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SZKOŁY GŁÓWNEJ GOSPODARSTWA WIEJSKIEGO

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CONTENTS

SPIS TREŚCI

PRELIMINARY ASSESSMENT OF THE COMMUNICATION MECHANISMS USED IN THE VIRTUAL ACADEMY OF THE SEMI-ARID TROPICS (VASAT) PROJECT[1]

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Key words: agriculture, information and communication technologies for development (ICT4D), extension, Reflective Appraisal of Programs (RAP), qualitative research
Słowa kluczowe:rolnictwo, technologie informacyjne i komunikacyjne na rzecz rozwoju (ICT4D), doradztwo, Reflective Appraisal of Programs (RAP), badania jakościowe

A b s t r a c t: Small and marginalized farmers of many developing countries in semi-arid tropics depend primarily on extension services for information. Information and Communication Technologies for Development (ICT4D) have shared actions to develop specific mechanisms and tools, to consider how they are applied, and to assess their outcomes and impact. Analysis of an eight-year extension project in 21 villages of Andhra Pradesh, India suggests that the development of a multimedia approach, which considers both the local farmers´ organization and context, brings about good results. Such outcomes are related not only to the technological frame, but also to economic, social, and ecological issues. A qualitative research study which takes into account the opinions of farmers and local people using the theoretical approach of Reflective Appraisal of Programs (RAP) is presented. Implications and lessons learned are considered for the project to be continued or for application in further ICT4D projects based upon the transfer of innovations and knowledge.

INTRODUCTION

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is continuously working for new and effective linkages between research and extension subsystems in the overall agricultural knowledge system to improve access to information. Economic, social and political life in the 21st Century will be increasingly dependent upon digital devices and those without Information and Communication Technologies (ICT) will be excluded [Heeks 2008, p. 26].

[1] Acknowledgemnts. The authors wish to acknowledge the VASAT Project team and its leader, especially mentioned, Dr. Balaji. Our profound gratitude to the people of Addakal and AMS Center for sharing their time, allowing us to carry out the interviews and meetings in the field.
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According to Balaji et al. [2007] and Rudgard et al. [2011], the Information and Communication Technologies (ICT) for Development (ICT4D) is an umbrella that includes computer hardware and software, digital broadcast, telecommunications technologies, social networks, interfaces for sharing information through the Internet, TV, radio, mobile phones, cloud computing facilities, and geographic information system (GIS). It also includes the policies and laws that govern their widespread use. This digital technology domain intersects with development goals in the search for a delivery mechanism [Heeks 2008, p. 27].

A "triple helix model" conceptual framework was used at ICRISAT to emphasize three strands to be observed as a unique chain[2]. Firstly, there is the need for useful knowledge. Secondly, the ICT4D model is emphasized. Thirdly, an open-distance paradigm is required in an effort to personalize learning for the masses. This also takes into consideration a future when distances will be shortened by access to technology.

ICRISAT, in collaboration with agricultural research institutions and aligned with the Consultative Group on International Agricultural Research (CGIAR) policies, initiated the Virtual Academy for the Semi-Arid Tropics (VASAT) Project. The objective was to develop opportunities to exchange knowledge among researchers, extension workers and farmers, focusing on the preparation of the community to cope with drought [Dileepkumar et al. 2006]. The project involved a platform for communication, considering that preparedness is better than relief and that the communication systems would necessarily combine top-down and bottom-up approaches, with the paradigm of open and distance learning , and ICTs applied to rural development [Balaji et al. 2007, p. 3].

Climate change is one scenario that continuously affects farmers, and the poor have created incomes both around technology and via technology [Heeks 2008, p. 29]. An assessment of mechanisms and tools used in extension initiatives such as the VASAT Project will yield further support for the work and might also provide insights for various interest groups working with ICT4D.

OBJECTIVES

The research focused on a preliminary assessment of the various communication mechanisms used in the VASAT project taking into account the framework of ICT4D in agricultural information. It describes the experience and analyzes its activities, the potential of the mechanisms used and the results. Specific Objectives:

– describe and assess the different communication tools and mechanisms used from the perspective of rural farm households,
– suggest areas of improvement, if there are any.

VILLAGE SETTING

THE PLACE AND THE PEOPLE

Addakal is a "Mandal" (country subdivision) in Andra Pradesh, one of the poorest regions in India. It covers 196 km^2 and consists of 21 villages whose economy is based upon agriculture and livestock [Sreedhar et al. 2009, p. 28].

[2] For more information about the "triple helix model": http://vasat.icrisat.org/?q=node/96

The region has a population of 46,380, of which 23,596 are male and 22,784 are female. It faces frequent droughts and migration has increased during the last 10-12 years. People look for work away from their farms during the summer time, searching for better income [Sreedhar et al. 2009, p. 28]. Institutional presence through development or extension organizations is weak. However, the strongest bonds to exchange information can be observed among farmers, and between vendors and farmers [Balaji et al. 2007, p.5].

In 2002, ICRISAT was involved in a governmental development program in Addakal, providing seeds and extension services. A federation of female, self-help, microcredit groups called Adarsha Mahila Samaikya (AMS) was a strong actor with 8,000 members from 21 villages in Addakal Mandal, Mahbubnagar district of Andhra Pradesh. Since 2004, ICRISAT and AMS have worked together in the VASAT Project using methodologies related to the ICT approach to foster drought preparedness. A hub-and-spoke model was designed, using local language (Telugu) [Sreedhar et al. 2010, p. 3]. At the beginning, basic ICT infrastructure facilities were used: a PC-based computer network with low cost Internet access in the Village Knowledge Centers (VKCs). Later, video and audio conferencing and mobile phone for two-way communication to ensure local knowledge acquisition was introduced. After successful pilot testing with three villages in 2004, it was up-scaled to eight in 2008, covering farmers in all the 21 villages in Addakal [Sreedhar et al. 2009, p. 30].

VASAT: COMMUNICATION TOOLS AND MECHANISMS

The VASAT project worked with drought preparedness based on an integrated approach for improving capacity in rural communities. An interface of ICT and distance-learning methods over a short period of time is used [Lavanya et al. 2010, p. 2]. The needs based content was prepared for the farmers and delivered in the local language[3].

Since 2004, the project has been developing access to ICT tools through providing the eight VKC with PCs and building the AMS through promoting a video conferencing infrastructure. ICRISAT provides technical information and financial support for data collection, and AMS provides the facilitators who convert local terminology into a scientific one and vice-versa, serving as a bridge between ICRISAT, AMS and farmers [Dileepkumar et al. 2005]. The role is being performed by eight Village Network Assistants (VNAs) trained by ICRISAT in ICT management.

The VKCs were designed based on the hub-and-spoke dynamics. Based on demand, the session schedules are prepared and provided in advance [Lavanya et al. 2010, p. 5]. The farmers´ queries are answered; if possible with the ICRISAT expert during the video conferencing session, or referred to a senior expert and the answers communicated to the VNAs. The facilitators translate the content into the local language. After the conference, the content is validated in order to build repositories at the VKCs and queries are uploaded to the Internet "aAqua" Forum[4] [Sreedhar et al. 2010, p. 3]. As the ICT initiatives progressed, the VNAs evolved as knowledge intermediaries.

Since 2009, a field investigator has been helping interaction between VNAs and farmers, answering questions about agricultural problems.

The project developed coloured maps using water budgeting measured by the farmers and GIS tools to facilitate drought preparedness [Patwar et al. 2009, Rudgard et al. 2011].

[3] More information about the VASAT Project: http://www.icrisat.org/vasat

[4] More information about the Forum: http://www.aaqua.org

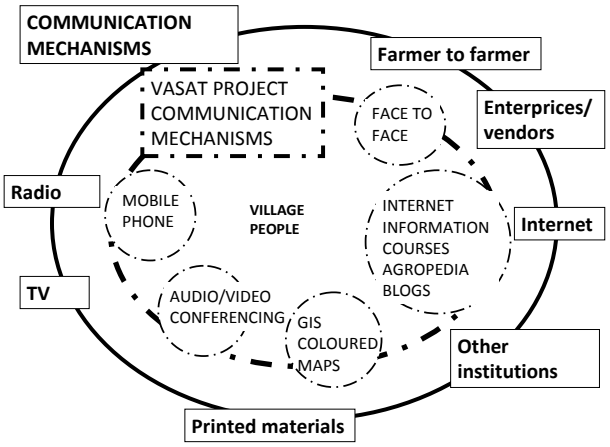

Figure 1. ICT4D mechanisms and tools used in the VASAT Project
Source: own study

According to Sreedhar et al. [2009, p. 9] the maps are easily understood by rural people and at the same time helpful for drought-related decision-making.

Recently ICRISAT has started using an experimental web-mobile phone communication platform. As video conferencing requires volunteers to move to the AMS Center, the project set up audio conferencing facilities in the villages, enabling several people to interact with the experts [Lavanya et al. 2010, p. 4].

The mechanisms used in the Project are shown in Figure 1. The Internet provides access to Agropedia, VASAT´s blog, wiki, courses and activities related to the project [Kaur et al. 2009, p. 2]. The Internet connection was used by rural people for other purposes such as weather and market information, package of practices, production practices and education etc.

METHODOLOGY

A preliminary assessment of the VASAT Project through qualitative research is presented. The research brings out elements about people´s perception and knowledge gained during the project. Analysis and systematization of secondary information, direct observation, semi-structured interviews and group meetings were used to elicit the stakeholders' opinions.

Evaluation is a management tool where the analysis of activities and their corresponding effects allows for reaching conclusions in respect of the objectives [de Hegedüs 1995, *Pautas para ...* 1997]. It is also a process to determine relevance, efficiency, effectiveness and impact of the project [Villarraga 1998]. The theoretical approach of Reflective Appraisal of Programs (RAP) [Bennett 1982] has been efficiently used in the evaluation of technology transfer projects [Albicette et al. 1999, de Hegedüs et al. 2000, Guerra, Zocco 2006], using different ICT tools. According to that model and from Bennett's hierarchy model for planning and evaluation [Bennett, Rockwell 2000].

Table 1. Addakal Mandal: Interviews and meetings

Village	VNA	Activity	Nº Female	Nº Male
Nijalapur	Ms. Ramayswaramma	SSI & GD	5	3
AMS Center		GD	21	5
Komireddypalli	Ms. Chandrakala	SSI & GD	16	-
Janampet	Ms. Vemmalmma	SSI & GD	11	1
Vemula	Ms. Narmadamma	SSI & GD	15	11
Kandur	Ms. Lalithamma	SSI	2	-

SSI: Semi-structured interviews, GD: Group Discussion
Source: own study

Seven levels of a Bennett Hierarchy Model of Planning and Evaluation identified were identified as: I - Input, II – Activities, III – output, IV – Reactions, V – Knowledge and Attitude change, VI – Practice change, and VII – Satisfaction of the services. The study was geared to the first five levels, focusing on five villages and the AMS Center (Tab. 1). Ninety interviews were carried out to know about relevant issues [Taylor, Bogdan 1986].

The respondents were farmers, VNAs, and AMS members attending the meetings and farmers interviewed in the field (Tab. 1). Interview dates were fixed in advance and conducted personally with simultaneous translation from the Telugu language. Meetings and interviews lasted approximately two hours. Notes and photos were taken and direct observation data were documented in a field diary [Taylor, Steele 1996].

Based on our understanding of the facts and related reviews, a pre-tested-structured questionnaire was prepared to collect data. A semi-structured interview schedule was also developed to investigate in depth various dimensions of the study. Data collection tools were prepared by giving due consideration to various socio-economic, personal, communication and farming variables.

RESULTS

A matrix summarizing the opinions of people and AMS members is presented in Table 2. An overview of outcomes in technological, economic, social and institutional components, regarding the different tools and mechanisms used in the VASAT Project is offered. The empty cells in the matrix indicate no comment about that item.

CONCLUSIONS AND LESSONS LEARNED

The project appears to have good results as some outstanding outputs were clearly seen in the field and perceived during the interviews such as: 1) the farmers have more agricultural information concerned with technical issues and know how to manage technology better; 2) they have learned to save agricultural inputs and still have better yields; 3) they incorporated new knowledge using the Internet, mobile phones, coloured maps and other tools; 4) they learned how to deal better with vendors; 5) capacity building helped people get better jobs.

Table 2. VASAT project results in 5 villages and AMS Center (K&U: Known and Used)

Components	Nijalapur Village	Komireddypalli Village	Janampet Village	Vemula Village	Kandur Village	AMS Center
Technological						
Video/Audio Conferencing	K&U	K&U	K&U	K&U.	K&U	Infrastructure
Internet	K&U	K&U	K&U.	K&U.	K&U.	K&U.
Colored Maps	K&U Fixed on the walls	NIL	Fixed on the walls	Fixed on the walls	Fixed on the walls	K&U
Cell Phones	K&U	For the future	For the future	NIL	K&U	K&U
Social						
Field Investigator	K&U. Good relation with farmers	K&U	K&U. Good relation with farmers	K&U	NIL	K&U
VNAs	K&U	K&U	K&U	K&U	K&U	K&U
Relationships	Farmer-to-farmer	NIL	Farmer-to-farmer	NIL	NIL	Farmer-to-farmer
	Farmer-vendors	NIL	Farmer-vendors	Farmer-vendors	NIL	Learned to negotiate
Gender issues	No gender differences	NIL	NIL	Some gender issues arose	NIL	No gender differences (Female 50%, Male 50%).
Labor	NIL	New jobs	New jobs	NIL	Men look for work	Rural employment grantee
Education and health	NIL	Internet for educational purposes	NIL	NIL	NIL	Programs: Livelihood, physical handicap, old pensioners, health insurance
Acquired knowledge	Learned a lot	Learned a lot	NIL	Learned a lot	NIL	Learned a lot
Economic						
	Aware of seed quality	Micro-financial groups	Micro-financial groups	NIL	NIL	Dairy cooperative, handloom, restaurant, self-help groups
	Better yields	NIL	Costs reduced	NIL	NIL	Costs reduced. Incomes increased.

Table 2. Cont.

Institutional						
	No extension	NIL	No extension	No extension	NIL	Focus of rural development. Relation with Bank.
Ecological						
Topics for further research	Drought, Pests Management	NIL	Water management	Irrigation. Nutritional crops deficiencies	NIL	Non pesticide management.

Source: own study

TOOLS AND MECHANISMS USED

The mechanisms and tools used for communication during the Project, which people were really acquainted with, were as follows: video/audio conferences, coloured maps, Knowledge Centers with PCs, VNAs, field investigators, capacity building, and mobile phones. It is suggested that a final assessment should be conducted, for there is a need to quantify the use and impact of each tool.

In line with what was expressed above, farmers used coloured maps for decision- making in relation to drought preparedness. The advice given by the field investigator or the VNAs people sent through the hub-and-spoke mechanism was used for quick response to agricultural problems.

As observed, farmers have internalized the knowledge using the information they had acquired. An in-depth study could be planned on the decision-making process of farm households in the study area.

ECONOMIC OUTPUTS

The farmers learned technical issues, which allowed them to have better farm management. To date, they have become critical towards seed quality, water availability and management. Better decisions were taken, such as which crop to grow based on science. They are concerned about reducing their costs, so they have been instructed on the benefits of precision agriculture such as input utilization to save money without sacrificing productivity. Farm households also use the Internet for other agricultural support like accessing market and price information and educational purposes. As a result of being better informed, farmers were in a good position to deal with vendors and save resources.

SOCIAL ISSUES

People in general, learned to improve their negotiation skills. This contributed to upgrade their abilities as a result of the various capacity building activities included in the project. The Knowledge Centers also opened doors to the young members of the farm household to have better access to information and educational issues.

As a result of the implementation of the Project, women were empowered to face new challenges. It was ensured that VNAs learned about technological issues, got new jobs or were involved in start-ups. In general the gender issues didn't surface though there were exceptions.

ROLES AMONG THE PEOPLE PARTICIPATING IN THE PROJECT

It was clear that the VNAs took pride in doing good job. This can be used as performance indicators for conducting impact investigations.

The KCs are already installed and can generate interactive information among farmers, promoting innovation. Consequently, capacity building to enable the VNAs as facilitators for development, upgrading knowledge, attitudes and aptitudes is needed.

Farmers have no time to attend meetings and courses, so new ICT tools for easy access to information, as well as effective methodology to be applied by the field investigators are also need of the hour.

A cordial relationship among AMS members, VNAs, field investigators, farmers, and ICRISAT researchers was observed. Institutions have to be aware of the importance of these, value them highly, and take into account that extension workers are part of the success of projects. A strong mechanism of coordination among actors by developing a network for faster information access is necessary.

HORIZONTAL AND VERTICAL LINKAGES

Dialogue and discussion at horizontal and vertical levels are important for facilitating community knowledge. ICRISAT needs to know first-hand information about the farmers´ problems for a better reach of the technological information proposed. The vertical linkages were enhanced through various capacity building activities. AMS members called ICRISAT to work together on the VASAT Project, and during the implementation, new mechanisms of communication emerged. It is noted that impact can be greater with better horizontal interactions with the user friendly ICT tools. Participatory research could be useful with pilot groups, considering the traditional farmer-to-farmer exchange of information. Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) could be of enormous help to the researchers to get in-depth understanding of the identification of research problems and finding suitable solutions.

OTHER RECOMMENDATIONS

INSTITUTIONAL

There was no evidence of a strong linkage between farmers and institutions. Thus, it seems apparent that extension support is needed.

The VASAT Project should be continued and enlarged as an example of how scientists test the relevance of their research with farmers. The value addition could be done to come up with a farmer friendly ICT4ARD platform to attend to their needs. The organization of the villages with private participation can improve production and explore new markets. Financial logistics, trained professionals, innovative learning methods and materials will be required to interact with farmers.

PROJECT ADVOCACY

The project and its results should be known by ICRISAT and other research institutions looking for a closer relationship with small and marginal farmers. Advocacy is strongly recommended for the multimedia approach: TV, radio, printed material, policy dialogues and newsletters. Institutional policies regarding the use of mass media and communication devices would be useful to standardize strategies and activities.

FOR FINAL ASSESSMENT AND OTHER PROJECTS

A final evaluation considering qualitative and quantitative methods should deeply assess activities, participation and reactions, evaluating knowledge, behaviors and impact using the seven levels proposed by Bennett [1982] and Bennett and Rockwell [2000].

The ICT4D framework can be applied in an effective way, using several mechanisms and tools with small farmers, especially considering countries where extension services count on few resources. Using ICT4D new interrelations among farmers, researches, institutions, local facilitators are generated and can possibly be viewed as a model to be adapted by research and extension institutions.

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WSTĘPNA OCENA MECHANIZMÓW KOMUNIKACJI UŻYTYCH W PROJEKCIE WIRTUALNA AKADEMIA TROPIKALNYCH OBSZARÓW PÓŁPUSTYNNYCH (VASAT)

Streszczenie

Małe i marginalizowane gospodarstwa rolne w wielu rozwijających się krajach na półpustynnych obszarach strefy tropikalnej są zależne przede wszystkim od usług z zakresu rozpowszechnienia wiedzy rolniczej. Technologie informacyjne i komunikacyjne na rzecz rozwoju (ICT4D) wiążą się z zainteresowaniem rozwojem określonych mechanizmów i narzędzi wraz z oceną wyników ich zastosowania. Analiza ośmioletniego projektu doradztwa w 21 wioskach Andhra Pradesh w Indiach sugeruje, że rozwój podejścia multimedialnego, badającego zarówno organizację lokalnych rolników, jak i kontekst, przynosi dobre wyniki. Takie wyniki są związane nie tylko z kwestiami technologicznymi, ale również kwestiami gospodarczymi, społecznymi i ekologicznymi. W artykule zaprezentowano badania jakościowe, w których analizowano opinie rolników i miejscowej ludności oraz zastosowano podejście teoretyczne na bazie refleksyjne oceny programów Reflective Appraisal of Programs (RAP). Wyniki badań można uznać za satysfakcjonujące, mogące stanowić podstawę do kontynuowania tego projektu lub kolejnych projektów ICT4D badających transfer innowacji i wiedzy.

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INVESTMENT DECISION SUPPORT SYSTEM FOR HIGH QUALITY CONTROL POSTS IN EUROPEAN UNION[1]

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Key words: control post, investment, BEP, mathematical model
Słowa kluczowe: punkt kontroli, punkt odpoczynku zwierząt, inwestycje, BEP, model matematyczny

A b s t r a c t: In 2010 an EU subsidy program started to create high quality control posts in Europe. Control posts are companies offering facilities for animals to rest and eat during long distance transport. They also offer facilities for trucks, drivers and competent authorities. A decision support program has been developed to support owners of control posts with their investment plan. The aim of this computer program is to calculate what increase in truckloads or in price per truckload is needed to justify the investment plans. The program was tested at two control posts participating in the EU project in Poland[2]. Both owners appreciated the added value of the program and suggested some improvements.

INTRODUCTION

The proportions of the regional production of animals in Europe are different from the respective regional consumption. As a result, animals and meat are transported all over this area. In the period 2005-2009 the number of cross-border truckloads of live animals within EU increased from 315,000 to almost 400,000 (excluding poultry). About two thirds of this transport is shorter than 8 hours, however, 16,000 to 24,000 truckloads so called "long distance transport" last more than 24 or 28 hours [Baltussen et al. 2011]. About 40% of these are cattle truckloads, about 40% are horses for slaughter truckloads, about 20% are pigs and about 5% are sheep and goats truckloads. Figure 1 shows the main long distance transports routes of cattle in 2009 in EU. The tendency was that during the period 2005-2009 the total number of consignments was increasing while the number of long distance transport has been decreasing since 2007.

The main routes of animals transported within EU have remained the same for a long time. The long distance transport has to stop at so called control posts, and has to unload the

[1] Paper was presented at the 19th Congress of the International Farm Management Association (IFMA), Warsaw (Poland), 21-26 July 2013.

[2] The authors want to thank the control posts owners for their cooperation.

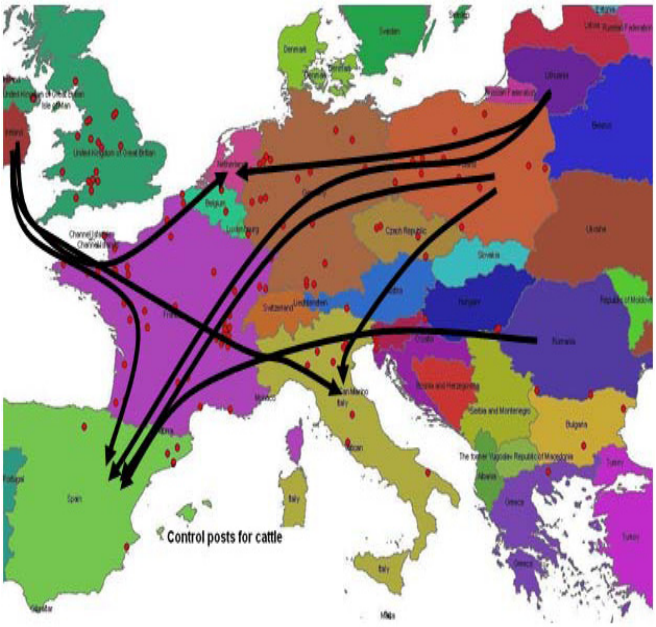

Figure 1. The main routes of long distance cattle transport in 2009 and location of the control posts for cattle
Source: [Gebrensbet et al. 2010].

animals, feed them and let them rest for 24 hours to reduce stress [Ljungberg et al. 2007]. At the beginning of 2010 there were 157 control posts on the official EU list (approved by the EU – SANCO/2677/99 Rev.167, 2012). However, only 113 out of 157 investigated control posts were still in operation. Data shows that 5 of them where suspended and 39 were closed down because of the lack of customers. The majority of the control posts in operation also report low occupancy. This tendency concerns all control posts on all routes no matter which species they deal with. Only four control posts reported the use of more than 60% of the full capacity during the whole year [Gebrensbet et al. 2010].

Transport of live animals including stops at control posts is regulated by Directive 1/2005/EC [Gębska 2013a, 2013b]. This regulation was evaluated in 2011 [Baltussen et al. 2011]. The main conclusions are that the introduction of that regulation slightly improved the animal welfare during transport especially during long distance transport and at the same time increased the transport costs for live animals. There are still differences in the implementation, enforcement and penalties for infringements of the Directive by individual Member States which undermine the level playing field for transport companies. This means that transport companies working according to the rules can hardly, or not at all, compete with transport companies who violate the rules.

The increasing demand for animal welfare standards during animal transport is observed in Europe [Edge and Barnett 2009]. It can be expected that in the coming years the EU will not change the regulation but will try to enforce it equally in all Member States. One of the effects will be that the number of stops at control posts will increase. The research carried

out by Baltussen et al. in 2011 showed that for example about 50% of all horse transport lasting 20 to 24 hours should have stopped at a control post, but it didn't.

Based on a feasibility study [Gebrensbet et al. 2010] the EU stimulated the improvement of the quality of control posts by two subsidy programs [SANCO D5/10753/2010, SANCO 10834/2011]. As a result, 11 control posts joined the high quality project in 2011 and additionally 5 control posts joined the high quality program in 2012. The goal of the first subsidy program is to develop a certification scheme for control posts to reach high quality standards with respect to animal welfare, bio-security and facilities for drivers and competent authorities and services for trucks [see Gebrensbet et al. 2010, SANCO D5/10753/2010, SANCO 10834/2011]. In the second subsidy program also transport companies are invited to develop a high quality scheme.

Most of the existing control posts have to be rebuilt or renovated to reach the high quality standards. For owners of control posts it is hard to decide if and in what facilities they should invest. It's difficult to predict the number of trucks stopping at their control posts, the willingness to pay for certain services (e.g. truck facilities, drivers facilities, animals facilities). Therefore, within this high quality program a computerized decision support system has been developed to support owners of control posts in their investment decisions. In this article this decision support system is described and two investment plans of control post are given as examples.

DESCRIPTION OF THE MODEL

A certain number of trucks with animals visit a control post a year. Each visit generates variable costs e.g. costs of fodder, costs of water, costs of electricity. The fixed costs grow if additional investments in equipment, buildings and new facilities are needed to enhance the quality of the control post. The costs of the adjustments need to be calculated to justify investment decisions. The additional revenues from the control post need to outweigh the additional costs.

To support an owner of a control post in managerial decision making, an economic model has been developed. The model supports owners in evaluating potential investment projects in two ways. Firstly, it helps the control post owners to decide whether they want to implement a particular investment project. Secondly, it will also help the control post owners to determine the optimal size of the investment. The tool is a deterministic mathematical program that calculates the break-even point for the number of truckloads at varying prices or varying occupancy rates. By "playing around" with various "what-if" situations, the owner of the control post gains knowledge about feasibility of the investment. The model offers the possibility to change the "price per load" (daily allowance per truck load) and to see the economic impact of the change. Thus owners are supported in making justified decisions in order to reach the desired standards.

The model consists of three different sheets for data input, a calculation module (i.e. the mathematical-/economic model) and the main sheet with the output of the calculation. The model is available online, free of charge and requires only Excel 97-2003 or later. It is available in 5 languages: English, German, Spanish, Polish and French. When the user chooses a language, all texts of the model (including buttons) are replaced by texts of the selected language (will be available: http://www.controlpost.eu/joomla/index.php/project-1/2011-05-30-09-54/prototype-break-even-analyses).

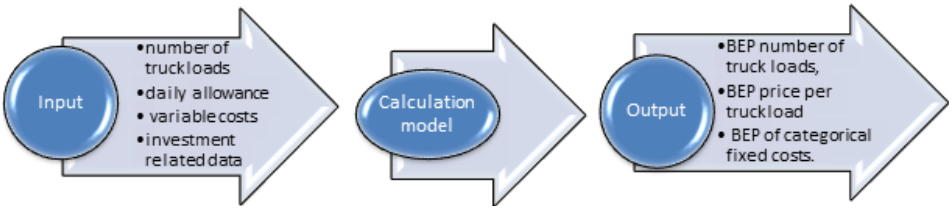

Figure 2. The decision support program for control post investment
Source: own elaboration.

INPUT

The data input requires information about a specific animal category. In the model eight animal categories are distinguished for the four species: cattle, horses, sheep and pigs. The user has to introduce the figures concerning the current (before-investment) and the future (after-investment) situation (e.g. value of the investment, maintenance). For each investment there is a separate input sheet, to calculate the annual costs. The program provides specific default values for some items, so the investor does not need to estimate them (e.g. 'useful life' or 'rest value' of the investment). The system enables to select the options from the list or enter your own figures.

Some investment costs (i.e. buildings and equipment) are divided into per-animal category and the rest are general investment costs not categorized (i.e. services for trucks, facilities for truck drivers, facilities for competent authorities).

CALCULATION MODULE

When the needed inputs are provided, the mathematical model starts to distribute the total amount of occurring costs to the individual animal categories. It is based upon the calculated gross margins of the animal categories. The larger gross margin the animal category produces the bigger the amount of general fixed costs is assigned to the animal category.

The main focus of the model is the break-even analysis. The model calculates three Break-Even Points (BEP) to cover all additional costs (Fig. 1). The three BEP are: the number of truckloads at a given price (allowance per day), the minimum price at a given expectation of occupancy and the combination of number of trucks and changing prices (daily allowance). Higher prices, more truckloads or lower value of planned investment will result in a higher level of project justification. Variations in additional costs or prices result in different break-even points. Break-even points for price, for number of truckloads, and for categorized fixed costs are calculated for each relevant animal category A separately:

$$\text{BreakEvenPrice}_A = ((\text{YearlyCosts}_A + \text{AllocationFixed}_A + \text{TruckLoads\_IST}_A * \text{GM\_IST}_A) / \text{TruckLoads\_SOLL}_A) + \text{VariableCosts}_A + \text{ExtraVariableCosts}_A$$

$$\text{BreakEvenTrucks}_A = (\text{YearlyCosts}_A + \text{AllocationFixed}_A + \text{TruckLoads\_IST}_A * \text{GM\_IST}_A) / \text{GM\_SOLL}_A$$

$$BreakEvenCatFixed_A = TruckLoads\_SOLL_A * GM\_SOLL_A - TruckLoads\_IST_A * GM\_IST_A - AllocationFixed_A$$

where:
$AllocationFixed_A = AllocationPct_A * GeneralFixedInvestmentCosts$
$AllocationPct_A = GM\_SOLL_A / \Sigma_A (GM\_SOLL_A)$; GM is abbreviation for Gross Margin
$GM\_IST_A = Price\_IST_A - VariableCosts_A$
$GM\_SOLL_A = Price\_SOLL_A - VariableCosts_A - ExtraVariableCosts_A$

The surplus (i.e. returns minus additional costs) is calculated for each relevant animal category separately from the returns, fixed costs and number of expected truckloads. These surpluses are summed up to yield the total surplus for the after-investment situation. The outcome can be compared with the returns from the before-investment situation.

OUTPUT

Annual costs of the investments for the animal categories as well as general investment items are presented on the main screen of the model. Investments, other costs and allowances are summarized as the difference between IST- and SOLL outcome. The break-even analysis results in three outcome values: break-even number of truckloads, break-even price per truckload and break-even of categorized fixed costs.

TWO EXAMPLES

The model has been tested on two control posts in Poland participating in the EU project for high quality control posts. Both control posts have been visited in the last 4 years, by 453 and 377 truckloads of animals a year on average. Both control posts can host pigs and cattle. From table 1 it can be concluded that the number of visits vary considerably from one year to another. Control post 1 was shut for half a year during 2012 because of renovation. Both control posts depend strongly on the transport of pigs from Denmark, Germany and the Netherlands to Ukraine, Belarus, Russia and Kazakhstan and on cattle transported the opposite direction from Lithuania and Poland to Spain and Italy. The transport of pigs is highly uncertain because of import breakdowns for safety or political reasons (e.g. to Russia).

The owner of control post 1, considered the investment in stables for pigs and cattle in order to create a high quality control post. He planned double of the existing capacity of stables while the owner of control post 2 considered the investment in a facility for truck wash (Tab. 2). The total investment for control post 1 and 2 was to 300.000 and 393.000 euro respectively.

The main question for owner of the control post 1 was if the investment in stables for cattle would be justified. The main question for the owners of control post 2 was if the investment in additional facilities for trucks and drivers could be justified

Table 1. Number of truckloads visiting two control posts in Poland during the period 2009-2012

Year	Control post 1		Control posts 2	
	pigs	cattle	pigs	cattle
2009	395	0	284	275
2010	790	8	327	104
2011	123	23	431	34
2012	51	87	468	89
Average	453	39	377	125

Source: control post documentation.

Table 2. Investments (in euro, excluding VAT) per control post to reach high quality

Type of investment	Control post 1	Control post 2
Stables	208,180	-
Truck wash	11,500	150,000
Access road and parking space	22,820	80,000
Tractor	45,000	-
Manure storage & fencing	12,500	85,000
Facilities for drivers	-	40,000
Charger	-	38,000
Total investment	300,000	393,000

Source: control posts documentation.

by an increased number of expected visits and/or a higher price per visit because of better quality facilities. For control post 1, its owner expects to host between 877 and 1162 truckloads of animals after the renovation. The first one being a pessimistic view and the second a more optimistic one. As a result of investment in control post 1 there was an increase in fixed costs by 44,257 euro. To achieve a break-even point without changing the daily allowance and without using EU funds, 781 truckloads are needed to compensate for the cost increase. In case of participation in the EU project, a subsidy of 69% is given for all the investment (except for land purchase). With the EU subsidy, the break-even point declined to 544 truckloads (Tab. 3). The number of truckloads needed for both break even points is smaller than the number predicted by the owner. They make respectively 47 and 62% of the expected consignments. Therefore, there is high probability that the investment will increase the income of the owner of control post 1.

As a result of investment in control post 2 there was an increase in fixed costs by 50,170 euro. For control post 2 the owner expects annually between 500 and 900 truckloads of animals after the renovation. To reach the break-even point without EU funding and without changing prices for services, 400 truckloads are needed. With the EU subsidies only 236 truckloads are needed to break-even. This makes 26 to 47% of the expected truckloads estimated by the owner (Tab. 3).

Table 3. Break-even analysis CP 1 and CP 2

Specifications	Self financing option		EU funds contribution option	
	Pigs	Cattle	Pigs	Cattle
Control post 1				
Number of truck loads /year before the investment	790	2	790	2
Number of truck loads /year after the investment	790	87	790	87
General fixed costs [€]	44,257		44,257	
BEP (Number of truck loads)	725	56	529	15
BEP (Price per truck loads) [€]	341	247	312	175
Surplus [€]	12,094		40,881	
Control post 2				
Number of truck loads /year before the investment	377	125	377	125
Number of truck loads /year after the investment	377	125	377	125
General fixed costs [€]	50,170		50,170	
BEP (Number of truck loads)	277	125	194	42
BEP (Price per truck loads) [€]	341	300	310	201
Surplus [€]	14,575		38,980	

Source: own calculation.

DISCUSSION AND CONCLUSIONS

The developed decision support model has proven its value at least for the owners of the control posts where it was tested. By "playing around" with expected numbers of truckloads and with prices per truckload they were able to get insight into the sensitivity of their investments. For both cases, the probability of net profits from these investments is quite high.

The testing of the model resulted also in some suggestions from the users for improvement of the model:

1. Make it more user-friendly. For example, by introducing separate "help-icons" for instructions. For the present model data descriptions and explanations are put in a Manual.
2. Introduce more flexibility. In the model, the stables can be used by one category of animals. In reality stables are used for different species. This complicates the calculations because also investments in stables have to be divided over the species.
3. For the calculation of the profits the number of truckloads is multiplied by the price per truckload. However, the owners of control post use different methods of pricing. Therefore, they suggested adding the possibility of choosing the way of data input--giving either a number of truckloads or a number of animals.

Many companies use models to assist managers. Models are needed to better understand a situation or to create a wide variety of options and can help understand financial and other business decisions [Chaudhry et al. 1996]. Models transform user inputs and data into useful information. Managers can manipulate the input to a model to change output and learn about consequences of the decision. A break-even model provides a quick glance at price, volume and profit relationships, that is why it is easy to understand and popular.

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Willy Baltussen, Wil Hennen, Monika Gębska

SYSTEM WSPOMAGANIA DECYZJI INWESTYCYJNYCH W PUNKTACH KONTROLI W UNII EUROPEJSKIEJ

Streszczenie

W 2010 roku w ramach projektu finansowanego przez Komisję Europejską rozpoczęto tworzenie w Europie sieci punktów kontroli z zapewnieniem wysokiej jakości. Punkty kontroli są to miejsca odpoczynku zwierząt wykorzystywane podczas transportu inwentarza na duże odległości. Oferują one pomieszczenia socjalne dla kierowców i lekarzy weterynarii sprawujących nadzór nad przewożonymi zwierzętami. Punkty kontroli zapewniają możliwość naprawy i mycia samochodów ciężarowych przewożących zwierzęta. Prezentowany system wspomagania decyzji został opracowany, aby wspierać właścicieli punktów kontroli w podejmowaniu decyzji inwestycyjnych niezbędnych do osiągnięcia standardu wysokiej jakości. Celem narzędzia jest udzielenie odpowiedzi, jaki musi nastąpić wzrost liczby ciężarówek korzystających z punktu lub o ile musi wzrosnąć cena, usługi aby zasadne były plany inwestycyjne. Program był testowany w dwóch punktach kontroli uczestniczących w projekcie Unii Europejskiej w Polsce. Właściciele punktów kontroli docenili przydatność programu i zasugerowali kilka ulepszeń.

