increase in agricultural production by 1,8%. the changes in rye production resulted in an average rate by 31,3% in 2005-2014. An increase in wheat production (6%), rye (33%) and pork meat (3%) also was recorded. In the case of other products which were taken under consideration, the decrease of share in total agricultural production it was observed.

The most favorable changes related to structural factors in agricultural production occurred in Hungary, Bulgaria and Slovakia. In this countries the biggest share of rye in total agricultural production could be observed. In this sector the changes were the biggest in these countries. The most favorable competitive effects took place in Spain, Bulgaria and Latvia, whereas the least favorable ones Lithuania, Spain and Bulgaria. It should be noted

that structure of agricultural production depend on agricultural prices. In 2005-2014 the downward trend of pig meat production could be observed, because of low supply of pork and beef. In 2014 due to the improvement of the economic situation in EU countries, as well as due to a decrease in crop prices, the future for meat sector seem to be better. Finally classic shift-share analysis and dynamic shift-share analysis approved to be a useful method in identifying changes related to structure and dynamics of size of agricultural production in EU countries.

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Methodological Aspects of Creating the System of Indicators of Crisis Prevention as the Foundation for Stabilization of Agricultural Production Based on Ukrainian Experience

Abstract. The article deals with the methodological principles of determining the indicators of the economic development of agricultural production, which are based on the requirements of the EU Common Agricultural Policy and which will identify the possibility of crises both in agriculture and its sub-sectors, as well as the national economy as a whole. The system which is reacting to the crisis indicators and allows assessment of the stability of economic development of agricultural production was proposed. Analytical approaches to diagnosis prehistory development and identify indicators – reacting to the crisis indicators by analyzing and evaluating indexes of dynamics in periods of stability (relatively stable path of development) and the crisis (sharp kink economic dynamics) and graphically analytical method of determination. For sectors show synthetic indicators (agricultural production, the level of monetization of the economy, import-export ratio) that serve as functional criteria for identify in previous periods of force majeure or crisis as precursor's crisis.

Key words: indicators of crisis, agricultural production, stabilization, crisis prevention, economic development, agrarian economy

Introduction

Current state of the economic development of agricultural production in Ukraine raises acute strategic issues of analysing the factors and components of economic growth aimed at levelling main structural imbalances and further sustainable economic development.

World economic environment is characterized by increasing impact of global challenges and rapid spread of crisis in all spheres of public life. The economy of any country cannot be considered as a separate economic system that is not influenced by geopolitical, demographic, foreign financial and economic processes, as well as climatic changes. Growing interdependence and interaction between national economies increase vulnerability to negative effects due to their interconnected financial-credit and foreign trade sectors.

Ukrainian agriculture is characterized by considerable openness and high potential growth rates. The process of structural transformation of the current economic system acquires new features and aims to improve its functioning. The economic system and the

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mechanisms of state regulation are in the process of formation. This reinforces the urgency of a comprehensive approach to assessing the factors that may adversely affect the economic development of the national economy and its sectors, as well as lead to internal crises. There is an overwhelming need to develop methodological approaches to the assessment of the economic stability, to integrate them into the system of national governance, namely to establish an appropriate system of indicators that will allow to respond quickly to crises in various government branches. The analysis of international experience in establishing indicators, which mark the existence or emergence of threats to the stability of economic development, shows that the most complicated step is the actual choice of variables to describe each separate crisis.

In the literature there are different definitions of "an indicator". The term "indicator" is defined as an aggregate measurement, connected with an important issue or phenomenon and performed on the basis of a series of observed facts. Indicators can be used to determine a relative item, or to indicate a positive or negative change. According to Eurostat, the statistical indicator shows the statistical data for a specific time, place, or other relevant characteristics, adjusted in at least one dimension (usually size), in order to enable comparisons (European Union, 2013, p. 20). In general, "indicator" and "measure" are terms used alternatively (Borys, 2005, p. 62). The most important feature of an indicator is its comparability (as opposed to the characteristics generally expressed in absolute values), which enables ranking of the compared object with other objects (Central Statistical Office, 2011, p. 15; Sekerka, Obrsalova, Bata, 2014, p. 223).

Ukrainian regulation ensures evaluation of the state economic and food security as an integral characteristic of the economic system, which includes the evaluation of the macroeconomic, investment, innovation, financial, social, foreign trade, energy, food, and demographic security components.

The development of a common framework for the assessment of countries' progress towards food security is challenging. Food security is a multifaceted phenomenon that is suited to multidimensional assessment (De Haen 2003; Heidheus& Von Braun 2004; CFS 2011). In the last two decades, the complexity of the concept, compounded by the impossibility of observing food security outcomes directly (Barrett 2010), led to a veritable proliferation of indicators (Hoddinnott 1999, CFS 2011). Accordingly, a common framework for the monitoring of food security – on the model of the Millennium Development Goals indicators (UN, 2003) – requires the international food security community to select and reach agreement on a core set of indicators that alone can provide an exhaustive, yet synthetic, picture of countries' and global food security. Ultimately, this overall objective relates to the selection of the most appropriate informational basis (Sen 1999) for the assessment of food security and to which criteria should underline the choice of a limited set of measures among the hundreds proposed in the literature. Clearly, the selection of the informational basis for the evaluation is inextricably linked to the formulation of value judgments, which need to be transparently conveyed to each of the relevant stakeholders of the assessment in order for it to be accepted by its final users (JRC-OECD 2008).

