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COMPARATIVE ANALYSES OF THE AGRICULTURAL SECTOR IN SELECTED EU MEMBER STATES

by

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CONTENT

1. INTRODUCTION

The study analyses the main developing trends and differences in agricultural industry of the selected EU-15 Member States, mostly in Central-East Europe (CEE) for the period of 2010 and 2017. Examined EU-15 Member States are Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Romania, Bulgaria, Slovenia, Croatia, Italy, Greece, Austria and Denmark.

Main indicators for agricultural conditions research in this region are:

- GDP growth;

- Agricultural production growth;

- Efficiency of the agricultural production (real income factor; output/input; gross value added/real income; private investment; real labour productivity per annual working unit);

- Income conditions of agricultural producers/farmers: price income, taxed income, central subsidies;

- Central subsidies changes for farmers;

- Number of the annual working unit (AWU);

- Technological development;

- Balance of Foreign Direct Investment (FDI) and the National Domestic Investment in performance of the EU-15-member states and its influences on the investment in agricultural industry.

Generally, the Visegrad-4 EU member states, Poland, Czech Republic, Hungary and Slovakia have achieved outstanding agricultural development and growth. Moreover the development and growth are significantly higher compared to the rest of EU-28 countries. According to Eurostat the economic growth with agricultural development in Visegrad-4 EU member states is at highest level in all of the EU-28. Additionally, to the Visegrad-4 EU member states, the other East and Central European economies of EU-28 have also played a significant role for

continuous developing trend of the agriculture in EU-28. Therefore, my PhD study and research are focused on EU-15 including Austria, Italy and Denmark. In spite that these three countries are not so strong in their performance or less than the performance of Germany, France and UK (United Kingdom), their performance and agricultural development, along with the strong effect Austria and Denmark have on the agricultural industry of East and Central European, make them eligible for research. Moreover, Italian agriculture is in a leading position in terms of organic farming and sustainable agriculture. Also, UN FAO (Food and Agriculture Organization) is located in Rome, therefore I extend my PhD research work also for Italy.

The agricultural development research in these EU-15 member states is based on the Statistical Package for the Social Sciences (SPSS). The analysis of the agricultural development and growth is based on five variances in 15 states. The analysis is consisted of two parts. This is due to the limitation of the SPSS statistical system, namely it only allows five economic variances in case of analysing 15-member states. In my study ten economic variances are used for the selected EU-15 member states. It is in my belief that five more economic variances are required in order to get clear results on the economic differences among these member states.

The main Hypotheses in my PhD research are as following:

1) There is a strong correlation between the input and output of the economic variances in EU-15 countries.

2) There is a strong correlation between private investment and the input; but also, between private investment and the output of the economic variances in EU-15.

3) Gross value-added changes have strong influence on the real income factor per annual working unit. There is correlation between the two economic variances.

4) Private investment has strong or mid correlation with the real income factor per annual working unit. FDIs have stronger impact on consumption of fixed capital increase (rise) in EU-15.

5) There is a strong and mid correlations between GDP growth (GDPGrowth176) and the real labour productivity (RLProd20178).

6) FDIs increased during the examined research period. GDP growth increase was higher than agriculture real labour productivity increase, hence the majority of FDIs were realised in other economic sector, and not in agricultural industry.

7) There is a mid-strong correlation between number of the annual working unit (AWU20177) and the real labour productivity per annual working unit (RLProd20178) because the labour force in number of Annual Working Unit can make an efficient labour separation by more specialization, and therefore, this can strengthen the growing trend of the real labour productivity per person (RLProd20178).

The scientific economic analyses are based on the main Eurostat statistical sources covering the economic conditions of all of the EU-28 member states including the EU-15 member states analysed in this dissertation.

The analyse focuses on the income position of farmers and AWU in EU-15 selected member states from 2010 to 2017 using Eurostat data.

As the statistical overview shows "as a factor of production in agriculture, capital can be thought of as the tools, machinery and equipment, farm buildings and plantations that are required to help produce crops or animal products. The Gross Fixed Capital Formation (GFCF) refers to the change in physical assets within a defined time period. It does not include depreciation of land nor land purchases. GFCF measures how much of the value added created by agriculture is invested rather than consumed and is, therefore, a key element for understanding future competitiveness in the agricultural sector. The agricultural sector in the EU invested EUR 57,2 billion euro in 2017, accounting for 30,4 % of gross value added (GVA). Almost one half of this investment was made in France (17,6 % of the EU total), Germany (16,2 %) and Italy (15,0 %). Relative to the size of their respective agricultural sectors and the value added generated, GFCF was highest in Finland, and then Latvia and Luxembourg". (See detailed in Statistical Books 2018, p. 30).

According to Eurostat database (2018), "the level of investment in EU agriculture was very similar in 2017 to that in 2009, the level of investment in EU agriculture was very similar in 2017 to that in 2009, although there were some fluctuations in the intervening years. Among the member states, there was particularly strong investment growth in Lithuania and Latvia (an

average 18,1 % and 11,8 % per year respectively), although this should be seen as timing lows in 2009. In contrast, there were strong contractions in Greece (-4,7 % per year on average), Luxembourg (-6,0 % per year), Malta (-6,8 % per year on average) and Croatia (-8,7 % per year on average). The Eurostat also widely shows the agricultural land prices and rents: huge variation between Member States, as each factor of production used in agriculture typically earns a type of income; labour receives a wage, entrepreneurs' profit, capital an interest and land a rent. Understanding land prices and rents is also a key element for understanding future perspectives for agriculture." (See detailed in Eurostat Statistical Books 2018, p. 30 and p. 71).

In my dissertation the research focuses on the correlation and significance among ten economic variances in EU-15 selected member states. The analysis emphasizes the correlation among the economic variances, and how the correlation can strengthen in case income of farms increases by representing the situation of AWU as equivalent with full time farming unit. In addition, the analysis aims to reveal how central subsidies influence the income positions of farming households and their agricultural production. Moreover, the research is also oriented towards finding whether increased investment in agriculture has impact on increased GVA in the year 2017.

The agricultural subsidies are of crucial importance for East and Central European EU member, as they boost the investment and development, hence improving income position of farmers. These investments could possibly contribute to increase the level of future competitiveness of the EU member states.

2. RESEARCH METHODS

The analysis of the dissertation focuses on the correlations and significance between different economic variances based on SPSS in agricultural industrial sector of the selected EU-15 member states. Therefore, the method of the correlation calculation between these selected economic variances in the agriculture is in the core of this research.