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WORKING CAPITAL MANAGEMENT STRATEGIES OF FAMILY FARMS IN POLAND

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Key words: net working capital, circulating assets, current liabilities, family farm
Słowa kluczowe: kapitał obrotowy netto, aktywa obrotowe, zobowiązania krótkoterminowe, gospodarstwo rodzinne

A b s t r a c t: The aim of this work was to define the working capital management strategies in two types of farms: dairy and arable. These groups of farms were taken from the FADN database. The same farms were investigated in the years 2004-2011. The share of circulating assets and current liability indicators in total assets, cash flow indicators and the share of liquid assets in circulating assets were used to define the strategies. Due to family farms having one "cash till" monetary means transferred to the family farm were used to calculate the share of liquid assets in circulating assets. The research confirmed that Polish family farms use a conservative asset management approach. This was proven by liquidity indicators and the high share of monetary means in assets. Farmers were also conservative in their approach toward short-term debt.

INTRODUCTION

The management of working capital plays a significant role for business entities. This is because solvency is to a large degree decided by working capital itself. Family farms should pay attention to this fact, especially since their business (as far as Polish conditions are concerned) is their main source of income[1].

If the farm is affected by financial problems – an inability to pay off debts – the family is also adversely affected. This may cause farmers (family breadwinners) to decide to maintain a high share of working capital. These farmers are often unaware of the fact that they are implementing a working capital management strategy. Moreover, does the type of production "dictate" the level of working capital and influence short-term debt? The aim of this work will be to define the working capital management strategy in two different types of production[2], i.e. arable and dairy cow ones. To fully achieve the main aim, the following

[1] Of course we have in mind only those entities which make a living from market produce and not those which are listed as family farms but whose members are inactive in animal and plant production.

[2] According to the FADN the type of farm is classified on the basis of the participation of the enterprise in creating standard gross margin (until 2008), however since 2009 the basis of farm type classification is standard production. For the purposes of this work (after the analysis of the period 2004-2008) it is assumed that those classified farms will continue to do the same in the years 2009-2011.

will be investigated: the level and changes in the value of working capital (from a nominal and updated perspective), the share of the most liquid assets and current liabilities in the structure of assets, and financial liquidity indicators. Furthermore, a thesis was formulated stating that polish farmers apply a conservative approach to working capital management and maintain a relatively large share of the most liquid assets in circulating assets and a relatively low level of short-term debt.

LITERATURE REVIEW

The management of net working capital is a key-area of financial decision-making faced by corporations and the owners of small and medium sized businesses. Working capital determines the continuity of the production cycle. Its management depends on the strategy applied. [Konieczna 2008]. It seems this is true of large entities whereas smaller ones such as family firms are less likely to build any form of strategy. It is often the case that owners are unable to define the very term: working capital. In academic literature it is defined in gross and net categories [Ryś-Jurek 2011, Sierpińska, Jachna 2007, Szyszko, Szczepański 2003, Wasilewski, Zabolotnyy 2009], as well as financial and accounting perspectives [Gołębiowski 2004]. In financial terms it is seen as the difference between fixed capital and fixed assets. The important role working capital performs in an enterprise is proven in works attempting to identify those factors which decide about its level in a particular business entity [Horrigan, 1965, Zhou 1995], but as B.A. Renjith Appuhami points out, less attention is paid to working capital than capital budgeting and capital structure. This seems inappropriate because working capital is the consequence of decisions made in the scope of financing the enterprise and a factor exerting an influence on short-term budgeting, and wider financial planning.

Moreover, A. Eljelly [2004] refers to the fact that efficient management of working capital gives more control over current assets and liabilities because it minimizes the risk of insolvency. It is worth remembering that financial security is especially important for small family businesses which are the family's main source of income. This problem is especially noticeable in polish family farms. Decisions made by the management or owners in the scope of working capital management affect the value for stakeholders [Shin, Soenen 1998], and the enterprise's profitability [Gill et al. 2010]. As research shows, attaining appropriate returns is not only important in large firms [Appuhami 2008], but also small businesses [Sunday 2011].

In academic literature concerning financial management [Czekaj, Dresler 2006, Franc-Dąbrowska 2008, Rutkowski 2007, Sierpińska, Wędzki 1997] the issues of working capital management are associated with implementing either an aggressive or conservative strategy in the management of current assets and liabilities. A separate classification of strategies concerning current assets and liabilities may cause various combinations of managing working capital, for example, conservative management of current assets with a large share of current assets and a dominating involvement of short-term debts or conversely. Other combinations of the conservative strategy of assets and aggressive liability strategy are also possible. Figure 1 presents working capital strategies.

As far as Polish farms are concerned, the question of working capital strategy is rarely undertaken, however such an attempt was made by Ryś-Jurek [2011]. This author's research concludes that in EU-27 farming, a conservative-aggressive strategy was applied in 2007.

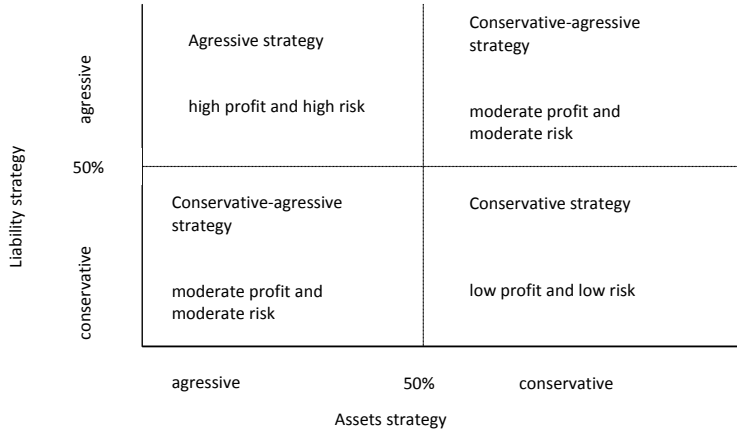

Figure 1. Working capital strategies
Source: own work based on [Franc-Dąbrowska 2008, Sierpińska, Wędzki 1997, Czekaj Dresler 2006].

The studies confirmed differences in households of different farming types. Households specializing in arable and dairy cow farming showed a slight (not exceeding 20%) share of circulating assets in total assets and around a 4% share of short-term debts. Therefore, it can be supposed that farmers will manage working capital similarly in those two farming types. Will family households behave similarly to farmers from other European countries despite inferior technology and a different way of organization? Taplin [2012] claims that organizational changes reduce income by lowering working capital size. Hayemi, Ruttan [1970] state that technology is included in fixed and circulating capital and increases productivity. Though polish farming remains relatively inefficient and traditional, an improvement has been observed in recent years. These changes may influence working capital management.

WORK METHODOLOGY

The research concerned the period between 2004-2011 and was derived from the database of "collecting accounting data from farms." This database represents 740 thousand commercial farms in Poland. To verify how farmers changed their approach to collecting working capital, only repeated farms were chosen from the database. In order to qualify to a farming group, those farms which belonged to the same farming type for the whole period of studies were selected. From amongst 8 farming types 2 were chosen, namely dairy cow (KM) and arable farm (UP). The selection was dictated by the fact that these are quite popular in polish family farms and are characterized by certain similarities and differences. What was similar was that the investigated farms possessed a significant (for polish conditions) arable land surface area. The differences concerned production organization, mainly within the scope of the necessity to maintain stock and possessing building inventory facilities.

After selection, it occurred that there were 292 dairy farms and 859 farms specializing in arable farming. The following indicators determined the strategy in the distinguished groups:

– A.1: the share of circulating assets in total assets [3], which was calculated as the ratio of circulating assets increased by money flowing into the household, to total assets,
– A.2: the current liabilities to total assets ratio, which can measure the level to which the farm's estate is financed by short-term foreign capital,
– A.3: the cash flow indicator calculated as the ratio of cash flow from the operational activity to negative cash flow from financial activity ,
– the share of the most liquid assets to trading assets calculated as the ratio of the size of monetary means transferred from the farm to the farming household [4] increased by remaining circulating assets except for stocks and live inventory[5].

Due to changes in the value of money over time, discounting was used to calculated updated values of working capital. Thus, it was possible to express the capital at base year value which enabled the comparison of changes in time. The price index of consumer goods and services published annually by the Central Statistical Office was used as the discount rate, whilst the procedure of updating value is expressed as follows:

$$KON_{2005(A)} = \frac{KON_{2005(N)}}{(1+i_{2005})}$$

$$KON_{2006(A)} = \frac{KON_{2006(N)}}{(1+i_{2005})\cdot(1+i_{2006})}$$

$$KON_{2007(A)} = \frac{KON_{2007(N)}}{(1+i_{2005})\cdot(1+i_{2006})\cdot(1+i_{2007})}$$

ect.

$$KON_{2011(A)} = \frac{KON_{2011(N)}}{(1+i_{2005})\cdot(1+i_{2006})\cdot(1+i_{2007})\cdot(1+i_{2008})\cdot(1+i_{2009})\cdot(1+i_{2010})\cdot(1+i_{2011})}$$

where: *KON* = net working capital calculated as fixed capital – fixed assets,
(A) – updated value,
(N) – nominal value.

The Kolmogorov-Smirnov test was used to verify the differences between groups of farms. Non-parametric tests were used because the investigated variables were not of normal distribution.

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[3] This is not a typical perspective due to the fact that money privately owned by the farmer and his family is included. However, because there is "one cash till" in the family farm it has been acknowledged that such monetary means can be treated as a part of the family farm's estate.

[4] This is an amount which the family receives at the end of the year. However, it is worth remembering that these means are often used in the farming enterprise, as the family farm has ''one cash till".

[5] Due to the fact that it is not possible to establish the amount of monetary means remaining in the family farm it has been established that a measurable way is information about cash flow, which indicates the difference between income and expenditures of the farm. Due to the fact that short and long-term liabilities paid off in a given year are included as current liabilities it has been assumed that the best indicator of such information is negative cash flow which shows expenditures used to pay-off the debt.

A DESCRIPTION OF INVESTIGATED SUBJECTS

Table 1 presents numerical data for basic factors of production in the groups of farms (land, capital, labour and economic results).

Those farms whose main source of income came from arable farming possessed more resources in basic factors of production. They had a twofold greater area of land and a 40% greater value of capital at their disposal in comparison with dairy cow groups. As far as labour was concerned[6] for every 100 ha UR the involvement of workers was similar, which results from the fact that the farmer's family constitutes the main source of labour. One can observe a 1-1.5 higher working unit in the case of dairy cow farms. This is the result of a low level of technological means still observed in family farms.

The level of farming income attained, indicated (on average) a 50 % greater value for arable farming. However, in the next years these values varied significantly. This could be the result of instability on the farming produce market and high fluctuations of prices for milk and crops. Despite these values being seeming more favourable for arable farms – this is only from a relative perspective. For every 1 ha UR – better economic results were obtained by dairy cow farms. Their average farming income being 2405 PLN/ha in comparison with 1970 PLN/ha for the arable farming group. Therefore farmers making a living from milk production, made better use of their land. This was a consequence of milk market regulations (milk quotas), which reduced livestock, the number of producers and increased productivity [Seremak-Bulge 2011].

Table 1. Basic factors of production in the groups of farms and economic results obtained in a given period

Year	Land [ha UR]		Labour [AWU/100 ha UR]		Assets [thous. PLN]		Revenue [thous. PLN]	
	UP	KM	UP	KM	UP	KM	UP	KM
2004	49,4	20,8	9,5	11,3	518,0	359,0	49,0	35,0
2005	50,9	21,5	9,5	11,2	493,0	383,0	40,0	43,0
2006	50,5	22,0	9,5	11,0	540,0	410,0	65,0	52,0
2007	52,8	22,3	9,3	11,0	636,0	458,0	98,0	62,0
2008	53,4	23,0	9,1	10,8	665,0	476,0	71,0	53,0
2009	54,5	23,6	9,0	10,5	1351,0	783,0	72,0	36,0
2010	55,6	23,5	8,7	10,2	1363,0	809,0	119,0	66,0
2011	57,0	23,8	8,8	10,2	1502,0	867,0	138,0	81,0
Average	53,0	22,5	9,2	10,8	888,0	568,0	82,0	53,0

Source: own calculations based on FADN PL data.

[6] In Polish family farming labour is presented in converted units, AWU is a unit expressing the amount of work per person employed in the farm. For 1 AWU it is assumed that 1 person works 2200 hours per year on the farm. These units include both hired and family workers.

RESULTS OF RESEARCH

Table 2 compares numerical data concerning the level of working capital from a nominal and updated perspective.

All the farms, irrespective of their group, achieved an average positive value of net working capital in each of the analyzed years. This means that mainly long-term capital was used to finance fixed assets. According to research carried out by Bereżnicka [2013] this was mainly own capital[7]. Thus, farmers limited financial risk and at the same time resigned from achieving additional benefits from leverage. Financial security is fundamental for Polish farmers in a market economy. This seems understandable, especially when the farm constitutes the whole family's main source of income. One must however add, that after Poland joined EU structures i.e. (since 2004), farmers took advantage of external financing to a greater extent in comparison with earlier years.

An incentive for long-term debt may be the possibility to take advantage of loans with preferential interest rates, as well as the urge to obtain investment financing from EU funds directed towards agriculture. A higher value of working capital was observed in farms with a greater area of farming land and capital. These differences disappear when calculating per unit of land. This indicates a similar approach of farmers in their quest to collect working capital. These differences were not statistically significant, recording a significance level of 0,05 – confirmed by Kolmogorov-Smirnov tests. One must note, that during the research period, working capital increased in both nominal and updated value. These changes occurred slowly in the price change perspective.

Table 3 compares data necessary to define working capital management strategy – the share of circulating assets in the estate and the share of short-term debt used to finance assets.

The share of circulating assets in total assets indicated a slightly higher value for the arable farming group. This may confirm assumptions about a relatively lower value of fixed assets for those farms and indicate the gathering of stock. It is worth paying attention to the fact that in 2009 the share of stock failed to achieve 20 % of the total value of assets in any group (similarly as in EU-27 countries). This was the result of a new method of estimating

Table 2. The level of net working capital in investigated groups between the years 2004-2011

Year	Net working capital (nominal value PLN)				Net working capital (updated value PLN)			
	arable farming (UP)		dairy cows (KM)		arable farming (UP)		dairy cows (KM)	
	PLN/ farm	PLN/ha	PLN/ farm	PLN/ha	PLN/ farm	PLN/ha	PLN/ farm	PLN/ha
2004	75863	2130	34122	1800	75863	2130	34122	1800
2005	69461	2050	33707	1800	69315	2000	33014	1700
2006	80533	2300	41487	2100	78093	2200	40232	2030
2007	98908	2600	49717	2500	93309	2400	46863	2300
2008	104401	2600	52372	2500	94522	2400	47416	2300
2009	111432	2700	55512	2600	97473	2400	48558	2300
2010	127689	3100	63424	2900	108866	2700	54075	2500
2011	156129	3400	83089	3700	127629	2800	68578	3000

Source: own calculations based on FADN PL data.

[7] In the years 2004-2008 the share of own capital used to finance the estate ranged between 88-90%.

Table 3. Indicators used to define working capital management strategy for the groups of farms investigated in the years 2004-2011

Indicator	2004		2005		2006		2007		2008		2009		2010		2011	
	UP	KM	UP	KM	UP	KM	UP	KM	UP	KM	UP	KM	UP	KM	UP	KM
A.1 [%]	24	19	32	22	27	21	28	21	27	21	16	14	18	16	19	17
A.2 [%]	5	2	4	2	4,3	2,1	4	2	8	6	2	1	2	1	2	1
A.3	0,5	5,5	4,5	9,5	1,3	2,1	6,4	2,5	4,3	7,8	2,7	9,2	2,4	6,0	1,2	9,1

Source: own calculations FADN PL data.

the value of land (according to market prices) not the effect of decisions (made by farmers) to leave less stock. This led to a significant increase in the value of fixed assets. On the other hand, this situation was caused by a drop in prices of farming produce, which had an impact on the value of gathered stock. Nevertheless, for plant producing farms, the share of circulating assets was 2 p.p. higher in comparison with the dairy cow group. By taking this indicator into consideration, it should be stated that Polish farmers had an aggressive approach to assets limiting the share of working capital. Such an assumption is not entirely true, but is rather a consequence of equipping farms excessively with fixed assets. Moreover, farmers do not gather stock because they frequently are unable to store it. In turn, short-term debt financed from 1-8% of assets, with a tendency of being nearer to the lower range. Arable farms had a relatively higher level of debt in comparison with dairy farms. This was probably due to a greater demand for working capital, obtained in the shape of working capital loans.

This is because farmers of this group possessed a larger area of land. Despite this, it was stated that farmers opted for short-term debts cautiously, to ensure the feeling of financial security. This is proven by a high cash flow indicator. It is obviously fair to assume that dairy farmers obtained higher indicator values (from 2.5-9.5), in UP group farms these ranged from 0.5 to 6.4. The results confirm that farmers opted for a conservative approach to managing working capital. An analysis of the structure of circulating assets was made to further the research and obtain confirmation for the conservative approach of farmers to managing assets. The results are presented in Figure 2. Figure 2 shows that Polish farm-

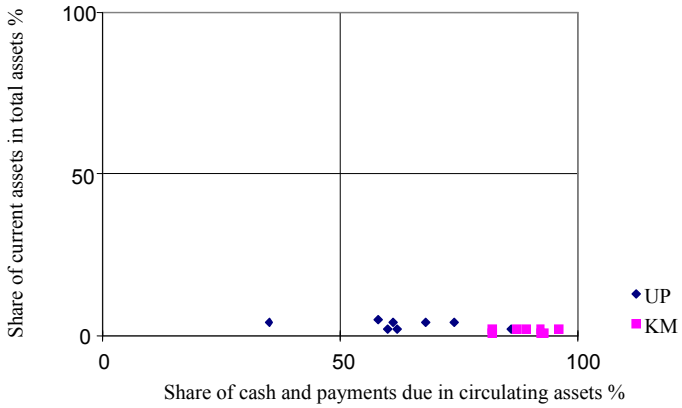

Figure 2. Asset and liability management strategies in the investigated groups of farms
Source: own calculations based on FADN data.

ers have a conservative approach to working capital management irrespective of the type of production. The results confirm a high regard for financial security. Such behaviour is understandable especially since the farm is the family's main source of income. It can be stated, that arable farms are close to applying an aggressive approach in the scope of asset management – and even achieve such a level in one of the analyzed years. This does not mean a change in the approach of farmers towards taking advantage of short-term loans and the re-disposal of money accumulated in the farm.

Most probably, the consequence of such behaviour in the farmers' management of working capital is obtaining a lower income (Fig. 1).

CONCLUSIONS

The researched groups of farms varied on account of factors of production. This had an impact on their level of net working capital. In both groups, farmers achieved a positive value of working capital which was shown by a positive rate of growth in nominal and updated perspectives. Despite differences in the total value of working capital, similar values were observed per surface unit. This means similar decisions are made by farmers concerning the size of circulating assets and level of short-term debt.

By taking into consideration the structure of assets and the share of short-term debt in liabilities it should be stated that polish farmers have an aggressive approach to the management of assets and a conservative one to managing liabilities (similarly to UE-27). However, this was not confirmed after researching financial liquidity. It was stated that arable and dairy cow farms possessed a conservative approach to managing circulating capital which is not only proven by high liquidity indicators but also by the structure of circulating assets.

The farmers conservative approach is most probably a result of the need to minimize financial risk and ensure financial security for the family. To define working capital management strategy in farming households, attention should be placed on the structure of circulating assets. This is due to the fact that the productive characteristics of these units require a high level of fixed assets. This has an impact on the relatively small share of circulating assets in total assets. In analyzing the structure of circulating assets one must take into consideration the monetary means transferred to the family farm. This is because they constitute financial background for the farm (despite not appearing in the balance sheet).

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Joanna Bereżnicka

STRATEGIE ZARZĄDZANIA KAPITAŁEM OBROTOWYM W GOSPODARSTWACH RODZINNYCH W POLSCE

Streszczenie

Celem opracowania było określenie strategii zarządzania kapitałem obrotowym w dwóch typach rolniczych - krowy mleczne i uprawy polowe. Grupy gospodarstw wyodrębniono z bazy FADN i były to gospodarstwa powtarzające się w okresie 2004-2011. Dla wyznaczenia strategii wykorzystano wskaźniki udziału aktywów obrotowych i zobowiązań bieżących w aktywach ogółem, wskaźnik płynności gotówkowej oraz udział najbardziej płynnych aktywów w aktywach obrotowych, do obliczenia którego wykorzystano także środki pieniężne przekazywane do gospodarstwa domowego, ze względu na występowanie w gospodarstwach rodzinnych tzw. „jednej kasy". Badania potwierdziły, że polskie gospodarstwa rodzinne realizują konserwatywne podejście do zarządzania aktywami. Przesądziły o tym wskaźniki płynności oraz wysoki udział środków pieniężnych w aktywach. Rolnicy także konserwatywnie pochodzili do zadłużania się w krótkim okresie.

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THE FUNCTION OF SMALL FARMS IN SUPPORTING BIOLOGICAL DIVERSITY OF AGRICULTURAL ECOSYSTEMS[1]

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Key words: small farms, diversity, weeds, preservation, agroecosystems
Słowa kluczowe: małe gospodarstwa, różnorodność, chwasty, zachowanie, agroekosystemy

A b s t r a c t. Biodiversity is formed, among other things, by the extensive use of arable land and therefore Poland has one of the most species abundant agricultural landscapes in Europe. Small ecological farms, especially in southern and south-eastern Poland, still host rare plant species named in the red lists of many European states. The diversity of animal and plant species in these areas is significantly higher than in the remaining parts of Poland. Consequently, the balance of agroecosystems is far more stable. The presence of rare plant species in the fields does not mean lower yields but contributes to maintaining the considerable diversity of insects and birds. Preserving the mosaic structure of crop fields and the traditional rural landscape is only possible on small farms and hence the importance of their continued existence.

INTRODUCTION

In the past people knew how to use natural resources skilfully. However, over time, they learnt to employ new technologies and unthinkingly ignore the laws of nature and to consider the extinction of a few species of living organisms to be unimportant, given the high diversity and the rapid progress. Shifting from hunting and gathering to farming caused replacement of the mosaic system of habitats by a growing number of single species cultivations. By simplifying the complex ecosystems and eliminating the 'unwanted' species, human beings made their diet poorer and changed the habitats of wild flora and fauna completely. By the end of the 20th century there were 4.5 billion people and as little as 180 species of plants used for consumed of which 6 species provided more or less 90% of the food of plant origin [*The state*... 1996]. In Polish registers there are 140 varieties of cultivated plants of several dozens of species [COBORU 2011].

Modern agriculture should put considerable emphasis on maintaining biological diversity. The purpose of original and modern agriculture is to produce food. The difference is that primitive farming used mainly the work of men and animals and simple tools while modern farming is based on advanced technology of cultivation, which is characterised by a very intense nature, and the entire production is dedicated for sale. There is no place

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to maintain diversity in agricultural ecosystems. Large scale monocultures, excessive agrochemical applications and heavy machinery have destroyed the balance of agroecosystems. The genetic impoverishment of crop plants has occurred; also accompanying plants species as well as microorganisms and animals directly related to them are disappearing. The survival of small farm agriculture is the only method of maintaining diversity and balance in agricultural ecosystems and preserving rare species of plants and the animals that depend upon them.

Weeds provide many positive impacts in agroecosystems. They protect the surface of the soil from crusting, drying and erosion. Furthermore, after ploughing weeds decay in the soil replacing composting and organic fertilisation. They also stimulate the growth of crop plants through their allelopathic activity – the so called positive allelopathy consists in improved growth of a given species in the vicinity of others, caused by emitting complexes of different chemical compounds. They can be used as a 'biological weapon'. Weeds may reflect actual habitat conditions and therefore can be used as bioindicators. They are food or ingredients of fodder mixtures for animals. They are also widely used in phytotherapy and the cosmetic industry.

MATERIAL AND METHODS

The research area is situated in the Nadnidziański natural landscape park and is partly within the 'Natura 2000' network (Ponidzie area). This area has been settled for a very long time. The oldest traces of settlement date back to neolith times. The Ponidzie was examined in detail, thanks to funding among others by the State Committee for Scientific Research of a supervisory research grant 'Diversity of field weeds of the Nadnidziański Natural Landscape Park, its determinants and preservation' [Dostatny 2000] and by a grant of the Ekofundusz Foundation as well as the Plant Breeding and Acclimatization Institute (2007-2009). A detailed survey of weed species was performed that enabled the comparison of changes occurring in plant communities and further monitoring thereof. The location of vanishing weed species, in particular among cereal crops cultivated on small farms of the region, were identified. Research was carried out in close cooperation with local farmers that were very helpful in providing information on traditional cultivations of the area. A favourable inclination towards the idea of maintaining of biodiversity and relevant activities was observed amongst these farmers.

Since 2004 missions to collect plants have been held that cover the area under study. Such missions have been organized annually by the National Centre for Plant Genetic Resources and their purpose was to collect ancient and local crop plants and their accompanying species, i.e. weeds. Also during the expeditions data were gathered and observations were made concerning genetic impoverishment of a given area.

In the years 2008, 2010, and 2012 phytosociological records were made using the Braun-Blanquet method [1964]. Each year 2 records were made from an area of 100 sq. m (within an area of 0.3 ha) in the crops at each farm during the growing season. In this paper only results referring to the share of coverage by crop plants and weeds in a given area (100 sq. m), calculated following a phytosociological record, will be used. Within the area of 0.3 ha farmers did not use any chemicals and the sowing rate for crop plants (cereal) was 30% lower than that recommended.

The occurrence of weed species in the cultivations of 10 farmers was monitored. The number of weed species in the material harvested directly by the farmer was identified. Marking of weed seeds was made according to Kulpa [1974]. For that purpose 0.5 kg of material was taken directly from the harvester on the aforesaid fields between 2008 and 2012. A list of weed species in the entire material was prepared based on the indices of frequency and abundance of occurrence [Kulpa and Tabisz 1963]. It must be mentioned that farmers who took part in the research have small farms (usually up to 10 ha) and despite crop rotation the fields were more or less in the same location year on year. Thus, the material could be compared.

RESULTS

Following the analysis of all phytosociological records that were made in individual years, it may be stated that the general weed coverage in fields used for this study did not increase, notwithstanding the fact that rare weed species occurred and the coverage of crop plant declined slightly. In 2012, the weed coverage was between 25-45% and the coverage of crop plants between 80 and 90% in all fields. However, in 2008 the weed coverage was between 25-40 % and the coverage of crop plants between 80 and 95% (Tab. 1).

Table 1. Comparison of percentage coverage of a crop plant and weeds in the ten researched smallholders

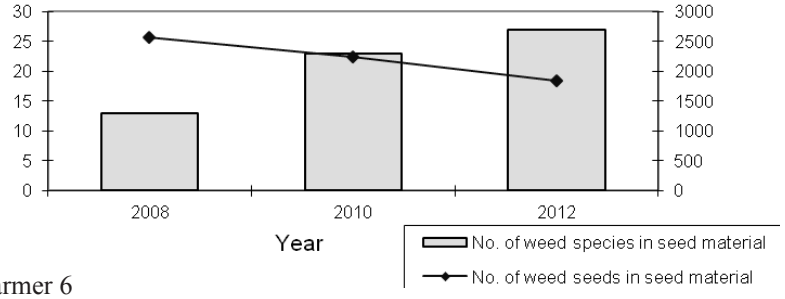
Farmer	Farmer field size [ha]	Year					
		% coverage of the crop plant/ % coverage of the weeds					
		2008		2010		2012	
1	10	85	35	85	30	80	25
2	10	90	25	90	35	90	30
3	10	90	25	90	25	85	35
4	9	80	45	90	30	90	30
5	10	95	35	90	35	90	30
6	10	80	40	90	35	85	35
7	7	90	35	90	30	80	45
8	10	85	40	85	40	90	35
9	10	85	40	85	35	90	30
10	5	85	40	85	40	85	35

*Area under study = 0.3 ha
Source: own study.

In the first years of the research, in most of fields studied, the average number of species was low, but their coverage was high, because two or three weed species were dominant. In the case of dominance of one weed species other species that are rare and characteristic for a given community do not occur; this leads to impoverishment of the floral composition of field weed communities. In consecutive years more weed species occurred in the fields and despite that fact the average weed coverage was the same or lower than in the first year of the study – no dominance of any of the weed species had ever been observed; they were usually quite evenly spread in the field (Tab. 1. and Fig. 1.).

a. Farmer 4

b. Farmer 5



c. Farmer 6

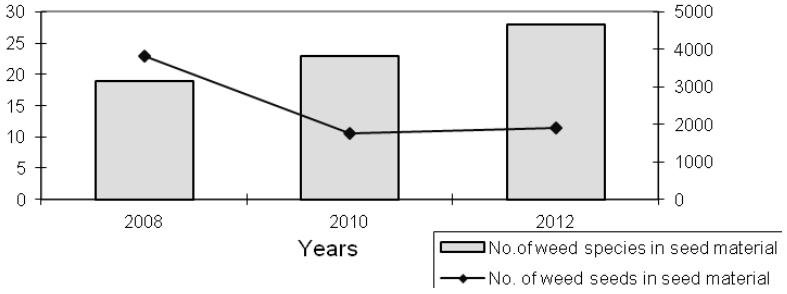


Figure 1. Number of weed seeds in the seed material of the selected smallholders
Source: own study.

In the analysed material (from 10 farms), after harvest in the initial years of monitoring in Niecka Nidziańska area, a small number of weed species was observed (from 65 to 67 species, between 2008-2010) with high numbers of the more common species such as: *Elymus repens, Avena fatua, Convolvulus arvensis, Galium aparine*, *Polygonum convolvulus*, that were present in almost every one of the 10 samples, with a high abundance index. In the following years, the number of weeds in the material collected from farmers increased gradually. In the last year the differences in abundance between common and rare weeds were not so evident (from 71 to 91 species in 0.5 kg of collected material, in all 10 samples). The abundance of common species declined, which was caused by the occurrence of other, less common, species, such as: *Adonis aestivalis, Aethusa cynapium, Agrosthemma githago, Bupleurum rotundifolium, Camelina microcarpa, Lithospermum*

arvense, Neslia paniculata, Valerianella dentata, among others. Specimens of these species probably came from the soil seed bank. After two years of research an observation was made that some rare species of weeds were occurring in cultivations, despite the fact that seeds of these weeds were not present in the collected seed material. In 2010 a few specimens of *Caucalis daucoides* were noted, while in 2012 the following species were recorded: *Ranuculus arvensis, Stachys annua* and *Bupleurum rotundiflorum* (it was increasing its coverage in the fields). After years of cultivation without the use of herbicides one may expect that weed species that had vanished, though still present in the soil seed bank, would germinate and create a full composition of the different, vanished weed complexes. A greater number of higher plants in crop fields means an increased abundance of other species such as: microorganisms, insects, birds, etc., that are necessary to keep agroecosystems in balance.

During the collection missions organised by the National Centre for Plant Genetic Resources in the last 10 years, we observed that the South and Southeastern part of Poland is still abundant in local, old varieties of annual vegetable plants, leguminous plants, medicinal plants and rare species of weeds, as well as old varieties of fruit trees. Rare species of weeds are only present in the fields in small farms in a few villages in Poland, where the mosaic structure of crop fields is preserved, as in the research area.

DISCUSSION

Very interesting weeds of crop fields occur in Niecka Nidziańska, on rendzina soils, which make up 1% of Polish soils. Most of them are very rare plants in Poland [Dostatny 2004]. An example would be *Adonis flammea* which is endangered due to intensified farming systems. There are several factors causing the extinction of the species as well as others of the *Caucalido-Scandicetum* communities. The main ones include intensification and modernisation of contemporary agriculture: introduction of prolific cereal varieties, improved cleaning of seeding material, long-term usage of herbicides. Equally significant are changes of habitat conditions, particularly strong and continuing acidification of limestone soils [Anioł-Kwiatkowska, Popiela 2011]. Also urbanisation and changing arable land into non-arable as well as abandoning farming of difficult land (e.g. high slopes) are of great importance. These factors have had a strong influence on the extinction of *Adonis flammea* and other species of the complex (*calciphile archaeophytes* related to traditional methods of cultivation, of Mediterranean reach).

Very often higher plants compete with one another, not only with the crop plant, which means that a greater number of weeds, with low coverage, only slightly decreases the yield of the crop plant. This phenomenon may be explained by the fact that the more species (partners) to share the resources of an ecological niche, which is a field, the more often growth of one of them limits the growth and development of the others which results in an absence of dominance. A reverse case occurs when one or several weed species predominate in fields treated with herbicides. Some of the species have become resistant to herbicides causing increasing numbers of them in the field (so-called compensation), consequently resulting in a drop of crop plant yield.

The layering architecture of the cornfield determines the inclusion of the weed seeds in the material collected (crop). Research made in Kurpie confirms this phenomenon [Dostatny, Małuszyńska 2007]. Most of the seeds came from the medium layer, some from the higher,

and only a few from the lower. Therefore, we do not have to be afraid of weeds from the lowest layer of cornfield getting into the harvested crop. Their presence is advantageous as they protect soils from crusting [Dostatny, Małuszyńska 2007]. This means that growing biodiversity in agricultural ecosystems does not equal a loss or deterioration of the quality of the harvest. Whereas a loss in biodiversity of rural areas caused by intensified farming, is inseparably connected with degradation of the agricultural ecosystems' functions.

Further existence of populations of rare, annual weed species is connected with turning of the soil surface during cultivation. This agrotechnical treatment prevents the invasion by biotopes of different grasses or perennials with higher competitive potential. We may hereby state that the seed resources in the soil are of crucial significance for the preservation and dynamics of populations of higher plants [Czarnecka, Czarnecka 2006].

Species that accompany cultivations have the ability to adapt to the life cycles of crop plants [Kornaś 1977]. A given complex of weeds with a whole spectrum of species reflects a specific type of cultivation. If the cultivation is abandoned, then the accompanying species slowly recede. The same happens with bird and insect species that were dependent upon these plants. For example for the last 300 years approximately 150 species of mammals (another 240 are endangered) and 100 bird species have become extinct; of which around 70% species died out due to the elimination of their habitats. In the second half of the 20th century world agricultural production became 2.6 times higher and mineral fertilisation 8 times more intense. At the same time 6 million hectares of arable land per year is reduced to desert owing to excessively extensive agricultural use.

The national strategy of preservation and moderate use of biological diversity (2003) emphasises that all that has not been previously appreciated or even intentionally destroyed, e.g. 'pests and weeds', should be preserved. Therefore, from the point of view of the convention and nature there are no 'pests' or 'weeds'. The strategy has been prepared at the request of the Polish Ministry of Environment and drawn up in accordance with the 'Convention on Biological Diversity' announced during the Earth Summit in Rio de Janeiro held in 1992. To maintain balance and increase diversity in agricultural ecosystems, a 'model refuge of agrobiodiversity' has been formed in Niecka Nidziańska, southern Poland. The model refuge has been created thanks to the funds of Ekofundusz Foundation and the Plant Breeding and Acclimatization Institute. Its aims is to preserve and maintain biodiversity in farming ecosystems and to protect field plant species that are threaten by extinction by maintaining typical weed species of the region in the fields. It would be possible in small farms. Individual small farmers often cultivate several varieties of crops. According to Boyce [2004] large farms, in contrast, are more likely to sow a single variety over a wide area. This inverse relationship between farm size and varietal diversity has several explanations. First, high diversity farming is generally more labour-intensive than low diversity farming. It takes more time and effort to cultivate varieties with different sowing dates, harvest times, and other requirements than to practice varietal monoculture. Second, high diversity agriculture depends on the farmers' knowledge of different crop varieties and their relationships to microhabitat variations and third, small farms often predominate in the marginal agricultural environments where the spread of modern varieties has been held in check by unfavourable growing conditions.

As has already been mentioned, weeds provide many positive impacts in agricultural systems and therefore they should be covered by protection or preservation schemes (reserves and refuges are not sufficient). The basis for an efficient plan of weed management is the ecological knowledge of this plant group and its relations with other organisms.

Research carried out in Great Britain [Marshall et al. 2003] show that many higher plant species influence the maintenance of a high diversity of insects. A drop in the number of food plants, i.e. weeds, may have an impact on the reduction of insect populations as well as other animal species, such as birds. Weeds play an important ecological role by giving shelter to spiders and insects on which birds feed (e.g. larks). Poland has 26% percent of the entire bird population that depends on arable land [*Birds in Europe…* 2004]. In order to keep this abundance of bird species, the current diversity of the agricultural landscape must be preserved [Wuczyński et al. 2011], this refers among others to buffer zones planted with grass and papilionaceous plants [Dajdok, Wuczyński 2008].

