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152nd EAAE SEMINAR

EMERGING TECHNOLOGIES AND THE DEVELOPMENT OF AGRICULTURE

PROCEEDINGS OF ABSTRACTS

August 30th - September 1st 2016
Novi Sad, Serbia

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PLENARY SESSION

Paper by Invitation

VALUE CHAINS AND TECHNOLOGY TRANSFER IN GLOBAL AGRI-FOOD SYSTEMS

Johan Swinnen[1]

Abstract: Value chains in the agrifood sector are undergoing a rapid process of modernization, characterized by the emergence of private standards and different systems of value chain governance. In this presentation I discuss the implications for technology use and adoption, taking into account imperfections in credit and technology markets and problems with contracting within value chains. I explain how these factors affect bargaining power and the division of surplus; and how the nature of the technology affects technology transfer and the implications for value chain governance.

Key words: *value chains*, *technology transfer, agri-food systems*

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TECHNICAL CHANGE IN AGRICULTURAL DEVELOPMENT OF THE WESTERN BALKAN COUNTRIES

Koviljko Lovre[1]

Abstract: In the long run, the growth of agricultural production is carried out with the relative fixity of arable land and the labour extraction from agriculture, so the crucial extent of the output growth is achieved on the basis of the increased use of non-agricultural inputs, quality improvement of all production factors and their favourable combinations. From this empirically indisputable fact, it is deductible that the technical progress is one of the key generators of agricultural production and productivity factors. However, the efficiency and diffusion of technical and technological innovations in agriculture are much more complex than in other areas of material production. It is primarily due to the inherent characteristics of agricultural development, immense numbers of productive individuals and decision-makers, dispersed economic and social structure, the role of "traditionalism," agricultural transformation and accumulation of non-agricultural resources, and growing role of institutional factors in the development.

At the international level, the pace of technical expansion is exceptionally unequal, even within the framework of a relatively homogeneous group of countries, such as the Western Balkans. The reason for this is primarily in the different levels of agricultural development, divergent institutional schemes, diverse approaches to methods of growth and operation of research and extension services, different levels of farmers' education and of overall economic development. From all the above stated, the objective of this work is a clear result: determining the technological progress pace and its contribution to the growth of agricultural production in the countries of the Western Balkans. The goal is to determine precisely the extent to which the technical progress has improved the agricultural competitiveness of the individual states. The research time span is primarily contingent by the efforts of these countries to become members of the European Union.

Key words: *growth and development of agriculture, technical progress, productivity, the Western Balkans.*

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APPLICATION OF ROBOT SYSTEM IN AGRICULTURE - CASE STUDY OF SERBIA[1]

Jonel Subić[2], Marko Jeločnik[3], Miloš Jovanović[4]

Abstract: Research described in paper was primarily focused on the economic analysis (cost-effectiveness) of the new technologies application (mobile robotized solar power generator) in vegetable production. Consequently, analysis was based on experimental measurements, in which were done parallel testing of energy efficiency and economic cost-effectiveness of use of 4 different pumping systems connected to different irrigation systems: electric pumps connected to the public electrical grid; pumps with gasoline engine; pumps with diesel engine; and electric pumps powered by solar power generator. The experiment was carried out on experimental plots under certain vegetable crops (cauliflower, tomatoes and lettuce) that were produced in the two production systems, on the open field and within the protected area (greenhouse), involving the use of irrigation (drip-drop and sprinkler system). Experimental plots are located in village Glogonj - Upper Danube region and village Veliko Selo - Central Danube region. After detailed analysis of results obtained within the one production cycle in vegetable crops production (analysis was done by use of analytical calculations based on variable costs), certain conclusions indicating economic justification of applied new technologies (mobile robotized solar power generator) have been made. Achieved economic effects are reflected through the reduction of fuel spent for irrigation (i.e., variable costs in cauliflower production were decreased for 486 EUR/ha; in tomato production for 554 EUR/ha; or in lettuce production for 340 EUR/ha).

Key words: *economic effects, new technologies, vegetable production.*

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SESSION ONE

The Role of Technology in Sustainable Agriculture and Food Security

INNOVATION IN THE HUNGARIAN FOOD ECONOMY – A REEXAMINATION

Imre Ferto[1]

Abstract: Innovative performance is increasingly identified as a key determinant of competitiveness. Innovation is even more relevant in the context of the Hungarian agro-food sector, a sector that has traditionally been internationally oriented but that also suffers from the legacy of former communist rule in which quality and innovative content of products and services was not a priority. This paper has looked specifically at the role of openness in the innovation process and a firm's absorptive capacity for explaining innovative performance. More specifically, this paper investigates the innovation process in the Hungarian agro-food sector using the concept of open innovation which refers to the fact that companies are increasingly using resources from outside the boundaries of the firm to speed up the innovation process (Chesbrough, 2003; 2006). While there is abundant evidence of the importance of open innovation in high-tech industries, studies in the food industry are still limited (see Enzing et al. (2011) for an example). Nevertheless, Archibugi et al. (1991) indicate that a more open system of innovation is particularly interesting for food companies, which normally rely even more on external resources than other industries. Our analysis a follow up research based on a survey in 2011 (Fertő and Tóth, 2016). Recent empirical analysis is based on the data from a 2014 survey of more than 300 small and medium size agricultural producers, food processors and retailers. We determine the impact of open innovation and a company's absorptive capacity on innovation performance employing two stage approaches. First, we apply a cluster analysis to categorise companies based on their open innovation absorptive capacity, firm and managerial characteristics. Second, using semi-non parametric probit models we find that open innovation positively influence the innovation performance for the product and market innovation. Estimations indicate that the absorptive capacity has positive impacts on technological and organisational innovation and on innovation propensity. Results suggest that there exist a considerable heterogeneity both within and between the supply chain segments regarding to the innovation performance.