The main economic variance in my research is the agricultural productivity, calculated by Eurostat and easily accessible in their statistical books. "The performance of the agricultural industry can be measured in terms of net value added at factor cost, which is GVA adjusted for the consumption of fixed capital, and subsidies and taxes on production. It is also known as factor income, as it is the remuneration available for all the factors of production. Factor income in the Economic Accounts for Agriculture (EAA) can be expressed per full-time labour equivalent (measured in AWUs) as an index. As such, it is considered as a partial labour productivity measure; it is a measure of the net value added by the equivalent of each full-time worker in the agricultural industry. This indicator of performance is measured in real terms (adjusted for inflation) and expressed as an index. It should not be confused with the total income of farming households or the income of a person working in agriculture" (See detailed in Statistical Books 2018, p. 72).

"To understand the development of this agricultural productivity measure, it is first necessary to understand the development of the agricultural labour amongst which this remuneration is notionally shared. As detailed in Chapter 2, with so much part-time, seasonal and unsalaried labour input in agriculture, the amount of work actually carried out in farming activities is best described when using a unit called the Annual Work Unit. This unit expresses the volume of work carried out in full-time work equivalents." (See detailed in Statistical Books 2018, p. 72).

Also "Over the long-term, the volume of agricultural labour has been in steep and steady decline, which means that the volume of total agricultural labour used by the agricultural industry contracted in almost all Member States during the period between 2005 and 2017; the sharpest declines were in Bulgaria (an average -7,2 % per year) and Slovakia (-6,1 % per year). This contraction in the agricultural labour force reflected both push and pull factors; there have been great strides in mechanisation and efficiency on the one hand and, on the other, a wider

choice of attractive job opportunities in other sectors of the economy. The main exceptions to this general trend were Malta (an increase of +1,6 % per year on average) and Ireland (+0,6 % per year on average). The reduction in the volume of non-salaried labour was more pronounced than for salaried labour at the level of the EU as a whole (-3,2 % per year on average compared with -0,3 % per year). There were higher levels of salaried labour input in Ireland (+5,4 % per year on average), Luxembourg (+4,3 % per year) and Belgium (+3,7 % per year) among others, but sharp declines in Slovakia (-5,7 % per year on average), Greece and Romania (both -3,6 % per year) and the Czech Republic (-3,5 % per year)". (See in detailed in Statistical Books 2018, p. 78)

Naturally the calculation of the agricultural productivity basically sets up the value of agricultural output, which has important role in the performance of the EU, in spite that this contributed to the economy of the EU by less share. Namely "the agriculture contributed 1,2 % to the EU's GDP in 2017. Primary agricultural production in the EU (henceforth termed 'the agricultural industry') is big business, even without considering its importance as the key building block for the downstream food and beverages processing industry. The agricultural industry contributed EUR 183,0 billion towards the EU's overall GDP in 2017. To put this in some context, the contribution of the agricultural industry was slightly more than the GDP of Greece in 2017, the 17th largest economy among the Member States. This contribution is the difference between the value of agricultural production and the value of various input costs built up in the production process, adjusted for taxes and subsidies on products. It is therefore interesting to look at the structure and composition of the value of this agricultural production and the various inputs used."(See in detailed in Statistical Books 2018, p. 72).

In my dissertation, I focus on the correlations among the economic variances that are considerably influencing changes or improvements on the agricultural productivity. In the SPSS statistical analyse the first five economic variances are OUTPUT171, as Output of the agricultural industry - basic and producer prices; INPUT172, as Own calculation: OUTPUT-GVA = INPUT based on data of Eurostat, Input of the agricultural industry - basic and producer prices; GVA173, as GVA of the agricultural industry - basic and producer prices, PrivIn164, as Private investments, jobs and GVA related to circular economy sectors, Value added at factor cost and the finally fifth economic variances the RIFAWU175, as Real Income Factor per AWU equivalent between 2010-2017 at factor price.

In the SPSS statistical analyse the second five economic variances are GDPGrowth176 = GDP Growth, 2000-2017, Gross domestic product at market prices, Chain linked volumes; AWU20177= Labour force directly employed - AWU in number 1000, in 2017 Farm indicators by agricultural area, type of farm, standard output, legal form and NUTS 2 regions [ef_m_farmleg]; RLProd20178 = Real labour productivity per person, 2010= 100, Labour productivity and unit labour costs [nama_10_lp_ulc], Index of the real income of factors in agriculture per annual work unit,; the Subsidies169= Subsidies 2010-2016, Million Euro, 2010= 100, The difference between an economy's external financial assets and liabilities is the economy's net international investment position, which may be positive or negative. The last, the tenth economic variance is the DIRINV1710= Direct investment in million units of national currencies between 2010-2017.

In addition, the Economic Sentiment Indicator (ESI) - commonly used and accepted in EU - is a composite indicator made up of five sectoral confidence indicators with different weights: Industrial confidence indicator, Services confidence indicator, Consumer confidence indicator, Construction confidence indicator Retail trade confidence indicator. Confidence indicators are arithmetic means of seasonally adjusted balances of answers to a selection of questions closely related to the reference variable they are supposed to track (e.g. industrial production for the industrial confidence indicator). Surveys are defined within the Joint Harmonised EU Programme of Business and Consumer Surveys. The ESI is calculated as an index with mean value of 100 and standard deviation of 10 over a fixed standardised sample period. Data are compiled according to the Statistical classification of economic activities in the European Community, (NACE Rev. 2, 2008; NEWS RELEASE, 2019).

Another indicator accepted in EU and widely used indicator for agricultural development is the Cereal Equivalent Productivity of Agricultural Labour (CEPAL) where

$$CEPAL = \frac{\text{Agriculture Value Added}}{\text{Agricultural Workers X Cereal Prices}}$$

Authors agree on the importance of the agricultural productivity in stimulating economic growth and structural change, but they also highlighted possible threats to agricultural labour productivity caused by environmental constraints or costs in using fossil fuels in agriculture

and by limited expansion of agricultural land. It is therefore also appropriate to develop targets for monitoring land and energy productivity in agriculture. Similar indicators to CEPAL can be constructed by replacing agricultural labour with land and fertiliser use in the CEPAL formula. They therefore define Cereal Equivalent Land Yield (CELY) as

$$CELY = \frac{\text{Agriculture Value Added}}{\text{Agricultural Land X Cereal Prices}}$$

and Cereal Equivalent Productivity of Inorganic Fertiliser (CEPIF)

$$CEPIF = \frac{\text{Agriculture Value Added}}{\text{Inorganic fertiliser use X Cereal Prices}}$$

Below are shown these two indicators by country income groups. As with CEPALs, cereal equivalent land yield rises steadily from low to high income groups, and has generally risen from 1980 to 2010, except for low income countries, with the extent of the rise varying between income groups, and with falls during periods of high cereal prices (in the early and late 90s and in 2008) and from 2004 in high income countries.