Transformation of the natural environment and the production of food through the widespread use of chemicals have a negative impact on human life. A reaction to the situation was, among others, Directive 2078/92 of 1992 of the UE Parliament introducing the term of agri-environmental plans, i.e. valuing such types of agricultural production that guarantee the preservation of the natural environment as well as enabling satisfactory economic results being the basis of agricultural production. Farmers who join the agri-environmental plans produce food and maintain diversity in agroecosystems and their activities are subsidised. In Poland, the national agri-environmental plan was established within the Rural Areas Development Plan aimed at satisfying objections, priorities and principles, based upon which activities towards a sustainable development are supported. The plan was drawn up by the Ministry of Agriculture and Rural Development and approved by the European Commission. The Sixth Package (second stage: 2007-2013) – Preservation of endangered genetic plant resources in agriculture is directly connected to the improvement of diversity in rural areas. Option 6.3 of the package – Seed production requested by gene bank, is addressed at small farms. Sub-option C provides for preservation of rare flora accompanying cultivations. Participation in this option allows farmers from Niecka Nidziańska (also from the rest of the country) to continue activities undertaken as part of the aforesaid project and enables other interested farmers from the entire country to join the plan which, with no doubt, contributes to the improvement of diversity and the maintenance of a balance of agroecosystems. In the third stage (2014-2020) this option will probably be moved into another package – buffer zones.

Rare species of weeds are only present in the fields of small farms in a few villages in Poland, where the mosaic structure of crop fields is preserved, like in the study area. According to Boyce [2004] and other authors [Altieri 2009], small farms are the 'keystones species' in agricultural ecosystems, because they sustain the crop genetic diversity that underpins humankind's long term food security. Unfortunately such places are becoming rare in Poland. The collection missions organised by the National Centre for Plant Genetic Resources in the last 10 years, showed that the South and Southeastern part of Poland is still abundant in local, ancient varieties of annual vegetable plants, leguminous plants, medicinal plants and rare species of weeds, as well as ancient varieties of fruit trees. Fortunately during the collection missions, many samples of the above groups of plants were collected. Those samples are stored in a "gene bank" (National Centre for Plant Genetic Resources) in *ex-situ* collection, but they do not represent an adequate substitute for *in situ* diversity for several reasons: the gene banks are not completely secure, they cannot adequately replace *in situ* diversity and because there is a big difference between "having" a seed in the bank and "knowing" what you have – since many genetic attributes can be observed only by growing plants in the microhabitats from which they come [Boyce 2004].

CONCLUSIONS

Constant presence of rare weed species in crop fields does not mean a "worse crop", as a significant part of these species belong to the lowest layer of the cornfield that will never be collected by a harvester. Additionally, after a longer period of ecological or extensive farming the ecosystems regains balance. Different species coexist, supplement and compete with one another, which does not end in the expansion of any of them. This is, with no doubt, more favourable to nature than uniform landscapes with vast areas of one crop plant, where only a few species of the most common weeds, resistant to herbicides, prevail, creating a simple system of agricultural ecosystems. The mosaic structure of crop fields of small farms ensures living conditions for many animals and plants already rare across Europe and may help us to save some species that could have a crucial importance for the generations to come. According to Boyce [2004], a productive and resilient world agriculture requires a diverse mix of crop varieties, agricultural techniques, and farming systems. In this mix, there is a future for small farms.

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ROLA MAŁYCH GOSPODARSTW W PODTRZYMYWANIU RÓŻNORODNOŚCI BIOLOGICZNEJ W EKOSYSTEMACH ROLNYCH

Streszczenie

W małych gospodarstwach ekologicznych, szczególnie w południowej i południowej-wschodniej części Polski można spotkać rzadkie gatunki chwastów, znajdujące się na czerwonych listach różnych państw Europy. Różnorodność gatunkowa zarówno roślin, jak i zwierząt na tych obszarach jest większa niż w pozostałych częściach Polski. W konsekwencji równowaga w agroekosystemach jest stabilniejsza. Obecność rzadkich gatunków chwastów na polach nie równa się obniżeniu plonów, a przyczynia się do podtrzymanie dużej różnorodności owadów i ptaków. Utrzymanie mozaikowej struktury pól uprawnych oraz tradycyjnego krajobrazu rolniczego jest możliwe tylko w małych gospodarstwach rolnych, dlatego jest tak ważne ich dalsze istnienie.

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CHANGES IN HOUSEHOLDS EXPENDITURES STRUCTURES IN THE EUROPEAN UNION – IS THERE CONVERGENCE?

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Key words: household expenditure structure, β-convergence, σ-convergence
Słowa kluczowe: struktura wydatków gospodarstw domowych, β-konwergencja, σ-konwergencja

A b s t r a c t. The aim of the paper is to answer the question whether convergence between households expenditures structures in the European Union exists. In order to study the phenomenon concepts of β- and σ-convergences are applied. The research is based on data on households expenditures in the period from 1995 through 2011 provided by EUROSTAT. It covers 27 countries and 12 groups of goods and services according to the COICOP classification. The analysis of results obtained allows to record convergence of both types for majority of structure components.

INTRODUCTION

According to Gerstberger and Yaneva [2013] consumption is a key indicator of citizens' well-being. It may be considered as ultimate purpose of economic behavior. It also plays an important role in economic theory and research on household expenditures and consumption is popular among economists. In Noll's opinion [Noll 2007], studying patterns, disparities and determinants of household expenditures and their changes across time by making use of large scale population surveys seems to be promising in various aspects. At the most general level it may provide insights into general consumption behavior as a major source of human well-being and respective choices, and restrictions. Then, investigating household expenditures and consumption patterns is considered to be key for monitoring and explanation of inequalities and changes in material living standards and general welfare. Finally, studying expenditures and consumption behavior of private households seems to be an important and promising strategy to extend mainstream approaches to studying inequality as a key topic of sociological and economic research.

Although there is a long history of research on patterns of household expenditures and their changes across time, those studies usually focus on single countries. International comparative studies on household expenditure patterns are rather rare. Noll [2007] reports one of the earliest works in this field by Houthakker [1957]. He also mentions a comprehensive EUROSTAT Report by Hagenaars et al. [1994] that presents for the first time results of detailed comparative micro-data-analyses for the by then 12 EC-countries using incomes and expenditures, and later papers by Dufour et al. [1999], and Kalwij and Machin [2004].

As there is a shortage of comparative research on changes in household consumption expenditure structures in the European Union, this study is an attempt to fill the gap. Therefore, convergence of new member states of the EU to the old ones in households consumption structures is examined. An analysis of households expenditures structures allows to reveal similarities and differences in standards of their livings, and more generally, to assess the living standard of the whole society. Problems of people living standards are becoming key in a policy and strategy of social development. For testing the occurrence of this phenomenon a variety of convergence concepts are applied. The most straightforward version of the concept is σ-convergence, which denotes diminishing differences between units over time. The subject of the analysis is to discover potential convergence among the EU countries in this field. This issue is important in relation to the problem of economic and social cohesion among the EU Member States.

DATA

Total household consumption expenditures were broken down into twelve categories by a system known as Classification of Individual Consumption by Purpose (COICOP). The Council regulation for the European system of accounts provides the underlying basis for the collection of data on household consumption expenditure referred to within this section. The data is provided by EUROSTAT. COICOP categories are the following 12 consumption areas:

– food and non-alcoholic beverages,
– alcoholic beverages, tobacco and narcotics,
– clothing and footwear,
– housing, water, electricity, gas and other fuels,
– furnishings, household equipment and routine household maintenance,
– health,
– transport,
– communications,
– recreation and culture,
– education,
– restaurants and hotels,
– miscellaneous goods and services.

The available data for 27 countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, the United Kingdom, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria and Romania) covers the period from 1995 through 2011.

METHODOLOGY

Recently, many economists try to explain the crucial issue of whether different countries or regions become similar to each other over time. Convergence between economies (i.e. countries or regions) is defined as the tendency for the levels of chosen indicator to equalise over time which will happen only if a catching-up process takes place. Usually, the Gross

Domestic Product (GDP) per capita is taken as the indicator. However, as highlighted in the 2009 "Report on the measurement of economic performance and social progress" by Stiglitz, Sen, and Fitoussi, actual individual consumption (AIC) per capita is an alternative indicator better suited to describe the material welfare situation of households as it takes account of widespread differences across countries in the shares of public financing for provision of education and health services to individuals [Gerstberger and Yaneva 2013]. In the research presented here, shares of each of 12 categories of consumption expenditures in total households consumption expenditures are taken into account. This is an important departure from other studies of the subject.

There are many approaches to testing the occurrence of this phenomenon. The most common concepts of convergence are β-convergence and σ-convergence. The concept of β-convergence originated in the economic growth literature. Its application in economics is verification of the hypothesis that poorer economies will tend to grow faster than richer economies. It has been an active area of research in the last years due to the development of the economic growth theory literature. Most of convergence models have their roots in the neoclassical Solovian growth model [Sardavar 2011]. Since the time of Barro's pioneering econometric proposals [Barro 1991], the phenomenon of economic convergence between countries has been empirically studied. It involves estimating the following regression [Próchniak and Rapacki 2009]:

$$\frac{1}{T}\left(\ln y_{iT} - \ln y_{i1}\right) = \alpha + \beta \ln y_{i,1} + \varepsilon_i , \tag{1}$$

where:
y_{it} – value of indicator for i-th country and t-th year,
$(\ln(y_{iT}) - \ln(y_{i,1}))/T$ – growth rate of indicator y,
ε_i – error term with finite variance σ^2 and mean equal zero,
α and β are the parameters to be estimated,
i – indicates country subscript (i = 1, 2,…,27).

$\beta < 0$ implies negative correlation between growth rate and initial log level of y. If the parameter β is significantly negative, one can record unconditional β-convergence[1]. That is, the growth rates of consumption depend upon the initial consumption levels only, and they are inversely correlated.

Another concept of convergence is σ-convergence concerning cross-sectional dispersion of given indicator. In this approach the standard deviation or the coefficient of variation[2] are taken into account. So, in our case: if the dispersion of expenditure share over the time diminishes, the presence of sigma convergence can be confirmed. Formally, for the coefficients of variation of each expenditure share trend models are estimated:

$$V_t = \alpha + \beta t + \xi_t , \tag{2}$$

where:
V_t – coefficient of variation of expenditure shares in the t-th year,
α, β – parameters to be estimated,
ξ_t – error term (t = 1, 2,…, T).

[1] When consumption growth is related to initial consumption level only (other variables do not play significant roles at all), convergence is said to be unconditional or absolute.

[2] Coefficient of variation is defined as the ratio of the standard deviation to the mean.

If the coefficient of variation statistically significantly decreases, this is taken as evidence of σ-convergence.

β- and σ-convergences are more complementary than substitutable concepts, so both of them must be tracked concurrently in order to show convergence. On the other hand it should be mentioned that β-convergence is a necessary, but not a sufficient condition for σ-convergence to take place [Sala-i-Martin 1996]. Moreover, there is some statistical relationship between those two convergences. Maurer [1995] explains it in six lemmas:

– σ-convergence implies necessarily β-convergence;
– β-divergence implies necessarily σ-divergence;
– β-convergence is compatible with σ-convergence or σ-divergence;
– σ-divergence is compatible with β-divergence or β-convergence;
– β-constancy is compatible with σ-convergence or σ-constancy;
– σ-constancy is compatible with β-convergence or β-constancy.

Next section presents results of application of those two concepts (β- and σ-convergences) to analysis of changes in households expenditures structures in the European Union.

RESULTS

Various researches show considerable differentiation of expenditure structures in the European Union countries [see Liobikienė and Juknys 2012, Liobikienė and Mandravickaitė 2012, Dudek and Koszela 2013]. These differences can result (inter alia) from various levels of income being at disposal of households in analyzed countries. In Table 1, there are presented results of testing β-convergence.

Table 1. Results of estimation of unconditional β-convergence models (1)

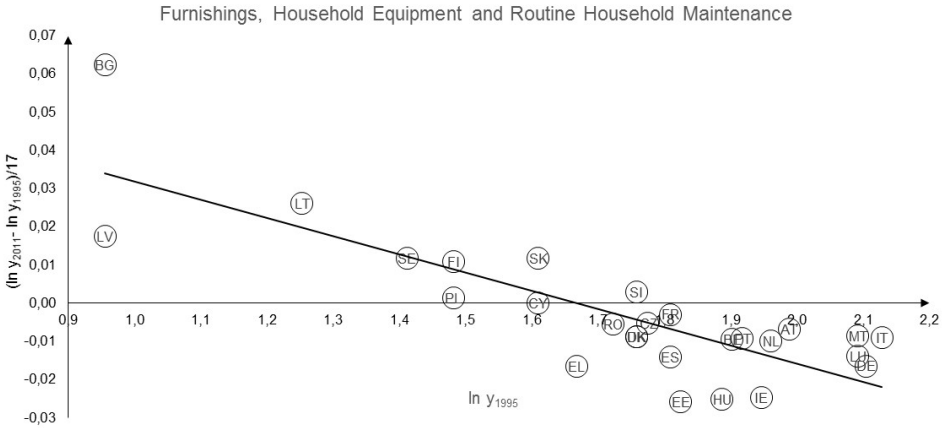
Share of expenditures on	α	β	R^2
Food and non-alcoholic beverages	0.0380**	-0.0179**	0.5678[a]
Alcoholic beverages, tobacco and narcotics	0.0218*	-0.0153**	0.1715
Clothing and footwear	0.0370*	-0.02869**	0.2345
Housing, water, electricity, gas and other fuels	0.0993***	-0.0308***	0.3969
Furnishings, household equipment and routine household maintenance	0.0796***	-0.0477***	0.6687
Health	0.2891***	-0.0124	0.0761
Transport	0.0940***	-0.0362***	0.4348
Communications	0.0529***	-0.0447***	0.3134
Recreation and culture	0.0756***	-0.0347***	0.6923
Education	0.0132**	-0.0308***	0.3833
Restaurants and hotels	0.0122	-0.0072**	0.1401
Miscellaneous goods and services	0.0535***	-0.0222***	0.3058

Note: * statistical significance at 0.10, ** statistical significance at 0.05, *** statistical significance at 0.01. [a] Relatively low values of coefficient of determination (R^2) are typical for β-convergence models [see Marques and Soukiazis 1998 or Próchniak and Rapacki 2009].
Source: own calculations.

On the base of information given in Table 1, one may record β-convergence for:
- food and non-alcoholic beverages,
- alcoholic beverages, tobacco and narcotics,
- clothing and footwear,
- housing, water, electricity, gas and other fuels,
- furnishings, household equipment and routine household maintenance,
- transport,
- communications,
- recreation and culture,
- education,
- restaurants and hotels,
- miscellaneous goods and services.

For those categories, values of β parameter are negative and statistically significant at 0.05 level. There is no β-convergence only in the case of share of expenditures on health. Figure 1 presents an exemplary graph of one of analyzed indicators – the share of expenditures on recreation and culture.

On the base of Figure 1 one may notice that rates of growth of shares of expenditures on recreation and culture are negatively correlated with the level of the shares in 1995. This means that in countries with low levels of the characteristic at the beginning of considered period, faster increase in recreation and culture budget shares occurs (for example in Lithuania, Latvia and Bulgaria those shares arose from almost 3% in 1995 to almost 7% in 2011). Whereas in countries with relatively high levels of the share, there were usually observable minor changes only (for example in the United Kingdom, Finland and Sweden the share was equal to 11%, both in 1995 and 2011).



Acronyms: AT – Austria, BE – Belgium, DK – Denmark, FI – Finland, FR – France, DE – Germany, GR – Greece, IR – Ireland, IT – Italy, LU – Luxembourg, NL – the Netherlands, PT – Portugal, ES – Spain, SE – Sweden, UK – the United Kingdom, CY – Cyprus, CZ – the Czech Republic, EE – Estonia, HU – Hungary, LV – Latvia, LT – Lithuania, MT – Malta, PL – Poland, SK – Slovakia, SL – Slovenia, BG – Bulgaria, RO – Romania

Figure 1. β-convergence evidence for the share of expenditures on recreation and culture
Source: own elaboration.

Table 2. Results of estimation of σ-convergence models (2)

Share of expenditures on	α	β	R^2
Food and non-alcoholic beverages	46.52 38**	-0.1132**	0.9674
Alcoholic beverages, tobacco and narcotics	41.4712***	-0.9266	0.0961
Clothing and footwear	19.9419***	0.1704**	0.3320
Housing, water, electricity, gas and other fuels	23.4048***	-0.3614**	0.9152
Furnishings, household equipment and routine household maintenance	29.0243***	-0.8524***	0.8509
Health	28.8355***	-5.9295	0.0007
Transport	18.7415***	-0.0859*	0.2129
Communications	22.2132***	0.3787**	0.2503
Recreation and culture	28.0031***	-0.5119***	0.8662
Education	57.4836***	-0.4274***	0.3667
Restaurants and hotels	53.1919***	-0.4710***	0.9048
Miscellaneous goods and services	37.7078***	-0.7311***	0.8051

Note: * statistical significance at 0.10, ** statistical significance at 0.05, *** statistical significance at 0.01.
Source: own calculations.

In the next step of the research, σ-convergence is tested. The results obtained are given in Table 2. On the base on information given in Table 2, one may conclude:

1. Differentiation of shares of expenditures on „clothing and footwear" and „communications" kept increasing in the period under consideration. This indicates divergence, whereas for both those consumption areas β-convergence was recorded.
2. There is no σ-convergence or σ-divergence for the following categories: "alcoholic beverages, tobacco and narcotics", and "health". This means that no significant changes (neither decrease, nor increase) were observed.
3. σ-convergence exists for such consumption areas as:
   - food and non-alcoholic beverages,
   - housing, water, electricity, gas and other fuels,
   - furnishings, household equipment and routine household maintenance,
   - transport,
   - recreation and culture,
   - education,
   - restaurants and hotels,
   - miscellaneous goods and services.

This is the characteristic of σ-convergence that it attempts to capture the cross-sectional volatility of a variable over time. The σ-convergence for selected shares of expenditures is displayed in Figure 2. Figure 2 reveals that in the period from 1995 through 2011 differentiation of shares of expenditures on such consumption areas as "food and non-alcoholic beverages", "housing, water, electricity, gas and other fuels", and "restaurants and hotels" kept decreasing. This phenomenon also occurs in the case of the following categories: "furnishings, household equipment and routine household maintenance", "transport", "recreation and culture", "education", "restaurants and hotels", and "miscellaneous goods and services". Therefore, for 8 of 12 consumption areas there was observed not only β-convergence, but σ-convergence as well.

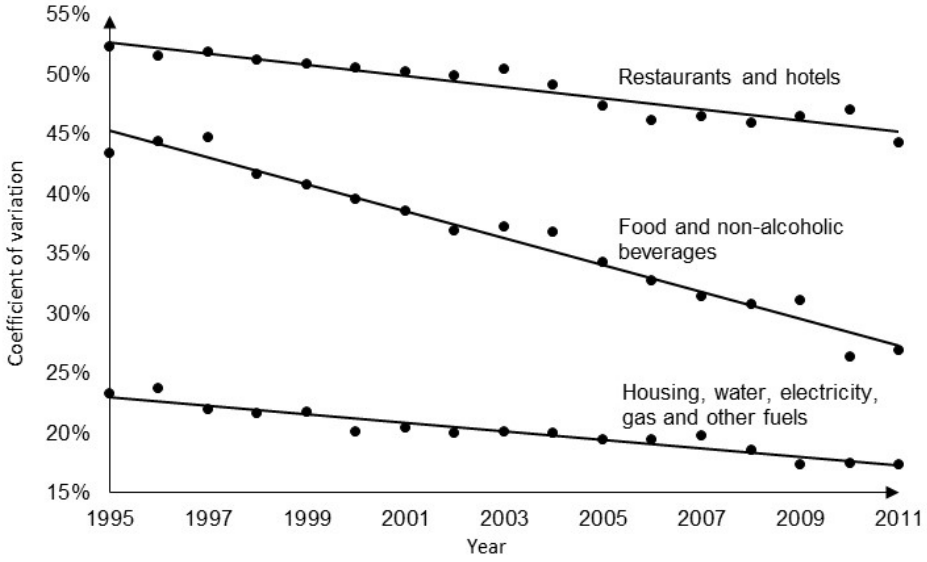


Figure 2. The σ-convergence for selected shares of expenditures
Source: own elaboration.

CONCLUDING REMARKS

A considerable part of research on expenditures and consumption is empirical in nature, but little comparative research has been done in this area, yet. The most of research has been carried out in the United States, whereas there is much less research addressing the issue in Europe [Noll 2007]. Nevertheless, problems connected with expenditures and consumption have attracted growing interest of scientists and researchers in recent years also in Europe. The European Union enlargement became the incentive for comparative studies.

This paper presents application of the concepts of β-convergence and σ-convergence to verify empirically the hypothesis of convergence between households expenditures structures in the European Union in the period from 1995 through 2011. The so-called β-convergence among a group of countries exists if the regression coefficient, β, in the model describing the dependence of growth rate of given indicator upon its initial level is statistically significantly less than zero. Testing for σ-convergence is based on the coefficient of variation of given indicator in the cross-section series. Usually, the Gross Domestic Product (GDP) per capita is taken as the indicator. In the research presented here, shares of each of 12 categories of consumption expenditures in total households consumption expenditures are taken into account. This differs the study from others of this type. The analysis of results obtained allows to record convergence of both types for majority of structure components.

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ZMIANY W STRUKTURZE WYDATKÓW GOSPODARSTW DOMOWYCH W UNII EUROPEJSKIEJ – CZY MA MIEJSCE KONWERGENCJA?

Streszczenie

Celem pracy jest odpowiedź na pytanie, czy istnieje konwergencja między strukturami wydatków gospodarstw domowych w Unii Europejskiej. Do analizy tego zjawiska wykorzystano koncepcję β- oraz σ-konwergencji. Podstawę badania stanowią dane, udostępniane przez EUROSTAT, dotyczące wydatków gospodarstw domowych w latach 1995-2011. Obejmują one 27 krajów i 12 grup dóbr i usług według klasyfikacji COICOP. Wyniki badań wskazują na występowanie konwergencji obu typów dla większości składników struktury.

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FACTORS AFFECTING RICE ADOPTION IN THE SOLOMON ISLANDS: A CASE STUDY OF FIU VILLAGE, MALAITA PROVINCE[1]

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Key words: farmer adoption, rice adoption, Malaiata Province, Solomon Islands
Słowa kluczowe: przygotowanie rolników do produkcji ryżu, prowincja Malaita, Wyspy Salomona

A b s t r a c t. In 2006, the Solomon Islands Government implemented the Rice Development Programme aiming to promote rice growing. However, the low level of rice adoption raised questions relating to the successful implementation of this programme. The aim of this paper is to identify the factors that contributed to farmers' decision to adopt or not to adopt rice. The data collected was analysed using the qualitative analysis. This study separated the factors that influenced the farmers' decision to adopt rice technology into three broad categories: characteristics of technology, internal factors and external factor. However, it was found that poor policy implementation, poor leadership by the community leaders and poor delivery of extension service were the key factors that affected the adopters' decision to discontinue the use of the technology in the end of 2010. This study also showed that the majority of farmers in Fiu village did not adopt the technology due to the negative attributes of the rice technology such as: complexity, lack of compatibility with traditional practices, resource requirements and risk of crop failure.

BACKGROUND

For decades, the people of the Solomon Islands (SI) have depended on traditional staple crops, such as sweet potato, cassava, taro and yam for their dietary energy [*Annual Report...* 2008]. However, this trend has slowly changed over the past 50 years, as the population has developed a taste for rice and rice is now third most important crop after sweet potato and cassava. Rice was first introduced into the SI in 1942 by American soldiers during World War II [McGregor 2006, *Annual Report...* 2009**,** Warner 2007]. However, 16 years after the war, the taste for rice had grown and this resulted in the first importation of rice in 1961. Rice imports increased from 2,700 tons in 1961, to 3,322 tons in 1970. The price of rice also increased from US$144/ton in 1961, to US$ 201/ton in 1970 [FAO 2010].

The increase in the price of rice imports over the period 1961-1970, led the SI Government to intervene by implementing a food policy during the 1960s. The aim of this policy

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was to limit food imports and increase local food production. In 1966 the government leased 4,235 ha of land to a privately owned Australian commercial company "Guadalcanal Plain Limited" (GPL) for rice production [Barrett 1970]. In 1967, the GPL planted 599 ha of rice and this allowed the SI to become self-sufficient for the first time [Barrett, 1970, Fleming 1996]. In 1975, GPL formed a joint venture with the SI Brewers Solomon Associates (BSA) a local based subsidiary of C. Brewer Corporation (a Hawaiian-based agribusiness firm) to form the Sol-rice Company. This company increased the rice area from 599 ha in 1975 to 2,512 ha in 1978 and allowed SI to become an exporter of rice to Australia, New Zealand and Fiji. When exports peaked at almost USD$ 5 million in 1980, rice had become the fifth most valuable export and the third most valuable agricultural export crop after copra and palm oil [Fleming 1996].

Rice exports declined through the early 1980s and in 1986, BSA withdrew from the joint venture, after four years of experiencing successive losses due to serious insect problems, a drop in world rice prices and the high costs associated with mechanised production practices. In 1986, the rice plantations suffered serious infrastructure damage due to cyclone Namu. As a result, the Sol-Rice Company ceased rice production and exports [Fleming 1996].

Despite the liquidation of the Sol-Rice Company, the rice consumption per head increased from 37 kg in 1987 to 72 kg in 2007 (Fig. 1). This was due to a combination of population growth (2.8% p.a.), rapid urbanization and change of consumption patterns [*Agriculture Corporate...* 2009]. The rice imports also increased from over 10,000 tons in 1987 to over 35,000 tons in 2007 (Fig. 1). From 1987 the world price of rice has been increasing (Fig. 2) and in 2008, the world price of rice spiked to US$ 1,664/ton [FAO 2010]. As a consequence, per capita rice consumption in 2008 dropped to a record low of 26 kg/head (Fig. 1).

The cost of rice imports and increased rice consumption were a major concern for the SI government. To reduce rice imports, improve food security and increase local rice production, the Ministry of Agriculture and Livestock (MAL) initiated a National Rural Rice Development Programme (NRRDP) in 2006 [*Annual Report...* 2008]. A Rice Section was

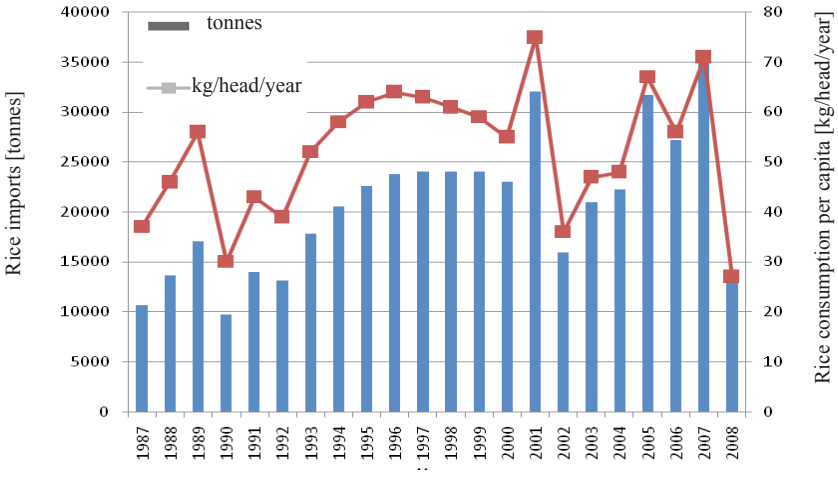

Figure 1. Rice consumption pattern in the Solomon Islands (1987-2008)
Source: [FAO 2010].

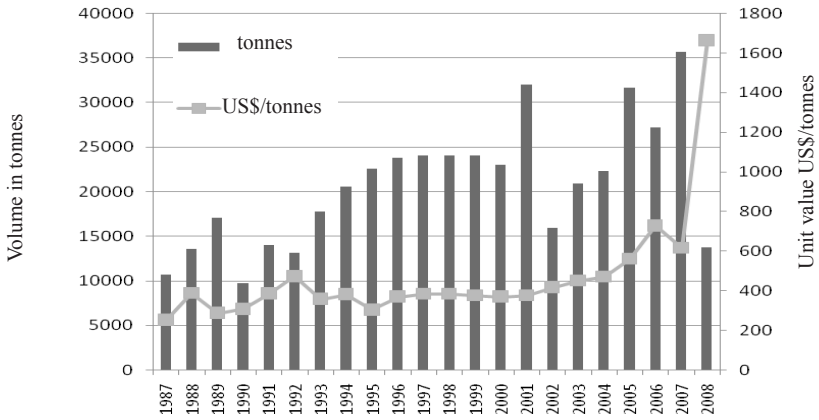

Figure 2. Rice imports into the Solomon Islands (1987-2008)
Source: [FAO 2010].

established to implement the programme and encourage local farmers to adopt rice growing. The Rice Section employed a community group approach because of the high labour requirements of rice growing. They also planned to provide farmers with assistance in the form of extension advice, labour subsidies, capital (e.g. tractors, fuel) and variable inputs (e.g. fertilizer, seeds). These incentives were to be provided for three years, to allow the rice farms to become viable and able to continue to produce without government assistance after the third year of operation [*Agriculture Corporate...* 2009]

Since the inception of the programme in 2006, the government spent approximately USD$ 1.73 million over a three year period [*Agriculture Corporate...* 2009]. Additional funds were invested in 2008, when the government provided an extra US$ 4.1 million [*Agriculture Corporate...* 2009]. In early 2010, a further USD$ 1.6 million was allocated from the government's budget, to assist with the rice programme [*National Rice...* 2010].

Despite the significant investment in this programme over the past five years, only a limited number of farmers have joined it [*Annual Report...* 2009]. NRRDP had only managed to establish 323 ha of rice in 5 years of operation, compared to their target of 3,000 ha [*Annual Report...* 2008]. This paper reports on a study that was undertaken to investigate why farmers adopted or did not adopt the rice growing technology promoted by the SI government.

RESEARCH METHODOLOGY

A single–case study approach was chosen for this research. The Fiu community Rice Project in the Central Kwara'ae Constituency of the Malaita Province was selected as case for three reasons: 1) it was the only rice project in Malaita province of the SI that was still functioning when the primary data collection was organised; 2) it was located in an area that was safe for the researcher to collect data, and 3) it was accessible, with respect to contacts and the existence of roads and transport to the study site.

The government officers involved in the rice programme and the Fiu rice committee members were the first respondents identified by the researcher. The farmers who adopted the rice technology were selected using a snowball sampling technique. In this case, the researcher used the committee members as a strategic starting point for the identification of information-rich respondents. A purposive sampling was used for the farmers who did not adopted the rice to capture a diversity of opinions and views of the members of the Fiu community.

The data collection for this research was carried out between June and July 2010. A total of 24 respondents were interviewed. The respondents included: two government officers (national & provincial levels); two Fiu project committee members; ten farmers in Fiu village who adopted rice technology; and eight farmers in Fiu village who did not adopt the rice technology.

Primary and secondary sources of data were used in gathering relevant information. The primary data was collected through semi-structured interviews that were tape recorded and later transcribed. Secondary information and relevant documents/reports were also collected from the governmental, regional and local offices relating to the Rice Development Programme as well as the Fiu community.

A qualitative data analysis technique developed by Dey [1993] was used to analyse the data. This is a three step iterative process comprising description, classification and connection. The data was transcribed, summarised and categorised to look for connections and relationships.

CLASSIFICATION OF THE CASE

The case studied is located in Fiu village in the Central Kwara'ae Constituency of Malaita province of the Solomon Islands. The age of farmers ranged between 20 to 65 years (Appendix 1). There was a low level of literacy amongst the farmers in the community. Most of the farmers had previous experience in growing rice as part of a community group in the 1990s. The main source of livelihood for the majority of people in the community was agriculture. They generated additional revenues from other activities such as fishing, pig rearing, and basket weaving. The Fiu Community Rice Project (FCRP) was situated close to Fiu village. The land on which the community rice project was located, was owned by the Church of Melanesia (COM) and leased to the community by the government for rice development. Because of this arrangement, tenure of land was therefore secure from disputes. The land area set aside for rice development was approximately 20 ha.

The case was a community project which required farmers to form a community group in order to grow rice (Appendix 2). The establishment of the community group was facilitated by local extension officers. Membership was open to all community members of Fiu village. The community rice project had 30 farmer members including six committee members. The main role of the committee was to plan and develop a work programme for rice production. There was no official constitution developed by the committee that set out formal rules to guide the project's operations. The decisions were made by the project committee with minimal consultation with group members.

The government provided support under the NRRDP for the Fiu community to grow rice. The support that the government had planned to provide to the Fiu Community Rice Project included the provision of capital and variable inputs, a labour subsidy, and the provision of rice information and technical advice from extension officers.

RESULTS AND DISCUSSION

The research findings revealed that there were several factors that influenced the farmers' initial decision to adopt or not adopt at the inception of the project in 2007. These factors could be separated into three categories: 1) characteristics of technology, 2) internal factors, and 3) external factors. These are discussed in the following section.

CHARACTERISTICS OF THE RICE TECHNOLOGY

The study identified six characteristics of technology to have influenced the farmers' decision to adopt the technology. The first four factors were consistent with Rogers [1995, 2003] adoption model. These are: relative advantage, compatibility, complexity and observability. Trialibility was not important because the rice technology requires 10-20 ha of land to be grown immediately, and therefore trialling it in a small scale was not possible. The other two characteristics of the technology that were identified related to resource use and risk.

The perceived relative advantages of rice that influenced adoption decision of farmers were: improved food security, improved income, early maturity of rice crop, improved palatability and convenience. The study revealed that flooding is the main threat to local staple production in the area. Therefore, farmers thought that because rice crop had much better storage characteristics than local staples crops, it would provide the source of food during this flooding period. The farmers also suggested that they would improve income through the sale of surplus rice and from the wages that they could receive through labour subsidy payments.

This research also revealed that adopters decided to grow rice rather than local staples because it only took three months to reach maturity, whereas the local staples took 6-11 months to mature. This meant that farmers could grow two crops of rice in the time it took to grow one staple crop which in turn could improve both their food security and income. This finding is consistent with the work of Feder and Umali [1993].

Because of a combination of poor group leadership and failure by the government to provide capital and variable inputs, many of these relative advantages did not eventuate and after two years of crop failure, the farmers decided to discontinue the project in late 2010. The result also revealed that farmers who had joined the community project and adopted rice were worse off in terms of food security and income than those that did not adopt. Azilah [2007] also reported that farmers may discontinue the use of a technology after being dissatisfied with the performance of the new idea.

In contrast to the 30 adopters, the majority of the community did not adopt the rice technology in 2007 because they believed that they would be better off in terms of food and income by growing their traditional staple crops, fishing and rearing pigs.

The rice was more complex to grow than the local staple crops. Despite this, thirty farmers adopted the rice technology because they had previous experience in rice growing and expected to receive extension support. Many of the non-adopters also had previous experience, but they did not trust the government to provide the necessary support, nor the leadership to manage the project effectively. Ogunlana [2004] and Rogers [2003] stressed that the greater the complexity of a technology the more negatively farmers may view it and that this may lead to its non-adoption.

Observability did not influence the farmers' initial decision in 2007 to adopt the rice technology because there were no similar projects within the vicinity to be observed. However, when the project was implemented during the period from 2007 to 2010, the non-adopters observed the project being poorly implemented and this confirmed that their initial decision not to adopt the rice technology was correct.

In this study, the resource use characteristics of the rice technology were capital and variable input intensive, labour intensive and land-using and had an important influence on the farmers' adoption decision. Although the adopters were aware of these negative resource-use characteristics, they believed that the government had put in place actions to overcome them. Sunding and Zilberman [2001] found that resource use characteristics often acted as barriers to adoption if they were not overcome.

In 2007, the non-adopters' perceived rice technology to be input intensive particularly when compared to their staple crops and this influenced their decision not to adopt, results consistent with the work of Khanna [2001]. The non-adopters also perceived rice growing as labour intensive, involving multiple activities and required a large labour force. They also did not adopt the technology because they also perceived rice growing as land-using compared to local crops.

The risk associated with the production of rice also influenced the farmers' adoption decision. Feder and Umali [1993] and Pannell et al. [2006] identified the risk associated with a new technology as an important factor that influenced the adoption decision of farmers. Although the adopters were aware that rice was susceptible to pests and diseases, it did not deter them from adopting the rice technology due to the available governmental support in terms of fertilisers, pesticides, and fungicide and extension support. However, when these inputs were not fully provided by the government, the rice crop was attacked by pests and diseases, and this in turn lead to crop failure.

INTERNAL FACTORS

Four internal factors that influenced the farmers' initial decision to adopt the rice growing technology were identified. These were: personal characteristic, on-farm factors, cultural factors and the leadership characteristics of the community group. Although other studies [Deressa et al. 2009, Doss and Morris 2001] have identified gender, level of education, and training as important determinants of the adoption decision of farmers, these factors did not influence the adoption decision of farmers in this study.