The agricultural sector is one of the most important components of any national economic system. In addition, its characteristic features are most noticeable during crises. It is explained by the fact that agricultural production is traditional and produces goods for mass consumption. Therefore, in times of economic recovery it develops relatively slower than other branches. However, during crisis and recession agricultural sector demonstrates

a higher level of stability that transforms it into a significant stabilizing factor in the development of national economy. At the same time, the most powerful macro challenge for the national agricultural sphere is economic reduction caused by diminished purchasing power, which lessens the capacity of the domestic food market. Thus, overcoming crises and stabilizing agricultural production in Ukraine are possible when there is a system of indicators preventing crises that will serve as the basis for stabilizing agricultural production.

The lack of theoretical and methodological study of this topic, its relevance for economic and social development of Ukraine helped us to define the research topic.

Currently there is no single methodology for monitoring and inspecting country's financial stability, which would be aimed at detecting harbingers of financial instability as crisis predecessors. Such inspection of macro indicators would allow to see the first signs of the crisis and to develop ways to prevent it using state regulation. Therefore, this research aims to develop the system of indicators recognizing pre-crisis states that would serve as the basis for stabilizing agricultural production.

The aim and methodology of the research

The aim of the research is to develop methodological principles of determining the indicators of the economic development of agricultural production, which are based on the requirements of the EU Common Agricultural Policy and which will identify the possibility of crises both in agriculture and its sub-sectors, as well as the national economy as a whole.

For this purpose, the method of descriptive analysis of secondary data has been followed (documents test method, literature analysis and critique). Based on the analysis of existing data, the key strategic documents and statistical information related to Ukraine have been reviewed.

Previous research allowed identifying the list of key macroeconomic indicators of stability and crises prevention, which are common for different countries and can be used in Ukraine (Table 1).

It should be noted that not all of these parameters could be used in the analysis of crisis (or development stability) due to the fact that there is no statistics on these indicators or they may not be effective for a particular country.

Therefore, the combination of these assessment features and indicators for monitoring and evaluating the stability of the national economy provides new quality analysis, modelling and forecasting of the economic development and integrates their key features.

There are various approaches to the definition of indicators preventing crises. The most frequently used indicators include government debt and GDP ratio, budget deficit and GDP ratio, trade balance and GDP ratio (Skrypnychenko, 2015). For quantitative analysis of indicator levels it is necessary to include the following markers: real sector indices (consumer price index, producer price index, GDP growth rate and deflator); budgetary sector indices (budget revenues and expenditures, deficit (surplus) of the unified and state budgets); monetary sector indices (weighted average interest rates on loans and deposits, inflation, exchange rate, foreign currency reserves, government debt); external sector indices (balance of payments of current account, exchange rate, external debt, etc.). External impact factors include: crisis intensification in a globalized economic environment, shock changes in energy prices, financial stability and access to financial

resources, geopolitical situation, international political relations, global supply and demand, trade barriers between countries, natural phenomena, ecology and more.

Table 1. Main economic development indicators used to evaluate threats in international practice and appropriate for testing in Ukraine

Sectors/Preventing indicators	Countries					Suggested for use in Ukraine
	Poland	Russian Federation	France	Hungary	Germany	
Non-financial sector						
Indicator of the industrial sector development	+	+	+	+	+	+
Indicator of the agricultural sector development (agricultural production)	+	+	+	+	+	+
Indicator of consumer sensitivity			+		+	+
Level of business activity in the country			+		+	+
Monetary sector						
Level of demand/supply of money (M2-M3 unit)	+	+	+		+	+
Price index (consumer price index)(CPI), producer price index (PPI))	+		+	+	+	+
Real interest rate on loans			+		+	+
Foreign currency exchange rate of the national currency to the US dollar	+	+	+	+	+	+
Volume of bank loans	+		+			+
Budgetary sector						
Level of the unified budget deficit	+	+	+	+	+	+
Level of foreign debt	+	+	+	+	+	+
Foreign economic activity sector						
Foreign trade indicators (export, import, trade balance)	+	+	+	+	+	+
Level of external state debt	+	+	+	+	+	+
Financial markets						
Stock market index	+	+	+	+	+	+
Indices of foreign stock markets	+	+	+	+	+	+

Source: developed using references: CFS, 2011; Csortos, Szalai,. 2014; Czyżewski, Kułyk,2010.

Results of indicator evaluation serve as the basis for the balanced macroeconomic policy in a volatile economic situation both for developed and developing countries. The choice of indicators and evaluation criteria was carried out basing on EU Macroeconomic Imbalance Procedure, Maastricht criteria of European integration, foreign research, and the analysis of trends in the Ukrainian economy.

The research results

The calculation results for determining indicators preventing crises and macroeconomic imbalances for real, budgetary, monetary and external economic sectors of Ukraine are given in Table 2. Indicators of imbalances in 2013-2014 show general macroeconomic disproportion. Growing imbalances in each sector in 2013-2014 create pessimistic forecast for the development of the macroeconomic situation in Ukraine in 2015 with further decline in economic dynamics and mounting crises.

The next step is to define the basic components of sustainable economic development of agro-food production, corresponding indicators, as well as their values using existing regulations and functioning experience of agro-food systems of the developed countries as the foundation. Afterwards, it is necessary to justify the fields of state influence, which should provide full-scale implementation of this process.