A sudden drop in upper middle-income countries' CELY in 1992 appears to be due to an unexplained rise in middle income countries' cereal areas in 1992. Values for CELY are heavily affected by land quality. This is not obvious in the income group comparisons, as there is some averaging of land qualities across countries. However, marked CELY differences across countries – as some countries are able to apply irrigation to obtain two or three crops per year in much of their agricultural land, while in others agriculture may be dominated by extensive low-quality grazing lands. The value of this indicator in cross country comparisons is therefore limited. However, it has considerable value as an indicator of changes in productivity over time within countries, and for regions and the world as a whole (Foley et al., 2011; Foresight, 2011; Godfray et al., 2010b; Pelucha et al, 2013).

The challenge that each country's agriculture across the world is facing is how to get high income countries' high labour and land productivity (shown by high CEPAL and CELY values)

without high use of fertiliser which leads to low CEPIF. On the other hand, low income countries are unlikely to achieve high yields and labour productivity with their low rates of fertiliser use – with many crops grown without fertiliser at all, and unsustainable soil mining in some areas. Low income countries will therefore need higher fertiliser use and lower aggregate fertiliser productivity to raise their yields – though there is scope for improving productivity of existing fertiliser use. Major challenges are faced by lower and upper middle-income countries as these countries are responsible for the majority of the world's fertiliser use but have low fertiliser productivity. These challenges, comparing 2008 global and high income (OECD) countries' CEPAL, CELY and CEPIF with illustrative sustainable targets for these variables.

Also, the other research analysing method mentioned by Kijek (Kijek et al, 2019; Kijek et al, 2016) is that "the wide applicability of total productivity indices in economic analyses is associated with their comprehensive nature resulting from the aggregate analysis of expenditure. According to need, different methods of TFP analysis are applied. Total factor pro¬ductivity of agriculture in the member states of the EU has been investigated quite extensively, but the studies often focused on a selected group of states (Brüm¬mer et al. 2002) or covered a short period (Čechura et al. 2014). The most commonly applied TFP index is the Malmquist productivity index (Brümmer et al. 2002; Coelli et al. 2005). In turn, alternative produc¬tivity indices, e.g. the Hicks-Moorsteen index or the Färe-Primont index are rarely mentioned in reference literature (Rahman and Salim 2013). One of the at¬tractive features of the Färe-Primont index is that its increase can be fully attributed to increases in scale and mix efficiency (i.e. economies of scale and scope). For example, the Malmquist index ignores productivity changes associated with changes in scale. Moreover, the Färe-Primont index satisfies an identity axiom and a transitivity test." (see in detailed in Wang et al, 2012; Salmerón and Romero-Ávila, 2015).

Although the precise targets can be debated, the challenge for the agriculture across the globe is how to dramatically raise agricultural labour and land productivity while reducing external input use. This is challenging when high external input use has been a major basis for previous increase in labour and land productivity. Most discussions of the challenges facing world agriculture focus on the need to maintain yields with lower external input use (that is with much higher external input productivity) but pay scant specific attention to the critical challenge of raising agricultural labour productivity (for example Foley et al., 2011; Foresight, 2011; Godfray et al., 2010b; IAASTD, 2009; Naylor, 2011; Pretty et al., 2011).

In my research the above mentioned analyses are not applicable, however, these are mentioned due to their particular relevance to the main objectives of my dissertation.

3. MAIN FINDINGS OF THE STATISTICAL ANALYSES FOR THE SELECTED EU-15-MEMBER STATES

1) The correlations among the variances are considered strong if the value is more than 0,500 (50%); if the value is close to 0,500, the correlation is middle and if the value is under 0,500 (50%) the correlation is weak. Naturally if the value of the correlation is close to 1,000 (100%) the correlation is very strong. Based on this, the correlation is very strong between OUTPUT171 and INPUT172.

The correlations are middle strong in between following variances, namely between OUTPUT171 and Privinv164 by 0,603 (60,3%), between INTPUT172 and Privinv164 by 0,463 (46,3%) and between GVA173 and RIFAWU175 by 0,562 (56,2%). This means that if the OUTPUT171 increases, then the INTPUT172 and Privinv164 will also increase. Consequently, if the INTPUT172 increases then the Privinv164 will also increase.

The same trend is valid between the correlation of GVA173 and RIFAWU175. Naturally if one of these economic variance changes , then the other economic variance will change in the same direction depending on the other variance (Table-4).

2) In case of Hungary the output, input and the private investment on the "X" line have increased, but the GVA and the real income factor per AWU have increased more than the increasing trend of the other three economic variances on "X" line. This means that the little moderate increase of private investment in Hungary could generate three times more increase in case of the GVA and two and half times more increase of real income factor for AWU for the same time period. In this period the first biggest increase of the GVA was in Lithuania by 90,7% increase, while in Hungary was the second member state and third member state was by 80,4% after Hungary at very directly. The average increasing level of GVA in EU-15 was 43%, while in EU-28 this rate was only 21,9%.

3) The results of Lithuania provide proof how much this member state has relative backwardness compared to the higher ranked EU-28 countries. The results also show how intensive private investment could generate considerable increase of real income factor for AWU. In Lithuania the most important objective was increasing and stimulating intensive

private investment. Once this is achieved, this investment increase will generate increase of real income factor. This order and rule will result in efficient and sustainable agricultural production growth by using advanced technology, both in Lithuania or in any other EU-15 and EU-28 country. Naturally, the agricultural production should be concentrated to increase the efficient level of the agricultural production. By using more advanced technology and techniques, and by extending the knowledge of farmers the yield per production cost or input will increase.

4) In case of Slovakia lower competitiveness in agricultural industry can be due to the higher real income factor per AWU. This was as a result of the national tax policy, but also because of low usage of advanced technology, while the private investment increased. The competitiveness can mostly increase based on the increased investment in advanced technology and not simply by income increase. EU harmonization policy gives more independence to the EU member states in their tax policy. However, the agricultural policy should be common including the price and subsidy systems. Probably the more favourable tax policy contributed to the increase of the real income factor in Slovakia, which was not the case than in Czech Republic.