Age has been reported to positively influence the adoption decision of farmers [Deressa et al. 2009]. However, in this study, the results were less clear cut. Age and the labour intensive nature of the crop influenced the oldest farmer not to adopt. The majority of farmers in this study had previous experience in rice growing and community groups in the 1990's, which influenced their decision to adopt the technology. Hassan and Nhemachena [2008] and Khanna [2001] reported that previous experience with agricultural technologies had a positive influence on the adoption decisions of farmers. However, the non-adopters found that the rice programme in the 1990's did not work well and this influenced their decision not to adopt. Despite many of the adopters having negative experiences in relation to the previous rice project and other government programmes, they still adopted the technology because they believed that the government would put in place mechanisms that would overcome the problems experienced in the past.

The on-farm characteristics that were identified to have influenced the farmers' initial adoption decision included: proximity of the rice farm to farmers' home, land free from land-dispute and location of the farm close to the water source. The proximity of the rice field to the farmers' homes reduced the time and effort required to travel to the farm. In the SI, land is increasingly a subject of conflict, where tribes argue with each other over which development projects they will undertake on their land. The location of the farm on a piece of land free of dispute influenced the farmers' decision to adopt the rice growing. The location of the farm close to an available water source also affected the farmers' decision to adopt rice. Despite a number of positive on-farm characteristics, the majority of the farmers in the village did not adopt the technology.

The cultural practices of the local community also influenced the farmers' decision to adopt rice growing and showed two contrasting perspectives. Rice played an important role as the main food source during local feasts, ceremonies and other traditional village activities. Herbig and Miller [1991] and Stanley et al. [2000] reported that farmers will only adopt a technology which is compatible to their norms and cultural practices. In contrast, the non-adopters stated that one of their reasons for not adopting the technology was because it was labour intensive and that this would limit the time they had available to attend cultural activities.

Leadership characteristics of the project leaders did not influence the decision of farmers who adopted the rice technology. Both, the adopters and non-adopters perceived that the leaders of the community group had limited technical skills and knowledge in rice growing, lacked both technical and management skills and had poor attitudes. Similar leadership characteristics were identified in the literature [Damanpour and Schneider 2008]. The non-adopters stated that the leaders did not put the interests of the community group ahead of their own. They showed a lack of respect towards some group members, even though they had considerable experience in rice production.

EXTERNAL FACTORS

This research identified five external factors that influenced the farmers' decision to adopt the rice growing. These were: government policy, infrastructure development, agro-climatic condition, access to extension services, and access to markets. Similar external factors have been identified in the literature [Akpabio and Inyang 2007, Granner and Sharpe 2004, Langyintuo and Mungoma 2008, Zeller et al. 1998].

This study found that government policy was one of the most important factors that influenced the farmers' initial decision to grow rice. Government policy provided several incentives: provision of capital and variable inputs, provision of a labour subsidy, adoption of a community group approach, leasing of suitable land, and provision of advice through the extension organisation. The key element of the policy that influenced the farmers' initial decision to adopt the rice technology was the community group approach. The adopters perceived the community group approach as positive because it increased the opportunity for group members to acquire new knowledge and skills from experts within the group. Other studies [Granner and Sharpe 2004, Meinzen-Dick 2002] also reported that a community group approach has the potential for pooling the abilities, expertise and resources of people in the group. The farmers also perceived that working in a community group would allow them to share the work load.

Poor implementation of the policy influenced the adopters to discontinue the rice technology in 2010. Only three of the policy elements (leased land, labour subsidies and provision of advice) were implemented, and the labour subsidy was only implemented partially. The government had failed to deliver the capital and variable inputs such as: tractor, rice processing equipment, fertilisers, pesticides and fungicides to the farmers as promised. This led to crop failures and discouraged the farmers from continuing the project.

The village had a good road and transport system. Access to processing equipment was also found to influence the farmers' decision to adopt the rice technology. It was found that the village had rice processing equipment and as such farmers compared this situation to the 1990's, when rice was harvested and sent to Honiara for processing, which was expensive.

The agro-climatic conditions of the area also influenced the farmers' decision to adopt the rice technology. Favourable agro-climatic factors such as: soil quality, rainfall sunshine hours and temperature were perceived by farmers to contribute to high rice yields and, therefore, it was expected that this would lead to improved food security and income.

Although the infrastructure and agro-climatic conditions were good the majority of farmers did not adopt rice. They mentioned that the quality of the road and transportation system in the area had greatly reduced the cost of transporting local produce to market.

Access to extension services was one of the factors that influenced the farmers' initial decision to adopt the rice growing. The farmers perceived that since they were located close to the provincial capital Auki, they would have good access to extension services. When the project was implemented post-2007, the extension officers provided advice on rice growing, but they did not provide the capital and variable inputs. Despite the provision of good advice on rice cultivation, failure to provide critical inputs resulted in crop failure and as a result, farmers discontinued growing rice in 2010.

Market access was an important external factor that influenced the farmers' decision to adopt rice. The Fiu Rice Project was located close to three expanding markets: Fiu village, Aligegeo School and Auki. The price for rice in these markets was also increasing due to the expanding population. Other studies [Akpabio and Inyang 2007, Ransom et al. 2003, Zeller et al. 1998] also reported that good access to markets positively influenced the adoption decision of farmers. In contrast, the non-adopters did not adopt rice because of access to the three markets. In this case, there was also a growing market for local staples and the non-adopters saw this as a better source of additional income.

CONCLUSIONS

The Rice Section of the MAL encouraged and promoted rice growing to farmers in the SI in order to be able to reduce the country's rice imports and improve food security in rural areas. The study identified that the decision related to the adoption of rice as a new crop was different to most other studies in two distinct ways. First, the new crop was to be grown by a community group as opposed to individual farmers. This meant that issues such as the management and leadership of the community group were important factors that are not relevant when an individual farmer grows a new crop on his own land. Second, where the adoption of a new crop is concerned, farmers tend to consider this as a substitution problem. That is, they consider if they are better off substituting a hectare of the new crop for a hectare of their old crop. In this instance, the substitution did not occur through land use, but rather through the substitution of labour.

The factors that influenced the adoption of rice growing could be classified into the characteristics of the technology, internal and external factors. However, the influence of these factors on the adoption decision of the farmers was context dependent. As such, a factor might be important to one farmer, but irrelevant to another from within the same community. This suggests that viewing adoption from a "factor" perspective is too simplistic and that future work should investigate adoption in a more systemic manner.

The case was interesting because the technology had a number of positive attributes and the government had gone to some lengths to counter the negative attributes. Rice growing provided a number of relative advantages over the existing crops, it suited the agro-climatic conditions, the crop was valued by the community and played an important role in cultural events, and the infrastructure in terms of processing, transport, markets and access to extension support was good. Against this, the negative attributes were the complexity, lack of compatibility with traditional practices, the resource requirements of the crop and the risk of crop failure. To counter these problems, the government developed a policy that would provide extension support, capital and variable inputs, a labour subsidy, undisputed land and a community group approach. Despite this, only 30 out of 1152 farmers in the village adopted rice growing.

The major constraint to adoption was the farmers' distrust of government programmes which have failed to deliver in the past. They also distrusted the leadership of the community group because they lacked technical and group management skills and put their own interests before that of the community. The farmers that adopted rice believed that the government would provide the promised support and that the extension service would develop the capability of the leadership such that the project would succeed. Unfortunately, the government failed to deliver key inputs which resulted in crop failure and the leadership of the community group proved inept in their management of the project.

For the project to be successful, funds needed to be made available so that the MAL could provide the capital and variable inputs and the labour subsidy in a timely fashion to the community group. This would have reduced the lack of trust that the farmers had in the governments' ability to deliver on programmes and help ensure high crop yields, whilst minimising the risk of crop failure. Furthermore, the selection of community group leaders with the right attitudes, technical and group management skills was critical for the successful implementation of the project.

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Appendix 1. Farmer and farm characteristics

Characteristics	Case study classification
Age of farmers (years)	20-65 years
Gender equality	Men usually make household decisions
Education	The majority of farmers have predominantly primary with limited secondary education. Literacy rates are low.
Experience with the technology (rice growing)	The majority of farmers had some experience with rice growing within a community project
Homogeneity	Four different tribes with four chiefs representing each tribe. The tribes share the same religion
Wealth	99% are termed as poor and only 1% are rich.
Livelihood situation	Subsistence agriculture and also gain income from fishing, pig rearing, and basket weaving.
Location of the rice farm	Close to farmers homes
Land tenure	The land is not in dispute
Farm size	20 hectares

Appendix 2. Community group characteristics

Characteristics	Case study classification
Nature of group	Formed by local extension officers
Membership	Open
Group size	30 farmers
Written constitution	No
Level of participation in decision making	Decisions were made by the leadership with minimal consultation with group members
Leadership capacity:	
Group management	Poor
Rice production	Poor

Elena Garnevska, David Gray, Simon Baete

CZYNNIKI WPŁYWAJĄCE NA ROZWÓJ PRODUKCJI RYŻU NA WYSPACH SALOMONA NA PRZYKŁADZIE WIOSKI FIU W PROWINCJI MALAITA

Streszczenie

W 2006 roku rząd Wysp Salomona realizował program zwiększania produkcji ryżu. Niski poziom jego produkcji rodzi jednak wątpliwości dotyczące skuteczności realizacji planu, którego celem było promowanie produkcji ryżu. Celem artykułu jest identyfikacja czynników, które przyczyniły się do podjęcia przez rolników decyzji o wprowadzenie (lub nie) produkcji ryżu. Zgromadzone dane poddano analizie jakościowej. Czynniki wpływające na decyzje rolników podzielono na trzy kategorie: technologiczne, czynniki wewnętrzne (związane z rolnikiem i jego gospodarstwem) oraz czynniki zewnętrzne (polityka rolna, rozwój infrastruktury, uwarunkowania rynkowe). Przedstawiono także główne czynniki, które skłoniły rolników do zaprzestania produkcji pod koniec 2010 roku (mało skuteczne wdrożenie instrumentów polityki rolnej, niski autorytet lidera grupy, niska dostępność specjalistycznych usług). Badania wykazały, że większość rolników, którzy nie podjęli się produkcji ryżu, kierowało się głównie trudnościami we wdrożeniu technologii.

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CHANGES IN THE MANUFACTURE OF AGRICULTURAL MEANS OF PRODUCTION IN LIGHT OF THE AUSTRIAN SCHOOL THEORY

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Key words: Austrian School, production structure, business cycle, agribusiness, agricultural means of production
Słowa kluczowe: szkoła austriacka, struktura produkcji, cykl koniunkturalny, agrobiznes, środki produkcji dla rolnictwa

A b s t r a c t. This work aims to verify the hypothesis which states that cyclical changes in the manufacture of agricultural means of production are more dynamic than changes in the production of foodstuffs. This stems from the Austrian School theory. In the theoretical part of this work the time-structure of production theory and its application to agribusiness is discussed. Whereas in the empirical part researches on the directions and dynamics of changes in the manufacture of selected means of production for agriculture and foodstuffs in the Polish economy have been conducted. They have shown that during the research period most production changes of the analysed means of production destined for agriculture were in line with the Austrian School hypothesis. During that period changes which are not consistent with the hypothesis also took place.

INTRODUCTION

The means of production and services for agriculture industry is one of the three components of the foodstuffs economy. It is also the part least referred to in Polish literature pertaining to agribusiness economics. However, it plays a leading role in the development of agriculture. Technical progress is first introduced in the means of production for agriculture industry. Machines and devices are becoming ever more modern and specialised. Mechanisation of work in agriculture is a natural process of moving away from labour intensive processes. This results in an improvement in productivity and efficiency, and consequently economic effectiveness of the means of production used in agricultural production [see Mrówczyńska-Kamińska 2012]. The production in the industry supplying agriculture with productive means and services, just the same as production in other agribusiness areas and industry in the entire economy is subject to cyclical fluctuations.

The work is of a theoretical - empirical nature. It aims to verify the hypothesis which states that cyclical changes in the manufacture of agricultural means of production are more dynamic

than changes in the production of foodstuffs. The hypothesis stems from the Austrian School business cycle theory, where the primary role is assumed by time-structure of production.

In the work, deduction and statistical indicators have been used as the research methods.

The research period covers 2002-2012. In that period, three (two complete and one almost complete) Kitchin cycles have been observed in the Polish economy.

TIME-STRUCTURE OF PRODUCTION IN AGRIBUSINESS

According to economists of the Austrian School the basis for understanding economic growth as well as cyclical fluctuations is theory of capital based on time-structure of production. This theory was proposed by Eugen Böhm Ritter von Bawerk [1891] and is still valid today. The time-structure of production means production stages ordered in accordance with the technical process of manufacture and sales of the product. In each and every one of these stages production has to last a certain time. Subsequently the goods being processed end up in the next phase of the production structure, where a certain time dedicated to changing and improving them must also elapse. Thus the manufacture of every good intended for consumption, staring with the initial stages always lasts a certain amount of time. Its practical determination is not possible due to the complexity of processes taking place in the modern economy. Despite the fact that this is a problem in analysing changes to the economy for researchers used to being able to measure and calculate everything, it is not a problem slowing down or preventing the operation of economic entities and growth. The evident phenomenon of the passage of time during a production process is accepted by economists from all schools of economics. However, only the Austrian School economists emphasise the significance of this change in the time-structure of production for processes occurring in the economy.

The rejection of a temporal structure of manufacturing by modern mainstream schools of economics stems from the adoption of the neoclassical theory of capital. It was founded by J. B. Clark and developed and fully formed by F. H. Knight [1934]. The Austrian School economists make a distinction between capital and capital goods. Capital is defined as the market value of capital goods [Huerta de Soto 2009]. It is an abstract concept used as a tool for economic calculations. Whereas capital goods are physical goods used at every stage of the consumption good production process. However, for mainstream economists these concepts are synonymous. Thus they do not see a need to differentiate between them. Neoclassical theory considers capital to be a uniform, permanent fund of values, which is not used up over time. It also assumes that capital goods are homogeneous. And thus the primary division of goods in the economy is into investment and consumption goods. And investment goods are treated as one whole. Thus they can be added and freely swapped and combined with other capital goods.

For the Austrian School the take on capital goods proposed by Clarke and Knight is one of the biggest errors in the entire theory of economics. Economists from that school also subdivide goods into consumption (end products or lower order) and investment (capital goods, intermediate or higher order) which are used for the production of the former goods. However, in accordance with reality they assume that capital goods are heterogeneous. Thus the use of every type of these goods should be analysed individually as their economic effects differ. Ever since Böhm-Bawerk, Austrian School economists have been subdividing intermediate goods in accordance to their distance from consump-

tion good [Skousen 2011]. Thus amongst those there are goods of a higher order further away (machines, devices) and closer (components, almost finished goods) to consumption. Also durable consumption goods should be treated as intermediate goods [Skousen 2011]. The division of capital goods stems from the existence of time-structure of production. At its particular stages other goods are used and processed in the productive process which lasts a certain period of time. Thus it may be said that the intermediate goods are at certain time distances from the end product.

"The fact that roundabout production methods yield bigger effects that direct methods, is one of the most important and fundamental statements in the whole theory of production" [Böhm-Bawerk 1891, s. 20]. The phrase "roundabout production methods" is often misunderstood. It does not mean that businesses aim to artificially complicate the consumption goods production process. As it is natural that they wish to achieve a given result using the simplest methods. "Roundabout methods" should be understood as a more developed production structure, i.e. one comprising of more productive stages. This is called extending (deepening) of the production structure. The aim of this process are benefits to businesses. The new methods are more effective economically. More stages means that more intermediate goods have to be used. This is only possible if businesses are able to finance that larger amount, and as such have more financial means at their disposal. The Austrian School emphasises that to ensure stable growth these means should originate from voluntary savings of entities in the economy. A developed production structure is very capital intensive. This has two primary consequences. Firstly, the use of more capital with the same amount of labour and land increases the production of consumption goods. Secondly, the production time is extended, and therefore the waiting time for increased consumption. The Austrian School economists consider, that a necessary condition for more lower order goods is the adoption of more complicated manufacturing methods and thus extending the production time. The time-structure of production as established by companies is not an independent entity but stems from its adjustment to the time-structure of consumption.

The classical structure of the foodstuffs economy (agribusiness) – the sector of the economy where entities conduct business operations directly or indirectly associated with the production of foodstuffs and the raw materials for its production – is oversimplified (as most models of the economy used by economists), but nonetheless is a good example of time-structure of production. It comprises of three main units aligned in accordance with the manufacturing process of the end foodstuffs product: 1) the industry supplying

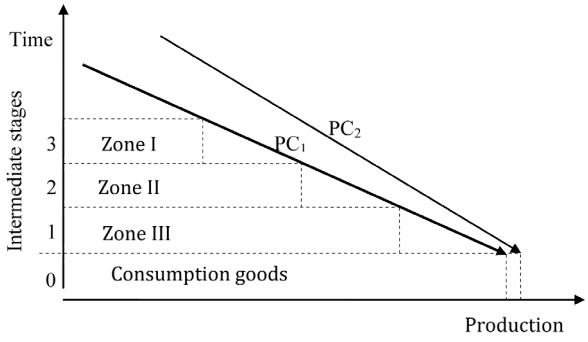

Figure 1. Structure of production in the foodstuffs economy.
Source: in-house materials prepared based on [Skousen 2011] and [Woś 1996].

agriculture with the means of production and services (zone I); 2) agriculture (zone II); 3) the foodstuffs industry (zone III) [Woś 1996]. Products manufactured by foodstuffs companies are closest to the consumer, whilst industries manufacturing agricultural means of production are furthest (Fig. 1). Today, vertical integration is a significant phenomenon pertaining to the structure of production in agribusiness. It aims to improve the profitability of foodstuffs production and establish a competitive advantage.

According to the Austrian School theory, in today's economy the main cause of cyclical fluctuations is the expansive monetary policy [Hayek 1967, Garrison 2001, Mises 2007]. The system based on fiat money and fractional reserves is also conducive to it. Loosening of this policy usually assumes the form for the central bank reducing interest rates. A decrease in interest at commercial banks allows companies to take out larger loans and due to the creation of money its supply is increased. Businesses do not differentiate between real or forced savings. And thus this is the starting point for errors in their calculations and decisions. The created money "(...) hammers a wedge between savings and investments" [Garrison 1986, p. 440]. The expansion phase of the business cycle begins. However the invested means do not grow uniformly at various branches of the economy. The dynamics of changes to production and prices of manufactured products in branches is proportional to their distance from the end consumption product and their durability. This happens because businesses attempting to reduce production costs first have to invest and obtain more efficient machines, devices and technological lines which will be used for direct production of the end product. They also expect an increase in the demand for the capital goods already being manufactured. These processes lead to the lengthening of the production structure and its widening, or the development of existing stages [Tempelman 2010]. In the agribusiness structure in accordance with the Austrian School theory the largest production growth should pertain to the agriculture means of production supply industry and the smallest to the foodstuffs industry. Graphically this can be represented as a transformation of the PC_1 production curve into a new curve PC_2 (Fig. 1). The depicted relations may by disturbed by various factors.

An expansive monetary policy enticed businesses to lengthen the end product time-structure of production. However the time-structure of consumption was not extended. The lack of compliance must lead to a breakdown in the economy [Jędruchniewicz 2012, 2013]. Consumers increase their demand at a moment when production of new goods has not been completed yet. The consumers do not want to wait! An increase in the interest rate and banks curbing financing for investments mean that businesses have no choice but give recognise their failure. A downturn phase begins which should be considered to be the period for ordering the manufacturing structure [Rothbard 2008]. Now production should decrease the fastest in zone I of the foodstuffs economy and slowest in zone III.

THE MONETARY POLICY AND BUSINESS CYCLE IN POLAND

The fiscal policy in Poland is subject to the attainment of its final goal. "The fundamental aim of the operations of the NBP is the maintenance of a stable price level with a simultaneous support for the economic policies of the Government as long as that does not obstruct the fundamental aim of the NBP" [The Act 1997, art. 3]. Price stability is understood as maintaining a low annual rate of inflation. Mainstream economists consider a low rate of inflation as the most conductive for the accumulation of wealth, as high infla-

tion, as well as inflation which is too small causes costs which exceed benefits to occur in an economy [Błaszczyk 2010]. They consider the optimal level of inflation to be in the 2-3% range. Since 2004 the National Bank of Poland, using these calculations has been setting an annual inflation target an a level of 2.5% with an acceptable deviation of ± 1 percentage point [*Strategia polityki*... 2003].

The Monetary Policy Council conducts its policy with the aid of the direct inflation target strategy as it is best suited to the performance of the fundamental aim formulated in such manner in a short time. The main characteristic if this strategy are public announcements of e mid run, quantified inflation target. This means that in the event of unforeseen disturbances, the monetary policy will be conducted in such was as to allow the return of the inflation rates to a level compliant with the defined target in the mid run. Determining the achievement of the target in the mid run will allow the bank to minimise fluctuations in production and employment in the short run. The most recent recession also strengthened another target of the central bank, being the stability of the financial sector.

The contemporary Polish monetary policy is conducted primarily by changes to interest rates. The reference rate which is shaped by open market transactions is the most important. Also, for most of the Austrian School economists its changes are a primary cause for cyclical fluctuations in the economy [Garrison 2001, Huerta de Soto 2009]. However, some representatives of this school are critical of its central role in the evolution of the production in the business cycle. Their arguments are convincing [Hülsmann 2011, Murphy 2013]. Therefore changes in the money supply should be considered to be the primary cause of changes in the economy. Whereas changes in interest rates only cause changes in the quantity of money. In 2002-2012 in addition to the monetary base the National Bank of Poland was using three measures of money supply. The level of M3 aggregate is almost identical to that of M2. Changes to the M1 measure were the most dynamic (Figure 2). This stems from the association of current deposit levels with changes in the economic situation.

The business cycle oscillations in economic activity characterized by their relative regularity. A classical cycle consists of four phases: recovery, expansion, recession and depression, and is based on the analysis of changes in the absolute levels of a category which describes the economy well [Estey 1959]. Contemporary research of cyclical fluctuations pertain to the aggregate rate of change of the selected category. This is the so called growth cycle. The empirical values are compared with the values of the estimated trend line. And so today, economists are of the opinion that the cycle consists of only two phases, namely a relatively high and low growth rate [Drozdowicz-Bieć 2012].

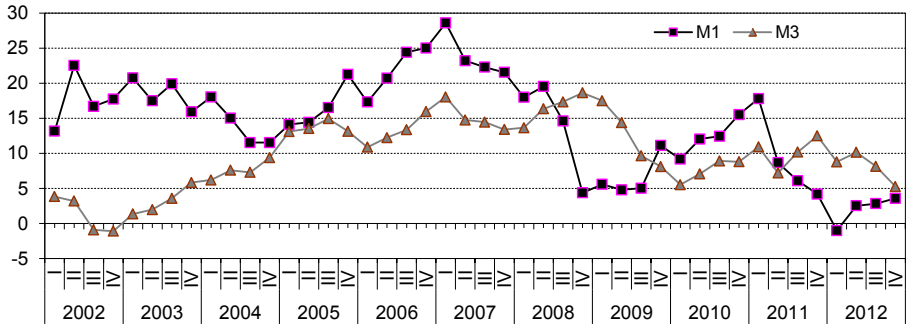

Figure 2. Annual changes to the money supply in Poland [%]
Source: own simulations based on www.npb.pl.

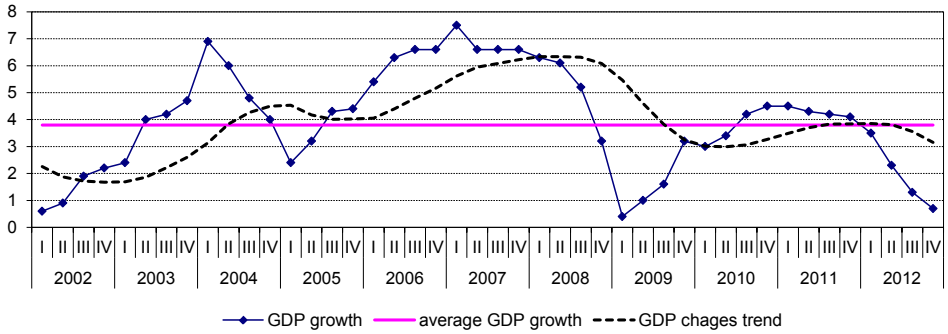

Figure 3. Annual changes to the real GDP in Poland [%] and their trend
Source: [*Biuletyn statystyczny* 2006-2012] and own calculations.

The main morphological feature of the economic cycle are its phases, that is, the periods between the lower and upper turning points or in other words points of improvement and deterioration of the economic situation. Determination of the phases of the cycle in Poland will be made on the basis of the rate of growth of gross domestic product. Hence the use of a method based on the changes trend in this category has was used. The annual average calculated from the 2- and 3-year floating average growth of the domestic product was adopted as the basis for determining the trend in GDP changes. On this basis, in 2002-2012 three growth phases were determined in Poland: Q3 2002 – Q3 2004, Q3 2005 – Q2 2008, Q4 2009 – Q4 2011 and three downturn phases: Q4 2004 – Q2 2005, Q3 2008 – Q3 2009, and from Q1 2012 (Fig. 3). The end of the second growth phase was arbitrarily delayed due to high and similar to the previous quarters GDP dynamics.

GROWTH OF MEANS OF PRODUCTION FOR THE AGRICULTURE

The supply agricultural means of production and services is an extensive and highly varied machine. It includes the production of 1) fixed assets, such as: buildings, tractors, agricultural machinery and equipment, etc., 2) current such as: certified seeds, means of protection, fertilizer, energy, etc., and 3) services, such as: veterinary and advisory services. The conducted analysis of the changes in the development of the production of goods used in agriculture is based on the data pertaining to the individual means, as there is no data describing means of production and services industry for agriculture as a whole.

According to the theory of the Austrian School the most dynamic changes relate to the production of goods which are at the beginning of the time-structure of production. Economists of this school attribute the same importance to durable goods. The more durable the good, i.e. the longer it is used in the economic processes, the larger the changes in its production. From among the goods constituting supply for agriculture structures and buildings are the most durable. During the period under analysis these also constituted the largest share in total investment outlays performed by farmers. The largest share was observed in 2003 – 40.5% and the smallest in 2010 – 34.5%, [*Rocznik statystyczny przemysłu* 2007, *Rocznik statystyczny rolnictwa* 2007].

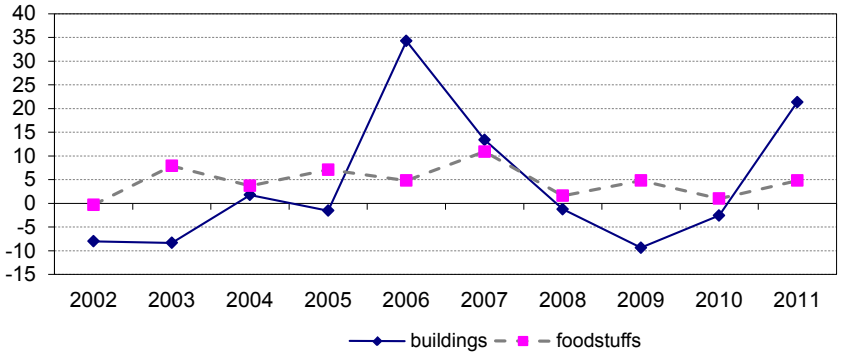

Figure 4. The annual changes in the production of buildings for agriculture and foodstuffs in Poland [%]
Source: [Rocznik 2006-2012b, Rocznik 2006-2012a] and own calculations.

An analysis of annual absolute changes in the production of buildings and structures used in agriculture, after excluding price changes by the use of the construction and assembly output indicator, shows that they were largely in line with the phases of the business cycle in the Polish economy (Fig. 4). The years 2003 and 2010 are exceptions. During that period, the economy continued the growth phase of the cycle, while investments in buildings in agriculture decreased. In both cases, these are the years immediately after periods of strong economic downturn. The low growth and weak financial condition of the did not encourage nor enable to undertake expensive investments.

The Austrian School business cycle theory predominantly pertains to relative changes. Thus changes to investments in buildings will be compared with changes in the production if foodstuffs, or those at a stage closest to the goods purchased by consumers. The comparison of the changes in the manufacture of these products confirms the thesis of that school in the lion's share of the cycle phases in Poland (Fig. 4). This is particularly evident after 2005. Then in the full growth years of 2005-2008 and 2011 the annual rates of growth exceeded the changes in the production of foodstuffs goods. Whereas during the crash (2009) the relationship was reversed. Then already in 2011 investments in buildings rose faster than the manufacture of foodstuffs. From the point of view of the Austrian School the most problematic are the investment changes during the growth phase in 2002-2004. This is a result of a number of factors. Firstly, the first full year of that phase is 2003. Secondly, the financial factor is the most important in influencing changes in production, but it is not the only one. In some situations the effects of other factors are stronger. Here as already mentioned the low growth and weak financial condition of the farmers were important. Thirdly, Poland then was not part of the European Union and thus farmers were not able to use Union funds intended for farmstead investments. Their ability to borrow money was weaker than after accession.

Across the entire period subject to analysis the differentiation of the rate of investment in agricultural buildings and structures confirmed the statements made by the Austrian School. Changes in the monetary policy affected the dynamic changes in building investments. Production structure widening and narrowing processes ensued. In 2002-2011 the standard deviation for the annual changes in construction investments amounted to 14.5 pp whereas foodstuffs industry production 3.4 pp. Thus the difference in these values was

four fold. Manufacture of buildings for the needs of agricultural production was significantly more varied than production of foodstuffs. This is confirmed by the coefficient of variation. For investments in buildings it was 365% and for foodstuff goods in was 73%. Thus it was exactly five times bigger. The data comply with the thesis of the Austrian School, which states that changes to the production of the end product are insignificant as compared to the changes in the production of capital goods.

There are many movable fixed assets for agriculture produced by the Polish economy. It is not possible nor purposeful to discuss the changes in the production of all of them. The tractor is of key importance on farms. In 2002 there were almost 46 tractors per 100 farms, whereas in 2010 almost as many as 65 [*Rynek środków...* 2013]. Thus changes in its production constitute significant information to verify the thesis of the Austrian School pertaining to the changes in the vertical structure of agribusiness.

In 2002-2012 changes in the production of tractors in Poland were in accordance with the business cycle phases (Fig. 5). During the growth period their production increased whereas during the downturn it decreased. Absolute changes are significant. However most important from the point of view of the Austrian School economists are relative changes. A comparison of the changes in the production of tractors and the changes in the production of foodstuffs articles, other words goods being the nearest to the end consumption confirms the claims of that school. During the period under analysis the variation in the production of tractors is significantly more than foodstuff products. The standard deviation of annual changes for tractors was 22 pp, where as for consumption goods it was 3.3 pp. Thus the difference is very large. It is even bigger for the coefficient of variation. For the production of tractors this coefficient was 890.3%, and for foodstuffs articles only 74.6%.

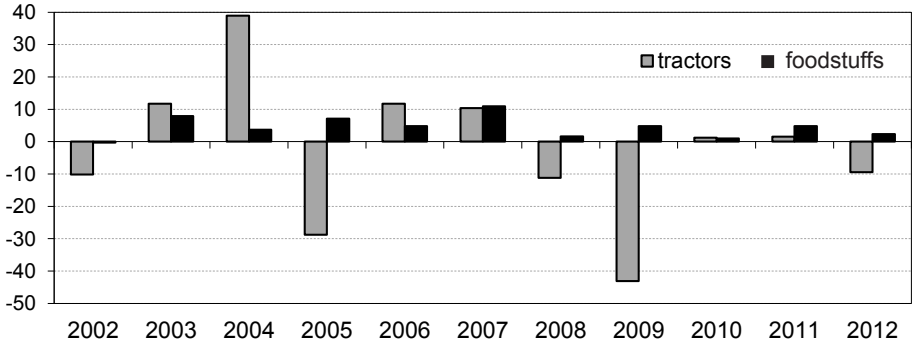

Figure 5. Annual changes in the production of tractors and foodstuffs products in Poland
Source: own simulations based on [*Produkcja wyrobów...* 2003-2012, Pawlak 2012].

The analysis of the entire process confirmed the accuracy of the Austrian School thesis. However in some years of the two growth years the rate of increase in the production was less than or close to the rate of change for foodstuffs articles. This was observed in 2007 and the entire growth phase of 2010-2011. Such a situation clearly corresponds to the changes in production of the analysed goods in the growth phase of 2002-2004. A rate of change in the production of tractors in Poland which is less than or close in Poland during those periods predominantly stems from an increasingly more difficult situation of the producers on the

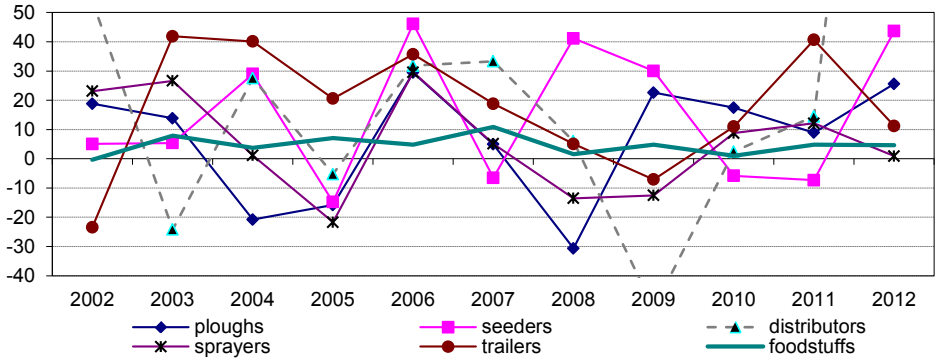

Figure 6. Annual production rates of agricultural machinery and foodstuffs products in Poland
Source: own simulations based on [*Produkcja wyrobów...* 2003-2012].

domestic tractor market. Polish companies were systematically losing their market share to imported tractors. Even in 2004 the share of tractors manufactured in Poland was circa 42%, whereas in 2010 just 12% [Pawlak 2012]. Thus in the periods of growth, in foreseeing the difficulties with sales businesses did not risk large increases in tractor production.

Apart from tractors the means of production industry also manufactures many other machines and devices used in agricultural production. Changes in the production of five agricultural machines was analysed: 1) ploughs, 2) field crop seeders, 3) mineral or chemical fertiliser distributors, 4) filed sprayers, and 5) agricultural trailers and semi-trailers. Figure 6 shows that the changes in the production of the analysed machines did not always run in the same direction. Also sometimes the directions of these changes did not comply with the directions characteristic for the phases of the business cycle development. However most changes and their dynamics were in accordance with the Austrian School theory pertaining to changes in time-structure of production phases. In the growth phases the production of most agricultural machinery was exhibiting strong growth, whereas during the downturn periods it decreased significantly.

The Austrian School theory states that an expansive monetary policy causes non uniform changes to production at particular stages in the production structure. It also recognises, but from time to time – and particularly with respect to specific goods and those with a small share in overall production – the relation in production changes as depicted by it may be disrupted by other factors, such as political changes in a country, changes in foreign trade or new agricultural production methods. An example are the rapid production increases in 2012 despite the fact that this was a year of deteriorating conditions for the entire economy. This is explained by increased demand by agricultural farms for machines and devices due to the Rural Area Development Programme which was coming to an end in 2013.

In analysing the production rates across the entire period under analysis it is evident that the changes in the production of agricultural machinery were decisively more dynamic than the changes in the production of foodstuffs articles (Tab. 1). This is primarily seen in the vales of the standard deviation and coefficient of variation. The largest standard deviation pertained to changes in the production of fertiliser distributors – 74.8 pp. Whereas the coefficient of variation reached its highest value for changes in the production of field crop sprayers – 311.8%.

Table 1. Statistical indicators describing production changes of machines in 2002-2012

Item	Average [%]	Standard deviation [pp]	Coefficient of variation [%]
Ploughs	6.8	20.3	300.0
Field seeders	15.1	23.2	153.6
Fertilizer distributors	29.7	74.8	251.9
Field crop sprayers	5.4	16.9	311.8
Agricultural trailers	17.7	21.2	120.0
Foodstuffs articles	4.6	3.2	69.6

Source: own simulations based on [*Produkcja wyrobów...* 2003-2012].

An example of a current means of production for agriculture, whose production changes will be analysed is the area of agricultural plant filed qualification area. The rate of change in the production of that good, which consists of the area of numerous plants, was large, but in most years was not in accordance with the business cycle phases (Fig. 7). Up to 2007 their area did not show even a single annual growth. Whereas in 2009 and 2012, or in years of worse economic situation an increase in the crops was observed. A comparison of the changes in the agricultural crops cultivation land area with changes in the production of foodstuffs does not confirm the Austrian School theory which says that changes to production at an earlier time-structure of production phases are more dynamic that changes to the production of goods which are closer to the consumer. In 2002-2012 the standard deviation for plant production (12.4 pp) was more than for foodstuffs products (3.2 pp). However this is not sufficient to consider that the Austrian School theory was not confirmed. The rate of change must also be confirmed by the directions of changes to production. Such changes in the crop area may be explained by: 1) the effect of farmer demand on qualified material; 2) in accordance with the views of the Austrian economists changes in the production of a good are also dependant on its durability. More durable goods will be used for a longer period of time and as such it will be possible to use them in more profitable possibilities for various production processes. Plants are not durable. They can only be sued once in agricultural production. Thus monetary expansion has a small effect on production changes.