Key words: *Open Innovation, Absorptive Capacity, SME, Agro-food, Hungary.*

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TECHNO-ECONOMIC FEASIBILITY AND THE POTENTIAL USE OF PORTABLE SOLAR IRRIGATION SYSTEMS IN AGRO-PRODUCTION SECTOR[1]

Nataša Kljajić[2], Vesna Paraušić[3], Aleksandar Rodić[4]

Abstract: The Republic of Serbia has favourable climate, land and water resources for intensive agricultural production. However, stable production is limited by rainfall, which is on the one hand insufficient and on the other hand unevenly distributed throughout the growing season. Therefore, the introduction of irrigation in agricultural production is of great importance because it contributes to the increase in production volume, it improves the quality of crop yields and the economic effects of investments in production. Depending on climatic conditions and the conditions for production, up to 100% higher yields can be obtained by irrigation, while in very dry years up to two or three times higher. It is also necessary to solve the problem of water intake, as well as to make the proper selection of equipment and devices for irrigation.

By adopting the "Law on ratification of the Treaty establishing the Energy Community between the European Community and the Republic of Albania, the Republic of Bulgaria, Bosnia and Herzegovina, the Republic of Croatia, Former Yugoslav Republic of Macedonia, the Republic of Montenegro, Romania, the Republic of Serbia and the UN Interim Administration Mission in Kosovo" ("Official Gazette of the Republic of Serbia ", No. 62/06), Serbia became a member of the Energy community and assumed the international obligations regarding the use of renewable energy sources (pursuant to Directive 2009/28 / EC on the promotion of the use of electricity from renewable sources). In accordance with this Directive and the Decision of the Council of Ministers of the Energy

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Community in 2012 (D / 2012/04 / MS - ENZ) and National Renewable Energy Action Plan of the Republic of Serbia ("Official Gazette of the Republic of Serbia", No. 53/13) a very ambitious and binding target was set for Serbia of 27% gross final energy consumption from renewable sources by 2020. A number of national legislative and policy documents point out that increased use of renewable energy sources is a main need and aim in order to improve agriculture and economic development of Serbia.

The implementation of solar panels that convert sunlight into electricity is recommended in order to use irrigation systems at affordable prices and save energy, that is, to start and operate the water pump at lower cost. This is particularly important for those areas that are suitable for agricultural production (which cannot be intense in the true sense of the word without irrigation), where there is no electric grid, and there are water resources: wells, groundwater, streams, canals, rivers or lakes. Due to low operating costs during use, the solar pump units prove to be more cost-effective than the petrol engine only after the second year of use. Accordingly, the paper discusses the use of renewable energy sources and portable robotic solar electric generators as new technologies in the implementing of irrigation as an effective measure in agricultural production in the Republic of Serbia. The efficiency of implementation and economic viability can be seen through the examples of their use in experimental fields in several localities.

Keywords: *Renewable energy sources, portable solar irrigation systems, energetically, environmentally and economically sustainable agricultural production*

POSSIBLE IMPACTS OF EU GHG MITIGATION POLICY ON WESTERN BALKAN AGRICULTURAL MARKETS

Guna Salputra[1], Ignacio Pérez Domínguez, Thomas Fellmann, Jesús Barreiro Hurle, Mihaly Himics, Heinz-Peter Witzke[2], Franz Weiss[3]

Abstract: The European Union (EU) countries have agreed on a new 2030 Framework for climate and energy, stipulating that EU greenhouse gas (GHG) emissions from several sectors should be cut by 30% below the 2005 level. As the EU's agricultural sector will be required to comply with this emission mitigation obligation, this is expected to impact agricultural markets inside and outside the EU. Employing the CAPRI modelling system, this paper specifically deals with the potential effects of the EU GHG mitigation policy on main agricultural markets in the Western Balkan (WB). For the analysis we simulate a scenario where mitigation efforts are shared in the cost-effective way between Member States. Due to huge GHG emissions reductions during the 1990s, WB countries, regardless of their actual or potential accession to the EU, are assumed to have no specific mitigation obligations. Results of the modelled mitigation policy scenario show a positive impact (+15%) on cereals production in the WB while the impact on meat and dairy production is negative (accordingly -17% and -1%). Subsequently the regions' trade balance improves for cereals and worsens for meat and dairy products. However, the economic effects for the agricultural sector in different WB countries is diverse and have to be considered in line with a highest potential increase of GHG emissions in Serbia (+8%) and highest potential decrease in Bosnia & Herzegovina (-7%).