This considerable increase of real income factor in Bulgaria was partly realised by increased private investment and probably by the favourable tax policy for farmers. Also, it is visible that Bulgaria had lower level of private investment, GVA and real income factor compared to the other EU member states.

5) The low real income factor in Croatia was as a result of the fact that the subsidies were dependent on the private investment for consumption of fixed capital. Therefore as the private investment decreased in Croatia, the subsidies also decreased, which finally led to decrease in the real income factor. The decrease of the real income factor, as result of output and private investment decrease, could not be compensated by favourable tax policy for farmers in order to increase their incomes (Table-1; Table-2; Eurostat, 2018). For example, the amount distributed for consumption of fixed capital, as private investment was 60,8 billion EUR in 2016 in EU-28. At the same time the subsidies amounted for 52,6 billon EUR, which compensated the 86,5% of all consumption of fixed capital, as private investment. Naturally the subsidies on the production should compensate the cost of the private investment and not to increase the real income factor per AWU.

6) The reason of the unfavourable agricultural industry of Greece is lack of capital. The agricultural production concentration in Greek agricultural industry was at very low level, therefore the capital accumulation was very weak with low usage of advanced technology. This led to decrease of output and decreasing trend of the competitiveness of the Greek agricultural industry and the farmers. The low output resulted in low price incomes and unfavourable income conditions for farmers. Low price income in future creates state of continuous lack of capital and weak capital power, hence negative prosperity. The farmers and rural population in Greece will continuously be poor or poorer and rural areas cannot keep the original population in their regions. Therefore, the domestic urban migration can increase in the future. Possibility of rural tourism will not be sufficient to ensure satisfactory income to keep the rural population in village areas.

7) It can be concluded that when the input increase is lower than the output increase, the GVA will increase (Bulgaria, Czech Republic, Hungary, Slovakia, Austria, Denmark, Italy, Romania, Slovenia, Latvia, Lithuania). Due to the fact that the average output in EU-15 increases more than the input, the GVA considerably increases.

In case of EU-28, the output increases more than the input, therefore the GVA also increases, but this increase less than the one of EU-15, because the increase of output of EU-15 more than one of EU-28 (Table-1).

When the input increases more than the output increase, the GVA will increase less (Greece, Estonia). Increased private investment activity, accompanied by efficient investment, will result with increase of the GVA, even if the level of input decreases (Bulgaria, Poland, Croatia).

8) Also, it can be concluded that if the private investment considerably increases and more than the GVA increase (Slovenia, Estonia, Austria), or their increasing trends are closed to each other (Denmark), this will lead to considerable decrease or little increase of the real income factor per AWU.

But if the private investment decreases more (Croatia) or increases less than the GVA (Bulgaria, Czech Republic, Hungary, Slovakia, Italy, Latvia, Poland), the real income factor per AWU will increase. Also, the average increasing level of the private investment increases less than

the GVA in cases of the EU-15 and EU-28-member states, therefor the real income factor per AWU increases.

In case of EU-28, the private investment increases less than the GVA, therefore the real income factor per AWU also considerably increases, but this increase is still lower than the increase of EU-15. This is because the private investment in EU-15 is higher than in EU-28 (Table-1; Table-3).

9) Generally, the subsidies on production are dependent on the measure of the private investment, namely consumption of fixed capital at level of the EU-28, which has an important influence on the change of the real factor income per AWU.

Therefore, these subsidies can only be provided for farmers if about 88% of the subsidies are used for extending and improving the production by using new technologies or creating new advanced infrastructure for the production process. This for example can be buildings, service network for improving agricultural techniques and equipment or innovation for the increasing knowledge for farmers and labour force in agricultural industry (Table-11; Table-2).

Sometimes it can happen, if the GVA and the subsidies on the production increase less than the real income factor per AWU increase, this can be as a result of favourable tax policy at national economic level, which is not common and not unified based on the EU harmonization policy. The tax policy remained within the national frame of each EU member state, in spite that the other policies, as agricultural policies, agricultural price policy and subsidy policy for the farmers or even the duty and single market condition are common. (Bulgaria, Slovakia, Italy, Lithuania, Denmark,). In Romania the subsidies on production were at very high level (sew Table-1 and Table -11), which allow moderate growth rate of the real income factor per AWU.

10) In spite that this increase of GVA was significantly high in Austria, the real income factor per AWU was at moderately low level at 7%. This is due to increased level of the input including the AWU or labour force input was at low level and also the private investment increased at high level by 30,1%. This created considerable capital power from income perspective of the labour input to the side of the private investment, therefore it can be concluded that the future increase of the income position will have to stagnate in order to show more significant interest for improvement and development to achieve modern and advanced

agricultural industry. This means that for the interest of the future economic prosperity the country should continuously increase the living standard on short-term period. In order for the country to become developed, the above-mentioned economic arrangement should be followed.

11) Table-12 shows strong and middle strong correlations. The GDP growth can influence the real labour productivity, because the more the GDP increases - including also the other economic sectors additionally to the agricultural industry – the more will the real labour productivity increase. Consequently, higher growth of the real labour productivity means that the value produced by AWU in agricultural industry can provide more value in agricultural sector, which added to the whole amount of the GDP at national level or level of each EU-member state. There is a strong correlation between both of them.

12) Also, there is a middle strong correlation between AWU20177 and the RLProd20178 because the labour force in number of AWU can make an efficient labour separation by more specialization, and therefore, this can strengthen the growing trend of the real labour productivity per person (RLProd20178). Naturally if the companies of the agricultural industry increased their owned real labour productivity, this means they can increase production value per AWU, therefore they can decrease the directly employed labour force in number of AWU. Moreover, these companies can extend their employment by their increasing price income. There is a mutual correlation between two economic variances (Table-12, Eurostat, 2018).

13) The share of the number of AWUs (AWU20177) in percent of the total population in each member state is important because all AWU produced the food for the total population in the selected EU-member states. Some imported food products could be calculated more than the national domestic food production. In this case, the share of AWU number was 1,8% of the total population of the EU-28- member states and 3,17% of the total population of the EU-15-member states by the end of the 2017. In Romania the share of AWU was 8,1% of the total population, and this was highest share of the population within the selected EU-15-member states. The second biggest share of the AWU number at national level in percent of population was 5,2% in Lithuania.