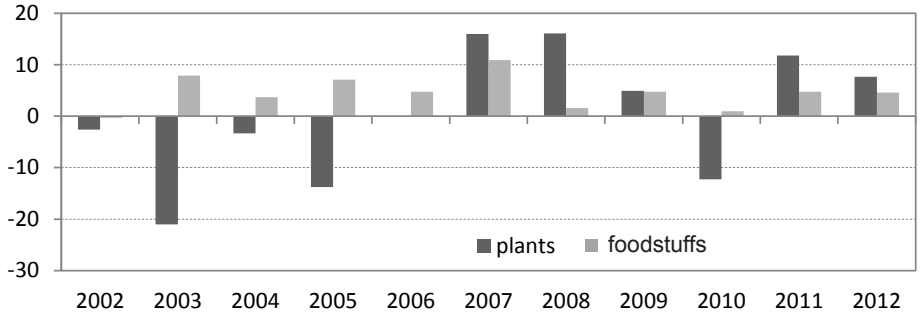

Figure 7. Annual changes in areas of qualified plants and production of foodstuffs articles in Poland [%]
Source: own simulations based on [*Rynek wyrobów...* 2013].

CONCLUSIONS

The Austrian School economists consider that the foundation for the understanding of cyclical production fluctuations is the time-structure of production theory. This means production stages ordered in accordance with the technical process of manufacture and sales of the consumption good. At each and every stage production can increase or decrease depending on the business cycle phase, the main cause of which is an expansive central bank policy. However the changes are not identical. Manufacturing production at stages far away from the end products should change more dynamically than that in stages closer to the goods designated for consumption.

The conducted analysis allowed for a positive, whereas not an unambiguous verification of the Austrian School hypothesis that the manufacture of means of production for agriculture changes at a faster rate than production of foodstuffs articles. In growth stages the agribusiness production structure was widened, whereas during the downturn stages it was narrowed (the initial stages of the structure). This is attested to by the majority of annual changes in constructing buildings and structures for agriculture, production of tractors and agricultural machinery such as fertiliser distributors, trailers and sprayers. However some of the observations were inconsistent with the hypothesis. In the 2003 - 2004 growth rate building manufacture was slower than the production of foodstuffs articles. The same changes applied to the rate of production of tractors in 2010 - 2011. Whereas in the analysed period most of the changes to the crop areas of qualified plants was not consistent with the Polish economy cycle phases. Such behaviour was affected by significant economic factors other than the monetary policy.

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Andrzej Jędruchniewicz

ZMIANY W WYTWARZANIU ŚRODKÓW PRODUKCJI DLA ROLNICTWA W ŚWIETLE TEORII SZKOŁY AUSTRIACKIEJ

Streszczenie

Celem opracowania jest weryfikacja hipotezy, że cykliczne zmiany w wytwarzaniu środków produkcji dla rolnictwa są bardziej dynamiczne niż zmiany produkcji artykułów spożywczych. Wynika ona z teorii szkoły austriackiej. W teoretycznej części opracowania omówiono teorię czasowej struktury produkcji i zastosowano ją do agrobiznesu. Natomiast w części empirycznej przeprowadzono badania kierunków i dynamiki zmian w wytwarzaniu wybranych środków produkcji dla rolnictwa oraz żywności w polskiej gospodarce. Wykazały one, że w okresie badawczym większość zmian produkcji analizowanych środków przeznaczonych dla rolnictwa potwierdziła hipotezę szkoły austriackiej. W tym czasie wystąpiły także zmiany, które nie były zgodne z postawioną hipotezą.

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DEVELOPMENT OF PRODUCTIVITY OF PIG FARMS IN GERMANY[1]

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Key words: Färe-Primont Index, pig farms, FADN
Słowa kluczowe: wskaźnik Färe-Primont, gospodarstwa trzodowe, FADN

A b s t r a c t. The development and change of productivity, as well as of its influencing factors, is of interest in economic research. In this paper we analyse the development of productivity in pig farms in Germany. Balanced farm panels are selected from the German Farm Accounting Data Network (FADN). As a productivity measure we use the Färe-Primont Index proposed by O'Donnell. Results shows a rather constant productivity level of pig fattening farms and decreasing productivity of farms specialized in piglet production. Due to cyclical pig prices the variation of productivity is rather high in pig farms. Significant scale effects are identified with highest TFP levels of large sized farms. The variation of income over time is much more pronounced than of productivity, which might partially be determined by the rather high aggregation of output and input variables used for the productivity calculations.

INTRODUCTION

The development and change of productivity, as well as its influencing factors, is of interest in economic research. Analysis can be undertaken at the global, sector or micro level. An assessment of productivity changes at the micro level is one of the activities of the OECD 'Network on Farm Level Analyses' for which the author will undertake TFP estimates for Germany. To explore our own experiences in this area, we used a free software package of CEPA[2] which allows the calculation of Total Factor Productivity (TFP) indices, i.e., Laspeyres, Paasche, Fischer, Lowe, Malmquist, Hicks-Moorsteen, and the Färe-Primont Index. However, the free-of charge version is limited to the calculation of the last mentioned tree indices. In this study we use this programme for productivity analysis for balanced samples of farms specialized in pig fattening or piglet production in Germany [Kleinhanss 2012b].

In addition to global productivity development, the question is how productivity is influenced by the huge variation of output and input prices. A further question is whether or not productivity estimates are similar with, for example, income indicators. Our methodology and data are briefly described in the following section. In a further step results of productivity estimates are discussed and finally compared with income indicators.

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[2] Centre of Efficiency and Productivity Analysis, School of Economics, University of Queensland, Australia.

METHODS AND DATA

The methods of estimation for productive indices can be categorized into parametric and non-parametric methods [Grilliches 1996]. 'The former involves econometric modelling of a production function and often uses regression techniques to estimate the relationships between total outputs and major types of inputs, … The residual of these regressions can be used as a measure of total factor productivity' [Zhao et al. 2012]. An example is the analysis of TFP between organic and conventional farms in Germany based on Stochastic Frontier Analysis [Tiedemann and Latacz-Lohmann 2011]. The so-called index methods – Laspeyres, Paasche, Fischer, Tornqvist – as well as Data Envelopment based Malmquist, Lowe, Hicks-Moorsteen and Färe-Primont indices – are non-parametric methods.

The Fischer Index is recommended by Zhao et al. [2012]. It is a combination of the square root of the product of the Laspeyres and Paasche Index. Diewert [1992] shows that the 'Fischer Index is exact for a quadratic cost function'… while the 'Tornqvist index is exact for a Translog cost function'. With regard to data requirements, a further advantage is that the Fischer index can work with missing or negative values and is therefore more appropriate for individual farm data. Analyses for US Agriculture based on the Fischer index were conducted by Ball et al. [2010].

Referring to the Lowe and Färe-Primont indices, O'Donnell [2012a] argues that they 'are economically-ideal in the sense that they satisfy all economically relevant axioms and tests from index number theory, including an identity axiom and a transitivity test. This means they can be used to make reliable multi-temporal (i.e., many period) and/or multi-lateral (i.e., many firm) comparisons of TFP and efficiency'. A further advantage of both indices is that prices for inputs and outputs are not required, and shadow prices derived from the Linear Programming solution are used instead. In particular input prices are often lacking at the farm level. An application of the Lowe index for US agriculture at State level was conducted by O'Donnell [2012b].

As the Lowe index can only be calculated with the professional version of DPIN, we focus on the Färe-Primont index, which can be calculated with the free-of charge version [O'Donnell 2011]. Although shadow prices cannot be listed by the free-of-charge version, they are internally calculated.

The Färe-Primont index proposed by O'Donnell [2012a] is composed of two indices developed by Färe and Primont [1995]:

$$TFP_{hs,it} = \frac{D_O(x_0, q_{it}, t_0)}{D_O(x_0, q_{hs}, t_0)} \frac{D_I(x_{hs}, q_0, t_0)}{D_I(x_{it}, q_0, t_0)}$$

The Färe-Primont index is calculated by referring to a reference farm i (to be determined) in the 1st period. To identify a reference farm we used the following procedure. In the 1st run we calculated TFP for all farms referring to farm i. Then we calculated the average TFP for the 1st period over all farms. Next we selected a new reference farm with a TFP closest to the average in period 1. In the 2nd run we used this farm as the reference farm (Ref); therefore TFP's of all other farms and periods are referring to Ref.

Farm data are taken from the German FADN (Farm Accountancy Network).[3] Balanced samples of farms were selected with non-missing data of each input and output used. For pig farms we selected two samples differentiated by farms specialised in fattening or piglet

[3] BMELV-Testbetriebe.

production, covering the economic years 2000_1 to 2010_11. The balanced panel of farms specialized in fattening includes 364 farms, those with piglets 195 farms. Results were stratified with regard to average pig livestock units (LU) over the whole period: <50; 50-100; 100-150 and >150. For the model we used the following set of aggregated variables;

– outputs: pigs (€), other returns including subsidies (€),
– inputs: variable costs of livestock production (€), variable costs of crop production (€), other variable costs (€, excl. land rentals and hired labour costs), land (UAA ha), labour (AWU).

PRODUCTIVITY CHANGE IN PIG FARMS

In this chapter we show first the results for one farm taken as an example. Then we describe changes of productivity for groups of individual farms as well as the variation by farm size.

TFP is calculated at farm level. As an example of the different outcomes of the model run we show changes of TFP and of partial indices for a farm taken as reference in the sample of pig fattening farms. Figure 1 shows the development (change) of productivity (dTFP) over the 11 year period, taking 2000_1[4] as reference. TFP increased in 2001_2, 2006_7 and 2010_11 while it was below 1 in the remaining years. It is the result of changes in output (dQ) referring to changes in inputs (dX). The highest level was reached in 2006_7. TFP shows a rather cyclical development which is partially influenced by pig-price cycles.

Besides TFP, the model also calculates other indicators, of which only changes in technical efficiency (dTech), changes in output-oriented technical efficiency (dOTE) and changes in output-oriented scale mix efficiency (dOSME) are shown. dOTE is close to 1 or greater than 1 indicating a small positive output-oriented efficiency change. While change of technical efficiency (dTech) was less than 1 in 7 years, it significantly increased in the last year.

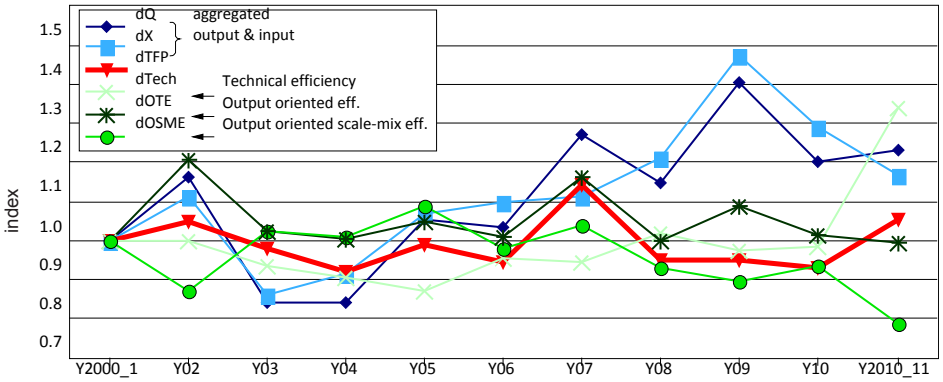

Figure 1. Development and decomposition of productivity – example of one dairy farm
Source: own study based on *BMELV Testbetriebe.*

[4] German FADN data are referring to economic years from July to June. In figures we use the following abbreviation, i.e. Y2000_1, where y: year; 2000: the 2nd half-year of 2000; _1: the 1st half-year of 2001 (or Y02: 1st half-year of 2002. .

TFP BY SPECIALISATION OF FARMS

In the following, TFP results are differentiated between farms specialized in pig fattening or piglet production. Figure 2 shows the development and variation of TFP in farms specialised in pig fattening. The box plot shows the Median and variation (50% of farms between 1st and 3rd Quantile), as well as minimum and maximum TFP's and so called outliers.[5] In the first year, 50% of farms reached TFP levels between 0.94 and 1.07. TFP levels decreased in the following three years and then increased to almost 1.0 on average in 2004_5, 2007_8 and 2010_11. In the interim years, TFP was around 0.95. Referring to the beginning and ending year, there is almost no increase of TFP. The spread of TFP for 50% of farms (box) is almost the same over the years. However, there is large variation from about 0.75 to 1.3 indicated by the vertical bars. Also, many individual coefficients are shown, indicating high TFP's in the upper part and low TFPs in the lower part of the figure. Some farms stay in the same category, i.e., ID=272 with very low TFP and ID=289 with a high TFP.

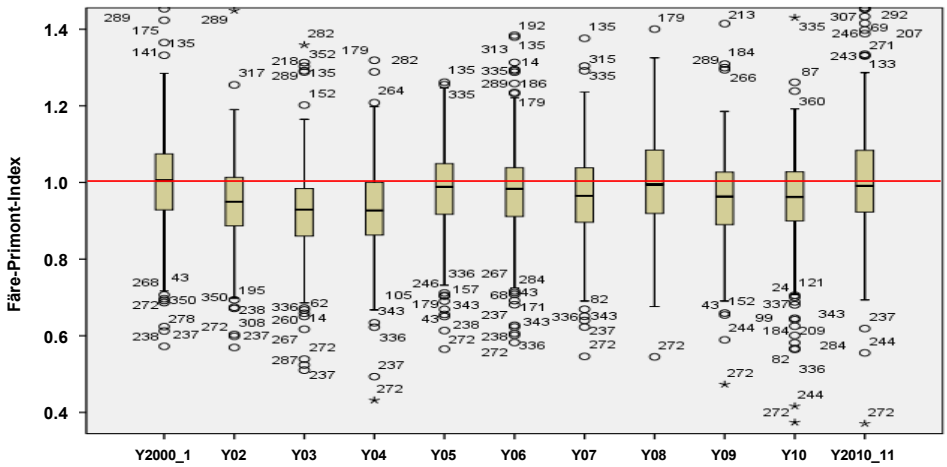

Figure 2. Development and variation of TFP of farms with pig fattening
Source: own study based on *BMELV Testbetriebe,*

TFP of farms specialised in piglet production is shown in Figure 3, indicating a cyclic development of TFP. It reached its highest level in 2000_1, and then decreased to 0.83 in 2002_3 to 2003_4. It increased again to 0.95 in 2004_5, decreased until 2006_7 and fell to the lowest level in 2007_8. Beside the pig price cycle, high price of feed induced this low level of TFP. In 2008_9 TFP increased again to 0.95 and dropped to 0.9 until 2010_11. Therefore TFP decreased 1% annually. Variation of TFP was about 0.2 for 50% of farms; it was rather stable over time. The variation between min and max TFP values was rather high and shows a cyclical development as well. It can be concluded, that the development of TFP in piglet production is more cyclic than in pig fattening with average levels of only 0.8 in 2003_4 and 2007_8.

[5] Minimum and maximum values are defined by 1.5 times of the distance of the box (representing 50% of observations. Outliers are defined by the distance between 1.5 to 3 times of the distance of the box; greater than 3 times of the distance of the box are defined as extreme values.

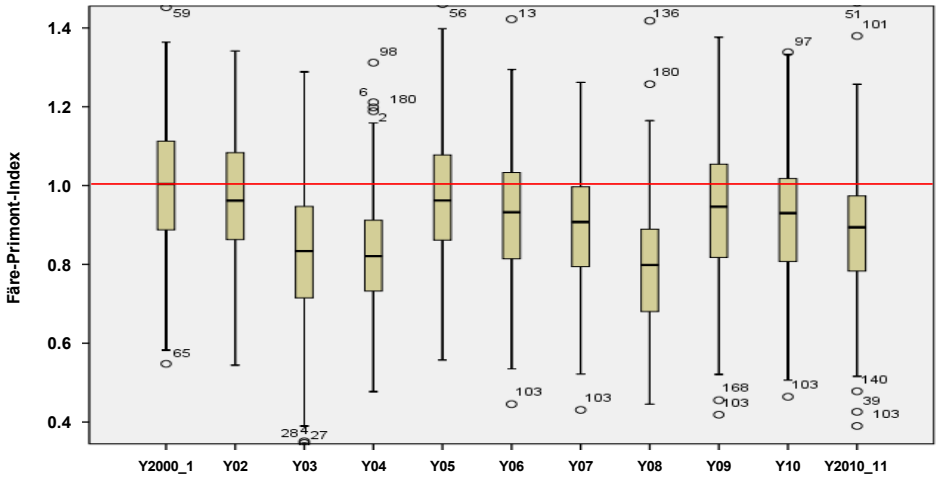

Figure 3. Development and variation of TFP of farms with piglet production
Source: own study based on *BMELV Testbetriebe.*

TFP BY SPECIALISATION AND FARM SIZE

Figure 4 shows average TFP's for both samples as well as by size classes, expressed in pig livestock units (LU). Average TFP of fattening farms is rather constant; it is close to 1 in the beginning, middle and end of the underlying period. It decreased to 0.92 in 2002_3 and the succeeding year and to 0.95 in 2008_9 and 2009_10. Small farms show TFP levels between 0.8 and 0.9. Farms of size class 50 to 100 LU show TFP levels of about 0.05 less than average. TFP for farms with 100 to 150 LU is close to average, while TFP of the largest farms is about 0.03 higher.

Farms specialized in piglet production show a larger variation of TFP by farm size. Small farms show low TFP levels of about 0.85 at the beginning, 0.75 in 2002_3 and 2007_8 and of around 0.8 in the remaining years. The TFP of size class 50-100 LU is slightly below average and those of size class 100-150 LU 0.05 above average. The group of largest farms show a TFP of 1.12 at the beginning and of about 1.05 in 4 other years. It dropped to about 0.85 in 2002_3 and 2007_8. It is worth mentioning that the spread of TFP between large and small farms became rather small at the bottom of a cycle while it broadened to 0.3 under favourable economic conditions.

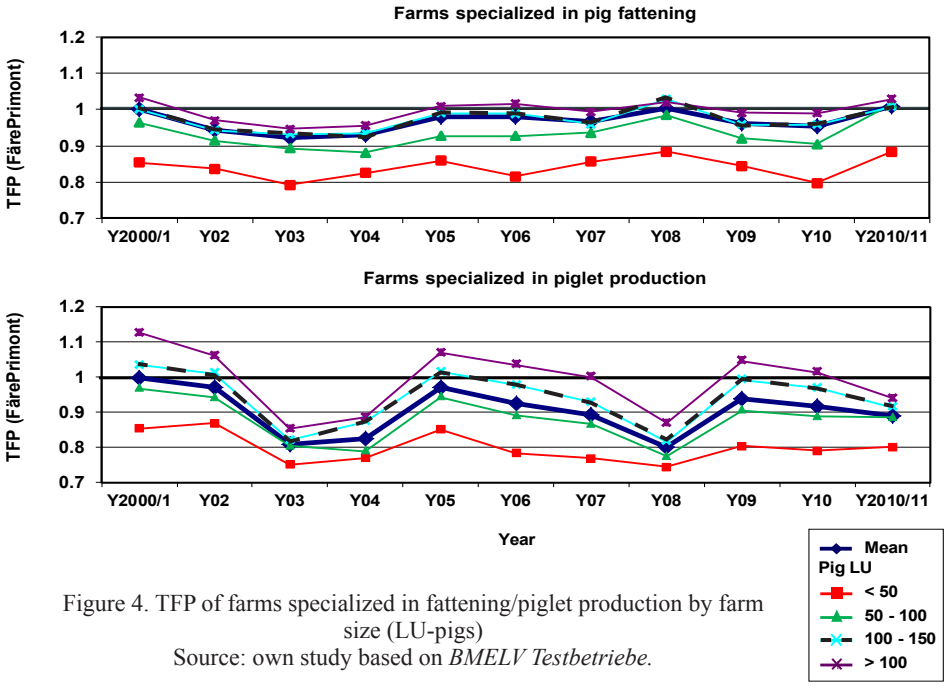

Figure 4. TFP of farms specialized in fattening/piglet production by farm size (LU-pigs)
Source: own study based on *BMELV Testbetriebe.*

COMPARING THE DEVELOPMENT OF TFP AND INCOME

In the following we compare the development of TFP with income. Family Farm Income (FFI) expressed in € per farm is used as the income indicator. Both indicators are expressed in relation to 2000_1 and no differentiation is made by farm size.

The development of average TFP for pig fattening farms (Fig. 5) looks rather stable; even under worse economic conditions the TFP index is only 5% lower. Variation of income is more pronounced; it was 45% less in 2002_3 and 25% less in 2009_10. The TFP of specialized piglet farms shows a higher periodic variation and a decreasing trend of TFP. Compared to this, the income variation is extremely high; it reached only 35% in 2003_4 and less than 20% in 2007_8 compared to the first year. After recovering in 2008_9 it halved again in 2010_11.

Based on these results it can be concluded that TFP estimates show much lower variation than the development of income. One reason is that TFP estimates are based on a rather aggregated set of output and input variables and not all variables influencing income are included in the TFP estimates.

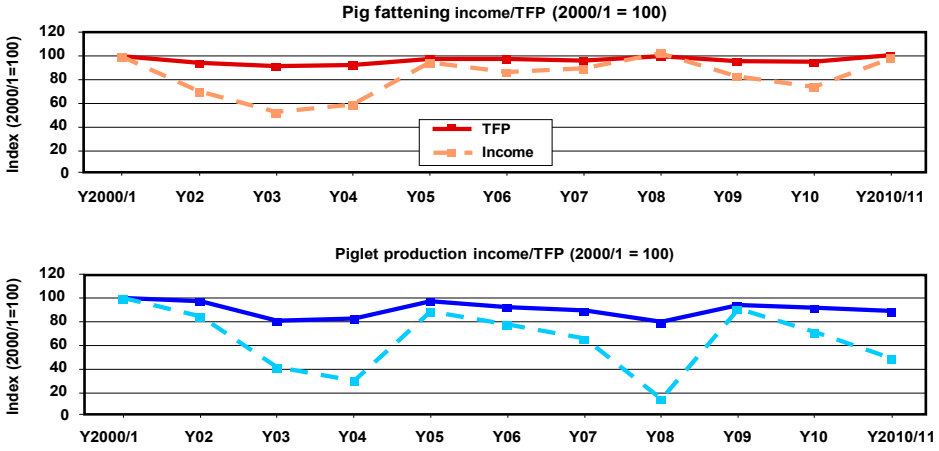

Figure 5. Comparing the development of TFP and income (FFI) of pig farms
Source: own study based on *BMELV Testbetriebe.*

CONCLUSIONS

This paper is a first attempt at analysing the development of TFP at the micro level. Balanced samples of farms specialized in pig fattening or piglet production drawn from the German Farm Accountancy Data Network were used. For the TFP calculations we used a free of charge program estimating the Färe-Primont index. It has the advantage that the prices of physical factors are internally derived from shadow prices of the Linear Programming model.

TFP is rather stable for farms specialized in pig fattening; it shows a higher variation and decrease of 1% per year in piglet production. The variation of income is much higher than of TFP. Under worst economic conditions it dropped by 40% below average in the year 2002-2003) in pig fattening. Income variation is extremely high in piglet production with around 80% lower incomes in two periods. In the year 2007_8 income fell by 80% while in pig fattening incomes increased slightly to the long term trend. This situation is influenced by changes in the market power of fattening farms against piglet producers: rising feed costs were entirely compensated by lower piglet prices. The work undertaken so far will be completed by estimates of the Fischer index.

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Werner Kleinhanss

ROZWÓJ PRODUKCYJNOŚCI GOSPODARSTW TRZODOWYCH W NIEMCZECH

Streszczenie

W opracowaniu przedstawiono zmiany produkcyjności w gospodarstwach trzodowych w Niemczech. Zbilansowany panel gospodarstw wybrano z niemieckiego FADN. Do pomiaru produkcyjności użyto wskaźnika zaproponowanego przez O'Donnella (Färe-Primont Index). Wyniki badań wskazują na dość stabilny poziom produkcyjności gospodarstw z tuczem trzody chlewnej i malejący poziom wydajności gospodarstw, które specjalizowały się w produkcji prosiąt. Z powodu cykliczności zmian cen trzody chlewnej występowało dosyć wysokie zróżnicowanie produkcyjności. Najwyższe poziomy omawianego wskaźnika uzyskiwały gospodarstwa wielkoobszarowe, w których ujawniały się efekty skali. Zróżnicowanie dochodu w czasie było o wiele większe od produkcyjności, co może częściowo wynikać z dosyć dużego stopnia zagregowania danych użytych do kalkulacji.

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CULTIVATION CONTRACT AS A FACTOR TO IMPROVE THE ORGANIZATION OF THE FOOD PROCESSING PLANT – LEGAL AND ECONOMIC ASPECTS

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Key words: cultivation contract, processing industry, vertical integration
Słowa kluczowe: umowa kontraktacji, przemysł przetwórczy, integracja pionowa

A b s t r a c t. This aim of this article is to determine the importance of the cultivation contract as a way to provide the raw materials for food processing plant directly related to the improvement of production and business operations. The material for investigation originated from the survey conducted among of 105 entities and from the charts of legal basis. The survey covered four groups of producers and the analysis depended on the duration and implementation of the cultivation contracts (within three years, such as: 1987, 2000, 2009) and the lack of its conclusion. The authors observed some important dependences among such factors as: the size of the farm, the labour forces, capital resources and farm's amenities. The conducted research has indicated the significant role of the cultivation agreement in both economic and legal terms, although some lack of economic trust appears among several farmers.

INTRODUCTION

In the era of liberalisation, globalisation and development of the farm and food industry it is crucial to maintain continuity of production. It is not possible without proper organisation of the company, including securing the resource base. Stability and continuity of the supply is a very important link in the food chain, which connects farming, processing and distribution. Their appropriate relationship has a significant impact on the level of economic prosperity, social and environmental situation of consumers [Czyżewski 2001, p. 17].

As Motowidlak [2009, p. 132] noted, business organisation requires, inter alia, centralisation of agricultural production, which is characterised by a high dispersion and diverse quality of agricultural products. It is therefore important to closely connect agricultural holdings with food processing plants. In this case vertical integration is of prime importance. Its main aim is to properly regulate the level and structure of agricultural production, which will facilitate the implementation of technological and biological advances.

The effectiveness of this implementation is related, inter alia, to a relevant contractual relation between the main participants of the agricultural market – agricultural producers and food processing plant. The type of contract, which is one of the instruments of vertical integration and at the same time also refers to the production activities in agriculture, is the cultivation contract. Under cultivation contracts there are certain relationships between the parties. They are extremely important for the increase of their competitiveness. Integration through cultivation contracts secures the resource base; moreover, it allows rationalising the use of factors of production, contributing in some cases to reduce the transaction costs.

Polish membership in the European Union and the adopted acquis communautaire has a significant impact on the transformation taking place in companies in the farm and food industry, since the compliance with the EU standards requires above all an efficient organisation of the activities of a company, which is also a guarantor of continuous improvement of quality and productivity. In the European Union legislature particular attention is paid to the process of properly developed raw material supply. It affects the organisation of production and the quality of delivered products. In this case, properly formulated cultivation contracts are treated as one of its elements.

The purpose of the article is, therefore, to determine the importance of the cultivation contract as a way to provide starting material for food processing, directly related to the improvement of production organisation and company activities. Cultivation contracts from a legal perspective can also be regarded as agro-industrial contracts, which constitute an important element in the supply chain. Therefore, it was also decided to show the benefits of entering into them by the processing plant and farmer.

MATERIALS AND METHODS

The analyses carried out in the article were conducted on the basis of both primary and secondary material. Economic analyses were based on primary data collected through direct interviews using a questionnaire survey among fruit and vegetable producers in the area of Środa Wielkopolska. Due to the Law on the Protection of Personal Data, as well as the obligation to comply with the obligation of confidentiality, in particular Art. 11 of the Act on Combating Unfair Competition of 16th April 1993 [Dz.U. z 2003 r., nr 153, poz. 1503, as amended] the food processing plant name with which farmers signed cultivation contracts has been changed. In order to determine the cultivation contract as a way to provide the starting material for processing, in the calculations a number of methods included in the descriptive statistics were used. In addition, the primary method used in this study was the descriptive method and dogmatic analysis of normative texts.

JUSTIFICATION OF ENTERING INTO CONTRACTUAL RELATIONS IN THE ECONOMY ON THE EXAMPLE OF CULTIVATION CONTRACTS

Agriculture, including food processing in particular, is a very specific and complex sector of economy. Companies in this sector base their business operations on relatively advanced internal management, while entering into contracts with external entities. Their development is determined by many factors, among which undoubtedly important are transaction costs, which affect the economic viability of the business.

Contracts play an important role not only in the current activities of a company, but also strategically, playing an important role in coordinating and ensuring safety of economic activities in circumstances where social norms which satisfactorily guarantee the realisation of commitments of the parties fail. Cultivation contracts in this case should be regarded as a form of complete contract, which means it is a contract already signed, the parties of which enter into its implementation on agreed conditions, and they pursue their own preferences to a limited extent, then they isolate themselves from each other [Stankiewicz 2012, p. 105].

At the same time the contract necessitates coordination of such elements as time and the dynamics of contracting processes. According to Stankiewicz [2012, p. 105], at the heart of the process of complete contract are commitment and renegotiation. It cannot be only regarded as an obligation, which has a legal format, and its aim is to produce a particular good. Nowadays, it is a complex process, which is divided into several stages (Fig. 1). It should not be forgotten that in a model approach, a food processing plant operates in the market understood as a place of comparation of supply and demand, which, in turn,

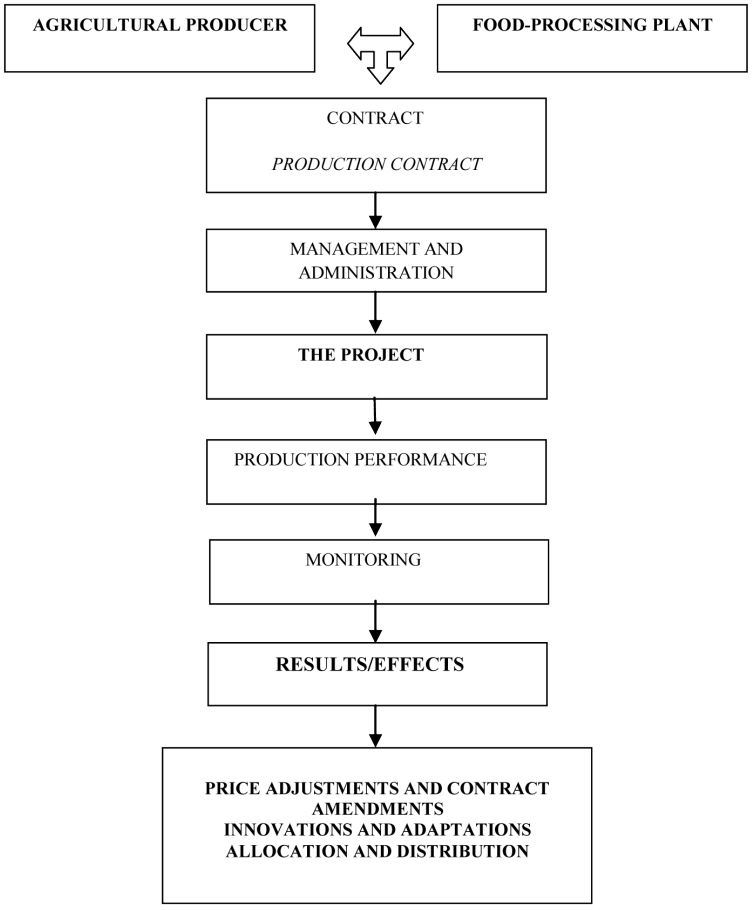

Figure 1. A contract farming framework based on agricultural production contract
Source: self-studies on the basis of [Eaton and Shepherd 2001].

leads to price fixing to ensure market balance. However, apart from these two market factors, market changes are affected by legal regulations, or implemented by the EU rules for operation and organisation of trade, implemented monetary policy guidelines, etc.

According to the basic trends of the new institutional economics, the analysis of processing plant functioning should be expanded to include the so-called transaction cost theory [Stankiewicz 2012, p. 99]. In the neoclassical approach the transaction costs complete the analysis. According to Coase, the presence of transaction costs explains the existence of the company as an organisational and contractual structure allowing reduction of transaction costs (fulfilling the contract) [Łobejko 2011, p. 110].

Williamson [1998, p. 30] distinguishes two types of transaction costs: ex post and ex ante. The first category includes the cost of designing, negotiating and securing contracts, which concern preparation and negotiation of contracts. Their size in the analysed case depends on the type of goods – that is raw materials for processing, which, under the contract are to be produced. The ex-post costs include: 1) failure costs, 2) cost of renegotiation, 3) establishment costs and running costs associated with governance structures to which the dispute shall be submitted, and 4) storage costs securing complying with the obligations. In Figure 1 they occupy the last position, and they are associated with the necessity to create a management structure and operate it in relation to the maladjustment and the need to renegotiate or monitor the process.

As part of the transaction costs there are distinguished search costs and 'contracting' and co-ordination costs. The first of these arise as a consequence of actions taken by the company (in this case the food processing plant) to find partners – agricultural producers. They also include the cost of verification (evaluation) of the reliability of potential parties. The next stage is the selection of partner(s) and the conclusion of agreement on cooperation. At this stage of the food processing's activities there are 'contracting' costs covering all business expenses incurred in connection with the conclusion of the final agreement. In the case under examination these include fees of lawyers, costs and time spent on the analysis of tenders and negotiations and as well as the production costs. In the case of long-term cooperation based on recurring contracts, which are usually cultivation contracts, these costs are reduced since part of the activities related to the conclusion of the contract (e.g. analysis of tenders) does not have to be borne. The last group of costs, that is the costs of coordination, include all costs incurred in connection with the cooperation of a business with third parties. At this place the cost of supply chain management and the costs associated with the enforcement of concluded contracts and the fulfilment of the obligations contained therein should be mentioned [Gruszecki 2002, p. 254-255].

Making a correct analysis of the discussed costs is a tool influencing the form of organising a business. In practice, as pointed by Łobejko [2011, p. 112], the food processing plant wishing to develop, to increase its competitiveness, to achieve greater profits, begins to search for innovative forms, including modifying the content of contracts. Therefore, the above mentioned organisational forms should also be analysed through the prism of competitiveness. At this place again a special role play certain contractual relations of cultivation contracts, including the need of both of the parties to compete – the agricultural producer and the food processing plant. Moreover, together with transaction costs there are considered in the analysis of the contract: the type of conditions prevailing in the market, the economic and legal form, ownership, type and size of transaction costs [Łobejko 2011, p. 113].

LEGAL CONSTRUCTION OF THE CULTIVATION CONTRACT

The cultivation contract is one of the agreements which shape the process of obtaining raw materials for the food industry. It influences the stage of production of agricultural raw materials for further processing and, therefore, the agreement is often referred to in the literature as a production contract or agro-industrial agreement [Domenech 2010, p. 33, Janarrelli 2011, p. 422].

The cultivation contract was introduced to the Civil Code as a separate nominate contract (Articles 613-626 of the Civil Code). However, it contains only a model of trade in agricultural products, which is based on a relative autonomy of the parties. In accordance with Art. 613 of the Civil Code, the agricultural producer agrees to produce and deliver to the contracting party the exact quantity of certain types of agricultural products, and the contracting party agrees to collect these products on the agreed time, pay the contractual price and meet certain additional obligations if the contract or special provisions provide for the obligations to comply with. These obligations might include, inter alia, providing the producer with the possibility to acquire certain means of production and receive financial aid, agronomic and livestock assistance, cash bonuses and bonuses in kind (Art. 615 CC). It can easily be seen in the cited article that this agreement includes cooperation of both parties, namely an agricultural producer, who can also be a group of agricultural producers, and the contracting party, for example, a food processing plant [Radwanski 2012, p. 8].

The cultivation contract is considered a subtype of the contract of sale, although, apart from the transfer of ownership of the product, it also covers production cycle [Szostak 2012, p. 68]. In the course of it, the contracting party may impose on the farmer an obligation to use certain means of production, rearing method or cultivation of plants. Moreover, it is entitled to perform supervision and control over the implementation of the contract. The producer must allow the contracting party (or an authorised person) to enter the area of agricultural land for the inspection purpose, measurement, soil samples analysis, etc. He or she is also bound by instructions and directions of the contracting party.

The element which connects the cultivation contract with sale is the responsibility of the manufacturer towards the contracting party under the warranty for physical and legal defects of the object of the contract. However, the defects must be relevant, namely, preventing the use of the product for the specified in the contract purpose (e.g. sugar beet with very low sugar content).

The cultivation contract is concluded in very special circumstances which exist in agriculture, since it is more than other areas of business prone to various risks. Therefore, the contracting party may oblige the producer to use certain instruments, limiting its occurrence. For example, the contract may require insuring the production as a whole or its individual stages.

In the event of breach of the cultivation contract or its improper performance, the agricultural producer is liable on general principles contained in Art. 471 of the Civil Code. This occurs when the blame may be assigned to the producer or the persons with the help of which he or she exercised the contract. However, he or she is not responsible for any failure to perform or improper performance of the obligation in the case when he or she notified the contracting party within a specified time about being unable to deliver the object of the contract. Obviously, it is important that the circumstances which prohibit producing and delivering the product were not the result of the actions of the producer.