Sustainable economic development of agricultural production is determined by stable growth of its volume, structural balance, environmental, economic and social efficiency. The abovementioned factors allow describing the development of the industry from the perspective of its economic sustainability using the following characteristics:

1) the dynamics of production volume and its turnover;

2) the ratio between livestock and crop production; structure of crops sowing and production amounts of livestock products;

3) the complexity of area resources use (regional specialization that meets bioclimatic, organizational and commercial potential of the area); specific output; level of economic diversification in rural areas; wages of employees in agriculture;

4) the share of organic farming; the level of use of environmental and resource-saving technologies, including waste management.

Table 2. The dynamics of macroeconomic indicators for crisis prevention and identification of sectorial imbalances in the economy of Ukraine

Indicators	Criterion	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Forecasting
Real sector													
Change in real GDP,% (YOY)	min -3% max 7%	9,50	12,10	3,00	7,40	7,60	2,30	-14,80	4,10	5,40	0,20	0,00	-6,8
Consumer price index (average per year),%	min - 2% max - 10%	5,20	9,00	13,50	9,10	12,80	25,20	15,90	9,40	8,05	0,60	-0,30	12,10
External sector													
Current account balance to GDP ratio,%	min - 4% max - 6%	5,77	10,49	2,94	-1,50	-3,69	-7,09	-1,49	-2,14	-6,05	-8,08	-8,75	-5,24
Change in the average exchange rate, UAH to USD, (YOY),%	min - 5% max - 5%	0,11	-0,25	-3,66	-1,46	0,00	4,30	47,92	1,85	0,40	0,29	0,02	93,92
Increase (decrease) in foreign direct investment in Ukraine (YOY),%	min 50%	102,48	21,44	340,28	-24,77	61,50	7,33	-53,13	24,86	22,96	-6,49	-38,14	-99,14
Budgetary sector													
Unified budget balance to GDP ratio,%	min - 3% max - 3%	-0,20	-3,20	-1,80	-0,70	-1,10	-1,50	-4,10	-6,00	-1,80	-3,60	-4,36	-6,40
Increase (decrease) in government debt to GDP ratio,%	max 4%	-13	-14	-28	-18	-17	11	149	13	-9	1	10	108
Monetary sector													
Change in average annual weighted rate on loans of commercial banks in national currency (YOY),%	min 5% max 5%	-19,0	-3,4	-7,5	-5,6	-7,9	26,6	16,5	-28,8	2,7	18,7	-10,7	17,6

Source: Skrypnychenko, 2015.

Previous studies reveal that the process of structural transformation of agricultural economy is now gaining new features and aims to improve its operation efficiency. Current conditions increase the need for a comprehensive approach to assessing the factors that may adversely affect the economic growth of the national agricultural economy and lead to internal crises. When developing methodological approaches to evaluating the stability of agricultural economy and outlining the conditions for their integration into the system of national governance (i.e. analysis, monitoring, forecasting and decision-making), it is quintessential to consider the factors that may cause risks for the agricultural economy operation in order to eliminate disparities and other negative conditions and processes. Only afterwards it is possible to create the growth and development forecast. Despite the differences in levels of socio-economic development and other factors, countries with transition economies have a lot in common, which permits conducting research using the same methodology. In such a way, we will be able to find the optimal agricultural business project plan, as well as determine the impact of each factor on the volume of production, and, most importantly, to outline the most significant factors for the agricultural economy of Ukraine. We use non-linear Cobb-Douglas production function (Formula 1):

$$ Y = \beta_0 X_1^{\alpha_1} X_2^{\alpha_2} e^E, \tag{1} $$

where Y - stands for the production process; β_0 is the technological factor; X_1 - X_2 are the factors that affect the final result; ε is the random variable (balance or error); α_1, α_2 are the elasticity coefficients of the relevant factors; e is the basis of the natural logarithm.

In order to shift to multifactor regression model, we created the following equation logarithm (Formula 2):

$$ \ln y = \gamma + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 + \varepsilon \tag{2} $$

where γ is the constant.

Mathematical side of the assessment of sustainability of agricultural economy factors in the nonlinearity of economic processes through the use of the multiplicative form of the integral index, where the weights are calculated by the principal components method of the Statgraphics package, which is based on the factor analysis and the contribution of each factor into the total variance.

The term expanded production function is used for the production function with five factors. Each factor is an integral indicator and characterises the presence and completeness of internal and external resources in the formation process of the economic development strategy for agriculture.

Therefore, we developed the functionality of the expanded production function that is represented by the following correlation (Formula 3):

$$ IA = F(IVD + ITR + INNT + IFR + IZED) \tag{3} $$

where IA is the integral index of agricultural production; IVD is the integral index of production activity; ITR is the integral index of labour resources; INNT is the integral index of innovation and technological development; IFR is the integral index of financial resources; IZED is the integral index of external resources.

Thus, the research of sustainability of national agricultural production (Table 3) confirms the necessity for creation of special resources, introduction of modern mechanisms and formation of policies in the field of the sustainability of national agricultural production, which would take into account current global trends of economic development. These special resources used in case of negative impacts on the economy include the compensatory resources, i.e. natural, technical, technological, personnel, space, time, financial, informational, non-material elements of national economic potential. Presence of such compensation resources as stocks of materials, financial reserves, intangible assets impart business entities with the possibility to compensate for their losses from various negative impacts.