Key words: *GHG emissions, climate policy, agricultural markets, Western Balkan, modelling*

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CONTEMPORARY UTILISATION OF RENEWABLE ENERGY SOURCES

Slaviša Đukanović [1]

Abstract: Last two years were extraordinary for renewable energy utilization in the world. An estimated 147 gigawatts (GW) of renewable power capacity was added in 2015, the largest annual increase ever, while heat capacity increased by around 38 gigawatts-thermal (GWth). Wind and solar photovoltaic (PV) had record additions for the second consecutive year, accounting for about 77% of new installations. For the first time in history, total investment in the renewable power and fuels in developing countries in 2015. exceeded that in developed economies. At the same time, employment in the renewable energy sector increased to 8 million jobs. Solar PV and bio fuels provided the largest numbers of renewable energy jobs. Considering all renewable energy technologies, the leading employers were China, Brazil, United States and India. Renewables are now cost competitive with fossil fuels in many countries and are established around the world as mainstream sources of energy. Cities, communities and companies are leading the rapidly expanding 100% renewable movement.

Key words: *renewable energy sources, utilization, investment, employment.*

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BIO-REFINING AGRICULTURAL CROP PRODUCTS INTO HIGH-VALUE MATERIALS – ECONOMIC IMPACTS ON THE AGRICULTURAL SECTOR

Jorgen Dejgaard Jensen[1]

Abstract: Implementing the vision of a bio-based economy requires the development of technological solutions to convert biomass into high-value materials for use in modern production systems. This paper aims to examine the economic consequences of scenarios, where technological solutions for conversion (bio-refining) of agriculturally supplied biomass are implemented on a large scale in Denmark. The technological scenarios are analysed in a partial equilibrium model of the Danish farm sector, which enables assessment of distributional effects between different farm types (crop, cattle, pig farming, full-time versus part-time farms, organic versus conventional farming, etc.). The model simulates production and input demand in different lines of agricultural production on different farm types based on cost minimization theory. Behavioural parameters have been obtained from econometric estimations or calibrated from field experiment data. The sector model is calibrated on farm accounts (FADN) data for Danish farms in 2011. Two alternative bio refining scenarios have been analysed and compared (static-comparatively) with a baseline scenario:

- extraction of high-value protein from green biomass to be used for e.g. pig feeding
- extraction of high-value components of the biomass for industrial processing

The vision of protein extraction from "green" biomass is to replace imported high-protein feeds (e.g. soya) by making protein from high-yielding crops (such as grass) digestible for non-ruminants (pigs, poultry), and hence increase the resource efficiency in the supply chain for non-ruminant meats. In contrast, the vision of the second scenario is to broaden the scope of bio refining, and not restrict the output to protein feeds. The economic impacts of these bio refining scenarios are not equally distributed across farm types. Production of green biomass for extraction of high-value proteins tends to replace roughage production aimed for cattle, which affects the growth potentials for milk and beef

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production on cattle farms, whereas costs for concentrate feeds are mainly affected on pig and poultry farms. On the other hand, production of "yellow" biomass (grains) for other industrial purposes tends to replace grain production on crop or pig farms. The economic analysis in the paper yields results on the distribution of economic outcomes on 15 different farm types, distinguished according to main production, farm size, soil type, organic status and full-time/part-time status. The analysis suggests some variation across these farm types in terms of their adoption of biomass production for industrial purposes, for example depending on their reliance on on-farm feed production. But the analyses also suggest that the economic gains from involving in biomass production seem to be relatively large on part-time farms.

The work with analysing economic impacts of biomass production for bio-refining is a field in progress, given that the development of biomass processing technologies for high-value purposes is still at its infancy, and results of quantitative economic analyses of such technologies are then also somewhat uncertain. Nevertheless, economic model tools and analyses are deemed as useful tools to identify some of the critical assumptions for the economic viability of alternative technologies within the field of biomass refining and hence for the economic sustainability of the bio-based economy.

Key words: *Bio-refining, high-value protein, high-value bio-based industrial components, agricultural sector mode.*

IMPROVING INFORMATION TECHNOLOGY FOR FOOD SAFETY IN SERBIA

Tatjana Brankov[1], Marinko Kresoja[2]

Abstract: Regarding complexity of the food supply chain, the application of up-to-date information technologies (IT) is becoming very important for production and trade of safe food. Moreover, consumers demand to know "who, what, when, where and how" of products they purchase. This article describes general food safety situation in Serbia structure of food safety and control system, risk management and risk communication of certain disease as well as forthcoming challenges in implementation of the acquis. Special emphases is given to the establishment and functioning of the Rapid Alert System for food and feed (RAFSS). The paper gives a spreadsheet presentation of more than 100 notifications originating in Serbia, recorded in RAFFS system for the period from 2005 to 2015 and classified as information, alert, and information for attention, border rejection or information for follow-up. The paper concludes that Serbia is moderately prepared for EU integration in the area of food safety, veterinary and phytosanitary policy. There is a need for adopting a national monitoring and control programme for food and feed safety needs as well as a programme for upgrading agri-food establishments. The general assessment is that Serbia should introduce, develop and improve the IT that serve as a tool for improving transparency in the food supply chain.

Key words: *food safety, IT, transparency, Serbia*

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DETERMINANTS OF CHANGES IN SALE OF RENEWABLE ENERGY TECHNOLOGIES (RETS) IN NIGERIA AND KENYA

Abiodun Elijah Obayelu[1], John Adeoti[2], Rene Kemp[3], Jacinta Ndichu[4], Julian Blohmke[5]

Abstract: This study analysed determinants of changes in sale of Renewable Energy Technologies (RETs) in Nigeria and Kenya. A total of 22 and 41 RETs marketers were purposively selected through a snowballing and interviewed in Nigeria and Kenya respectively in 2013. Data were analysed with both descriptive and inferential statistics. Fullness of RETs package was found as a common determinant of changes in sale in the study areas. In addition, while the level of research in RETs and number collaborators had positive and significant effect on sale in Nigeria, degree of standardization influenced sale in Kenya. Provisions of financial support and advisory services to clients by marketers however have significant negative effect in Kenya against degree of domestic knowledge in Nigeria. Increase in sale in Nigeria therefore calls for more sensitization of people on the domestic uses by the marketers, while increases in number of technology collaborators, provision of both advisory and financial support to clients are imperative in Kenya.