There are also situations in which neither party is liable for the breach of contract (such as drought, flood, etc.). In such case, the producer is obliged to return the previously received down-payment and bank loans.

It should be noted that the provisions of the agreement in question involve basic core principles and rules which were to facilitate and harmonise the application of different norms relating to it, but placed in many different acts. For many years, the cultivation contract was concluded on the basis of a specific pattern. Only when Poland was preparing to join the Common Agricultural Policy and the gradual implemented the acquis communautaire, the cultivation contract was subjected to 'some' influence of the EU legislation in the area of formation and operation of certain agricultural markets. An example may be the sugar or milk market. Accordingly, Regulation No 261/2012 provides for the possibility of imposing by the Member States the responsibility to conclude the contract under national mechanisms affecting the milk market under the implemented so-called 'Milk package' [OJ L 94, 30.3.2012, p. 38-48]. As noted by the European Union legislature, cultivation contracting can help to reinforce the responsibility of economic operators in the dairy chain and raise the awareness of the need of greater sensitivity to signals coming from the market, improving price transmission and adapting supply to demand, as well as helping to avoid certain unfair trade practices. Due to the fact that there is no EU legislation on such contracts, the Member States may decide to introduce a duty to use it within their systems of law of obligations and contracts, provided that this is done in compliance with the EU regulations, and in particular with the proper functioning of the internal market. However, all of these basic conditions should be negotiated on the principle of freedom of contracts [Regulation No 261/2012, paragraphs 9-10].

CULTIVATION CONTRACTS AS A MEANS OF OBTAINING RAW MATERIALS FOR FURTHER PROCESSING

This research was carried out in one of food processing plants in Greater Poland which acquires agricultural raw materials from local producers of fruit and vegetables. Among these a survey was conducted. It took a total of 105 entities, of which 23 were selected for further research[1]. There were four groups of producers analysed depending on the duration vand implementation of the contracts (year 1987, 2000, 2009) and the lack of its conclusion.

When analysing the research material there were some dependencies noted. First, the area under agricultural producers who entered into an agreement in 1987 and 2000 was enlarged compared to those who entered into a contract only in 2009 or they were not a party to it. At the same time the greatest diversity of the area was observed in the group of entities not signing the agreement. Thus it can be concluded that a long-term performance of the agreement contributes to the concentration of agricultural land under cultivation of fruit and vegetables and rationalisation of production.

Moreover, in the group of agricultural producers who signed cultivation contracts only in 2009 or did not sign it at all, labour force per 1 ha was significantly higher than in the case of producers bound by earlier contracts.

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[1] For the research was used primary data contained in the thesis of P. Tomczyk: *The meaning of cultivation contracts in improving the efficiency of production in horticulture*, Poznan UP, 2012. The author has consented to the use of research results.

It was also noted that in relation to the labour force it can be noticed that the greatest diversity of employees on a contract of employment was observed in the case of cultivation contracts carried out since 1987. In the other groups, the standard deviation was minimal. The situation was different in the case of seasonal workers. The largest standard deviation – at the level of 11.9 – was in the non-contracting producer group. This demonstrates a high diversity of employment. The highest number of employed farm owners and their family members was observed in the contracting group after 1987. In their case, the standard deviation reached the value of 7.78.

With regard to the capital expressed in machinery, equipment, the value per 1 ha and per one unit was the largest among entities not being a party to the contract. Thus, it can be concluded that the level of modernisation of farms is in favour of manufacturers producing outside contracting. The situation is much different in terms of the value of buildings and constructions. Here there is a significant advantage to the contracting agricultural holdings since 1987.

Looking through the prism of the capital resources of farms with a division into the number of machines, their market value and the market value of buildings and constructions, it appears that the largest number of machines occurred in the contracting group since 2000 and amounts to 20 units. A similar situation is for the value of their buildings. The study also included additional indicators which are used to determine the role of contracting in the effects of production, namely, the analysis of total costs and revenues. A clear advantage of the revenue occurred in the case of entities which did not enter into the agreement. However, in the 1987 and 2000 groups the increase was small, and in the third group (contracting concluded in 2009) there was a drop in revenue noted. In addition, in the non-contracting group there was a clear cost advantage over the other groups. A clear decrease in costs occurred in the group of entities which entered into agreements in 2000 and among non-contracting entities.

Analysing the effectiveness for various production factors among the entities which signed the agreement and produced outside it in 2010-2011, it should be noted that in the case of land efficiency[2] there can be noted a clear advantage among the producers who did not enter into contracts; however, in the case of work efficiency – it was larger in the same group[3]. Moreover, the capital efficiency ratio during the period in question is twice as high in the non-contracting group. In the contracting group for 1 PLN equity capital was 90 groszys (2010) and 89 groszys (2011). The capital efficiency ratio among the non-contracting entities was 1.90 PLN.

CONCLUSIONS

It can be noticed that cultivation contract concluded between the agricultural producer and food processing plant allows for better planning, organising and controlling the flow of raw materials. Definitely on its 'design' depends the efficiency and effectiveness of actions taken by the food processor. However, it cannot be unequivocally stated that in the considered case contracting has a significant role in the production process in economic terms. However, agricultural producers have guaranteed collection of agricultural materials according to a set schedule and they receive a fixed price. It allows at the time of concluding the contract to estimate their income.

[2] Land efficiency ratio = average revenue/land resources.
[3] Labour efficiency ratio = average revenue/labour force.

Proper balance between the elements of the contract must be made with a particular emphasis on the present on the market advantage of supply over demand. Therefore, it should be remembered that in the supply chain this fact places consumers of agricultural products in a privileged position. They have some influence on the decisions taken by the contracting parties. At the same time the weakest link in the chain is the agricultural producer, who needs special protection. This is more and more often expressed in normative acts, as exemplified by the Regulation No. 261/2012 regarding the possibility for Member States to decide on the obligation to conclude cultivation contracts and the milk market.

The research has shown no direct links between the cultivation contracts and production efficiency in examined farms. However, seeing it from the angle of the means of production, long-term performance of the agreement influenced on land enclosure and rise in labour's involvement of the farms' owners and their families. Among the others – the farms without concluded contracts – there was huge diversity of land area, increased labour forces per 1 ha and high level of mechanization and modernization. The work and land efficiency factors reached the highest amounts.

The structure of the conducted contract goes far beyond the framework set out in the Civil Code, since it must be kept adjusted to the objectives of the organisation and functioning of the food processing plant and market's needs. At the same time it should be recognized as an instrument which secures the acquisition of raw materials for further processing. Besides due to its proper structure, it becomes a way to help reduce the risk of agricultural production.

Existing under the cultivation contract certain relations between the parties are extremely important for the increase of both their competitiveness and durability of cooperation. This agreement allows rationalising the use of production factors, including reducing the cost of production. However, from the point of view of the contracting party, a food processing plant, except the quality its timely execution is of prime importance.

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KONTRAKTACJA JAKO ELEMENT POPRAWY ORGANIZACJI PRZEDSIĘBIORSTWA PRZETWÓRCZEGO – ASPEKTY PRAWNE I EKONOMICZNE

Streszczenie

Określono znaczenie umowy kontraktacji jako jednego ze sposobów dostarczania materiału wyjściowego do przetwórstwa, związanego bezpośrednio z poprawą organizacji produkcji i działalności przedsiębiorstwa. Dane do badań zebrano na podstawie ankiety przeprowadzonej wśród 105 podmiotów. Analizowano cztery grupy producentów w zależności od czasu trwania i wykonywania kontraktacji (lata 1987, 2000, 2009) oraz braku jej zawarcia. Stwierdzono zależności pomiędzy zawarciem kontraktu a wielkością gospodarstwa rolnego, zasobami siły roboczej, modernizacją gospodarstw i ich wyposażeniem. Przeprowadzone badania wskazują na doniosłą rolę i znaczenie tej umowy zarówno w ujęciu ekonomicznym, jak i prawnym. Jednakże zauważono także u niektórych producentów rolnych brak zaufania co do skuteczności kontraktacji.

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THE AGRICULTURAL COMPANIES AND THEIR VALUE SPREAD WITHIN THE VISEGRAD GROUP[1]

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Key words: agricultural company, costs of equity, net income, returns on equity, value spread
Słowa kluczowe: przedsiębiorstwo rolnicze, koszt kapitału własnego, dochód netto, stopa zwrotu z kapitału własnego, wartość spread

A b s t r a c t. This paper provides unique comparisons of agricultural companies from the Visegrad Group countries using the value spread indicator. Companies in these countries have similar geographical conditions and they experienced relatively similar historical development. Nevertheless, the agricultural sector in each of these countries is different to some extent. The value spread indicator provides information about whether the costs of a company's equity are covered by the returns on that equity. Moreover, this indicator serves as a verifier of the income valuation framework. The aim of this paper is to explore the value spread of agricultural companies in the countries of the Visegrad group both from country and primary activity perspectives. This paper finds that only a part of the companies sampled is able to create the income value and cover its costs from the returns on equity. Based on empirical tests, it was shown that there is a slightly positive dependence between the value spread and the country of origin of the agricultural company and between the value spread and the primary agricultural activity. Poland is the country with the majority of companies with a positive value spread and the most successful parts of agriculture are support and non-traditional activities.

INTRODUCTION

A large body of literature explores the magnitude of company valuation by various methods based on the net present value principle [Damodaran 2007, Koller et al. 2010, Plenborg 2002]. Despite the broad use of income valuation methods, their applicability is closely connected with the company's future perspective, the so-called going concern principle. If it cannot be assumed that a company will remain viable and active in the future, the income valuation methods are not applicable. The overall process of company valuation via the income valuation methods is rather complex and extensive including various sub-calculations. Therefore, it might be useful

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to know in advance, whether the income method requirements are met and thus the method is applicable for a specific company (valuation object). These requirements are:
– the going concern principle, as mentioned above,
– the continuous competitiveness of a company,
– the growth potential of the industry and
– the ability of a company to meet its liabilities in due time [Mařík 2007].

The going concern principle is met if a positive cash flow can be expected in the long term. There is the possibility to examine the fulfilment of some of these requirements via the so-called value spread [Cassia, Vismara 2009, Mařík 2007]. The value spread is the difference between return on equity and costs of equity and serves as a basis for an economic value added (EVA) calculation, or in other words for economic-profit-based valuation models [Dluhošová 2004, Koller et al. 2010]:

$$EVA = (ROE - r_e)E \tag{1}$$

where EVA is the economic value added, ROE is the return on equity, r_e is the costs of equity and E is the equity. Besides, the value spread can be also found within the model of residual income (RI) valuation, also known as the Edwards-Bell-Ohlson (EBO) model. The empirical usefulness of the residual income valuation model (RIVM) was discovered for example by Lee et al. [1999, cited in Mishra, O'Brien 2005[, or by Skogsvik [2002], Bild et al. [2002], Landsman et al. [2006], Stubelj et al. [2009], and Elsner et al. [2012], however, Plenborg [2002] expresses the RI approach in terms of financial ratios, as:

$$P_0 = BV_0 + \sum_{t-1}^{\infty} \frac{(ROE_t - r_e)\, BV_{t-1}}{(1 - r_e)^t} \tag{2}$$

where P is the firm value, BV the book value of equity, ROE the return on equity, and r_e the cost of capital (equity holder). The RI is defined as the difference between ROE and r_e, known as the value spread, multiplied by the BV [Plenborg 2002].

Therefore, the value spread is not only a direct verification tool for the applicability of the income valuation methods (both EVA and RI), but also a preliminary indicator of the economic performance of the company. Any value creation in a company is closely related to the relation between the rates of return obtained (ROE) and expected (r_e) [Mařík 2007].

In comparison with the individual profitability ratios, which do not measure the company's success nor reflect the factor of risk, the ROE indicator when compared to the opportunity costs, it provides information about a company's overall financial situation. The success or failure can be easily identified based on the size of the value spread: by how many per cent is the return on equity higher/lower than the costs of equity. In order to provide the information in monetary units, the difference can be multiplied by the equity. The multiplication of the value spread by the shareholders' equity represents the economic profit generated within the year by the company [Neumaierová 2005]. The limitation of this spread lies in its historical nature, since it measures only historical parameters and cannot provide a predictive perspective.

This paper sets out an investigation of whether or not agricultural companies from member countries of the Visegrad group (V4) create value using the value spread between company's return of equity and costs of equity. Finally, the independences of the value spread and country of origin of the agricultural company and between the value spread and

the primary activity are verified via the Chi-square test of independence, and if dependence is detected, the Cramer's V coefficient is then employed. The following hypotheses are tested:

H_1: Creating value according to the value spread indicator does not depend on the **country of origin** of the agricultural company within the observed sample.

H_2: Creating value according to the value spread indicator does not depend on the **primary activity** of the agricultural company within the observed sample.

The objective of this paper is to explore the economic performance of agricultural companies in the countries of the Visegrad group both from the country perspective and from the primary activity perspective. The findings of this paper may be used for the process of company valuation, namely for pre-selection of suitable valuation objects, since the income valuation methods cannot be applied widely. Moreover, the findings may also discover potential differences between the sample companies from the V4 countries both from the country perspective and the primary business activity perspective. These differences can stem from the different political systems, public subsidy policies, climatic zones, or geographical location.

The paper is structured as follows. Firstly, the methods used and data sample are introduced. Secondly, the results and their findings are challenged by the current literature and finally, conclusions based on the main findings are summarized.

METHODOLOGY

The sample used in this paper consists of all active agricultural companies with recent financial data from the V4 member countries (Czech Republic, Poland, Slovakia and Hungary) listed in the Amadeus database of the Bureau van Dijk (Amadeus) in 2010. The Amadeus database contains and provides comprehensive financial information on millions of European companies. The data are standardized and collected by national agencies. For the purposes of this paper, the year 2010 was selected together with 4,004 companies from the agricultural sector (CZ NACE 01, excluding hunting – 01.7), see the Table 1.

For each company the following variables were calculated as follows:

– return on equity (ROE) is calculated as profit (loss) for the period divided by shareholders' equity, expressed as a percentage (i.e. multiplied by 100),
– costs of equity *(r_e)* are estimated via build up model INFA as an heuristic model which determines costs of equity as a sum of risk-free rate and individually estimated risk premiums specific for a particular company [Neumaierová 2005, Kolouchová, Novák 2010].

$$r_e = r_f + RP \tag{3}$$

where r_f is the risk-free rate and RP stands for additional risk and is calculated as:

$$RP = rLA + rPOD + rFINSTAB + rFINSTRU \tag{4}$$

in which all *r*s stand for additional risks associated with company size, business risk, financial stability and financial structure, respectively. Generally, additional risk associated with company size determines the company's equity in the context with stated values and if the equity is higher, there is no additional risk, if lower, then the 5 percentage points are added. Similarly, additional risk associated with business risk compares the return on assets (ROA) with the industry average in the particular country. If the company's ROA is higher than the industry average, no additional risk is added, if lower, then 10 percentage points are added. Analogously, additional risk associated with financial stability monitors

Table 1. List of examined NACE codes and their description

NACE code	Description	NACE code	Description
0110	**Growing of non-perennial crops**	**0140**	**Animal production**
0111	Growing of cereals, leg.crops, oil seeds	0141	Raising of dairy cattle
0113	Growing of vegetables and melons	0142	Raising of other cattle and buffaloes
0119	Growing of other non-perennial crops	0143	Raising of horses and other equines
0120	**Growing of perennial crops**	0145	Raising of sheep and goats
0121	Growing of grapes	0146	Raising of swine/pigs
0124	Growing of pome fruits and stone fruits	0147	Raising of poultry
0125	Growing of other tree and bush fruits	0149	Raising of other animals
0128	Grw.of spices, drug and pharm. crops	**0150**	**Mixed farming**
0129	Growing of other perennial crops	**0160**	**Support activities to agriculture and post-harvest crop activities**
0130	**Plant propagation**	0161	Support activities for crop production
		0162	Support activities for animal prod.
		0163	Post-harvest crop activities
		0164	Seed processing for propagation

Source: own work based on database Amadeus.

the current ratio and the additional risk associated with financial structure monitors the interest cover indicator.

The value spread is calculated as a difference between the return on equity and the costs of equity. If the return is higher than the costs, then new value is created, if the return is lower, then value is destroyed.

$$value\ spread = ROE - r_e \tag{5}$$

The descriptive statistics for each variable, country and also for the entire sample is provided in Table 2.

To verify the value creation of agricultural companies in the each V4 member country, the value spread was calculated for each individual company within the sample.

A Chi-square test of independence was used to investigate the independence between value spread and country of origin of the agricultural company and between value spread and primary agricultural activity. All the variables are categorical: value is/is not created, country of origin of the agricultural company is CZ (Czech Republic), PL (Poland), SK (Slovakia), or HU (Hungary) and crop production (perennial and non-perennial), plant propagation, animal production, mixed farming and support activities, see Table 1. The general Chi-square test of independence framework by Hendl [2009] is used, as provided below:

Table 2. Descriptive statistics for each variable

ROE [%]	CZ	PL	SK	HU	V4 - total
Mean	5.54	13.73	2.38	3.83	6.89
Median	4.02	12.81	0.96	3.94	4.94
Mode	0.45	31.38	0.01	8.42	2.74
Std. deviation	48.32	56.68	69.70	44.36	54.57
Kurtosis	110.31	136.30	91.37	56.87	116.78
Skewness	-4.17	-2.39	-5.26	-2.60	-4.04
Minimum	-860.74	-962.50	-929.83	-490.02	-962.50
Maximum	628.49	816.22	541.92	428.15	816.22
Sample size	1,616	1,064	714	610	4,004
r_e [%]	CZ	PL	SK	HU	V4 - total
Mean	16.92	17.43	21.52	24.70	19.06
Median	12.89	11.85	19.23	22.97	16.81
Mode	8.75	10.99	9.15	42.50	8.75
Std. deviation	9.19	8.87	10.35	9.69	9.84
Kurtosis	-0.72	0.42	-1.11	-1.08	-0.68
Skewness	0.74	1.25	0.30	0.38	0.70
Minimum	6.81	7.22	8.59	12.11	6.81
Maximum	38.75	40.99	39.15	42.50	42.50
Sample size	1,616	1,064	714	610	4,004

Source: own work based on database Amadeus.

$$x^2 = \sum \frac{(observed\ frequency - expected\ frequency)^2}{expected\ frequency} \tag{6}$$

where χ^2 is the Pearson's test statistic which can be compared to a critical value for a given significance level and degrees of freedom. The degrees of freedom (*df*) can be calculated as the number of categories in the table *r x s: (r-1) x (s-1)*. The tables are called contingency tables. If the test statistic is higher than the critical value, the hypothesis is rejected. In the case where the hypothesis is rejected, the dependence is further examined by other coefficients, for example by the Cramer's V coefficient.

$$V = \sqrt{\frac{x^2}{n\,(m-1)}} \tag{7}$$

in which *V* is Cramer's V coefficient, *n* the total number of cases and *m* is the lower number for total rows or columns. The Cramer's V coefficient is within the range of 0, 1; when the coefficient is equal to zero, there is no dependence; if the coefficient is 1, there is a strong relation between selected variables.

The independence test is given at the 5% level of significance (P value = 0.05). All the statistics of this paper are conducted using the IBM SPSS software.

RESULTS AND DISCUSSION

VALUE SPREAD VS. COUNTRY OF ORIGIN

Firstly, the independence between the indicator value spread and the country of origin of the agricultural company is tested. The contingency Table 3 is provided for the value spread and country of origin overview. Each row presents the absolute and also relative frequency of companies firstly with positive and secondly with negative value spread according to the company's country of origin, for example, in the CZ there are only 483 companies from the CZ sample, i.e. 29.9% of CZ companies, having positive value spread and 1,133 companies, i.e. 70.1% having negative value spread. At the end of each row, the total absolute or relative frequency is shown, for example, in the CZ, there are 1,616 companies, i.e. 100% of the CZ sample. Analogously, each column provides the absolute and relative frequency of companies according to the positive/negative value spread in each country and at the end, the total absolute or relative frequency for the value spread is shown, for example, in the CZ, there are 483 companies creating a positive value spread, i.e. 29.9%, whereas in Hungary, there are only 104 companies reporting a positive value spread (17% only).

Table 3. Country and value spread in crosstabulation (all NACE codes)

Country ISO Code	Absolute frequency value spread			Relative frequency value spread [%]		
	positive	negative	total	positive	negative	total
CZ	483	1,133	1,616	29.9	70.1	100.0
PL	532	532	1,064	50.0	50.0	100.0
SK	139	575	714	19.5	80.5	100.0
HU	104	506	610	17.0	83.0	100.0
Total	1,258	2,746	4,004	31.4	68.6	100.0

Source: own study.

Table 4. Chi-Square Test (VS and country of origin) and symmetric measures

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	278.028	3	.000
Likelihood Ratio	276.937	3	.000
Symmetric measures			
Phi	.264		.000
Cramer's V	.264		.000
N of Valid Cases	4,004		

Source: own elaboration.

According to the preliminary findings it appears, that while companies creating value for their owners having ROE (obtained returns) higher then r_e (expected returns) are rather rare in Slovakia and Hungary, only 19.5% and 17% , in the Czech Republic and Poland the situation is considerably more optimistic (almost 30% and 50%, respectively). The most optimistic situation appears to be in Poland, where the ratio is 50% of companies creating value. This disproportion can be the result of low return on equity, or the high costs of equity capital. Unfortunately, both these aspects are typical for agricultural companies in general [Kopta, Maršík 2009].

For verification of the relation between the two variables (value spread and country of origin of individual agricultural company) the Chi-square test of independence was employed (Tab. 4). According to the results of the Chi-square independence test the hypothesis about the independence H_1 "Creating value according to the value spread indicator does not depend on the country of origin of the agricultural company within the observed sample" can be rejected at the given significance level.

Therefore, it can be said that creating value depends on the country of origin of the agricultural company: CZ, PL, SK, HU, within the observed sample. Since creating value according to the value spread is not independent of the country of origin of the agricultural company, a symmetric measure (Cramer's V coefficient) was employed. Based on this coefficient, the dependence between the variables is slightly positive.

There are also other differences stemming from the production deviation: crop vs. animal production. In Slovakia, for example, local agricultural companies have to face a decreasing trend in the arable land area, in favour of setting the land aside from the production [Božík 2011]. Moreover, Božík [2011] states that there is a slump in animal production tending towards the complete end of animal production in Slovakia.

In order to deal with these aspects of the agricultural sector, there is a need to enhance the initiatives for horizontal integration of agricultural companies. Wolz, Fritzsch and Pencáková [2006] have shown that the ability of agricultural companies to cooperate horizontally positively influences the net incomes of these companies, especially in terms of collective bargaining for the prices of inputs [Banaszak 2007]. This horizontal cooperation may be in the form of agricultural cooperatives; however, many companies employ strategic alliances in the form of mutual cooperation. These strategic alliances are relationships based on formal agreements between companies willing to agree upon certain objectives, whilst remaining independent companies [Wu et al. 2009]. Since this type of horizontal integration can be considered as a response to the competitive environment [Dickson, Weaver 2011], it is more often advantageous to cooperate when trading internationally within a global field of business [Isoraite 2009], regardless of the industry [Shah, Swaminathan 2008].

VALUE SPREAD VS. PRIMARY ACTIVITY

Secondly, the independence between the indicator value spread and the NACE primary activity is tested. As presented in the table 1, the primary activities were grouped into the six areas and challenged by the value creation represented by the indicator value spread (Tab. 5).

In the first row, there are number of companies with negative value spread for every NACE primary activity. For instance, there are 720 agricultural companies reporting negative value spread within the NACE code 011x and in total there are 2,746 companies

Table 5. Value spread and NACE primary activity in crosstabulation (all V4 countries)

		NACE Primary activity						Total
		011x	012x	013x	014x	015x	016x	
Value spread	negative	720	62	13	607	1,133	211	2,746
	positive	417	21	8	146	550	116	1,258
Total		1,137	83	21	753	1,683	327	4,004

Source: own study.

Table 6. Chi-Square Test (VS and NACE primary activity) and symmetric measures

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	70.767	5	.000
Likelihood Ratio	75.037	5	.000
Linear-by-Linear Association	5.310	1	.021
Symmetric measures			
Phi	.133		.000
Cramer's V	.133		.000
N of Valid Cases	4,004		

Source: own study.

among all the NACE groups reporting negative value spread in the period analysed. In the second row, analogously, there are a number of companies reporting positive value spread. In the last row, there is the total number of companies operating in each examined sector.

The results of the chi-square test of independence are summarized in the Table 6. According to the results of the Chi-square independence test the hypothesis about the independence H_2 "Creating value according to the value spread indicator does not depend on the country of origin of the agricultural company within the observed sample" can be rejected at the given significance level.

Therefore, it can be concluded that creating/destroying value (value spread approach) depends on the primary activity of the agricultural company: crop production (perennial and non-perennial), plant propagation, animal production, mixed farming and support activities, within the observed sample. Since creating value according to the value spread is not independent of the primary activity of the agricultural company, a symmetric measure (Cramer's V coefficient) was also employed.

Since independence cannot be confirmed, the following Table 7 presents the different economic situations in the V4 countries using the indicator value spread for individual agricultural activity. In the Czech Republic, the most successful agricultural NACE codes, according to the value spread in 2010, were related to post-harvest activities. In contrast, in Poland, the most effective activities were related to growing non-traditional trees, soft fruits or raising alternative livestock. Similarly in Slovakia, the raising of sheep and goats was relatively successful. In Hungary, besides the raising of sheep and goats and other animals, the post-harvest activities are the most economically efficient sub-sectors. The least efficient NACE codes are related to raising dairy cattle or mixed farming in each of the countries examined.

Table 7. Selected NACE codes and the percentage of companies with positive value spread in each V4 countries [%]

NACE code	Note	CZ	PL	SK	HU
0111	cereals, oil seeds	40 !	56 !	27 ✗	19 ✗
0125	other trees, bush fruits	0 ✗	75 ✓	0 ✗	0 ✗
0141	dairy cattle	16 ✗	6 ✗	8 ✗	8 ✗
0145	sheep and goats	0 ✗	0 ✗	75 ✓	100 ✓
0149	other animals	50 !	89 ✓	40 !	100 ✓
0150	mixed farming	26 ✗	59 !	20 ✗	8 ✗
0160	support activities	40 !	0 ✗	0 ✗	0 ✗
0163	post-harvest activities	100 ✓	50 !	50 !	100 ✓

Source: own study.

With respect to the results, criticism of the value spread indicator needs to be provided. In compliance with the literature on agricultural economics, the return ratios are often negative [Kopta, Maršík 2009] and therefore cannot cover the costs of equity which are estimated via INFA method, which uses risk premium for each individual company. This risk premium is rather high, due the specifics of agricultural companies. Moreover, Střeleček, Lososová and Zdeněk [2007] have identified important characteristics of Czech agricultural companies: increasing dependence of public subsidies on net incomes, which can be considered as above-average compared to the EU-15. Moreover, Vavřina et al. [2012] provide evidence that this is the case for all V4 agricultural companies. Based on this fact, it can be inferred that EAT can be partly shielded by these subsidies. Vavřina et al. [2012] also showed that there is an increasing tendency of public subsidy financing in the period 2004-2011.

As far as public subsidies are concerned, any reduction or elimination of this kind of financing would inevitably lead to a slump in the entrepreneurial income in Slovakia [Božík 2011]. Agricultural companies in Poland appear to be most economically efficient, on the other hand, they are beneficiaries of hidden or indirect subsidies which may result in better economic performance (Tab. 3). Therefore, it cannot be directly deduced that polish agricultural companies are more competitive in comparison with the other V4 member countries [Vavřina et al. 2012].

Assuming there are only 31.4% of V4 agricultural companies suitable for the income valuation method, there are 68.6% of companies which need to be valued by alternative approaches. Besides the income valuation approach, there are also market and asset valuation approaches [Koller et al. 2010]. Nevertheless, since the market valuation approach can be applied only within the functional company market, it can be inferred that this approach is rather non-applicable in the Czech Republic [Krabec 2009, Mařík 2007]. Therefore, only the asset valuation approach is relevant. From this perspective, it can be deduced that 68.6% of V4 agricultural companies can be valued only within the scope of deducing the liabilities from the company's assets (the asset approach) without any regard to future prospects. These facts may lead to the conclusion that a majority of V4 agricultural companies do not cover their costs of equity by returns on equity and therefore do not fulfil the requirement of the going-concern principle.

However, since the value spread measure is rather strict, there is an alternative value spread considering return on invested capital (ROIC) instead of ROE and weighted average costs of capital (WACC) instead of r_e [Koller et al. 2010, Mařík 2007, Kislingerová 2001]. This spread may provide more optimistic values since the invested capital is a sum of a company's property, plant, equipment and working capital – cumulative sum of company's investments in the core operations [Koller et al. 2010].

CONCLUSIONS

Overall, the picture that emerges from agricultural companies in the V4 is consistent with the findings of Kopta and Maršík [2009], Banaszak [2007] or Vavřina et al. [2012]. There is confirmation that the value spread is positive only in 31.4% of cases: only 31.4% of the sample report higher returns on equity than the costs of equity capital. This fact may be caused by agricultural specifics, namely by considerable fluctuations in cash flow, low return ratios or high indebtedness which is reflected in the higher cost of equity capital,

as outlined by Střeleček, Lososová and Zdeněk [2007], Banaszak [2007] or Vavřina et al. [2012], partly verified by the examined variables, see Table 2.

For the verification of the relation between the two criteria (value spread and country of origin of the individual agricultural company and value spread and the primary agricultural activity) the Chi-square test of independence was employed to accept or reject the two hypotheses: "Creating/destroying value according to the value spread method does not depend on the country of origin of the agricultural company within the observed sample " and "Creating value according to the value spread indicator does not depend on the primary activity of the agricultural company within the observed sample". On the given significance level, both hypotheses were rejected and an alternative hypothesis can be accepted, that it can be said that creating/destroying value depends on the country of origin of the agricultural company, and primary activity of individual co*mpany* within the observed sample. Based on Cramer's V coefficient, the dependence is slightly positive (Tab. 4 and 6).

In other words, it can be assumed that the differences among individual agricultural companies in the V4 countries are statistically significant. Moreover, there are 68.6% of V4 agricultural companies that do not cover their costs of equity by returns on equity and therefore cannot be objects for the income valuation methods (mainly the economic-profit-based valuation models). Therefore, this majority of sample companies can only be objects for asset valuation approaches.

Besides, it can be concluded that the creation/destruction of value (value spread approach) depends on the primary activity of the agricultural company: crop production (perennial and non-perennial), plant propagation, animal production, mixed farming and support activities, within the observed sample. Based on the selected results presented in table 8, concerns based in the Czech Republic recognized the advantage of service-related activities, in Poland of alternative animals or plants, in Slovakia of traditional raising of sheep and goats and in Hungary there is a recognition of the success of animal production. in As the literature suggests, the raising of dairy cattle belongs to the less economically effective agricultural activities in all countries.

Finally, the value of this research is limited by its currency, since it was conducted in one year only. This limitation is slightly compensated for by the sample size, which are 4004 agricultural companies from the Visegrad group countries.

There are several possibilities for extending this research: the research sample can be enlarged by adding all the EU member countries, whilst still working with cross-sectional data only, or enlarged in terms of time, i.e. include also other years to work with panel data. The second perspective is to follow the different scenarios of the Common Agricultural Policy (CAP) of the EU beyond 2013 and their consequences on individual agricultural companies in the sample countries, especially if the scenario re-focusses on the termination of the public subsidy scheme. Finally, the income valuation methods can be further examined, explored and adjusted to be more applicable for the specifics of agricultural companies. The most important challenge in the company valuation process is the quality and availability of data. In this particular case, a digital analysis might be applied in order to discover any data inconsistencies and eliminate the effects of such inconsistencies within the research sample, i.e. research findings. Assuming the data are true and unbiased, the close correlation between valuation subject (i.e. expert) and valuation object (i.e. a company) is essential and inevitable. Based on this fact, the resultant value is often a trade secret.

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PRZEDSIĘBIORSTWA ROLNICZE A WARTOŚĆ SPREAD W RAMACH GRUPY WYSZEHRADZKIEJ

Streszczenie

W artykule przedstawiono unikalne porównanie przedsiębiorstw rolniczych z krajów Grupy Wyszehradzkiej, z zastosowaniem wskaźnika spread. Przedsiębiorstwa z tych krajów funkcjonują w podobnych warunkach geograficznych oraz mają zbliżony rozwój historyczny. Niemniej jednak sektory rolne w każdym z tych krajów różnią się. Wskaźnik spread dostarcza informacji, czy koszt kapitału własnego przedsiębiorstwa jest pokryty przez stopę zwrotu z kapitału własnego. Ponadto, wskaźnik ten służy jako weryfikator ram wyceny dochodu. Celem opracowania jest określenie wartości spread przedsiębiorstw rolniczych w krajach Grupy Wyszehradzkiej. Badania wskazują, że tylko część badanych przedsiębiorstw była w stanie pokrywać koszty kapitału własnego przez stopę zwrotu z kapitału. W badaniach empirycznych wykazano, że istnieje zależność pomiędzy wartością spread i krajem pochodzenia przedsiębiorstwa rolniczego oraz między wartością spread i zasadniczą działalnością rolniczą. Polska jest krajem, w którym większość przedsiębiorstw cechuje się dodatnią wartością spread.

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THE ANALYSIS OF SUBREGIONAL DIFFERENCES IN COST EFFICIENCY OF POLISH DAIRY FARMS USING THE FADN DATABASE[1]

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Key words: FADN data, FADN regions, FADN subregions, cost frontier function, fixed effects, inefficiency, cost efficiency index
Słowa kluczowe: dane FADN, regiony FADN, podregiony FADN, graniczna funkcja kosztów efekty stałe, nieefektywność, wskaźnik efektywności kosztów

A b s t r a c t. The cost efficiency of the dairy subsector has been analyzed using data for two FADN regions and four subregions in Poland for the period 2004/05-2007/08. The cost efficiency indexes have been calculated for each farm from two FADN regions and two other FADN regions after each was further subdivided into two subregions. Both regional and subregional analyses revealed large differences in relative cost efficiency of dairy farms in each area. In particular, the subregional analysis suggests that Podlaskie and Łódzkie subregion seem to have a relatively larger number of very efficient dairy farms followed by the Wielkopolskie and Kujawsko-Pomorskie subregion. Overall, however, every region seems to have a large number of farms, which could improve their cost efficiency. Given the location of dairy processors, dairy farms in the two mentioned subregions and the region of Pomorskie and Mazury have a relative advantage, while the subregion Mazowieckie and Lubelskie has an easy access to the largest market represented by Warsaw and surroundings. The dairy industry may generate some jobs in subregions leading in milk production, especially if the elimination of milk quota in 2014 will increase demand for milk and dairy products in neighboring countries leading to expansion of milk production.

INTRODUCTION

Price milk volatility has increased on the European and world milk market since 2007 [Wysokiński, Jarzębowski 2013]. Particularly, the 2007-2008 price fluctuations revealed the need for comparative analysis of milk production costs across the European and Polish dairy farms [Ziętara 2010]. Wojciech Ziętara [2012] also suggested a need for evaluation of the relative competitiveness of Polish dairy farms against the European Union (EU) farms. Kołoszyc [2013] stated that the global financial and economic crisis of 2008 affected every aspect of the dairy industry including production.

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Barnes et al. [2011] reported on cost efficiency of farms, including dairy farms across the EU countries. Results indicated a relatively strong position of the Polish dairy sector. In an earlier study, Revoredo-Giha and Renwick [2010] analyzed the cost efficiency of nine farm types in five EU countries using the FADN data base for the period 1995-2007 including those for Poland and Hungary for the period of 2004-2007. According to the results, dairy farms showed a similar level of cost efficiency across farm sizes and across four FADN regions in Poland. However, Parzonko [2013] noted a clear polarization of milk producing areas in Poland. In particular, the diverting milk procurement trends between Podlaskie and Podkarpackie Voivodships between 2004/2005 and 2010/2011. Sobczyński et al. 2013] suggested undertaking a subregional analysis in the future to further discern the relative cost efficiency across various milk producing areas in Poland.

This paper examines the cost efficiency of dairy farms, while accounting for regional and subregional differences. Regional and subregional differences in particular, allow to anticipate the relative strengthening or weakening of the dairy sector. Dairy industry can become more regionally concentrated driven by the natural resource base most suited for milk production. In addition, the subregional differences implicitly indicate the ability of dairy farms to create additional jobs in rural areas. The unemployment rate is high in rural areas of Poland and some leading milk producing areas experience a high unemployment rate. The non-farm jobs are limited, especially in certain areas [Klepacka 2012]. Outmigration has intensified after Poland's accession to the EU in 2004, and the opening of labor markets in many of the older EU member-countries. As a result, the local labor availability changes because laborers can find better paying jobs abroad. Dairy farms typically use more labor than other farm types. Therefore, this study results provide a measure of cost efficiency at the regional and subregional level that measures possible ability of dairy farms to respond to cost cutting pressures, while implicitly painting picture of the sector's role in the rural labor markets, especially those suffering from outmigration and depopulation.