According to the research results, there is a possibility of the negative scenario for the economy of Ukraine in 2016, which might be caused by deterioration in external economic conditions due to falling prices on world commodity markets, as well as the failure to obtain a sufficient amount of EU financial and technical resources that are necessary for adaptation of Ukrainian economy to the requirements of the European market, implementation of the association propositions and introduction of the new European standards, all of which is stated in the Ukraine – European Union Association Agreement (Skrypnychenko, Yatsenko, 2014).

In case of continued geopolitical confrontation economic dynamics will stall: hryvnya devaluation will occur gradually, the inflation level will rise, growth of production costs and the lack/halting of external and internal investment will not provide the required development of industries and will reduce the competitiveness of Ukrainian products, as well as lead to the loss of some segments of international markets.

Table 3. The level of sustainability of agricultural production in Ukraine for thebiennium 2010 -2020

Year	*Forecast sustainability level
2010	0,492
2011	0,502
2012	0,508
2013	0,499
2014	0,476
2015	0,430
2016	0,436
2017	0,448
2018	0,451
2019	0,520
2020	0,60

* corresponds to: poor sustainability level (0.4-0.59); sufficient sustainability level – > 0.80; satisfactory sustainability level – 0.6-0.79; dangerous sustainability level – 0.2-0.39; critical sustainability level – <0.19.

Source: calculated by the author.

During the forecast period of 2010-2020 the risks and negative factors influencing Ukrainian agricultural economy include:
• increased influence of the external economic environment risks on domestic economic conditions;
• decline in foreign investment, curtailing investment plans, deteriorating external economic conditions;
• uncertainty of the energy costs (the price of natural gas) and sources of its supplies to Ukraine;
• further complication of external economic relations;
• rising unemployment, aggravating problems of balancing state and local budgets;
• increased devaluation expectations in the exchange market;
• higher inflation, maintaining low credit activity of commercial banks, continued growth of the insolvency of the real economy, significant emission to finance budget deficit;
• increasing domestic debt without adequate use of the resources for the economy modernization;
• instability of the domestic financial and banking systems, low level of trust.
Calculations of the stability level of agricultural production and the parameters of the agricultural production functioning in Ukraine display non-compliance on all markers (Table 4), which suggests that current agricultural model provides low economic sustainability.

However, it is clear that sustainability limit values have not been reached, as agricultural production is quite dynamic, although unbalanced. The main question is the margins of the agricultural system that largely characterize the potential for further development, as well as establish key indicators for further assessment and monitoring (which should be able to determine the impact and indicate its direction).

Factors affecting the development of the agricultural system that are based on economic sustainability are quintessential for the research. The most important endogenous factor is the manufacturer's financials, while macro-level factors include government policy in agricultural production, agricultural markets and incomes of the population.

The most important characteristic feature of the development prospects of the research area is its financial condition, including its sustainability. In this regard, it is important to monitor the investment level of the industry and profitability of agricultural production. We discovered that although the profitability of agricultural production in 2010-2012 was four times higher than the average profitability in the national economy, the level of fixed investment in the industry in 2011 exceeded the average investment level of the previous year only by 10%. Moreover, it should be highlighted that the resources of the industry are the smallest (almost ten times less than the average index).

Table 4. The system of indicators preventing crisis in agricultural production

Indicator	Indicator value	International indicators	Indicators in Ukraine
1	2	3	4
1. Growth rate of agricultural production	4%		2001-2005 – 1,95 %; 2006-2010 – 2,4 %; 2012 – –0,5%; 2013 – 13,7 %
2. Level of crops yield variation	no more than 10%	5 %	15 %
3. Optimal structure of agricultural crops sowing	improving soil fertility by 40-55 %	50-70 %	violations in all regions of Ukraine; violation in Zhytomyr region exceeded the norm by sowing sunflower 11 times
4. Structure of meat production by type	beef-pork-poultry 40-45% - 30-35% - 15-20 %	Canada 1 : 1,7: 1,08	1 : 1,8 : 2.7
5. Amount of livestock per 1 hectare of arable land:	according to sales sources	-	demand is not satisfied by 40%
including : balance of humus in the soil	1 head of cattle produces 9-10 tons of manure; 8-13 tons of manure are necessary, therefore value amounts to 1	1	1990 – 1; 2012 – 0,4.
water overspend, groundwater contamination	-	USA: 16 kg of grain and 70 thousand litres of water per 1 kg of beef	low level of livestock raising development
6. Soil fertility	resource-saving equipment and technology, organic fertilizers	resource-saving equipment and technology, organic fertilizers	water and wind erosion reduces approximately 450 to 600 million tons of topsoil annually; 30 million hectares of land are degraded; 14 to 17 million hectares of land are in erosion danger
7. Gross production: including production per 1 ha	1300	France – 1955 Canada - 449	530 USD/hectare
production per 1 employee	256105	France – 46772 Canada - 45438	4360 USD per 1 employee
8. Energy capacity of agricultural production	0,05	USA – 0,048; Russian Federation – 2,1	0,116
9. Share of processed agricultural products	≈100 %	level of socio - economic development	beef - <2%; milk - 0.01%; grains and legumes - 1%; sunflower - 0.4%; vegetables - 0.3%; poultry - 89%