Keywords: *Growth, energy efficiency, clean energy, energy demand, sustainability, Africa*

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SESSION TWO

New Technologies and Changes in Supply Chain Organization and Performance

NEW TECHNOLOGIES IN PRECISE AGRICULTURE AND POSSIBILITIES OF APPLICATION IN SERBIA

Miladin Ševarlić[1], Sofija Mladenović[2], Rade Nastić[3], Marko Živković[4], Luka Živković[5]

Abstract: The constant growth of the world population increases the need for food. Price level of food has a long-term growth on the world market. This has a direct effect on the number of malnutrition people in the world. Therefore, there are greater demands set upon the sustainable agriculture in terms of optimization and lower production costs, increase of yield and improving the quality of agricultural products, but also the protection of the environment and human health. Under certain condition application of new technologies (autonomous machines, robots, drones and nanotechnology) in the system of precise agriculture could respond to these requests. Innovations in agriculture can achieve goals without the need for genetic modification of seeds and application of total herbicides which are harmful to the health of both farmers and consumers. In Serbia, the development of precision farming based on the application of new technologies is in the stage of "pioneer" venture of certain agribusiness companies.

Keywords: *precision agriculture, new technologies (independent machines, robots, drones and nanotechnology), the efficiency of agricultural production, Serbia.*

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FARM ACCOUNTANCY DATA NETWORK AS A TOOL FOR MEASURING EFFICIENCY OF APPLIED NEW TECHNOLOGIES IN AGRICULTURE

Zorica Vasiljević[1], Vlado Kovačević[2], Sladjan Stanković[3]

Abstract: The aim of the paper is to determine potential use of Farm Accountancy Data Network (FADN) as a tool for measuring efficiency of new technologies in agribusiness sector in EU and Serbia. The paper provides a broader context for understanding the concept of new technologies as a Precision Agriculture and Smart Agriculture. Effective system for measuring results of applied new technologies in agriculture is analyzed in this paper both at the level of individual farms and agrarian policy. FADN is the accountancy system uniform for all EU countries. As the FADN has same methodology in collecting and processing data for all EU countries, results are comparable for all EU countries and candidate countries. Serbia has started with FADN introduction in 2011 and an efficient system has been established so far. Results of the paper are showing that FADN can be excellent tool for measuring effects of the new technologies' application. The FADN data as e.g. the used working unit (AWU), fixed capital, variable expense, yields per hectare, profit margin can be used as indicators for effectiveness of the new applied technologies. In this paper there are suggested some new indicators that could be included within the FADN.

Keywords: *Precision Agriculture, Smart Agriculture, FADN, Efficiency of new technologies.*

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PRODUCTION OF HARD CHEESE FOR THE RUSSIAN MARKET

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Abstract: Given that the production of milk and dairy products in Serbia is to some extent compromised, because there is already an influx of cheap dairy products from the EU, all to the detriment of domestic producers, and it also don't benefit consumers because they do are not able buy cheaper products, it is necessary to look for other solutions. The Russian market is interesting because good prices can be achieved and large quantities of products sold. Hard cheese is particularly interesting because it is known for its quality and long shelf life. The problem of our dairies is that almost no dairy produces hard cheese for cutting and grating from cow's milk, mainly hard cheeses of pasta filata type and smaller amounts of hard cheese are made from sheep's milk.

The group of hard cheeses includes large number of varieties of cheese which are divided into extra-hard, hard with holes and hard without holes. They are characterized by: low moisture content, which is achieved by size of particles during the cutting of the cheese curd and using the high temperature processing of the curd; clean rind, or not having rind at all in the case that it is packed into some sort of foil and a method of ripening under the influence of an enzymes originating from a starter culture and rennet. This is hard cheese, that goes through a series of physical-chemical and microbiological changes during the ripening period, affecting the sensory characteristics. Below the rind is straw-coloured dough, without any cracks, which melts in the mouth. The flavour is delicate, mildly sharp, but not too narrow and complete despite a low fat content. Hard cheeses have a long ripening period, and thus have greater digestibility, higher concentration of free amino acids and a higher concentration of short and medium chain free fatty acids. The high concentration of calcium in cheese has significant impact on the formation and protection of teeth and bones, prevention of osteoporosis

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and hypertension. Thanks to its high sensory and nutritional properties, and also long shelf life, hard cheese Čarnok has a high commercial value. Čarnok cheese is mainly sold in whole sheave or cut to pieces on the spot in shops or packaged into ¼ kg pieces.

This paper describes the technological process of making hard cheese called Čarnok produced in Dana dairy plant in Vrbas. This is a new type of hard cheese in Livno cheese type that is produced in Serbia, which is already on the domestic market and will soon be exported to the Russian market.