POLAND'S DAIRY SECTOR BEFORE AND AFTER THE EU ACCESSION

Livestock production dominates in Polish agriculture. The share of farm sales revenue generated by livestock or livestock product sales increased from 53.4% to 62.2% between 2004 and 2011, respectively [Abramczyk 2013]. Milk production assured a steady demand for labor and guaranteed regular revenues. As a result dairy farms enjoyed a steady income and employment stability.

The annual milk production rapidly declined from 16 bil liters in 1989 to about 11.5 bil liters in 2000 [Lira 2013] following the adoption of the market-based resource allocation mechanism. Only after the accession to the EU in 2004, Poland's milk production begun to increase slowly within limits permitted by the CAP. The production reached 12 bil liters in 2011. However, earlier farmers responded to market prices by increasing the marketable share of milk production from 73.5% in 1989 to 80% in 2010 [Lira 2013].

Parzonko (2013) noticed the increasingly visible regional differences in milk production. Domańska (2013) stated that the Pomorze and Mazury regions held the competitive advantage in milk production over other regions, followed by Małopolska and Pogórze. Mazowieckie and Podlaskie Voivodships placed third according to Domańska [2013]. Sobczyński et al. [2013] applied cost efficiency measures and placed the FADN defined Podlaskie and Mazowieckie as well as Wielkopolskie and Śląskie regions as most efficient in dairy production.

In recent years, there has been a notable concentration of processing capacity as the dairy processing cooperative sector undergoes cost-induced re-structuring. Increased cost efficiency could lead to less expensive raw milk supplied to processing plants, especially if processed by cooperatives where dairy farmers are shareholders.

COST FRONTIER ESTIMATION APPROACH

An inefficient farm could improve its efficiency through better input use [Langemeier 2010]. The current study limits its scope to cost efficiency. It uses the stochastic cost frontier model implying that the most efficient farms are located on the frontier function. The cost efficiency index ranges from zero to one, i.e., the highest efficiency level. The fixed effects stochastic cost frontier model can be written in the following way [Kumbakhar, Knox Lovell 2003], where i denotes farms and t the periods:

$$\ln E_{it} = \ln C\,(Q_{it}, W_{it}, \tau_t; \Omega) + v_{it} + u_i \tag{1}$$

In equation (1), $\ln E_{it}$ is the logarithm of the observed expenditure and $\ln C\,(Q_{it}, W_{it}, \tau_t; \Omega)$ is the logarithm of the deterministic cost function that depends on the outputs Q_{it}, the input prices W_{it}, a deterministic trend τ_t to capture technological change, and a vector of parameters Ω. The statistical error is represented by v_{it}, which is assumed to be independent and identically distributed with mean zero and variance σ_v^2. The time invariant inefficiency term u_i is positive.

The estimation of the stochastic cost frontier (i.e., $\ln C\,(Q_{it}, W_{it}, \tau_t; \Omega) + v_{it}$) and the inefficiency terms (i.e., u_i) requires the choice of a functional form for the deterministic part of the stochastic cost frontier (i.e., $\ln C\,(Q_{it}, W_{it}, \tau_t; \Omega)$). A generalized multiproduct translog cost function [Caves et al. 1980] was selected because it imposes fewer a-priori restrictions than other functional forms commonly used for the task. As explained by Caves et al. [1980] in the context of multiproduct estimation, some outputs might not be present on a farm, and therefore the logarithm used in the translog function will produce an error. Instead, they propose the use of a Box-Cox transformation to substitute for the logarithm of the output terms. It should be noted that the Box Cox transformation is only one of the possibilities. Therefore, this paper applies f(Q) = Q, which provides a hybrid between the translog function and the quadratic function. Thus, for the case of n inputs and m outputs, the cost function is given by:

$$\begin{aligned}\ln C\,(Q_{it}, W_{it}, \tau_t; \Omega) = {} & \alpha_0 + \varphi_0 \tau_t + \varphi_0 \tau_t^{\,2} + \sum_{j=1}^{n} \alpha_j \ln W_{jt} + \tfrac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \beta_{jk} \ln W_{jt} \ln W_{lk} \\ & + \tfrac{1}{2} \sum_{j=1}^{m} \sum_{k=1}^{n} \delta_{jk}\, f\left(Q_{jit}\right) \ln W_{kt} + \sum_{j=1}^{m} \gamma_j f\left(Q_{jit}\right) + \tfrac{1}{2} \sum_{j=1}^{m} \sum_{k=1}^{m} \rho_{jk}\, f\left(Q_{jit}\right) \cdot f\left(Q_{kit}\right)\end{aligned} \tag{2}$$

As the stochastic cost frontier is a cost function, it has to satisfy the properties of any cost function [Chambers 1988]. Price homogeneity and symmetry were directly imposed in (2) through the following restrictions to the parameters (3):

$$\sum_{j=1}^{n} \alpha_j = 1;\ \sum_{j=1}^{n} \delta_{jk} = 0;\ \sum_{j=1}^{n} \beta_{jk} = 0;\ \sum_{k=1}^{n} \beta_{jk} = 0;\ \sum_{j=1}^{n} \sum_{k=1}^{n} \beta_{jk} = 0;\ \beta_{jk} = \beta_{jk} \tag{3}$$

A stochastic cost frontier using a panel data fixed effects model considers inefficiency as a time invariant [Schmidt, Sickles 1984, Kumbakhar, Knox Lovell 2003, Greene 2005]. A common problem in the estimation is that the use of a fixed effect model precludes the use of time invariant variables. However, in the context of cost function estimation, this can be overcome due to the fact that the parameters associated with input prices can be estimated from the cost share equations, where the inefficiency term (i.e., the fixed effect terms) do not appear.

The equation to be estimated is presented in (4), where the intercept in (4) is $\alpha_{0i} = \alpha_0 + u_i$.

$$\ln E_{it} = \alpha_{0i} + \varphi_0 \tau_t + \varphi_0 \tau_t^{\,2} + \sum_{j=1}^{n} \alpha_j \ln W_{jt} + \tfrac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \beta_{jk} \ln W_j \ln W_k + \tfrac{1}{2} \sum_{j=1}^{m} \sum_{k=1}^{n} \delta_{jk} f(Q_{jit}) \ln W_k + \sum_{j=1}^{m} \gamma_j f(Q_{jit}) + \tfrac{1}{2} \sum_{j=1}^{m} \sum_{k=1}^{m} \rho_{jk} f(Q_{jit}) \cdot f(Q_{kit}) + v_{it} \tag{4}$$

The dataset does not contain input prices for each farm. However, in the context of cross section estimation, the approach is to assume that all farmers face the same prices [e.g., Alvarez, Arias 2003]. However, for estimating a cost function using panel data it is possible to introduce prices, assuming that all the farmers face the same input prices within a year (i.e., across farms), but that prices change over time.[2]

Equation (4) was estimated for five inputs (i.e., n) and three outputs (i.e., m). Given the high number of parameters to be estimated, the following econometric procedure was employed. First, the system of $(n - 1)$ cost shares was computed, using Iterative Seemingly Unrelated Regression Equations (ISURE) and imposing the constraints in (3). This step provided the values for all the terms in (4) that were associated to input prices. Second, all the remaining parameters of the cost function, except the fixed effect terms (i.e., output terms not associated with prices) were estimated using the within estimator (ordinary least square applied to the variables expressed as deviations of the means by farm as in Hsiao [1993]). Finally, the fixed effect terms used in the construction of the relative cost efficiency indices were estimated from equation (4) by evaluating the function at the mean value of the variables by farm [Atkinson, Cornwell 1993, Kumbakhar, Knox Lovell 2003, Pierani, Rizzi 2003][3].

As shown in Kumbhakar and Knox Lovell [2003], the relative cost efficiency index (CEI_i) for a sample size N was computed as equation (5) based on the estimated fixed effect intercepts (i.e., α_{0i}), where for the most cost efficient producers it has a value equal to one:

$$CEI_i = \exp\{-(\hat{\alpha}_{0i} - \min_i \{\hat{\alpha}_{0i}\})\} \qquad i = 1,..., N \tag{5}$$

The results of the cost function estimations for two large FADN regions and four subregions provided insights into cost efficiency differences and were used to calculate elasticities of substitution among the input categories. The majority of the calculated elasticities are statistically significant and all have the expected signs with the exception of the energy elasticity of substitution, which has a positive sign and is statistically significant in the Dolnoslaskie and Opolskie subregion. The subregion is not a major area of dairy farm location[4].

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[2] In a different context, similar assumptions can be found in the estimation of demand systems, where price elasticities are sometime estimated from time series because of the lack of variability of prices in cross section datasets [Hsiao 1993, p. 206].

[3] The farm level estimated fixed effects used to compute the relative cost efficiency indices were assumed to be constant over time due to the short period covered by the sample (in the best case, information was available for some farms for eight years) [Kumbakhar, Knox Lovell 2003, p. 170].

[4] Results of estimation are not shown due to space limitations, but are available from the authors upon request.

DATA

The study uses data from the Farm Accounts Data Network (FADN) database, which includes annual records of a wide range of financial and non-financial data for a selection of full-time farms across the EU. In case of Poland, the data used were available only since 2004/2005, that is after the country's accession to the EU. This resulted in an unbalanced panel dataset.

Costs and outputs by farm type were computed directly from the FADN data. Costs were allocated to one of five groups: materials (e.g., feed, fertilizer); energy; labor (i.e., all labor used including that of the farmer, farm family, business partners, and hired workers); land (owned and rented) and capital (e.g., rent, depreciation). The three outputs were considered: crops, livestock, and other outputs, all of them in real terms.

The estimation of cost functions requires input prices. But, FADN data include only input expenditures and not the paid input prices paid (or quantities used). Therefore, Eurostat's input price indices data (base year 2004) were used for agricultural materials, energy, and capital as an estimate of prices paid by farmers. The labor and land input prices were estimated from the FADN data.

The national FADN farm panel consists of farms participating voluntarily, therefore, the panel may not be fully reflective of Poland's dairy sector. Farms with very small herds are likely underrepresented. However, the study focuses on the competitiveness of producers and their ability to create jobs in rural areas rather than milk self-supply, the primary reason behind a small animal herd.

The data are annual observations for the period 2004/2005-2007/2008. The unbalanced panel included 1,877 farms, but a total of 3,840 observations is used in this study. Farms were located in a number of administrative regions, which were grouped by the national reporting agency in four large regions including the Mazowieckie-Podlaskie, Wielkopolsks-Śląsk, Pomorze-Mazury, and Małopolska-Podgórze. For the purpose of this study, of the first two regions each was subdivided into two subregions to account for subregional differences in cost efficiency. The four subregions were Wielkopolskie and Kujawsko-Pomorskie, Dolnośląskie and Opolskie, Mazowieckie and Lubelskie, and Podlaskie and Łódzkie. The reported farm data included all standard information in the FADN data base. Rural jobs are particularly needed in the two latter subregions, although Kujawsko-Pomorskie also experienced a relatively high rural unemployment.

ESTIMATION RESULTS AND IMPLICATIONS

The cost efficiency index was calculated for every farm in the region or subregion against the most efficient farm in a particular area. The results are comparable among farms within an area, but not across areas because the most efficient farm, which serves as the benchmark, is different in every region or subregion. The efficiency indicators are relative with respect to the frontiers represented by the most efficient producer or producers. For example, a cost efficiency coefficient equal 0.5 implies that the cost at the frontier is 50 percent of the observed cost at that particular farm in one of the studied areas. The maximum potential cost reduction at that farm resulting from cost efficiency improvement is 50 percent. The way in which costs are reduced is not determined in this study but left to the farmer. In real world situation, a farmer facing a decrease of revenues may withdraw from production altogether, or improve the dairy farm cost efficiency by a fraction that would adequately compensate the revenue fall.

The distribution of dairy farms in each area according to various levels of cost efficiency is illustrated in Figures 1 through 4 and refer only to subregions because of the limited article length. Figures show a wide distribution of farms in terms of their relative cost efficiency. In different areas the potential for improvement varies. The area cross comparison is indirect and based on the concentration of cost efficiency indicators in area-specific range and the number of dairy farms with low cost efficiency index.

The Pomorskie and Mazury FADN region shows a few farms with very high cost efficiency on or near the cost frontier, but the vast majority of farms appears to have large reserves to improve their cost efficiency. An earlier paper suggested that that area is the most efficient milk producing area, but the analysis was based on qualitative assessment [Domańska 2013].

Małopolska and Pogórze shows much different distribution of farms based on their cost efficiency indicator. A handful of efficient farms is clearly outnumbered by the vast majority of farms with the cost efficiency coefficient values below 0.5. Sobczyński et al. [2013] indicated that his area was not likely to remain an area of commercial dairy production. Others suggested that any dairy should focus on organic or niche market production, where the latter involves value adding activities such as production of local cheese. The area is characterized by relatively high rural unemployment and dairy can contribute to job creation if on-farm or local cheese making becomes widely spread. There is potentially country-wide demand for regionally made cheese.

Four figures depict the distribution of farms according to their relative cost efficiency in subregions. Figure 1 shows Wielkopolska and Kujawsko-Pomorski subregion. Similarly to the two FADN regions, there is a small group of cost efficient dairy farms establishing a frontier that at present is unattainable by the majority of farms. However, the number of farms in a subregion exceeds that of Pomorze and Mazury region. The majority of farms can seek improvement in cost efficiency and likely remain competitive in milk production because there is a well developed subregional processing capacity.

A couple of dairy farms with relatively high cost efficiency sets the benchmark for others in Dolnośląskie and Opolskie subregion (Fig. 2). The dominant portion of farms is associated with the cost efficiency indicator that is less than 0.3. Costs at farms with that level of efficiency can be reduced by up to 70 percent. But, it remains unclear if farmers would chose to improve because the area comprises of two districts with very different

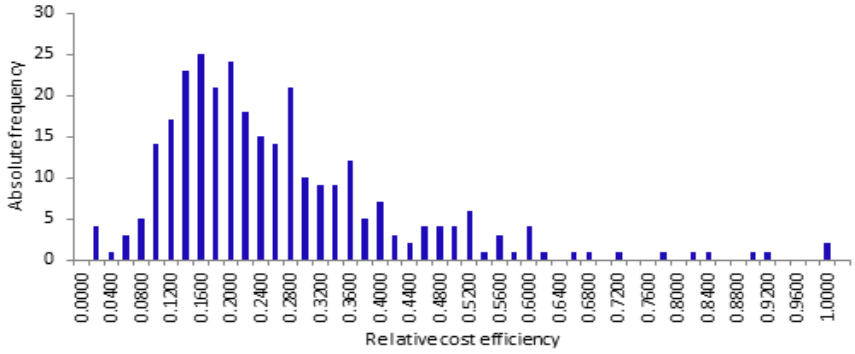

Figure 1. The distribution of dairy farms in terms of cost efficiency in FADN subregions of Wielkopolska and Kujawsko-Pomorskie, Poland
Source: Authors' calculations based on estimation results using the FADN data.

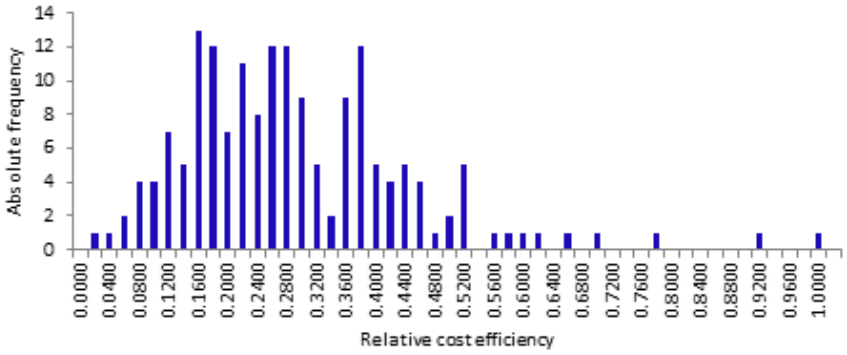

Figure 2. The distribution of dairy farms in terms of cost efficiency in FADN subregions of Opolskie and Dolny Śląsk, Poland
Source: Authors' calculations based on estimation results using the FADN data.

farming culture and farm structure. The subreginoal demand for dairy products is high because this area leads the country in yogurt consumption and is high consumer of cheese, but less of fluid milk. Subregional dairy processing capacity may be less developed, but farmers could supply milk to processors in other areas or neighboring countries.

The next two figures (Fig. 3 and 4) show the relative cost efficiency of another subdivided FADN region. Figures 3 shows the relative cost efficiency of dairy farms in Mazowieckie and Lubelskie area and the frontier delineated by a very few farms. For the majority of the dairy farms the value of cost efficiency indicator ranges from 0.26 to 0.40 suggesting substantial opportunities for cost reduction. The dairy processing capacity is large in Mazowieckie Voivodship and the sprawling Warsaw and its suburban areas represent a highly concentrated market posing little challenge in terms of logistics and distribution. Therefore, the dairy sector in this area, having ability to reduce cost while at the same time located near processing facilities and large market, is posed to remain competitive in the foreseeable future should competitive pressure increase.

Finally, the subregion perceived as having the largest potential for dairy production (mostly Podlaskie Voivodship) shows that the cost frontier is determined by a few farms (Fig. 4), but in the number similar to that of the whole FADN region of Pomorskie and Mazury. The majority of farms has the cost efficiency indicator value between 0.22 and 0.52 suggesting opportunities for cost reduction. Because several large processing facilities are located in the area, the dairy plants can be supplied with a large volume of raw milk lowering the transportation costs. The relatively short transportation distance from farm to the processing plant is an important source of competitive advantage for the dairy sector there given the subregion location away from major demand centers.

An important aspect of competitive advantage of the dairy sector is not captured by the FADN data reporting framework in Poland. Namely, the dairy production area of Podlaskie Voivodship, included in Mazowieckie and Podlaskie FADN region and the dairy producing area in Warmińsko-Mazurskie Voivodship included in Pomorskie and Mazury FADN region, are in the same geographic area split by administrative boundaries delineating the two FADN regions. Therefore, to assess the cost efficiency of dairy farms

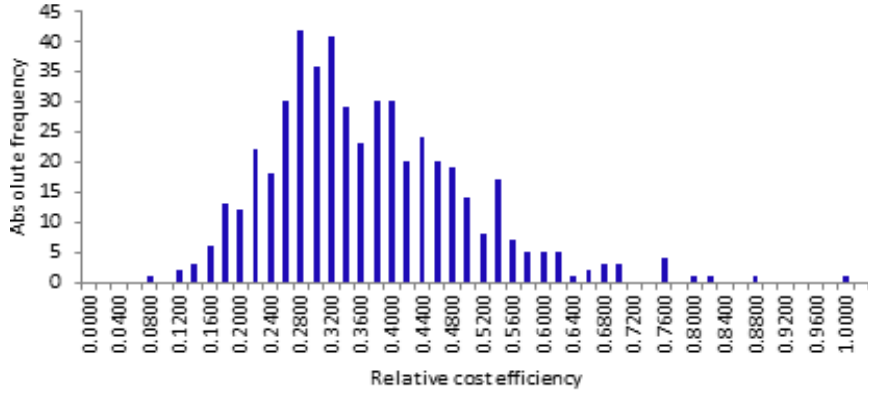

Figure 3. The distribution of dairy farms in terms of cost efficiency in the FADN subregions of Lubelskie and Mazowieckie, Poland
Source: Authors' calculations based on estimation results using the FADN data.

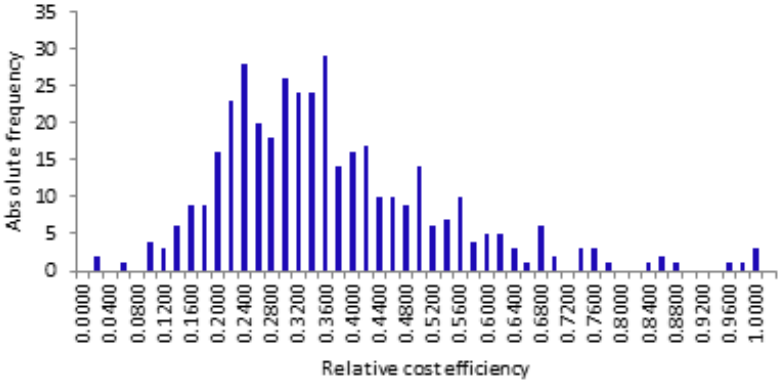

Figure 4. The distribution of dairy farms in terms of cost efficiency in the FADN subregions of Podlaskie and Łódzkie, Poland
Source: Authors' calculations based on estimation results using the FADN data.

and their competitiveness the analysis should focus on a sample of dairy farms from re-designed subregions. In particular, the sample of dairy farms from the above mentioned Voivodships should be created ignoring the currently applied division dictated by FADN regions. Moreover, such analysis could also paint a better picture in terms of job creation potential in the dairy production and processing.

CONCLUDING REMARKS

This study was undertaken in order to evaluate the possibilities of cost reduction by dairy farms evaluated at a lower aggregation level than the FADN regions in Poland in response to conclusions of an earlier analysis [Sobczyński et al. 2013]. By establishing possibilities for cost reduction both the dairy sector and policy makers gain insights into the potential response to changes in prices or broader cost competitive pressures exerted by external factors.

In particular, Wielkopolska and Śląsk as well as Mazowieckie and Podlaskie representing two FADN regions were divided into two subregions, i.e., Wielkopolska and Kujawsko-Pomorskie, Dolnośląskie and Opolskie, Mazowieckie and Lubelskie, and Podlaskie and Łódzkie, respectively. Such subregions closely account for the actual regions of dairy production concentration, historically determined farm structure, natural resource endowment, and the milk processing plant location. Also, the suberegions better reflect the area dairy farm numbers than the large aggregated FADN regions.

The artificial formation of FADN regions is evident. The cost efficiency histograms suggests differences in production costs. Cost efficiency comparisons are valid only within the region because the cost frontier is determined by the most efficient farm or farms. A number of very efficient farms is limited in each region, but relatively highest in the Podlaskie and Łódzkie subregion. The remaining farms in each region appear to have substantial reserve and capacity for cost reduction. Whether such opportunities will be realized depends on each farm operator and external pressures such as the access to milk processing plants. Some farms show very low cost efficiency and likely will cease to produce milk in coming years or will be absorbed by larger farms, some of which, depending on the region or subregion, may not continue dairy production. Farms like that seem to be located in Małopolska and Pogorze FADN region, in particular.

The potential for cost reduction suggests that the competition among farms in the defined subregions will continue in the foreseeable future. It will be interesting to see how the subregional dairy production will respond to the expected changes in the dairy industry after April 1, 2013, when milk quotas will be abolished in the EU. Poland›s dairy exports have been increasing in recent years, but mostly involved processed dairy products such as yogurt and cheese. If Polish dairy producers exploit their potential for cost reduction, there could be opportunities for further exports increase including exports of fluid milk to destinations not constrained by transportation costs.

Dairy farms utilize more labor than field crop farms and the continuing development of that subsector of agriculture could offer, however limited, job opportunities. Enlargement of herds eventually will require hired labor to improve economic returns. Already, between 2009 and 2010, the employment in agriculture increased by about 2,400 jobs [*Rocznik satystyczny*... 2011], but the data do not provide details about the farm type or geographical area, where the new jobs were added. However, the general trend of an increase in agricultural employment is consistent with both the demographic changes and reversal of migration due to the shrinking job market in other EU countries. The full demonstration of the financial crisis in 2008 and the subsequent economic slowdown in many EU countries led to a decrease in demand for labor. Lower labor demand and the lack of prospects for a speedy recovery caused many job-seeking migrants from Poland to return home. The reverse migration increased the supply of labor, including the labor in rural areas and areas where outmigration was largest.

The elimination of milk quotas planned for 2014, if associated with increased demand for dairy in Poland's neighbors, could increased the local rural demand for labor. At the same time, the economic growth is expected to accelerate in the euro zone in 2014, which could translate into renewed job-seeking migration from Poland. Still, as the new generation enters the job market in Poland, there is no immediate threat of labor shortage in rural areas. This is especially true of areas located in eastern and north-eastern Poland, some of which have well developed dairy sector.

Among the limitations of the study is the potential imprecision of deflating prices of inputs and outputs. The lack of price information in the FADN data set also forces the assumption that farmers across regions and subregions face identical prices. Although not completely unreasonable because of the lack of other obstacles than transportation costs, some potential imperfection in pricing inputs can occur. In addition, the labor cost likely varies across regions due to wage and cost of living variation and could have affected the results.

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ANALIZA SUBREGIONALNYCH RÓŻNIC EFEKTYWNOŚCI KOSZTÓW W POLSKICH GOSPODARSTWACH MLECZNYCH NA PODSTAWIE DANYCH FADN

Streszczenie

Efektywność kosztów w subsektorze mlecznym analizowano na podstawie danych z dwóch regionów FADN i czterech podregionów w Polsce w okresie 2004/2005-2007/2008. Indeksy efektywności kosztów wyliczono dla każdego gospodarstwa z dwóch regionów FADN i podzielanych z nich dwóch subregionów. Analiza na poziomie regionów i subregionów wskazała na duże różnice we względnej efektywności kosztów gospodarstw mlecznych w każdym obszarze. Analiza subregionalna wskazała, że pod względem najwydajniejszego gospodarstwa w danym obszarze, subregion podlaskie-łódzkie miał większy udział wysoko wydajnych gospodarstw niż subregion wielkopolskie-kujawsko-pomorskie. Ogólnie, na każdym obszarze znajduje się duża liczba gospodarstw, które mogłyby poprawić efektywność kosztową. Ze względu na położenie przetwórców mleka, gospodarstwa mleczne mają względną przewagę w dwóch wymienionych subregionach i w regionie Pomorskie-Mazury, natomiast subregion mazowieckie-lubelskie ma łatwy dostęp do największego rynku reprezentowanego przez Warszawę i okolice. Przemysł mleczarski może tworzyć miejsca pracy w podregionanch wiodących w produkcji mleka, szczególnie jeśli weliminowanie kwot produkcji mleka w 2014 r. spowoduje wzrost popytu na mleko i produkty mleczne w krajach sąsiednich i doprowadzi do wzrostu produkcji mleka.

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INSTITUTIONAL ENVIRONMENT FOR ICT UTILIZATION IN RURAL INDIA

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Key words: role of ICTs, institutions, policy analysis, rural development, India
Słowa kluczowe: rola ICT, instytucje, analiza polityki, rozwój obszarów wiejskich, Indie

A b s t r a c t. Agriculture is one of the most important sectors in India, and could benefit tremendously with the applications of ICTs especially in bringing changes to socio-economic conditions of the poor in rural areas. Achieving these benefits requires proper institutions for ICT adoption and utilization. Therefore The current state of major Indian institutions (ICT and rural policies) using document analysis is evaluated against supporting progress in areas of the horizontal side of the "cube framework" in rural India. Major finding is that The Five Year Plans, National ICT and Telecom Policies are developing in the right direction and government initiatives are increasingly maturing, but may lack some specific solutions.

INTRODUCTION

Domination of agriculture sector in India is still clearly visible: more than half of India citizens is employed in this sector, which stems from the fact that almost 70% people live in rural areas (more than 80% in 1965). Ca 60% of land has been used for agricultural purpose for the last 50 years. In terms of value added, agricultural sector has been steadily decreasing since 1965, when it accounted for 45% of India's GDP to 17% in 2012, mostly because of rapid growth of value added in manufacturing and even greater in services.

Changes in rural India are even more visible in quality-terms and expectations. Today's farmers not only want to feed their families, but also want some extra food production that can be sold in the market to earn sufficient money to fulfil other needs. Along this line, new methods of agricultural growth and rural development are sought to enable this. One of them is the introduction of Information and Communication Technologies (ICT), which enable the dissemination of requisite information at the right time. Although ICT sector brings opportunities for rural development, they are dependent on a series of factors. All these factors rely on certain institutional environment, with significant participation of the government and its support. Institutions at the highest level in the country are set to assist and reinforce building specific solutions for specific problems in rural areas which cover utilisation of ICT for broader development of rural India. Properly shaped institutions enable development of ICTs and its influence on rural India.

GOAL AND METHOD

The field of research that examines the link between information and communication technologies and socioeconomic development (which is referred to as ICTD or ICT4D[1]) has been carried forward by researchers mapping methods from their disciplines onto this terrain. The ICT4D community has searched for comprehensive and adequate conceptual frameworks. In 2003, the United Nations Regional Commission for Latin America and the Caribbean (UN-ECLAC) proposed a three-dimensional conceptual framework that models the transition toward information societies as the interplay among technology, policy, and social change, a so-called "cube framework". It has its theoretical roots in Schumpeterian innovation theory [Hilbert 2012]. In line with the Schumpeterian school of thought, the first enabling factor for the associated socio-economic transformations is the existence technological infrastructure: hardware infrastructure and generic software services. Additionally, capacity and knowledge are the human requirements to make use of these technologies. These foundations (horizontal green dimension in Figure) are the basis for the digitization of information flows and communication mechanisms in different sectors of society. More and better information and communication furthers the development of a society. Aside from its reliance on technology, ICT4D also requires an understanding of community development, poverty, agriculture, healthcare, and basic education.

Based on the "cube framework" an ICT4D analysis framework was compiled by the author [Sobiecki 2012] which comprises of a set of complementary vertically-aligned groups of factors of ICT development. Major factors for ICT development and influence on economy are grouped into:

- diagonal side of the cube:
  - institutions & regulations (environment for other categories),
- horizontal side of the cube:
  - technology (innovations),
  - market implementation (profitability and business environment),
  - accessibility (physical presence),
  - affordability (reasonable price),
  - know-how (knowledge to use),
  - adoptability (acceptance).

Progress in all of these areas makes the development of ICTs complete and enables the society (vertical side of the cube) to develop – utilize (apply) ICTs in real life.

In terms of rural development it means that ICT may enable farmers not only to develop better in terms of production, but also to have better lives because the access to accurate, current prices and the demands of the products gives them opportunity and more market power to negotiate which improves their incomes. Second, they may have access to agriculture information on efficient grooving crops, weather dealing with climate change, drought, poor soil, erosion and pests etc. ICTs may also give access to national and international markets for the farmers. In terms of societal development – great distances between villages become smaller. ICT may contribute to a favourable policy on development and sustainable growth of the agriculture sector [Motes 2010].

[1] Further reading: Heeks [2008], Sutinen, Tedre [2010], Unwin [2009], Harindranath, Sein [2007], Kleine [2013].

This paper focuses on the diagonal side of the cube with respect to the horizontal side. The current state of major Indian institutions (ICT and rural policies) using document analysis are evaluated against supporting progress in areas of the horizontal side of the cube in rural India.

Documents which are being evaluated are: recent Five year plan (2012-2017), National Telecom Policy 2012 and chosen public initiatives/activities run, initiated or funded by central government (Ministry of Rural Development and Ministry of Communications and Information Technology), state governments and major public and non-government organizations (IAMAI, NASSCOMM).These documents cover major sources of institutional environment for development of ICT in rural India. General law and economic system, pure ICT or pure rural development policies (e.g. poverty reduction) as well as specific institutional solution in states (except for funded programmes) lie beyond the scope of the article.

LITERATURE REVIEW

The directions of institutional change in Indian agriculture sector and ICT sector have been widely discussed. S.M. Pal et. al. [2003] review broadly existing theories of institutional economics and examine the roles of the government, the state, markets and collective actions for evolving the knowledge-intensive agriculture in India [Motes 2010]. Research on role of ICT in Indian socioeconomic development: in general as well as in rural areas have also been undertaken several times. Geoff Walsham [2010] used the published academic literature to examine ICT-based initiatives and their impact on the broader development of India, described remaining problems and suggested approaches for the future. A. Garai et. and B. Shadrach [2006] analysed the potentials of ICT for a holistic development of India, with special focus on rural development process, "by infusing knowledge connectivity to human agencies while smoothening the nation's migration from an agrarian society to a knowledge society". They asses developmental impact of ICT on society using the human development measurement tools. Many authors contributed to the subject by evaluating specific initiatives, being a part of general institutional environment. Among them are C.J. Glendenning and P.P. Ficarelli [2012], G. Kumar and R. Sankarakumar [2012], T.M. Qaisar et. al. [2011], S.Y. Bhor et. al. [2010] and many others.

There are, however, none known research specifically on subject being the goal of this article, that is on institutions supporting the ICT development in rural areas of India. This article aims at fulfilling this gap.

ANALYSIS

GENERAL REFORMS AND REGULATIONS

The spread of ICTs began accelerating in India with the liberalization of the telecommunications sector as part of the New Economic Policy in July 1991. Throughout the early 1990s, various aspects of the telecommunications industry were opened to the private sector, including radio paging and mobile phones. The government's New Telecom Policy of 1999 and New Internet Policy of 1998 have further spurred the growth of the ICT sector, resulting in a large number of manufacturing units and internet service providers (ISP) setting up bases in the country. Since the deregulation of the telecommunications sector in

the late 1990s, users in India have been able to choose among hundreds of different public and private service providers [FreedomHouse 2012].

The Indian economy since independence in 1947 is based on multi-level planning through the institutions of five-year plans, medium-term plans, annual plans, state plans and specific policies. The plans are built, developed, implemented and monitored by the Planning Commission, established in 1950. The Commission's mission is to gather information on the state of country development, exploring the possibilities of further development and plan the best use of the resources of the country, by setting quantitative indicators to be achieved. The institution of the plans evolved from a highly centralized specific planning to setting a mission, vision and strategies for development and decision-making on national priorities. The master executive authority is the government, who also finances its implementation via its agencies [Sobiecki 2012].

Current, Twelfth Five Year Plan for years 2012-2017 [Planning Commission 2011] relies on an extensive range of government programmes (mentioned further), which cover a wide variety of sectors, to help achieve the inclusive and sustainable growth. Unlike in the Eleventh Five Year Plan, there are only a few targets specifically for ICT in rural areas set. One of the targets for the Telecommunication Sector however is "Mobile access to all villages and increase rural teledensity to 70 per cent by 2017." In the specific plan for rural development, however, we do not find tasks based on ICT development in rural India, which shows that role of ICTs has been under-valuated. There are no new initiatives as well in rural development, nor skill development, which may be considered as a drawback in comparison with the 11th plan, where more than 10 targets concerning Network Expansion and Rural Telephony were set[2]. The explanation for this may be need to concentrate in the general plan on still-not-enough-developed fundamental areas like improving sanitation conditions, providing drinking water and electricity, teaching basic skills, while leaving existing projects concerning ICT development in rural areas intact.

NATIONAL POLICIES

In 1999 an important policy was introduced (New) National Telecom Policy 1999, which announced a new era in ICT sector. Completely new approach and goals were set. Among the objectives were: "Strive to provide a balance between the provision of universal service to all uncovered areas, including the rural areas, and the provision of high-level services capable of meeting the needs of the country's economy", "Encourage development of telecommunication facilities in remote, hilly and tribal areas of the country", "Transform in a time bound manner, the telecommunications sector to a greater competitive environment in both urban and rural areas providing equal opportunities and level playing field for all players", "Encourage development of telecom in rural areas making it more affordable by suitable tariff structure and making rural communication mandatory for all fixed service providers." and "Increase rural teledensity from the current level of 0.4 to 4 by the year 2010 and provide reliable transmission media in all rural areas" [*National Telecom*... 1999].

[2] Among them we find: one telephone per three rural households by 2007; One phone per two rural households by 2010; 200 million rural connections by 2012 (i.e. a rural teledensity of 25%); For rural telephony the infrastructure will be shared at least amongst three service providers; To support for development of general telecom infrastructure in rural areas, initially pilot projects would be undertaken for the same [Planning Commission 2006].

The stated objectives of the draft National IT policy include the goals of making at least one individual of every household e-literate and of leveraging ICTs for key social sector initiatives like education, health, rural development and financial services to promote equity and quality. Equally significant are the objectives of enabling access to content and ICT applications by differently-abled people to foster inclusive development and of encouraging use of mobile phones for value added services and transactional services such as financial services. The stated mission draft National Telecom Policy 2011 included creating a knowledge based society through proliferation of broadband facilities in every part of the country. Its objectives include enabling citizens to participate in and contribute to e-governance in key sectors like health, education, banking etc. to ensure equitable and inclusive growth and to reposition the mobile phone from a mere communication device to an instrument of empowerment that combines communication with proof of identity, fully secure financial and other transaction capability, multi-lingual services and a whole range of other capabilities that ride on them and transcend the literacy barrier [Gulat 2011].

National Telecom Policy 2012 continued this path. Most of this policy was to underscore the imperative that sustained adoption of technology would offer viable options in overcoming developmental challenges in education, health, employment generation, financial inclusion and "much else. [*National Telecom*... 2012]. Therefore in the multi-level scheme of the policy, the first point of the mission in NTP 2012 was "To develop a robust and secure state-of-the-art telecommunication network providing seamless coverage with special focus on rural and remote areas for bridging the digital divide and thereby facilitate socio-economic development" [*National Telecom*... 2012]. Among the objectives we find "Increase rural teledensity from the current level of around 39 to 70 by the year 2017 and 100 by the year 2020.", and "Simplify the licensing framework to further extend converged high quality services across the nation including rural and remote areas. This will not cover content regulation." [*National Telecom*... 2012]. There is a whole section (strategy) aimed at rural areas, where the goal is "To develop an eco-system for broadband in close coordination with all stakeholders, including Ministries/ Government Departments/ Agencies to ensure availability of media for last mile access, aggregation layer, core network of adequate capacity, affordable equipment including user devices, terminals and Customer Premise Equipment and an environment for development of relevant applications. Formulate policies to promote competition by encouraging service providers, whether large or small, to provide value added services under equitable and non-discriminatory conditions", "To lay special emphasis on providing reliable and affordable broadband access to rural and remote areas by appropriate combination of optical fibre, wireless, VSAT and other technologies. Optical fibre network will be initially laid up to the village panchayat level (…). Extension of optical fibre connectivity from village panchayats to be taken up progressively to all villages and habitations. (…)" and "To stimulate the demand of broadband applications and services, work closely with Department of IT in the promotion of local content creation in regional languages which would enhance the investment in All-Internet Protocol (IP) networks including NGN". No skill development in ICT area is set as a strategic field." [*National Telecom*... 2012].