1	2	3	4
10. Ratio between wages of rural population and the average salary in the country	1	balanced wages	rural population receives 67% of the urban population salary
11. Employment in rural areas	100 %	reasonable settlement of urban and rural population	the share of people whose age exceeds working age is 1.6 times higher than that of urban population and the share of the easiest professions is two times higher.
12. Proportion of arable land used for organic farming	5 %	average through Europe - 3%	1 % (0,7)
13. Level of use of agricultural production wastes	100 %	≈ 100 %	official statistics does not provide such indicators (biogas, dry organic fertilizer, pellets, bioplastics, etc.)
14. Financial state of the industry	100 %	100%	profitability of agricultural production is 4 times higher than the national economy average index; resources of the industry are 10 times less than the national economy average index ; investment rate amounts to 2-6% of the total investment
15. Amount of innovative enterprises	100 %	100%	80% of agribusinesses have net income; innovative activity of farmers amounts to 20-25%
16. Supply of agricultural production equipment: - number of combine harvesters per 1000 hectares of sown area of grain; - tractor engine power per 100 hectares of arable land	100 %	USA 15; 200 France 16; 277	- 4 units; - 53 hp;
17. Share of irrigated land	9,5 %	drip irrigation	0.5 to 2/3 of water volume is lost
18. Use of certified containers for durable storage	100 %	100 %	≈ 70 %
19. Share of skilled agricultural workers to the total number of workers	100 %	≈ 90 %	agriculture - 30%; average national economy index - 57%
20. Agricultural national policy	scientifically justified	preventive measures, subsidies, grants	expenditure amounts to 2012-2013 - 8.5 billion UAH; GVA - 8.7 billion UAH

Source: own calculations.

As for the agricultural policy and the policy for the population incomes, it is necessary to assess the level of state support of agricultural production and the real income of the population. Obviously, public sector funding is inadequate (especially during crisis years) and structurally imbalanced in groups of producers and fields of impact. These issues are the subjects of debate; however, the situation does not change significantly. The level of budget financing of agriculture, forestry and fisheries in Ukraine is quite low: 2.4% of total expenditures and 9.1% of gross value added in agriculture in 2009-2011 (as compared to 0.6% and 14.6% respectively in the USA, 7% and 51% in Latvia, 11% and 30% in Belarus) (Esquivel G. and Larrain F., 1998).

Total amount of costs allocated by the Ministry of Agrarian Policy and Food of Ukraine in 2012 - 2013 has been relatively stable (8.5 and 8.7 billion UAH) (The Law of Ukraine, 2012). However, the costs for "Research, applied scientific and scientific and technical developments..." reduced by 29% during this period. The volume of financial support of the agricultural activities reduced even more (from 827 million UAH in 2012 to 97 million in 2013).

One of the main prerequisites for the stable increase in the volume of agricultural production is to raise real incomes, which determine solvent food demand. According to the research, income and food consumption in 2011-2012 enhanced, albeit slightly. Thus, total household resources taking into account changes in consumer prices in 2012 increased by 16% compared to the previous year, while the total cost of food enlarged by approximately 10 (State Statistics Service of Ukraine, *2013*).

It should be highlighted that in order to implement the objectives of the Strategy for the economic development of agricultural production the state should use various forms and methods of influence on economic processes. The form of ownership, state intervention in the economy, specific conditions and goals of socio- economic development of the country define necessity and limits of use of certain forms, as well as implementation methods.

The state should take over the function of coordinating all economic activities of the national economy, providing them with information about the objectives and priorities of socio-economic development of agricultural production, establishing social and economic standards of business preferences.

In order to achieve the abovementioned goals, the state should use state orders, credit instruments, guarantees, interest rate subsidies, tax debts restructuring, tax benefits, state appropriations, customs and tariff benefits, etc. Strategic planning is crucial for social development.

First and foremost, it makes it possible to foresee future events and take corresponding measures to solve possible problems.

Secondly, strategic planning leads to consensus between different groups of society in defining goals, ways and measures necessary to achieve the intended result.

Thirdly, it helps to determine the optimal model of use of limited material, human and financial resources. Moreover, strategic planning provides guidance that allows both government and society to assess the effectiveness of the production activity.

We emphasize that the strategic management of agricultural production should be based on the integral use of modern technology, equipment and information systems that represent the latest achievements in analysis, forecasting of the economic system, situational modelling and formalized expert knowledge for handling operational information. Such planning aims at quality decision-making in management, which would outstrip potential deviation or disturbance. It is constantly evolving to meet new

requirements of time and technological progress, therefore, there should exists a system of alternative development vectors of the investigated production branch. The basis for performance assessment is the diagnostics of the economic environment based on the evaluation and analysis of the economic, technological, social, environmental, political, market, and international factors. The criteria for the assessment of the strategy for the socio- economic development of the national agricultural production based on the interaction of factors of economic growth should include:

• profitability level of various forms of economic activity of agricultural enterprises, which, on the one hand, would provide increasing consumption, and on the other hand, give the possibility of savings;

• degree of labour resources use and increasing level of employment;

• living standards in rural areas;

• degree of capitalization and increased solvency;

• creating demand for agricultural products, formation of wholesale agricultural markets;

• improving the quality and, consequently, increasing gross and marketable products that meet market requirements and standards for export-oriented agricultural products as additional factors of economic growth;

• development of cooperative, collective and integral forms of regional management.

Thus, the main goal of the strategy for the economic development of agricultural production is to ensure sustainable economic growth of agricultural production and, therefore, the national economy as a whole taking into account the system of indicators preventing crisis; to increase the amount of competitive agricultural production in domestic and foreign markets; to reduce total cost per unit of manufactured goods levelling down human impact on the environment.