14) The smallest share of the AWU in percent of the national population was 0,86% in Denmark, 0,9% in Slovakia and 0,97% in Czech Republic by the end of 2017. The most favourable conditions were in those EU-member states, where the share of the AWU number

was at the lowest level in percent of the population. This data shows how the agricultural industry was concentrated and how the usage of agricultural inputs and land plots were concentrated. The level of the mechanization and technical equipment supply also contributed to decrease the AWU number and to increase the level of the production efficiency and profitability. The last one means better income for the agricultural industry in selected EU-15-member states (Table-11; Eurostat 2018 and own calculation).

15) FDIs in Croatia were intensive in this sector, which resulted with the highest increase of subsidies by 730% in this period, subsidies mainly used for the consumption of fixed capital. Therefore, the increase of the FDI brought more advanced technology in Croatia, which stimulated development of the real labour productivity and increase of the national GDP growth in the agricultural industry. Subsidies on production in Croatia provide a proof of technological improvement due to FDI.

16) Generally, in those EU-member states, where the share of AWU number is at level of about the 4% of the population the agricultural industry cannot be successful nor internationally competitive. Solution for this issue is concentration of the agricultural production and usage of inputs, including the labour force, in order to increase the competitiveness of agricultural industry of all of the selected EU-15-member states. This should be accompanied with improved mechanization and application of advanced technical equipment. Countries with low AU are: Romania (8,1%), Lithuania (5,2%), Poland (4,3%), Greece (4,2%), Hungary (4,0%), Latvia (3,95%), Slovenia (3,9%), Croatia (3,8%), Bulgaria (3,49%). The most competitive agricultural industry has Austria, Italy, Denmark, Czech Republic, Slovakia and sometimes Estonia. In CEE member states, the agricultural industry is growing, providing a good opportunity for decreasing their backwardness from the average level of the EU-28.

17) The number of AWU in Romania had share 8,1% of the total population, while the number of AWU in Poland had only 4,3% of the total population. This data shows large number of AWU in Romania. Therefore, the Romanian agriculture is not competitive at international level. In my opinion if in any of the EU-member state that has share of the AWU number between 3%-4% or higher of the total population, its agriculture could not be competitive at international level.

18) In Bulgaria the share of the AWU of the total population was also at high level compared to the other EU countries, hence its agriculture is less competitive for this period of 2010-2017. Bulgaria also has had the same challenges as Romania for this period, namely considerable backwardness of the agricultural industry compared to the developed countries of EU-28. Even though Bulgaria had considerable and intensive growth rate, this was not sufficient to reach the advanced EU-28 countries.

19) In Austria the real labour productivity had lower increasing rate compared to the EU-28, but this does not mean that Austria does not have enough advanced technologies. This lower increase was due to the fact the Austria is already very much developed and further development can be more difficult compared to the EU-28. Those countries, which are less developed in terms of agricultural real labour productivity, could realise more intensive developing trend than countries having high developed productivity. In general, at present the low cost labour force of selected EU-member states in Central East Europe can be less productive than one of Italy, Austria and Denmark if the advanced technology cannot be accompanying with agricultural industry and production. International competitiveness of the agricultural industry cannot be realised achieved without advanced technology based on the international qualified assurance standard and ISO (international standard organization) accepted by international agreement.

20) There is a middle strong correlation between the real labour productivity (RLP20178) and the number of the AWU, as labour force directly employed in agricultural industry (AWU20177) by 0,412 (41,2%). This means that the real labour productivity increases, which can lead to future decrease of the number of the AWU. In any way the real labour productivity can only develop based on the technological development. Technological development can decrease the number of the AWU and can stimulate surplus labour force of agricultural industry to the other economic sectors, as industry or services sectors.

21) In Italy the subsidies on the production, compared to the Austrian case, was in a more favourable state, because the investment increased, resulting with for more consumption of fixed capital. Also, looking into the balance between the national and foreign financial resources to cover the cost of the direct investment, FDI resources were more available than national. Therefore the value is negative, namely 10% in Italy (Table-11). The subsidies on the production has increased by 16,7% in Italy, because the FDI for fixed capital consumption were

higher than the domestic investments in Austria in the same period. The FDI was more dominant and for more investments aiming at increasing consumption of fixed capital in Italy than in Austria.

22) GDP growth increase of Estonia was highest among EU-15-member states, which also could provide a proof, that in spite the moderate increase of the real labour productivity, GDP growth rate increased. This also shows that developing only the agricultural real labour productivity is not enough to stimulate increasing GDP growth rate. GDP growth can be achieved also by development of other economic sectors as well. The importance of the role of the agricultural industry can be different among the EU-15-member states. In some cases the real labour productivity in agricultural industry cannot create significant GDP growth increase, because the development of other economic sectors has more important role and their economic strengthen is more considerable, than the role of agricultural industry. Estonia is an example where the other economic sectors have bigger and stronger role than one of agriculture for the GDP growth increasing rate. In Estonia also this can be proofed by the small share of the AWU number as 1,5% of the total population.

But in some other cases the agricultural industry and its real labour productivity can have more impact on the GDP growth increase. For example, in case of Latvia the real labour productivity in agricultural industry increased by 20,9% more than in case of Estonia. The GDP growth rate of Latvia increased considerably more compared to EU-15 and EU-28, but little compared to Estonia, namely by 27%. In Latvia and Lithuania, the real labour productivity of agricultural industry contributed for increased GDP growth more than in Estonia (see Table-11).

23) In Austria, the national domestic investment based on the national financial resources increased by 124,5% – one and quarter times more since 2010. The value of this increasing rate is positive, because this increase has happened in field of the national investment and not in field of foreign one. But in Austria their investment activities focused mostly on other economic sector out of the agricultural industry, therefore the real labour productivity increased only by 2,5% less than in Slovenia, despite that fact that the GDP growth in these two countries was the same. Also, in Austria subsidies on the production have decreased by 5,6%, because the investment was mostly realised in other economic sectors. There are two marginal values in the selected EU15 member states; one is Slovenia by increase of foreign direct investment and the other one is Austria by increase of national-domestic investment. In spite that Slovenia realised

considerable development in the agricultural industry, the large share of the AWU number remained as 3,9% of the total population, while in Austria this share was low, namely 1,16%.

24) In those cases when the FDI has strongly increased during the examined period and the GDP growth increase was higher than the increase of the real labour productivity of agriculture, then most of the FDI were realised in other economic sectors and not in agriculture (Austria, Estonia, Hungary, Lithuania, Slovakia). But when the real labour productivity of agriculture increased more than (Romania, Bulgaria, Croatia) or closed to increase of the GDP growth rate (Denmark, Czech Republic, Latvia, Italy, Poland, Slovenia) and subsidies on production concerning the consumption of fixed capital in consequence of the strong activity of FDI, therefore most likely the FDIs were realized in agricultural industry. Greece in not belonging into any of these three groups of the developing trends, because it realised a considerable decline in the economic growth, in real labour productivity and in the subsidies on production.