Key words: *technological process, hard cheese, high commercial value, Russian market*

ICT PLATFORM TO IMPROVE FARMS CAPABILITIES

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Abstract: The main objective of the new agricultural sector is to improve the productivity in a sustainable way. To face this challenge the new CAP (Common Agriculture Policy) includes a set of fundings due to increase the skills of all agricultural operators through professional trainings. The Information and Communication Technology may represent a useful tool for knowledge transfer in this field. The creation of online platforms dedicated to vocational education allows farmers, in particular for digital connected enterprises, to access to valuable information related to good agronomical practices, newest regulations and all technical specifications approved by European Union. According to this, the purpose of our research is to implement a platform that enables operators to get information on their main agronomical activities and crops business, such as organic production, irrigation, fertilization, application of integrated pest management and related aspects.

Key words: *CAP, ICT platform, knowledge transfer, integrated pest management, improve farms capabilities*

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REVEALED COMPARATIVE ADVANTAGE IN CORN SEED TRADE BETWEEN SERBIA AND EU MEASURED BY MORTA

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Abstract: Trade of corn seed between Serbia and European Union is one of the top traded agro-food products for Serbia. By implementation of Stabilization and Association Agreement with EU, Serbia has tended to establish free trade zone. In order to monitor changes in the mutual trade of corn seed, market oriented revealed comparative advantage (MORTA) approach will be used in order to appraise trade changes in relative comparative advantage. Term covered will analyze period before and during the implementation of the Stabilization and Association Agreement with EU (2004-2014) by utilizing Eurostat and Republic of Serbia Statistical Office database. Analysis will be performed at the level of all EU member state, but will also monitor relative comparative advantage changes on the main individual EU markets. This paper shows that during the observed period, Serbia is losing its relative comparative trade advantage.

Key words: *market oriented revealed comparative advantage, agro-food trade, EU, Serbia, corn seed*

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HOW TO IDENTIFY THE VALUE-BASED FOOD CHAINS: A SLOVENIAN CASE STUDY

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Abstract: Since 2011 one of the new types of food chains has been often described in scientific literature. It is called value-based food chains (VBFC) and referred to as the food chains with added values. The added values are usually expressed through three different ways such as i) high quality food products, ii) different protected designations and iii) fair business relationships among the actors in food chain. This paper discusses which the indicators for identifying the added values are and additionally unravels different social and economic interactions between actors among the supply chain, also recognized as the characteristics of VBFC.

Key words: *Value-based food chains, added values, Planika dairy*

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EFFICIENCY IMPROVEMENT OF SOYBEAN PRODUCTION IN SERBIA

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Abstract: Soybean production in Serbia is growing with achieved planted area over 200,000 hectares in 2016. The paper investigate differences in efficiency of non genetically modified soybean production among farms with objective to identify possibilities for further improvement. Examined sample of farms is located in Serbia-north region, that account for 96% of total soybean production in Serbia. Sample is structured from three group of farms: organic, conventional and conventional participating in extension program, all classified by size. Data are gathered through questionnaire and interview during visit of farms in 2015 production year. To accomplish this, non-parametric models of Data Envelopment Analysis (DEA) was used to identify differences in efficiency of soybean production among farms in sample. The results reveal importance of extension work in area of technology improvement of soybean production.

Kay words: *soybean, efficiency, farms, DEA*

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IMPACT OF NEONICOTINOID RESTRICTIONS ON PEST MANAGEMENT

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Abstract: Neonicotinoids are the most important insecticides used for seed treatments in agriculture. In 2013, the European Commission restricted the use of three major neonicotinoids (clothianidin, imidacloprid, thiamethoxam) due to concerns over potential risks to pollinators. How farmers modified their pest management practices is essential to estimating the economic and environmental consequences of the restrictions. We use original farm survey data to examine at the adaptations in eight case studies in three crops and seven countries, comparing growing seasons before and after the restrictions. Here we report on the preliminary results for maize farms in France, Italy and Spain. Total insecticide use increased in France, while it remained constant in Spain and Italy. Most French and Spanish farmers switched from restricted (thiamethoxam, clothianidin) to unrestricted (thiacloprid) neonicotinoid seed treatments. French farmers also applied more pyrethroid insecticides. Majorities of French and Spanish farmers perceived the substitute seed treatments as less effective than the restricted ones. Overall they tended to view the restrictions as increasing the time, cost and chemical burden of crop protection. Italian farmers modified their practices only marginally due to previous national restrictions and use of neonicotinoids by a significant minority of farmers continued and remained unaffected by the restrictions.

Key words: *Neonicotinoids, farm survey, impact assessment.*

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SUPPORT TO SMALL PRODUCERS OF TRADITIONAL MEAT PRODUCTS TO IMPROVE PRODUCTION PROCESS AND RAISE CAPACITY

Predrag Ikonić[1], Tatjana Tasić[1], Aleksandra Novaković[1], Jovanka Lević[1], Olivera Đuragić[1]

Abstract: Traditional meat products characterized by unique features and quality take an important place of the European and Serbian food market. However, small producers of traditional products in Serbia usually encounter technical and financial problems to comply with official food safety regulations. Therefore, Provincial Secretariat for Agriculture, Water Management and Forestry in cooperation with Institute of Food Technology (FINS) decided to support small producers of traditional meat products in order to improve their production process, raise capacity and the level of competence. In the long term, the main goal of this project is the preservation of cultural heritage, development the rural areas, improvement of tourist offer, increase of employment, as well as indirect development of livestock production in the Autonomous Province of Vojvodina. The program has been implemented during three years starting in 2013. Until now, total of nineteen traditional producers have been successfully supported.