Conclusions

Given the fact that Ukraine's economy is currently in a phase of recession, it is crucial to timely identify threatening macroeconomic imbalances in order to rapidly identify and avoid potential crises. Taking into account the challenges and methodology for the sustainable development of agriculture in Ukraine, we developed the system of indicators preventing crises, which comprises social, economic, environmental and human aspects. This methodology bases on scientific approach to conducting business projects and includes modern mathematical methods, models, software applications, and international legal instruments. The system of indicators used by the international scientific community should be reviewed and adapted to the functioning peculiarities of domestic agricultural production.

The comparison between world parameters of agricultural production and those existing in Ukraine reveals non-compliance in all indicators, which leads to the conclusion that current agricultural model displays low economic sustainability. However, it is clear that sustainability limit values have not been reached, as agricultural production is quite dynamic, although unbalanced.

Solving the problem of the development of agro-food system depends on the ability of the state to effectively stimulate this field, adequately control all processes and strictly punish non-compliance. In order to improve current trends and to prevent future crises, the

fields of state influence on the agricultural sector aimed at ensuring its sustainable economic development should include improvement of the financial condition of small and medium agricultural producers and rural residents, the development of agricultural innovations, environmental security and control of natural resources use in agricultural production.

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Cultural Aspects of Employer Branding

Abstract. The article presents the results of the research carried out among students coming from the UK, Ukraine, and Turkey. Surveys were conducted in 2015 amongst 105 coming students from: of Great Britain (34 persons), of Ukraine (40 persons), of Turkey (34 persons). The study aimed to show the relationship between the culture of these nations and the employer branding. The results showed the existence of relationships between cultural assumptions and factors influencing the choice of taking up employment by foreign students.

Key words: employer branding, culture, nationality

Introduction

Contemporary organizations are accompanied by constant change. In connection with the changes that occurred in the labor market at the turn of the century it has changed the attitude of both the employer and the employee. The first one is at war with the competition for the most qualified and competent personnel, while the second puts increasing demands and expectations of the employer (Wojtaszek, 2012).

The increasing globalization of the business operations forces companies to recruit highly skilled workers from many countries of the world in order to maintain competitive advantage. Hence there are challenges to implementing and developing strategies to deal with intercultural differences within the organization. International cooperation and faster developing contacts also pose a challenge in obtaining

and retaining the right employees. As marketing managers working in multinational companies must master the global differences in values, attitudes and customer behavior, so brand managers should focus on understanding what influences the choice of employer for potential employees from different markets of the world, as well as analyze differences and similarities existing among them (Christiaans, 2012).

Employer branding is translated and understood as "to build the image of the employer" or "employer brand building." These are the actions undertaken by the organization, addressed to current and potential employees, in order to build its image as an attractive employer, as well as supporting its strategic business goals (Kozlowski 2012). The term employer branding has many definitions and its translation into Polish is not a simple task, given the complexity of the problem, which stems from the interchangeability of terms such as 'brand', 'brand building' and 'image'. As a result, the authors taking this subject call this issue in different ways, often describing it really the same process. The article follows the definition of employer branding for M. Kozlowski: "These are all

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activities undertaken by the organization, addressed to current and potential employees, in order to build its image as an attractive employer, as well as supporting its strategic business objectives." At the same time specifying the definition, it should be added that not all the company actions must be officially named employer branding to be included in such . The aim of the article is to show the links between culture and employer branding.

Cultural dimensions according to G. Hofstede

Dutch social psychologist Gerard Hofstede examining the relationship between organizational culture and the nation has shown that the public have the same problems, but differ in approach of solving them.[3] He said that certain patterns of thinking, feeling and behavior that distinguish members of one organization from another, are typical representatives of the people (Hofstede, Hofstede., Minkov, 2011). He created a cultural model subjected to continuous development, in which he has identified six dimensions of national cultures that characterize the nation determining its position in relation to others.

Cultural dimensions proposed by G. Hofstede are (Hofstede et al., 2011):

1. Distance to the power from small to large. The very concept of power distance is defined as "... the range of expectations and acceptance of unequal distribution of knowledge, expressed by less influential (subordinates) members of the institution or organization. The term "institutions" set the basic social structures, such as family, school or local community, "organizations" are workplaces.

   In studies comparing the values of leadership in different countries it has been observed that there are differences in both the mindset of leaders and subordinates - but their opinions are more reliable because we usually more objectively evaluate the behavior of others than our own (Hofstede et al., 2011). "Power distance" dimension shows the extent to which individuals perceive and accept social inequalities, and that power is distributed unequally.

2. Individualism and collectivism

   In the case of this dimension a measure is a activity of individual or a team. This means that individualistic society is suach, in which the individual is seen as an essential part of a larger community, and in the collectivist a man by belonging to a larger group gains identity by membership (Ratajczak, 2006).

   Extreme collectivism and extreme individualism are two opposite poles of the national cultures dimension. When creating a classification of this cultural dimension individualism and collectivism were associated with specific factors. In the case of individualism these were: time off from work, freedom in choosing the right style of work and the work as a challenge, while giving a sense of satisfaction (Hofstede et al., 2011). Collectivism was assigned to the following factors: work providing training, good conditions in the workplace, as well as full use of the skills and competencies of employees (Hofstede et al., 2011).

   Students from countries belonging to the individualistic ones attributed special importance to the values of tolerance toward others, no attitude to competition, harmony in relationships with others, satisfaction of the occupied position in life, and being conservative. In contrast, students from collectivist societies considered as most

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[3] http://geerthofstede.nl/index (08.07.2016).

important: obedience to parents, respect for ancestors, financial support for parents, chastity of women and patriotism and respect for tradition (Hofstede et al., 2011).