25) The agriculture is now characterized by having high number of landowners and AWU, less concentration of arable land and farming system. Therefore the real labour productivity can consequently be little extending for longer period, it can also stagnate. This condition can easily lead to decreased competitiveness of the Hungarian agriculture and also worsen income positions of farmers and farming households. Furthermore, this can lead to less capital accumulation for investment in agricultural sector. Hungarian agriculture is facing a large challenge to concentrate the agricultural production and to use more advanced mechanization, modern techniques and equipment.

26) In Denmark the cooperative system helped the farming system and farming household scheme to concentrate using agricultural input and land-use in order to increase the profitability, production productivity and real labour productivity at very high level. This country's agriculture is characterized with advanced mechanization, which keeps the income and international competitiveness position stable in a long run for all co-operative members. The Danish farming co-operative system is an example how to create well-functioning vertically integrated product channel based on the co-operative system. ARLA-Foods Cooperative is an example with starting point from the soil of the arable land to the consumers' table, for agricultural and food products through the basic agricultural and food production, food manufacturing industry, the whole trading and retail trading steps directly to the consumers. The cooperative system should not be regarded as a private company for one unit of basic

production, purchasing and selling. The co-operative system is based on the single independent, or individual producers as farmers, while a private company normally is not consisting of independent producers. Usually a private company is one producer, which cannot share more than 30% of one kind of product or product group market organization based on the Law of Competitiveness in EU.

This chapter provides an overview of the economic conditions of each EU-member state based on ten different economic variances selected to five-five variances in order to determine the similarities and difference among the EU-15 selected Member States. This type of analyse is required to apply the SPSS statistical system. The SPPS can exactly describe the economic differences among states by figures and calculations. In the next chapter, is presented a summary of the statistical analyses concerning the selected EU-member states.

4. CONCLUSION AND RECOMMENDATIONS

The selected EU-15 Member States are faced with some challenges. One of these challenges is the low number of AWUs (AWU20177) as percentage of the total population of each member state in this research. This is important because the AWUs produced total food consumption in the selected Member States.

In this case, the share of AWU number was 1,8% of total population of the EU-28- member states and 3,17% of total population of the EU-15 Member States by the end of the 2017. In Romania the share of AWU was 8,1% of total population, a country with highest level in the share of the population within the selected EU-15 Member States. The smallest share of the AWU in percent of the national population was 0,86% in Denmark, 0,9% in Slovakia and 0,97% in Czech Republic by the end of 2017. In those Member States, where the share of AWU number is as high as about 4% of the population, the agricultural industry cannot be successful or internationally competitive. Possible solution is concentration of the agricultural production and use of inputs including the labour force, in order to increase the competitiveness of agricultural industry.

Based on the above-mentioned analyses for the agricultural industry it can be concluded that the competitiveness of the selected EU member states is less competitive compared to the competitors of the world economy. This is mainly because the farm structure of these countries is very diversified. This is the case for the agricultural sector of Romania and Poland. Lower competitiveness is valid for all EU-28 when these are compared to the agricultural sector of the US. The solutions for overcoming this challenge are summarized below:

- increase the level of the mechanization for larger farm size;
- qualified skills demand should be closed to the internationally accepted technological developed level;
- increase the input efficiency;
- increase the labour force efficiency in this sector;
- strong cooperation among the producers of the agricultural basic materials, manufacturing industry, whole traders and retail traders;
- development of infrastructure and logistic networks among them;

- maintaining low level of central governmental debt in GDP, especially when increasing subsidies for farmers, house hold farming family system.

Generally, the main goal of the selected EU-15-member states is to increase their competitiveness of the agricultural industry globally. Therefore, the input and output should increase by private investments, with possible FDI and decreasing number of the AWU. In order to achieve this, it is important for farmers to develop the real labour productivity, accompanied with increase of the real income factor per AWU and to obtain the subsidies for increased investment in fixed capital.

5. NEW SCIENTIFIC RESULTS

The new scientific results are summarized below, as a reflection to the hypotheses mentioned in the beginning of the dissertation. The summary is as follows:

1) The correlations among the variances can be middle strong if the value is more than 0,500 and close to 0,500; if the value is below 0,500 (50%) then the correlation is weak. If the value of the correlation is close to 1,000 (100%), or more than 0,900, then the correlation is very strong. Based on this, the correlation is very strong between OUTPUT171 and INPUT172. This means that if the OUTPUT171 increases then the INTPUT172 will also increase.

2) The correlation is middle strong in between following variances; namely between OUTPUT171 and Privinv164 (Private Investment) by 0,603 (60,3%) and between INTPUT172 and Privinv164 by 0,463 (46,3%). Also, if the Privinv164 increases then the OUTPUT171 and the INTPUT172 will also increase.

3) The correlation is middle strong between Gross Value Added (GVA173) and Real Income Factor per Annual Working Unit (RIFAWU175) by 0,562 (56,2%). Naturally if one of these economic variance changes , then the other economic variance will change in the same direction depending on the other variance (Table-4).

In case of Hungary the output, input and the private investment on the “X” line have increased, but the GVA and the real income factor per AWU have increased more than the trend of the other three economic variances on “X” line. This means that the little moderate increase of the private investment in Hungary could generate increase of input and output and three times more increase of the GVA, which led to two and half times more increase of real income factor for AWU, than the GVA for the same time period. In this period the first biggest increase of the GVA was in Lithuania by 90,7% increase, which led to increase of the real income factor by 50%, while in Hungary the GVA173 increased by 81,0% and RIFAWU175 increased by 66,2%. The average increasing level of GVA in EU-15 was 43% and RIFAWU175 was 39,2%, while in EU-28 this GVA173 rate was only 21,9% and real income factor increased by 25,2%.

4) Strong and middle strong correlations exist between GDP growth (GDPGrowth176) and the real labour productivity (RLProd20178), because the GDP growth can influence the real labour productivity (RLProd20178). The more the GDP increases - including also the other economic sectors additionally to the agricultural industry – the growth stimulates developing trend of the real labour productivity. Also, more growth of the real labour productivity means that the value produced by AWU in agricultural industry can provide more value in agricultural sector, which added to the whole amount of the GDP at national level or at the level of each selected EU-member state. There is a strong correlation between both of them.