Key words: *traditional meat products, small producers, rural development, livestock production*

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MODELS OF SUCCESSFUL FAMILY BUSINESS ON FARMS BASED ON THE PRODUCTION OF MILK AND TRADITIONAL DAIRY PRODUCTS

Anka Popović-Vranješ[1], Snežana Janković[2], Rade Jovanović[2], Tijana Lopičić-Vasić[1], Goran Grubješić[1]

Abstract: Using the experience of more developed countries in terms of a successful family business on registered farms and own experience through the creation of a large number of projects for facilities in the household and sole trade businesses (STB) for milk processing and production of various dairy products in Serbia, this paper presents models of successful family business in medium and small farms. It concerns the registered farms (RF) dealing with bigger or lesser production of milk (cow, goat or sheep), where there are basic predisposition for a narrow specialization in milk processing, primarily in the production of indigenous, but also other dairy products, where with the small investments a serial production and good quality of products can be provided. Past experiences show that due to the non-inclusion of science and practice in such projects, small producers are generally left to cope with production alone, and are in the hands of dairy plants and milk prices that they designate. It is not unusual that in the period when dairies have a surplus of dairy milk, they cancel the purchase of milk starting from the small producers, and especially then farmers find themselves in trouble if they do not have possibilities for their own processing.

The paper presents technical and technological solutions for improvement of the quality of those producers who sell their products on the market, because they make up for a large percentage of the total producers. With the joining of Serbia to the EU, conditions of production of food of animal origin on the RF will change in regards to the conditions in which it was previously possible to produce these products. These conditions will be similar to what we see today in many RF in Croatia, Slovenia, Austria, Italy or France. In order to help our producers, it is important to develop projects and create

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technical and technological conditions and provide funds for needed equipment for the manufacture of products, as it was done in the project of the Provincial Secretariat for Agriculture, Forestry and Water Management of AP Vojvodina 2013-2016. With this project, adaptation of premises and purchase of necessary equipment in 34 RF was co-financed, in order to align with EU standards in the field of production and processing of milk. This is an example of project that improves the quality of milk, increases livestock, employment of household members engaged in livestock production, expands the range with new products, product branding and raising standard of living in the countryside.

Key words: *models of successful family business, milk and traditional dairy products*, *technical and technological improvement, project*

ECONOMIC JUSTIFICATION OF APPLE STORAGE

Željko Kokot[1], *Todor Marković*[2]

Abstract: Competitiveness in the global market involves quantitative and qualitative security to offer. In order to ensure continuous supply of market with high-quality fruit during the year, it is necessary to store freshly harvested fruits. The basic method for successful storage of fresh fruit is cooling. Cold storage facilities provide optimum conditions for preserving the quality of the fruit until the moment of their launch on the market. In addition to preserving the quality of fruit in cold storage facilities, disposal of investments provides the opportunity to achieve higher selling prices. Apple, as one of the most important fruit species on the Serbian market is characterized by strong seasonal character of offer. This practically means that most producers sell apples during harvest season, when supply is greatest, and thus accept the price established by the market, which is usually very low in this period. By postponing sales, and with effective storage in cold storage facilities, producers are able to sell their products at a time when the offer is lower and demand is higher. On this way is achieved much better financial result.

Key words: *market, cold storage facility, sales price, apple.*

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SESSION THREE

Technology Transfer and Impact on Agricultural and Rural Development

TECHNOLOGY TRANSFER IN CONTRIBUTION TO REGIONAL DEVELOPMENT THROUGH AQUACULTURE PRODUCTION

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Abstract: World aquaculture is one of the fastest growing industries for the production of food of animal origin. Currently, many countries are engaged in fishing are considering the fishery as a component of the strategic importance of providing food security, and promoting social and economic development of certain regions. Nowadays, Russia is among the ten largest producers of fish products, ranking 7-8 places among the countries of the world in terms of yield, which is about 4 million tons. Global fish production has grown steadily over the last five decades, the supply of fish intended for human consumption, grew by an average of 3.2% per year, outpacing the global average annual population growth of 1.6%. In 2015, the fishing industry has continued its development, demonstrating an increase in output, demand, trade volumes and prices.

Aquaculture in the world are often run on by small and family businesses that had to be developed in the federal and regional programs of small and medium agribusiness development programs of agriculture and its sub-sectors. In most countries the development of aquaculture policy is based not only on the principle of stimulating the industry by including a preferential lending, funding research, providing farms for planting, free allocation to companies ponds to grow fish and other aquatic biological resources, but also by developing the innovation through mechanism of technology transfer.

Key words: *fisheries, governance of fisheries, regulation of fishing activities, technology transfer in aquaculture.*

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IMPLEMENTATION OF INFORMATION TECHNOLOGY IN RURAL TOURISM IN THE REPUBLIC OF SERBIA[1]

Predrag Vuković[2], Vesna Popović[2], Slavica Arsić[2]

Abstract: The rapid development of information communication technology (ICT) in the last forty years has affected to all spheres of society. The economy is in information technology (IT) found support for its certain industries to be more competitive. Advantages of business that can be realized by using IT has influenced that its application has been made in all sectors of the economy. The practice in some countries has shown that IT play a key role in business (for example, Small Business and Entrepreneurship), as well as the impact on the development of certain regions (rural or urban), or the impact on local economies, etc.