3. Masculinity. Different mental programming of societies associated with this dimension beyond the social character is also the emotional character. Social roles can be imposed by external factors, but it is how people feel from there, they lie deep within them. Defining masculinity, it can be stated that "... it is a feature of societies in which the social roles based on gender are clearly defined, it means that the men are expected to assertiveness, hardness and being directed the on material success, while from the women's modesty, sensitivity and thoughtfulness quality of life. While femininity is characterized by a society in which social roles of both sexes penetrate each other, that is, both the men and women expected to be the same" (Hofstede et al., 2011). Therefore, it can be stated that the dimension of masculinity and femininity distinguish between countries in which dominates the focus on competition and results, and those in which good atmosphere, concern for others and quality of life are important.

4. Uncertainty avoidance a dimension that determines whether a given culture, people readily accept the change or defend against them, trying to reduce the risk, also determines how they deal with uncertainty and stress in novel situations (Hofstede et al., 2011).

5. Long - versus short - term orientation is the ratio of the time in a given society and the importance attached to the future or the present and the past, and also deals with the ability to distinguish between long - and short-term attitude to life (Ratajczak, 2006). The present dimension consists of the following values: perseverance, economy, development of human relations by status, a sense of shame, and on the other hand: reciprocating greetings, respect for tradition, stability and a balance (Hofstede et al., 2011).

6. Indulgence versus restraint is the latest dimension, where indulgence is defined as the opposite of restraint; together they make up one of the dimensions of national culture. Indulgence is characterized by a society that allows you to meet the basic natural human desires associated with pleasure and joy of life (Hofstede et al., 2011). Cultures, which have a high rate of indulgence are a big contrast to the restraint, where positive emotions are not easily exposed, happiness, freedom, and the rest is not applied the same weight.

    Restrictiveness is characterized by a society that limits the satisfaction of basic and natural human needs associated with benefiting joy of life and fun and they regulate this sphere of strict social norms "(Hofstede et al., 2011).

    Interesting results, obtained during the research, is the work context in an international environment where the cultures of indulge put more weight on the freedom of speech and self-control, and in the restrictive cultures there is more sense of helplessness in the face of their own destiny. In the workplace it can be a reference in the approach of having and expressing their own opinion. In the cultures of indulge the employees in the first place put personal happiness and freedom, and therefore more easily they are willing to leave their job if they feel unfortunate there (Hofstede et al., 2011).

Cultural conditions of the factors determining the choice of the employer

Surveys were conducted in 2015 among 105 students from: the UK (34 people), Ukraine (40 persons), Turkey (34 people). Respondents represented 68% of urban and 32% rural. They came from different regions of the countries represented. Classification of cultures by G. Hofstede was taken as a basis for analyzing the cultures of selected countries. It was assumed that: there are relationships between cultural dimensions and assessment of the factors determining the choice of the employer. The students surveyed were asked about the factors that guide them when choosing an employer. At each of the 12 factors listed in the questionnaire they have to determine their validity using the scale.Job, including 27 people as very important and 12 as valid. Similar were respondents' answers from Turkey, where most of them, because the 20 of surveyed considered "stable jobs" as an important factor when choosing an employer (Table. 1).

Table 1. Factor "job stability"

Country of Origin of Students	Definitely irrelevant	Irrelevant	important	Very important
The UK	5	13	10	6
Ukraine	0	1	12	27
Turkey	2	5	20	6

Source: own research.

In the case of students from the UK responses divided respondents into those who don't attach importance to "stable jobs" factor where 13 respondents identified this factor as irrelevant and 5 for strongly irrelevant. The high number of surveyed students from Ukraine and Turkey indicating the nature of "stability" factor may be due to the "Uncertainty avoidance" cultural dimension which is defined as "the degree of threat felt by members of a particular culture in the face of a situation of new, unknown or uncertain" (Hofstede and al., 2011).The research of G. Hofstede shows that Ukraine has a very high rate, as many as 95[4] (scale 5-115) for mentioned dimension, and Turkey – has the indicator 85[5].

Cultures of strong avoidance of uncertainty, according to the classification of cultural dimension of G. Hoftsede in the context of work, organization and motivation are characterized by longer periods of employment, less frequent rate of change of employer, and generally living in the name of the idea of "time is money". In the case of this dimension the main motivators are: meeting the security needs and the recognition of belonging to a group (Hofstede et al., 2011).

Table 2. Factor „Starting salary"

Country of origin of students	Definitely irrelevant	Irrelevant	Important	Very important
The UK	0	4	13	17
Ukraine	0	14	18	9
Turket	0	7	12	9

Source: own research.

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[4] http://geert-hofstede.com/ukraine.html (dostęp: 20.09.2015).
[5] http://geert-hofstede.com/turkey.html (dostęp: 20.09.2015).

Members of cultures with a low uncertainty avoidance, as the United Kingdom, frequently change jobs and are employed for a shorter period of time. They treat the work as a necessity, but at the same time have a positive attitude to idle, while in the case of cultures with strong uncertainty avoidance, there is a great need to be constantly busy and hard work is an inner need (Hofstede et al., 2011). It can be concluded that students from Ukraine and Turkey treat job stability higher than students from Great Britain.

Another of the factors studied was "starting salary". The students evaluated the extent to which the amount of the proposed remuneration at the time of applying for a job is a decisive factor (Table 2).