5) The FDI (DIRINV1710) has strongly increased for the researched period, but the GDP growth increase was more than the increase of the real labour productivity of agriculture, therefore, most likely the FDIs were realized in other economic sectors than in agricultural industry (Austria, Estonia, Hungary, Lithuania, Slovakia). But when the real labour productivity of agriculture increased more than (Romania, Bulgaria, Croatia) or closed to increase of the GDP growth rate (Denmark, Czech Republic, Latvia, Italy, Poland, Slovenia) and subsidies on production concerning the consumption of fixed capital in consequence of the strong activity of FDI, therefore most likely the FDIs were realized in agricultural industry.

6. SUMMARY

The study analyses the main developing trends and differences in agricultural industry of the selected EU-15 Member States in Central-East Europe for the period of 2010 and 2017. These EU Member States are Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Romania, Bulgaria, Slovenia, Croatia, Italy, Greece, Austria and Denmark.

The analyse focuses on the real income factor per AWU in the selected EU-15 Member States based on the Eurostat database. The main economic issue is the real labour productivity concerning the private investment based on the balance of the foreign direct investment and the national domestic investment accompanied with subsidies covering mostly the consumption of the fixed capital. The real labour productivity has also correlation with number of AWU and the GDP growth rate. The private investment has strong correlations with output and input. Also, the GVA has stronger correlation with output and the real income factor per AWU. In this study, the SPSS research methods were used to evaluate the robustness of the correlations among the economic variances.

There is a considerable difficulty for the selected EU-15 Member States. Namely in the majority of the EU-15, the share of the number of AWUs (AWU20177) was more than 4% of the total population of each member state in this research. This is important because the AWUs produced total food consumption in the selected Member States. Because of the high level of the AWU number in all member states, the international competitiveness of the agricultural industry of these member states decreased, risking losing their market positions.

In those Member States, where the share of AWU number is at level of about 4% of the total population, the agricultural industry cannot be successful or internationally competitive. Possible solution for this issue is concentration of the agricultural production and usage of inputs, including the labour force in order to increase the competitiveness of agricultural industry.

List of Publications by Nikola M. Trendov

Publications in journals (peer reviewed)

1. **Trendov, M.N.** and Vasa, L. (2015): Pathway to EU integration: Rural Development Policies of the Western Balkan Countries. Case study of Macedonia, Montenegro and Serbia. *KKI Studies* T-2015/5. ISSN 2064-9460

2. **Trendov, M.N.** and Vasa, L. (2016): Governance Structure within the cooperative "Res-Group" in Supply Chain Management of Apple Production in Prespa Region, the Republic of Macedonia. *LIMES Journal of Social Science and Humanity*, Vol. 8, No. 3, pp. 33–42. ISSN 1820-0869

3. Shaqiri, F. and **Trendov, M.N.** (2017): Agricultural Subsidies' Effects on the Agricultural Productivity in Kosovo, *International Journal of Ecological Economics & Statistics*. Vol. 39, No. 1, pp. 54–63. ISSN 0973-7537 (Scopus Index)

4. **Trendov, M.N.** (2017): Comparative study on the motivations that drive urban community gardens in Central Eastern Europe. *Annals of Agrarian Science*, Vol. 5, No.1, ISSN 1512-1887 (Scopus Index) DOI: 10.1016/j.aasci.2017.10.003

5. **Trendov, M.N.**, Olagunju, K., and Pesevski, M., (2017): Are Agricultural Subsidies Efficient Tool for Agricultural Sector of the Republic of Macedonia? *Bulgarian Journal of Agricultural Science*, Vol. 23, No. 3, pp. 363-369. ISSN 1310-0351

6. **Trendov, M.N.** (2017): Index of the Development of Circular Agriculture in the Republic of Macedonia, *Visegrad Journal on Bioeconomy and Sustainable Development*, Vol. 6, No. 1, pp. 35-38. ISSN 1339-3367 DOI: 10.1515/vjbsd-2017-0006

7. Olagunju, K., Neszmelyi, Gy., Oguntegbe, F.K., **Trendov M.N.** and Ogunniyi, I.A. (2017): Welfare Impact of Rural Infrastructural Development in Oyo State, Nigeria, *Asian Journal of Agricultural Extension, Economics & Sociology*, Vol. 17, No. 2, pp.1-13, ISSN 2320-7027. DOI: 10.9734/AJAEES/2017/33325

8. Angeloska, A., **Trendov, M.N.** and Stratan, D. (2017): Transaction costs within the individual and cooperative apple producers in Prespa Region, the Republic of Macedonia. *Economy and Sociology*, Vol. 3. pp. 45-54.

9. Stratan, D., Angeloska, A. and **Trendov, M.N.** (2017): Rural Women Entrepreneurship in Macedonia and Moldova: Comparative Study. Economy and Sociology, No.4, pp. 53-61.

10. Vasa, L., Angeloska A. and **Trendov, M.N.** (2017): Comparative analysis of circular agriculture development in selected Western Balkan countries based on sustainable performance indicators. Economic Annals-XXI, Vol. 168, No.11-12, pp. 44-47.

Publications in conference proceedings (peer and not peer reviewed)

1. **Trendov, N.** and Pesevski, M. (2014):"The Role of Rural Women in SME`s of agro-food production: case study in Republic of Macedonia-Increasing family income or becoming professional entrepreneur". International Scientific Conference XIV - Gyöngyös, Hungary 2014, pp. 1501-1508. ISBN 978-963-9941-76-2

2. **Trendov, M.N.,** (2014):"Cooperative membership choice from a transaction costs economic perspective within apple producers in case of Prespa Region, Republic of Macedonia". VUA YOUTH Scientific session "Lets science bring us together" - Godollo, Hungary 2014, pp.126-136. ISBN 978-963-269-451-1

3. **Trendov, M.N.** and Stratan, D. (2015): WTO Perspectives on Developing Countries. *Economic Growth in Conditions of Globalization*, Vol. 10, No. 1, pp.97-99. ISSN 978-9975-4185-1-5

4. **Trendov, M.N.,** and Vasa, L., (2016): "DCFTA and ENPARD Opportunities for EU-Ukraine Agri-trade Partnership: Experience and Policy Recommendations from Visegrad Countries" In*: Supporting Economic Reforms in Ukraine by Transferring V4 Experience*. Budapest, Institute for Foreign Affairs and Trade. pp. 22-37. ISBN 978-963-7039-41-6