Tourism has also used the advantages that brought rapid development of information and communication technologies. This is particularly present in so-called. "mass forms of tourism". Today, the application of IT is much more represented in the mass forms of tourism. Application of computer reservation systems and global distribution systems completely changes the role that intermediaries (travel agencies / tour operators) have until recently. However, on the other hand, the application in rural tourism was delaying and today is the same situation. This has resulted in the backwardness of rural tourism development for other forms of tourism. This is not characteristic only for the countries of Western Europe and North America, but this is a global trend. A characteristic of rural tourism is the physical distance between the rural tourism offer and demand which is located in the urban city centers. Precisely the role of intermediaries is to make their connection. The application of ICT has significantly contributed to improvement of intermediaries business. In order to made rural tourism offer

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available to urban tourist demand, one of the important conditions is to educate local rural population for use IT in rural tourism business. This requires special training programs for local population and its dissemination. This comes from the fact that progress in the development of IT has enabled a wide range of tools and services with which improved business in tourism. Really this fact reinforces the requirement for educating the local rural population in order to implement its use in the business of rural tourism.

Rural tourism in Serbia has been developing since the seventies of the twentieth century. The period in which rural tourism recorded the stagnation of development and later lag, was in the nineties and reason is well-known events that were characteristic of the entire area of former Yugoslavia. After 2000 begins new accelerated development of rural tourism. A special expansion has been recorded since 2006, when the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia has allocated around 92 million dinars for the development of rural tourism. Today, almost all regions in Serbia have a greater or lesser level of development of rural tourism. What appears as a problem in tourist business is just a lack of application ICT. This is characteristic of the organization and management of rural tourism at all levels from local, regional to the national. Also, the use of the Internet in the tourism business is not satisfactory. One of the main obstacles to the computer implementation in rural tourism business is non-literacy of the local rural population.

However, the application of information and communication technologies if it is not applied properly can bring negative consequences for development of rural areas. This is primarily related to the fact that the local population receives information via ICT about a better quality of life outside the areas where they live, which can encourage the process of migration from rural to urban metropolitan areas. In other words, the rural population using ICT can begin to strive to live in urban city centers. It is in this role is the management of rural tourism destinations, to adequately make IT close for rural population that it applied in rural business, i.e. to make rural tourism offer closer to urban city demand. In these programs, we must emphasize the advantages that can bring life in rural areas than in urban centers. As one of the tasks which stands in front of Serbia is development of network economy, which would be based on the adopted Strategy for the Development of the Information Society till the 2020. Expectations are that the implementation of information and communication technologies contribute to the development of rural tourism, and increasing the income of the local population, would enable farms as small business entities to remain

competitive in the tourism market which is precisely one of the characteristics increased competition. The aim of the article is based on the analysis of the current situation in the sector rural tourism in Serbia and point out the importance of the application of information and communication technologies indicate the necessary steps with which would promote business in rural tourism in the micro and macro level. Micro level, in terms of small family farms and macro level in terms of operations at the level of rural tourist destinations (villages, local rural areas, region or country as a whole).

Keywords: *rural tourism, destination, business, Internet, databases, education, local population.*

IMPACTS OF R&D INVESTMENTS ON EUROPEAN AGRICULTURE

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Abstract: The paper aims at providing an evidence-based assessment of the impacts of R&D investments on agriculture in Europe, hence contributing to fill a literature gap. Different panel specifications are applied on 16 European countries, by employing FAOSTAT and OECD data. Given the reduced length of the available time series (30 years), the impacts of R&D investments on the value of gross agricultural production (GVA) and on total factor productivity (TFP) are estimated within inferential frameworks able to manage the country effects and the degrees of freedom.

The results range between 3 and 15% of rate of return, varying according to model specification and computation technique. The values are deemed coherent with the evolution of research productivity of the last three decades, affected by reduced R&D investments. However, these results are not exhaustive given the limitations due to the partial availability of important determinants such as foreign spillovers and CAP evolution.

Keywords: *impact analysis, R&D investments, productivity, rate of return.*

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THE AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEM: RESEARCH AND TECHNOLOGY ADOPTION IN SERBIAN AGRICULTURAL SECTOR

Biserka Komnenić[1], *Danilo Tomić*[2]

Abstract: *Purpose* – The purpose of this paper is to empirically investigate efficiency of implementation of Agricultural Knowledge and Information System in Agricultural Sector of Serbia (AKIS). The study sought evidence from main Serbian AKIS institutions: The Serbia public agricultural research and educational institutions and extension services. *Design/methodology/approach* – Empirical analysis is conducted through questioner designed in accordance with the purpose of research, which is distributed to public agricultural research and educational institutions: research institutes, laboratories, and agricultural faculty's agricultural stations and advisory service institutions. *Structure of paper* – In introduction we explain the contemporary paradigm of Knowledge Economy and its influence on new approach to knowledge and innovation approach. In first part of the paper importance of AKIS, his theoretical and political background, especially in relation to EU agricultural policy and goals determined by the European Union's Standing Committee on Agricultural Research (SCAR) is explained and definitions of AKIS and its key subcomponents were given. Second part explains the new changing pattern of innovation and gives innovation classification frame which is further used in empirical research. In third part of the paper empirical research is presented and analysed and at the end of the paper one overall conclusion is given.