For more than half of Britons the amount of initial salary was a very important and significant factor only for 4 people it was not important.

For students from Ukraine "starting salary" also mattered, 14 respondents considered it as important, and 18 as very important. For 1/3 of Ukrainians initial salary factor was irrelevant. Turkish students gave similar responses.

For most respondents, regardless of their country of origin "starting salary" is important. Moreover, none of the respondents declared that the testes factor is "definitely irrelevant."

Another factor that has been subjected to analysis was "partnership relations" in the workplace (Table 3).

Table 3. Factor „Partnership relations in the workplace"

Country of origin of students	Definitely irrelevant	Irrelevant	Important	Very important
The UK	1	2	10	21
Ukraine	8	17	11	4
Turkey	3	9	13	8

Source: own research.

They are more frequently indicated in the studies as one of the employer selection factor. Defined as partnerships, which should be based on the principle of equality of roles and rights (Korah, 2009).

Definition, perception and understanding of the partnerships varies among different cultures. For the vast majority of British students factor "partnerships" was important, ie. 21 respondents recognized partnerships as an essential element of choice of employer, 10 marked it as "important" and for only 1 person it was not relevant factor.

The result obtained in the case of British students may be due to the low power distance, which refers to the societies in which partnerships are rooted in the beliefs of most at the stage of childhood, where parents and children treat each other as partners and children treat teachers and vice versa (cf. Hofstede et al., 2011). The experiences and role models from childhood often are transferred later on relationships in the workplace, which in the case of culture of low gap might result in a partnership between superiors and employees, and goes even further in the context of organizational culture on small differences in wages between high and low positions. Additionally, these relationships also allow for situations in which supervisors use their own experience and experience of subordinates (Hofstede et al., 2011).

Replies of Ukrainian students strongly differed from the responses of British students. More than half of Ukrainians do not attach much importance to "partnerships". 17

respondents do not constitute it as a significant factor when choosing a job, and for the 8 partnerships were clearly irrelevant. High power distance, from the perspective of the workplace is characterized by a society whose members maintain formal relations and strongly feel dependency on people managing their heads (cf. Hofstede et al., 2011).

Large variations occurred among the responses of Turkish students, however, it is clear that for most of them partnership will be important when choosing an employer, 13 of them said it is important, and 8 - it is very important. According to the 9 respondents partnerships are irrelevant, and for 3 definitely irrelevant.

Turkey in the context of "distance power" dimension, against the UK and Ukraine, ranks in the middle[6], which means that it neither belongs to countries with high power nor with low, which certainly has different effects on different aspects of life.

In summary, it can be said that students from the UK and Turkey appreciate partnerships factor in the workplace much more than students from Ukraine, but it should be emphasized that among the British it is much more visible. In the case of the Turks another studies should be conducted in order to verify whether a greater impact on the "partnerships" factor has "power distance" cultural dimension or perhaps age, sex, size, or "acquiescence - restrictiveness."

Table 4. Frequently indicated communicatin tools

Communication tools	Students from the UK	Students from Ukraine
Social networking	30	26
Job advertisements on websites	9	23
Corporate site / bookmark CAREER	25	16
Mobile applications	8	9
Conversation with an employee of the company	0	3
Company Blogs	5	3
events at universities	1	3
videos	3	3
Mailings / newsletters	6	2
College Career Fair	1	2
company brochures	2	1
Open days	2	1
Programs reference for employees	2	0
TV	0	0
Radio	0	0

Source: own research.

Analysis of the results showed that all students, regardless of their country of origin, most frequently used communication channel such as the Internet. Out of 15 most popular and used by employers tools of communication with employees aimed at gaining workers, students pointed to social networking sites. They were pointe by 30 from 34 respondents from the UK, 32 from 40 respondents from Turkey and 26 out of the 40 respondents from Ukraine. Besides social networking British students also pointed to the company's corporate websites (Table 4).

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[6] http://geert-hofstede.com/turkey.html [Access: September 2015].

For 23out of 40 Ukrainian students as well as for the Britons, job advertisements in web portals and employer websites, belong to the most visited sites on the Internet (Table 1). Similarly, among Turkish students the most popular were social networking sites, the employer websites and job portals.

In summary, regardless of nationality, surveyed students, as the most popular tools to communicate with a potential employer pointed out: job advertisements on websites and professional sites. Besides given tools there were also mobile applications and corporate blogs. The least popular are the traditional forms of communication, ie.: radio, television, brochures, leaflets, posters. Low popular were also events at universities, university Career Fair, Open Days at the companies.

Summary

Analysis of the results showed the existence of the relationship between cultural assumptions and factors determining the choice of taking up employment by foreign students. Students from Ukraine and Turkey treat job stability higher than students from Great Britain. Members of the cultures with low uncertainty avoidance like the United Kingdom frequently change jobs and are employed for a shorter period of time. They treat the work as a necessity, while having a positive attitude to idle, as opposed to cultures with strong uncertainty avoidance, where there is a strong need to be constantly busy, and hard work is an inner need.

For the majority of the surveyed students, no matter what country came from, "starting salary" was important. Material factor, regardless of the culture was important for young people from the point of view of the employer's choice.

Students from the UK - a country with a low power distance and Turkey - a country with a medium range power factor, valued partner relationships in the workplace much more than students from Ukraine - a country belonging to the cultures with high power distance.

Respondents from all three countries studied - The United Kingdom, Ukraine and Turkey chose the Internet as the most frequently used channel of communication during the job search.

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