5. **Trendov, M.N.,** Olagunju, K., and Pesevski, M., (2016): "Are Agricultural Subsidies Causing More Harm Than Good? Evidence From Agricultural Sector of the Republic of Macedonia". International Scientific Days 2016, Nitra, Slovakia, 19-20 May. DOI: 10.15414/isd2016.s1.07

6. Olagunju, K. and **Trendov, N.** (2016): "Can off-farm employment provide new pathways to improve livelihood of rural farming households? Evidence from Nigeria". Policy and economics for sustainable agriculture and rural development: proceedings of papers, 10th International Conference 12-14 May 2016, Ohrid, Association of agricultural economics of Republic of Macedonia. pp. 269-278.ISBN 978-9989-2358-7-0

7. **Trendov, M.N.,** and Olagunju, K., (2016):"CAP Performances of the Visegrad Countries after the European Union`s Accession". Scientia Iuventa 2016, Proceedings from international conference of PhD students. April 2016, Banska Bystrica, Faculty of Economics, Matej Bel University. pp.575-584. ISBN 978-80-557-1084-6

8. Olagunju, K. and **Trendov, N.** (2016): "Welfare Impact of Rural Infrastructure in Nigeria". 152th EAAE Seminar "Emerging Technologies and the Development of Agriculture". Novi Sad, Serbia 2016, pp. 304-316. ISBN 978-86-6269-052-4

9. Shaqiri, F. and **Trendov, M.N.** (2017): Agricultural Subsidies' Effects on the agricultural productivity in Kosovo, "Actual Economy: Eurasian Discourse on Global Challenges" conference proceeding, International Conference 26-27 January 2017, Baku.

Publication in book of abstracts

1. **Trendov, N.** (2013): "Development of agriculture in Macedonia, by strengthening farmers' knowledge based on non-formal education". International Scientific Conference VUA - Godollo, Hungary 2013, pp. 421-426. ISBN 978-963-269-376-7

2. Goda, P., Kis, M., and **Trendov, N.** (2015): Comparative study on urban community gardening in Central Eastern Europe. Second International Conference on Agriculture in an Urbanizing Society "Reconnecting Agriculture and Food Chains to Societal Needs". Rome, Italy 2015, pp.150

3. Olagunju, K., and **Trendov, N.** (2016): "Welfare Impact of Rural Infrastructure in Nigeria". 152th EAAE Seminar "Emerging Technologies and the Development of Agriculture". Novi Sad, Serbia 2016, pp.34. ISBN 978-86-6269-050-0

Published book

1. **Trendov, M. N.**, Varas, S. and Zeng, M. (2019): Digital technologies in agriculture and rural areas – Status Report. Rome: FAO.

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Searle, S., Petrenko, C., Baz, E. and Malins, C. (2016): *Crops of the Biofrontier: In search of opportunities for sustainable energy cropping*. Washington D.C.: The International Council on Clean Transportation.

Conferences attended

1. 18th IFOAM Organic World Congress – 13-15 October 2014, Istanbul, Turkey

2. "FIKUSZ Symposium for Young Researchers" - Óbuda University - Keleti Faculty of Business and Management, 14-15 November 2014, Budapest, Hungary

3. "Hungarian Regional Science Association 12nd Annual Meeting" - University of Pannonia - Faculty of Business and Economics, 27–28 November 2014, Veszprém, Hungary

4. "Action for family and consumer wellbeing" – IFHE, University of Malta, 19-21 March 2015, Valletta, Malta

5. "BASEES Annual Conference 2015" - Fitzwilliam College, Cambridge University, 28-30 March 2015, Cambridge, United Kingdom

6. "Regional Workshop on National e-Agriculture Strategies" FAO-GAK-SZIU, 22-24 June 2015, Godollo, Hungary

7. Second International Conference on "Agriculture in an Urbanizing Society" – Roma Tre University, 14-17 September 2015, Rome, Italy

8. 39th European Commission on Agriculture (ECA) – FAO REU Budapest, 22-23 September 2015, Budapest, Hungary

9. 10th International Conference "Economic Growth in Conditions of Globalization" - National Institute of Economic Research, 15-16 October 2015, Chisinau, Republic of Moldova

10. International Conference "Emerging Markets and Queries in Finance and Business" – Petru Maior University, 30-31 October 2015, Targu Mures, Romania

11. "Supporting economic reforms in Ukraine by transferring V4 experience" – Institute for Foreign Affairs and Trade in Budapest, 10-11 December 2015, Budapest, Hungary

12. International Conference "Association models of agricultural producers in the Republic of Moldova vs V4 countries" – National Institute of Economic Research, 26 February 2016, Chisinau, Republic of Moldova

13. "Scientia Iuventa 2016", International conference of PhD students., Faculty of Economics, Matej Bel University, April 2016, Banska Bystrica, Slovakia

14. "Policy and economics for sustainable agriculture and rural development", 10th International Conference, Association of agricultural economics of Republic of Macedonia, 12-14 May 2016, Ohrid, Republic of Macedonia

15. "International Scientific Days 2016", Faculty of Economics and Management, State University of Agriculture in Nitra, 19-20 May 2016, Nitra, Slovakia

16. "Thematic University Business Forum – Breaking Boundaries for Future Careers", Haaga-Helia University of Applied Sciences, 2-3 June 2016, Helsinki, Finland

17. "Expert Consultation on e-Government aspects of national e-Agriculture strategies for sustainable family farming", FAO-REU Budapest, GAK-SZIU and ITU, 22-24 June 2016, Visegrad, Hungary

18. "Emerging Technologies and the Development of Agriculture", 152th EAAE Seminar, August 30-1 September 2016, Novi Sad, Serbia

19. "3rd European Meeting of Community Supported Agriculture Movements", URGENCI Network, 16-18 September 2016, Ostrava, Czech Republic

20. "ICT in Agribusiness Conference", ICT Chamber of Commerce MASIT, 23–24 November 2016, Skopje, Macedonia

21. "Regional Symposium on Agroecology for Sustainable Agriculture and Food Systems in Europe and Central Asia", FAO-REU Budapest, 23–25 November 2016, Budapest, Hungary

22. "AMA Global Marketing SIG Special Conference - Global Marketing in an Era of Change", American Marketing Association, 6-9 April 2017, Havana, Cuba

23. CEMA Summit 2017 "Farming 4.0 - moving towards connected & sustainable agriculture in Europe", CEMA European Agriculture Machinery Organisation, 12th October, Brussels, Belgium.