Key words: *Agriculture, Knowledge, Innovation, Research, Transfer, Serbia*

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FOREIGN INVESTMENT, NEW TECHNOLOGIES AND LABOUR RELATIONS IN RUSSIAN SUPER LARGE FARMS

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Abstract: The post-Soviet region, like Latin-America, has seen the rapid emergence of super large farms. The rise of these farms is accompanied by the introduction of international best practices, in terms of machinery, the use of GPS and ICT technologies, and new agronomic and labour practices. This paper studies the export of these new technologies, especially focussing on the obstacles and frictions related to their effective implementation. It identifies major socio-cultural and legislative obstacles. It also shows that within these super large farms, technologies are frequently used for other aims than the original function. In these farms, with large numbers of workers and widespread labour motivation problems, GPS technology for instance, is applied more as a labour monitoring device rather than a form of precision farming. This application has (negative) consequences for the reception of new technology by workers, sometimes leading to outright resistance. The paper is based on fieldwork in various regions in Russia, with the methods consisting of in-depth interviews, farm visits and document research. It draws on socio-technical systems, labour, and friction theories for analysis.

Keywords: *land investment, labour, agro holdings, technology, large-scale farms, Russia*

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EXPORT PERFORMANCES OF AGRICULTURAL SECTOR OF THE WESTERN BALKAN COUNTRIES

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Abstract: Within the process of accession to the European Union, the agricultural sector of the Western Balkan countries is one of the most important chapters in process of negotiations, both because of its importance in overall economy and its low competitiveness. The transformation of the Western Balkan countries' agricultural sector created the gap in agricultural development performances between these countries and the European Union countries. The analysis of export performances of agriculture includes dynamics of agricultural production growth, level and structure of export, as well as the value of export in relation to engaged labour and agricultural land. In order to find the level of comparative advantages of agro-food products at the international market, an index of revealed comparative advantages is dynamically analyzed. All indicators are calculated separately for each country and comparison with the countries of the European Union has been made. In relation to the main objective of this article, which was to identify the development of exporting performances of agricultural sector in the Western Balkan countries within the process of integration to the European Union, it may be stated that despite the good comparative advantages of agricultural sector which these countries have, performances in the Western Balkan counties are noticeably worse than in the European Union countries, so good pre-accession policy, as well as market adjustment, are crucial tasks for the Western Balkan countries during the accession process.

Key words: *Agriculture, Comparative advantage, Western Balkan.*

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WELFARE IMPACT OF RURAL INFRASTRUCTURE IN NIGERIA

Olagunju Oluseyi Kehinde[1], *Nikola Trendov*[2]

Abstract: This study examined the impact of infrastructure development on poverty status among rural households in Oyo State, Nigeria. Data collected from a random sample of 263 households were subjected to descriptive statistics and inferential statistics such as Foster, Greer and Thorbecke (FGT) poverty measure and probit regression model. Findings revealed that majority (77%) of the households were categorized as poor. The likelihood of rural households being poor was influenced by years of experience, livelihood diversity, and access to good road, access to educational facilities, access to agro-processing facilities, access to health care facilities and access to electricity. The poor state of infrastructure and services calls for major investments across all categories which was found to have contributed to negatively to improved welfare of households in the study area. Rural poverty reduction polices should be designed to provide incentives and attract private sector investments towards infrastructure development in rural areas at affordable cost.

Key words: *Infrastructure, Poverty, Impact, Probit regression, Nigeria.*

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SUPPORT OF USE OF RENEWABLE ENERGY SOURCES AS WELL AS AN INSTRUMENT OF RURAL DEVELOPMENT

Goran Vasić[1]

Abstract: Mankind is faced with many challenges caused by increasing human population. Despite the problems, such as the supply of food and drinking water, organization of health care, one of the most urgent problems is the supply of energy. Republic of Serbia has made a commitment to follow the energy policy of the European Union, and to reach the target of 27% share of renewable energy sources (RES) in the energy mix, by the year 2020. Biomass, which is predominantly located in rural areas, makes about 60% of registered potential that can be exploited to meet this goal. Despite of significant contribution to environmental protection, accelerated implementation of the RES can be a very effective instrument for rural development. Guarantee Fund of AP Vojvodina has developed a special-purpose credit line thanks to which existence they first realized projects and gained initial experience in implementing this important policy.

Key words: *Renewable energy sources, rural development, biomass, Guarantee Fund of AP Vojvodina*

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DOES FARMERS' AWARENESS OF INNOVATION AVAILABILITY IMPROVE FARM-LEVEL PROFITABILITY?

Michele Vollaro[1], Meri Raggi[2]

Abstract: The paper aims at analysing the determinants of farmers' adoption of innovations and studying their effect on profitability. Differently from existing literature, this paper proposes a demand-driven approach by employing a backward impact-pathway approach. We investigate how knowledge about scientific research, performed to develop the available innovation, influenced the adoption decisions of farmers and farms' profitability. Relying on primary data collected in the Bologna province, an econometric analysis is conducted in order to asses in primis whether and how the prior awareness of available innovations affected the adoption decisions and then to estimate the impacts of such decision on farm profitability. The results indicate that prior knowledge, although not determinant for the adoption decisions, triggers significant improvements in cost reduction and levels, value added and quality of production. The paper findings suggest that a timely diffusion of well-brokered research outcomes might provide for competitive advantages to active farmers.

Keywords: *impact analysis, R&D outcomes, innovation adoption, profitability*

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