National Policy on Electronics 2012 is expected to create an indigenous manufacturing eco-system for electronics in the country therefore does not rely on rural areas. Only in one of the 14 objectives in the draft of the policy one could find [*Approval of National*... 2012] "To use technology to develop electronic products catering to domestic needs, including rural needs and conditions, as well as international needs at affordable price

points". In final version this objective was changed into "To use technology to develop electronic products catering to domestic needs and conditions at affordable price points" [*National Policy*... 2012].

Among programmes of the Ministry of Rural Development we find five major programmes: Rural Employment, Rural Livelihoods, Rural Connectivity, National Social Assistance and Caring for the Differently Abled. In the livelihood programme (Aajeevika-National Rural Livelihoods Mission, NRLM) ICT are mentioned only once: Aajeevika will coordinate with the financial sector and encourage use of Information, Communication & Technology (ICT) based financial technologies, business correspondents and community facilitators like "Bank Mitras" [*Annual report*... 2012]. In the rural employment programme the Ministry has strongly supported the use of Information Communication Technology (ICT) to improve programme efficiency, streamline processes as well as place information in public domain via e-FMS (an electronic Fund Management System), e-MMS (Electronic Muster Management System).

NASSCOMM AND IAMAI

NASSCOMM, National Association of Software and Services Companies is the biggest industry association for the IT-BPM sector, established in 1988. Its members represent 95 per cent of industry revenues. The objective of NASSCOMM is to build a growth led and sustainable technology and business services sector in the country. Its mission covers general ICT development, however without mentioning the support for rural development. NASSCOMM runs couple of programmes: Global Trade Development, educational Sector Skills Council (EdI), National Skills Registry for IT/ITES Professional (NSR-ITP), Diversity & Inclusivity, Domestic Market Forum, National Skills Registry, but none of them aims directly at or covers the rural development issue [NASSCOM 2013].

IAMAI, Internet And Mobile Association of India is another not-for-profit industry body. It was registered under the Societies Act, 1986. Its mandate is to expand and enhance the online and mobile value added services sectors [IAMAI 2013]. The association's activities include promoting the inherent strengths of the digital economy, evaluating and recommending standards and practices to the industry. IAMAI is the only specialized industry body in India representing the interests of online and mobile value added services industry. IAMAI provides yearly reports on the state of ICT development in India on digital advertising, mobile VAS, online entertainment, general Internet development (I-Cube) with specific version dedicated to rural India, mobile Internet and social media in India. IAMAI generally underlines the need to support digital revolution in rural India [*Digital India*... 2009] pointing out that there are 5 broad areas which if taken together and deployed over internet would truly empower rural India by providing much needed economic security: Healthcare, Education, Poverty alleviation, Democracy/Governance, Commerce, and recommends specific actions and changes in law and regulations to improve access, affordability, application and adoptability, but does not run or funds any programmes by itself.

MAJOR GOVERNMENTS INITIATIVES

The flagship project of the government in India is NeGP (National e-Governance Plan) [NeGP 1, 2013], that has been underway since 2005. The NeGP aims at improving delivery of Government services to citizens and businesses with the following vision: *"Make all Government services accessible to the common man in his locality, through common service delivery outlets and ensure efficiency, transparency & reliability of such services at affordable costs to realise the basic needs of the common man"* [NeGP 2, 2013]. NeGP therefore is one of the biggest central government projects and comprises 31 mission mode projects (MMPs), which are further classified as state, central or integrated projects. None of the central government mission mode projects[3] is aimed at rural development nor at ICT.

One of the most important for rural areas MMPs on the state level is e-Panchayat, providing comprehensive software solution attempting automation of Gram Panchayat (local self-governments) functions. National Land Records Modernization Programme (NLRMP) is another MMPs on a state level with main objective to modernize the land records system in the country. NeGP implementation involves setting up of common and support IT infrastructure such as: Common Services Centres (CSCs), State Wide Area Networks (SWANs), State Data Centres (SDCs) and National e-governance Service Delivery Gateway. The CSCs provide high quality and cost-effective video, voice and data content and services, in the areas of e-governance, education, health, telemedicine, entertainment as well as other private services. A highlight of the CSCs is that it offer web-enabled e-governance services in rural areas, including application forms, certificates, and utility payments such as electricity, telephone and water bills. In addition to the universe of G2C services, the CSC Guidelines envisage a wide variety of content and services.

There are about 90,000 CSCs operational in various parts of India. With India having about 600,000 villages, each Common Service Centre on an average serves about 6 villages approximately [*Internet in rural…* 2011]. SWAN is also an important ingredient for the success of the CSC scheme, as it is the backbone for CSCs with its optic fibre bandwidth connectivity.

Other notable Government initiatives include Sarva Shiksha Abhiyan (SSA) and the National Rural Employment Guarantee Act (NREGA) scheme. The SSA has helped computer literacy to rise among school children while also increasing Internet awareness and usage. As part of NREGA, a web based system has been designed that villagers can use for their personal use and obtain their payment online, while also storing their money safely. The scheme provides a legal guarantee for 100 days of employment in every financial year to adult members of any rural household [*Internet in rural…* 2011].

T.M. Qaisar et. al. [2011] show in their analysis that vast majority of the agricultural information services via ICT are initiated, implemented by public organization (international organizations, NGOs, central government, state government, national agricultural research centre and other): 54 out of analysed 69. In terms of funding – public organizations' share is even greater: 67 out of 75.

[3] These project's names are: Banking, Central Excise, e-Office, Income Tax, Insurance, IVFRT, MCA21, MNIC/UID, Passport, Pensions, Post.

DISCUSSION AND RECOMMENDATIONS

Agriculture is one of the most important sectors in India, and could benefit tremendously with the applications of ICTs especially in bringing changes to socio-economic conditions of poor in backward areas.

The Five Year Plans, National ICT and Telecom Policies of the Indian Government are developed in the right direction and the government initiatives are increasingly maturing, but may lack some specific solutions.

As X. Fua and S. Akter show in their study[4], the most important problem for majority of farmers in adopting ICT is 'Tendency of following traditional method of cultivation', followed by 'Language of data information provided by ICT media are not able to access', 'Poor rainfall and irrigation facilities make dispassionate to access ICT application on agriculture' and 'Market information on price, supply and demand adversely affect the price paid to the farmers' [Fua 2012]. These problems are still not faced by the institutional solutions. Therefore the author recommends some changes.

Achievements of India's rural telephony objectives needs to be approached in a holistic and integrative manner wherein not only due policy and regulatory glitches need to be ironed out, but also various procedural concerns also need to be addressed. A good example is the system of European Union programmes and projects within them on specific subjects.

Many programmes and policies respond to the problems of inadequate physical and financial resources, technical capabilities and extremely limited computerization – concentrating on delivering infrastructure, services that facilitate solving problems of rural folks and markets (i.e. PPP), but seem to forget about the human factor. There are programmes addressing the problem of languages in ICT services (i.e. Technology Development for Indian Languages [*Technology development*... 2013]), but still the central policies and general institutional framework lack underlining the role of know-how in ICT and attitude towards ICT in rural areas. A step forward may be a central government initiative "e-Governance in Municipalities" that envisages covering Urban Local Bodies (ULBs) to improve the efficiency and effectiveness of delivery of municipal services to citizen, but still it is limited to know-how in municipal services.

Farmers sometimes become averse to adopting technology as they think that it might result in their losing their traditional methods of cropping practices [Marichamy 2013]. They simply do not want to use such systems, even if the cost incurred is negligible. Other authors like S. Sanyal underline [Sanyal 2011] that many projects aiming at technological upgradation and implementation of ICT in rural areas have failed in the past because of lack of willingness among rural people to absorb such schemes. Therefore, the attitude and mind-set of farmers needs to be changed first. There is a need to win their confidence and create awareness about the benefits of ICT in agriculture. S. Sanyal proposes an addition to the national ICT policy – the Development Communication, which intensifies the rural development process by mobilizing rural people for development action and ensuring an information flow among all concerned with a development initiative. Methods of development Communication include: community radio, participatory video, documentaries, folk media, grassroots comics, community newspaper, street theatre, puppetry, bioscope and photography – methods already used but not integrated in any general framework.

[4] The study was conducted on a sample of 300 farmers selected by lot, therefore can't be regarded as representative, but shows some trends.

Unlike in European Union, there are no accessible, official, comprehensive, quantitative analyses or reports of fulfilling the millennium goals, the national plans; nor are there any reports on on-going, completed or interrupted projects. The absence of comprehensive information on the projects suggests that projects need to be more carefully documented, information on the projects needs to be more readily available and project evaluations need to be shared [Qaisar et al. 2011].

There is a needed for a more discriminating attitude towards regulations by TRAI, taking into account specifics of rural regions and supporting its development in the fields of rural markets (rural ICT entrepreneurship), accessibility and affordability.

No rural national policy supports ICT utilisation or ICT entrepreneurship in rural India, nor it uses it in guaranteed employment programme as an option of employment, nor in Aajeevika, a programme aimed at improving skills of the rural folks [*Aajeevika Skills…* 2013]. More cooperation between the Ministry of Rural Development and the Ministry of Communication & Information Technology is needed.

Greater emphasis must be placed on the availability and relevance of services and content in local language or multi-media/accessible format as per needs of target beneficiaries. Capacity building of various stakeholders to use ICTs is essential for the goal of ICT enabled rural development to be achieved. This requires a shift in focus away from purely technology related issues to the evolution of policies, strategies and schemes that ensure cross-sectorial and multi-stakeholder involvement and engagement including most of all the local communities and target beneficiaries themselves**.**

FURTHER STUDIES

The goal of this study was to assess the current state of institutions in India. There is already a growing body of evidence to show that sound ICT institutions does benefit development goals. However these results do not answer if this correlation is direct or indirect, nor about the strength of the link.

Therefore, as a next step, the author encourages those involved in ICT4D practice and research to consider empirical links that they have worked on, and to review them against the rural development. Further works in the field of ICT4D in rural India are needed to verify the strength of the positive link between ICT institutions and rural development, which will give further possibilities to verify the link in other countries.

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Grzegorz Sobiecki

INSTYTUCJONALNE OTOCZENIE DLA ZASTOSOWANIA ICT NA OBSZARACH WIEJSKICH W INDIACH

Streszczenie

Rolnictwo to jeden z najważniejszych sektorów Indii, który może w znacznym stopniu skorzystać z zastosowania ICT, szczególnie dla budowania zmian w warunkach społeczno-gospodarczych biednych regionów wiejskich. Osiągnięcie tych korzyści wymaga odpowiednich instytucji, które wspierałyby przyswajanie i wykorzystanie ICT. Podjęto próbę przedstawienia obecnego stanu głównych instytucji Indii, aby ocenić je pod kątem budowy dogodnego środowiska dla przyswajania i wykorzystania ICT w regionach wiejskich Indii. Stwierdzono, że pięcioletnie plany polityki narodowej dotyczące ICT i telekomunikacji rozwijają się w dobrym kierunku, a rządowe inicjatywy stają się coraz dojrzalsze, ale brakuje im specyficznych rozwiązań.

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DEVELOPMENT OF THE AGRIBUSINESS SECTOR IN KAZAKHSTAN

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A b s t r a c t. The article examines the agricultural sector of Kazakhstan after independence in 1991, as well as problems and issues that arise during this process. The study used data from official statistics, policy documents and materials of the Department of Agriculture published on the website and articles on agrarian issues. The article highlights the social problems of agrarian sector that need to be addressed. Domestic grocery production is weak competitive both in foreign and national market due to low level of quality products. Kazakh producers are losing much part of the food market due to lack of capacity for processing of agricultural raw materials and to its low quality as well as to weak links between farmers and processors.

INTRODUCTION

The theory of sustainable development in the past two decades has become the most popular. Now in the literature, there are dozen definitions of sustainable development. This reflects the complexity of the concept, including economic, environmental and social aspects of human development, as well as divergent views of scientists, entrepreneurs and politicians.

Historically, the concept of "sustainable development» is associated with the environment. One of the earliest definitions of "sustainable development" was suggested by the Canadian Commission for the Protection of the Environment in 1915: "Every generation has a right to a certain percentage of natural capital, but the bulk of that capital should be transferred to the next generation intact".

In 1987 The International Commission on Environment and Development has defined Sustainable Development: "Sustainable development - it is development that meets the needs of the present, but without compromising the ability of future generations to meet their own needs. It includes two key concepts: Requirements, which is necessary for the existence of the poorest segments of the population that should be taken first priority; Limitations, which is imposed by the condition of technology and the organization of society imposed on the environment's ability to meet present and future needs".

The definition of 'sustainable development' in relation to the agrarian sphere is formed in the material, taken at the session of the FAO (Food and Agriculture Organization) in Rome in 1996, as follows: "The main objective of the sustainable agriculture and rural development is to increase food production and ensuring food security. To solve this problem it is necessary to support educational initiatives that use economic innovation and develop new technology acceptable, thus ensuring stable access to food, which corresponding to human needs and nutrient; access for poorer groups, to develop commodity production, seek to reduce unemployment and increase income levels in order to combat poverty; manage natural resources and protect the environment" [FAO 1996].

One of the main principles of sustainable agriculture is to ensure food security of the country. Internationally accepted definition of food security, which is given in the Rome Declaration of the World Forum on Food Security, held under the auspices of FAO in November 1997 in accordance with this definition of "food security – is to ensure access by all people at all times to the food needed for healthy and active life. With the achievement of food security food available in sufficient quantities, their supplies are relatively stable and every needy person can get food" [FAO 1997].

Sustainable development of the agricultural sector is defined closely interrelated components: economic, social and environmental. The main criteria for the sustainable economic development of the industry are the growth of the production of safe food to meet the needs of their populations, ensuring economic efficiency, allowing to deliver expanded reproduction. The social component of sustainable development involves increasing the level and quality of life of farmers, stabilization of demographic and migration processes in the countryside.

In determining the sustainable development of the agrarian sector should adhere to the unity of these components. The economic component includes an increase in the volume of agricultural production, improving the efficiency of agricultural production and the contribution of rural entrepreneurship in the economy of the region and the country, social – to achieve full employment of the rural population, align the village standards of living to the city, ecological – sustainable use of natural resources and preservation of the natural environment. Crucial role in the sustainability of agriculture and its individual branches has socio-economic and agricultural policies of the state. To characterize the social stability it is advisable to use the following indicators:

– the ratio of wages in agriculture to wages for the economy as a whole.
– the ratio of consumer prices to the average wage in agriculture.
– turnover rate in agriculture.

METHODOLOGY

The objective of study is to analyze the current state of the agribusiness in Kazakhstan, discover main problems of sustainable development and elaborate perspective tools to ensure sustainability. The analysis involved data of statistics agency of Kazakhstan Republic and carried out them mainly in the quantitative and qualitative context, using the descriptive statistics. In the analysis, method comparative analysis was implemented. The period of analysis was 1991-2012.

The current state of the rural economy is analyzed by the examples of the modern practice of Kazakhstan. Special attention is paid to the social factors of agricultural development. All this is carried out due to objective studying of levels, structure and tendencies of economic development of the agribusiness in Kazakhstan.

BACKGROUND OF KAZAKH AGRICULTURE

Agriculture is a key sector of agribusiness everywhere, including in developed countries, despite its relatively small share. The size and level of its development influences all other areas of agribusiness, and, in many ways, the national economy.

The main trends of world development in the agricultural sector are the globalization of trade, vertical integration, the increasing demand of product safety and product quality and the increasing demand for organic products.

Kazakhstan is geographically the 9th largest country in the world and the proportion of agricultural land is 34.3%. The population of the republic is relatively low – 16.44 million people, of whom 45.5% is rural. The share of the employed population in the economy of the agricultural sector is about 28%. The population of Kazakhstan settled on its vast territory is very unevenly distributed. Even in average indicators the difference of the density of population across regions (oblast) of the country differ in times, from 3.32 people per square kilometer territory in the West of Kazakhstan, up to 10.68 people in the South of Kazakhstan. A comparison of regional data (rayon) reveals even greater variance: from 2,21 in Aktobe to 22.2 in the South of Kazakhstan [*Agriculture, forest…* 2012].

Kazakhstan, in developing its economy, defines its place in the global economic system. Foreign trade turnover over last five year increase on 55,3% (Tab. 1). However, the main part of growth was growth of an import. It calculates 84.2% to level of 2007.

Table 1. Trend in foreign trade's turnover of Kazakhstan

Indicator	2007	2008	2009	2010	2011
Foreign trade turnover [mln $ USA]:	80 511.7	109 072.6	71 604.4	91 398.1	125 019.7
– import	47 755.3	71 183.6	43 195.7	60 270.8	87 964.0
– export	32 756.4	37 889.0	28 408.7	31 126.7	37 055.7

Source: [*Agriculture, forest...* 2012].

Through economic reform, Kazakhstan tries to overcome the raw-material orientation of its economy, largely inherited from the Soviet system. The agrarian sector of the country is playing an active role in this process. The agrarian policy of Kazakhstan aims to develop a globally competitive specialization in non-primary sectors. Given the role of food security in ensuring the independence of the country, and that more than 45% of the population lives in rural areas, the state and development of the agriculture is great importance for the sustainable development of the country.

The agriculture in Kazakhstan is one of the most promising sectors of the economy [Fennell 2011]. However, there are various issues that must be addressed by the government, including the improvement of product quality and the creation of national brands, infrastructure development, improvement the quality of rural labor resources in agribusiness and the creation of conditions for improving the technical support of agricultural production.

The agricultural sector as the guarantor of national food security and development of export potential has the paramount political importance. The issues of food security are included in the list of national interests, their decision is related to the sustainable development of agriculture and agribusiness. Export potential of agriculture in the country is very high, especially for the production of grain and flour. In conditions of essential dependence of the country on raw materials export the using export opportunities of agricultural economics can make a significant contribution to the development of economy.

The agricultural production is very important for social and economic rural development, for example through employment creation in remote areas and areas with difficult climatic conditions. There is high demand for greater equality across regions, to ensure the territorial integrity of the state, and the rational use and protection of unique natural and biological resources. Kazakhstan has a large area and uneven settlement of the inhabitants. There are 45.5% of the population lives in rural areas. In some areas the share of rural population exceeds 60% (Alma-Ata oblast – 76.7%, South-Kazakhstan oblast – 60.8%, Zhambyl oblast – 60.7%).

However, the agribusiness of the country still has some disadvantages – low rates of structural and technological modernization of the industry, unsatisfactory level of development of market infrastructure, small-scale agricultural production, instability of the financial sector, lack of private investment in the development of the industry and the shortage of skilled personnel, etc.

During the reforms domestic agriculture could not reach a new qualitative level. Certain products still have not reached pre-reform levels of production. For example, in 2011 the production of meat (slaughter weight) in farms of all categories was 61.8% of the 1991 level. The scale of the agricultural production is also reduced; the crop area declined by 38.6% between 1991 and 2011, the number of animals also reduced during this period: cattle by 35.6% and sheep, goats, pigs and poultry – by 50%. Agricultural productivity remains low, the yield of grain, which is the main export product was 8 quintals per hectare in 2010, while in developed countries it fluctuates from 20 to 45 quintals per hectare [*Agriculture, forest...* 2012].

The share of agriculture in the GDP of Kazakhstan for the past 20 years has decreased from 34% to 4.5%, while employed labor force in rural areas are accounted 28.3%. This is a confirmation of the low labor productivity in the sector and low primary incomes of the rural population. It should be noted that the reduction of the prices on agricultural products by more than twice and the growth of price indices on industrial goods considerably influenced the decline in the share of agriculture too.

Thus, the agrarian reforms in the transition to a market economy have been found ineffective with a painful impact on agricultural production. This is evidenced by the fact that Kazakhstan takes 49th place in the world in concordance with the report on global competitiveness, annually published by the World Economic Forum in terms of efficiency of agrarian policy.

Table 2. Trend in area, yield and production of a cereal and a meat in Kazakhstan

Indicator	1991	2001	2011
Crop area [million ha]	34.94	16.79	21.08
Cereal's area [million ha	22.75	13.20	16.22
Cereal's production [Mt]	11.99	15.90	26.96
Number of animals [million unit] catles	9.59	4.11	5.70
Meat production [Mt]	1,52	0,66	0.94

Source: [*Agriculture, forest...* 2012].

REGIONAL TRADE AND SPECIALIZATION OF AGRICULTURE

The main object of the present industrial and innovative state policy is the development of a globally competitive specialization of Kazakhstan in the manufacturing sectors of economy for sustainable economic development. In order to diversify and increase the competitiveness of Kazakhstan's economy in the long term the Master Plan on Forced Industrial-Innovative Development of Kazakhstan for 2010-2014 has been adopted and it is implementing.

In this regard, a large and important task is raising the agricultural sector of the economy to a qualitatively new level of development and thereby improving competitiveness, which is especially important in light of the country's integration with Russia and Belarus, and the subsequent entry into the World Trade organization.

Although in recent years, Kazakhstan, like other CIS countries outran the most developed countries by economic growth by 2-3 times, including the United States and the majority of the countries of the European Union, the quality of that growth still remains unsatisfactory. In recent years the volume of Kazakhstan's trade in the total world trade has grown rapidly. In 2010 the foreign trade turnover of country exceeded the level of 1995 by 10 times. Between 2005 and 2009 years Kazakhstan took 48th place among the world exporters with the annual rate of export growth at 16%. Kazakhstan's share in world exports of flour for the years 2005-2009 was 15.2%, and for this the country took second place. However, currently the exports of Kazakhstan mainly consist of commodities of the raw group: 72.4% – mineral raw materials and fuel, 15.4% – ferrous and nonferrous metals [*Agriculture, forest…* 2012].

The growth of Kazakhstan's exports, the most part of which, as before, are mineral resources (oil, gas, metals), certainly mitigates the country's crisis and assists the implementation of the structural reforms. However, it leaves the national economy vulnerable to the global economic downturn and to the decline of the energy prices. Moreover, the dependence on imports for many vital goods including food remains.

It becomes evident that to further increase the pace of the extraction of raw materials while maintaining an expensive and inefficient production structure will threatens the country with a gradual transformation into a raw materials appendage of the world economy. The only way to counter this is through the upgrading of economic structure, the transition on the resource-saving innovative path of development in all sectors of the economy, including agriculture. First steps in this direction have already been made, but given the scale of the lag, they must repeatedly accelerate, in order to maintain the existing scientific and educational potential, to restore cooperative communication, to provide a competitive regime, and an effective partnership in science and technology, to create conditions for the transformation of innovation in a powerful lever of the economic recovery.

The favorable situation in world energy prices is a bonus for the restructuring of the economy, so that it may transfer into an innovative, high-tech way of development and hence lower the probability of economic and political shocks and risks. It is better to increase the potential level of competitiveness in all sectors of the economy, including agriculture, in order to survive being conditioned by unilateral export orientation.

In this regard, it should be noted that even now an annual turnover of the global market for new technologies and high-tech products in terms of value exceeds on several times the turnover of the raw materials markets, including oil and gas. But the share of Kazakhstan, as well as other CIS countries in total volume of this innovative market, as opposed to raw materials, is disproportionately small – only 0.3% versus 39% in the US, 30% in Japan and 16% in Germany. Accordingly, the share of high-tech industries in the structure of Kazakhstan's economy is now only a little more than 2%, while in China the figure is 14%, and in the USA 22%. This is not surprising, as far as in both developed and rapidly developing countries are much more heavily invested annually in research and technology development. Thus, the share of spending on civilian research and development in the US, Japan, Switzerland, South Korea is 2.5-3.5% of GDP, while in Kazakhstan it is 0.15%. This ultimately increases the already substantial gap in innovative development between countries.

DIVERSIFICATION OF KAZAKH AGRICULTURE

Currently, one of the main factors hampering the development of food production in Kazakhstan is the persistently low level of industrial processing and incomplete utilization of the capacities of processing enterprises. The fact that the share of agriculture in GDP is double hire than the share of the food industry speaks the non-use capacity of the raw materials base of the agribusiness. So, the share of food in total industry in 2011 amounted to 4.8%, and in the 1st quarter of 2012 it had dropped to 4.3%. In general, this indicator has reduced over the past 3 years. The share of light industry is even less significant and amounted to 0.2% in 2011, and no positive changes have been seen to date [*Agriculture, forest*... 2012]. It should be noted that growth in agricultural production is constant, but despite this, the share of industrial processing of agricultural raw materials is very low, and the finished product has a weak competitiveness, which is due to the technological backwardness of processing companies.

In 2010, production of meat in carcass weight increased by 4.6% compared to 2009. The share of industrial processing in the total meat production amounted to 24.2%. The use of the average annual capacity of the meat processing plants was 65%. Thus in 2010 the volume of imports of meat and meat products amounted to 193.2 thousand tons, and exports of meat and meat products amounted to only 2.5 tons. It should be noted that the bulk of the imports of meat products comprise products of deep processing [*Agriculture, forest*... 2012].

In 2010, milk processing enterprises of the republic processed 1.4 million tons of milk for production of dairy products, what accounted for 30.4% of the total volume of milk production. In 2010, imports of dairy products in terms of milk amounted to 877.9 thousand tons. During the reporting period, exports of dairy products amounted to only 10.2 tons. The development of milk processing is hampered by delays and incomplete utilization of production capacities of most of the specialized companies. The reasons of this situation are a violation of the economic relationship between raw material suppliers and processors, the low quality of raw materials, imperfect system of settlements between enterprises and the low purchase prices on the products of agricultural producers [*Agriculture, forest*... 2012].

A more positive situation emerged in the grain processing sphere. Today in the republic the power of the mills is 8 423.6 thousand tons per year; nearly 3 times higher than domestic demand for flour and therefore provides a stable export. In 2010, the more than 55% of grain which was produced in the Republic was industrially processed for flour, with an average utilization factor of mills at 45% of capacity. The share of flour exported from the production volume amounted to 61% in 2010. There is potential in the country for the export of pasta. According to Customs Control Committee the import of pasta in 2010 was 12.9 thousand tons, 40.8% more than in 2009. However, the infrastructure of the grain production requires attention: the technological level of the transport and the grain elevator infrastructure lag behind the increased capabilities of national grain production. The active procurement of the grain carriers, construction of the grain elevators, including the terminal type near the port and the international transport corridors are required.

The next factor adversely affects on the development of the food industry regarding a processing of agricultural raw materials and an increasing the competitiveness of production is the very low level of implementation of international quality and safety standards based on international standards ISO and HACCP in the food industry. As a result, product has lower consumer quality compared to foreign food. Currently, domestic food products are worse in terms of different parameters. It is due to lack of modern technologies for processing, packaging and storage (there is a shortage of storage facilities for fruits, vegetables,

refrigeration for meat, milk, slaughter houses, etc.). Moreover, the agricultural raw materials supplying of the food industry also largely don't meet the standards of quality. Controls must be organized to ensure compliance international standards. At the same time, the new technology for processing of the agricultural raw materials can significantly reduce the loss of product during its storage and processing and provide long-term maintaining their quality.

Production of high-quality agricultural products in accordance with the requirements of technical regulations and standards is one of the target indicators of the Program for the development of agriculture in Republic of Kazakhstan for 2010-2014 years, adopted in October 2010 and it is implemented currently. Within the mentioned program a package of measures provides to establish a system of quality control, scientific and personnel support agricultural industries, informational and marketing provision of the farmers.

It should be noted that at present the main obstacle in the transition to an intensive economic model in the agricultural sector is low level of the government support. The experience of developed countries, where the agribusiness system was controlled by the state for a long time, clearly confirms that in a market economy the viability of agricultural enterprises, the efficiency of agricultural production and the relative stability of social realms in rural areas significantly depends on government regulation.

The improvement of access for agricultural producers to credit is one of the important areas of state support in agriculture. The agricultural lending market in Kazakhstan is characterized by high transaction costs and low allocative efficiency of resources. The unstable financial situation of borrowers and lack of insurance of the bank sector leads to tighter credit conditions: high interest rates, a limit of the loan length and an overestimation of the requirements for collateral. This in turn reduces the demand for loans and limits a supply on credit resources.

Agriculture is not included in the main areas of funding the domestic banks, its share in total bank loans is very small – 4-5%. And for agriculture banks set the highest interest rate - about 16%, when an average level is 14.5%. Moreover, the banks distribute loans mainly among medium and large agricultural producers, which accounted for 95% of loans. The share of small farms is only about 4-5%, while they produce almost half of the gross agricultural output [Bisenova 2011].

Thus, in the agricultural sector due to the high level of operational risks and financial instability the formation of the credit system is more complex than in any other industry, and therefore often budgetary funds are used as credit. The problem of providing rural producers with long-term loans in order that they invest in fixed capital, the need for which is enormous, requires the implementation of major public-private long-term investment.

Given the negative situation in the credit market of the republic, the government significantly supports the sector in recent years. The volume of lending in 2009 grew on average by 37% compared to 2007 [*Agriculture, forest*... 2011].

The main operator of the state micro-credit programs of the rural population is the joint-stock company (JSC) "Fund for Financial Support of Agriculture", which is a subsidiary of JSC's "National Holding" KazAgro ".

In 2011, the Foundation carried out six lending programs, in particular: "Rural microcredit" is aimed at the micro agricultural producers and rural residents, "MCO" is intended to finance micro-credit organizations, "Sybaŧa" is for the purchase of breeding stock and bulls for reproduction young meat breed cattle, "Eginzhay" is for lending during the spring, "Tabigiorta" is to support projects for the development of ecological tourism and the implementation of alternative energy sources, for development of forestry, fishing, hunting, and leasing of the complexes of a greenhouse.

SOCIAL ASPECTS OF RURAL DEVELOPMENT

The radical-liberal market reforms in the agricultural sector of Kazakhstan in the 1990s led to the degradation of the social sphere of the agricultural sector. As a result of the reorganization there was a complete collapse of the life support system, just over the years 2000-2009 about 700 villages were emptied. The standard of living of the rural population is lower than the urban population. So in 2009 the average income of the rural population used for consumption was lower than the urban population on one-third. About 12% of the rural population lives under the poverty line, while in urban areas this figures is 4.1%. that is more than 3 times. In some regions the gap is much higher, so the poverty rate reaches 43% in Mangistau region and 17.1% in Almaty region (oblast).

At the same time there is a significant income differential between urban and rural residents. For example, in 2010 6.5% of the population had incomes below the subsistence level, while involved in this category residents are 3.7% in urban areas, residents of the rural population account 10.1%. Indicator of the depth of poverty in urban areas is 1.1%, in rural areas – 1.7% [*Science and innovation*... 2011]. Thus, the successful solution of social problems and improve the welfare of the people require more attention to the problems of agrarian sector. Agribusiness as the main activity of the rural population and a preservation of rural areas as background of their habitat needs support.

Profound differences in income levels were detected by statistical agencies during the expert evaluation of per capita income across rural settlements. In some depressed areas per capita income of villagers was far below subsistence level. The low level of per capita income in rural areas, among other reasons, is due to the difference in the size of households. The average size of the households in the country is 3.9 persons, while in rural areas 58% of households consist of four or more people, including 35% with five or more people, and 10% of households have four or more children (in the cities, only 3% of households have four or more children).

In villages the level of a housing construction, an engineering, a social infrastructure, an education services quality, a healthcare and a consumer services are significantly worse in comparing to cities. Currently, less than 40% of villages have a central water supply. On January 1, 2011 the level of improvement of rural households is estimated: heating from a single center – 4%, sewerage – 10%, gas – 94%, water in the house – 24%, bath – 5%, hot water supply – 3% [Karambetova, Asanova 2011].

The unjustified disparity in social condition is one of the reasons for the lag of the Republic in terms of labor productivity and efficiency of agricultural sector. In the village there is an acute problem of staffing. According to the forecast of local akimats the shortage of specialists only in the social sector for 2009-2011 amounted to 26 584 people (Ministry of agriculture of RK).

A feature of the rural areas of Kazakhstan is the spread of small villages over very large territories. To create decent living conditions in these dispersed small villages is very difficult because of the high cost of communications, roads, electricity, gas, etc. Small villages are consequently unable to have modern medical and educational institutions. In the northern regions of the country, where about 80% of cultivated land locates, the winters are long (7 months) and cold, farmers do not work during this period, except for animal husbandry. Much of the pasture is located in the desert and semi-desert areas with low population density and settlements. The next feature of the community of the rural settlements is the production and social-living isolation. There are a dozen farms, cooperatives and limited liability partnerships within one district.

For example in the village of Zhambyl in the district of Almaty region that is homed 2.9 thousand people two Ltd, three production cooperatives and 247 farms operate. They own the land, livestock, equipment, buildings and other means of production, but farmers are cautious to accept the legal form of cooperation, perhaps because of the past memory of the collective farms [Grigoruk 2012].

The overcoming of a rural population separation requires an organizing core. The local akimates cannot solve this problem due to lack of authority. They are representatives of the authorities in the village, and their functions extend to the enforcement of legislation. The cooperatives of public-private partnership may be solution. Their composition must to the machine-technological stations with a base for the repair of equipment. Thus, they can become centers of interest to farmers through addressing the lack of equipment and technical services, the problems of the marketing and processing, the agrochemical service, the provision of fuel and lubricants, the breeding of animals and seeds, the maintenance of the drainage systems in the area of irrigated agriculture, etc.

The sustainable balanced development of the national economy in the coming decade should achieve through accelerated diversification and increasing competitiveness. An important segment of diversification is the development of agriculture. It should take place in three main areas.

First, it is the growth of productivity. The labor productivity in the agriculture of the republic is lowest, around 3 thousand dollars per employee per year. In developed countries the figure is 50-70 thousand dollars. Right here are the growth prospects for the village. Only agro-industrial diversification will solve this difficult problem. It needs a sharp increase in processing of agricultural raw materials, new equipment, new technologies and approaches in agriculture. The world's experience and implementation them in the agriculture of Kazakhstan are necessary.

Secondly, it is a providing food security in the country. By 2014, more than 80% of the domestic market of food products must be native foods.

Thirdly, to realize of export potential, primarily in the markets of the Customs Union, Central Asia, the Caucasus and the Middle East.

The development of national competitive advantages of domestic production needs to create high-commodity farms, industrial associations, to develop downstream products, to develop a modern product storage systems, to regulate a prices on socially important food products, to insure food quality on all parts of product promotion, as well as to create long-term inter-regional relations between the producing regions and the consuming regions.

CONCLUSIONS

The article analyzes the agrarian sector of Kazakhstan for the period after the acquisition of independence. The analysis showed that the agrarian economy of Kazakhstan have a number of distinct advantages, nevertheless it faces several challenges. Such issues as improving product quality and the creation of national brands, infrastructure development, improving the quality of labor resources in agriculture and create conditions for improving the technical support of agricultural production require the systematic work by the state.

The results of undertaken by the government measures to improve the agricultural economy does not always achieve the intended results. Thus, despite the positive trend of development in the past few years, agriculture accounts for only 4.5% of GDP of the country. The high share of import for basic foodstuffs remains on the domestic market because the low competitiveness of agricultural products.

Sustainable development of the agricultural sector is closely linked to social issues. The social component of sustainable development involves the increasing life quality of farmers, stabilization of demographic and migration processes in the countryside. Social policy plays crucial role in the sustainability of agriculture and its individual branches. Social factors of the development of rural areas can't be solved without a government support.

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ROZWÓJ SEKTORA AGROBIZNESU W KAZACHSTANIE

Streszczenie

Przedstawiono sektor rolnictwa w Kazachstanie po uzyskaniu niepodległości w 1991 roku. W badaniach wykorzystano dane statystyczne oraz informacje z oficjalnych dokumentów dotyczących rolnictwa. Wyniki badań wskazują główne problemy sektora rolnictwa. Niska jakość produktów branży spożywczej sprawia, że jest ona mało konkurencyjna zarówno na rynku lokalnym, jak i zagranicznym. Kazachscy producenci nie są konkurencyjni na rynku żywnościowym przede wszystkim z powodu braku rozwiniętego przetwórstwa surowców rolnych, niskiej jakości surowców rolniczych oraz słabych związków między rolnikami i przetwórcami.

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ESTIMATING INCOME RISK AT THE PIG SECTOR LEVEL[1]

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Key words: income risk, income losses, simulation, pig sector, MCS
Słowa kluczowe: Słowa kluczowe: ryzyko dochodowe, straty w dochodach, symulacja, metoda Monte Carlo

A b s t r a c t. The paper presents a possible theoretical approach how income risk could be indirectly analysed at the sector level. This is an important step in the early development stage of eventual policies dealing with income issues. In such circumstances one should have reliable information about the characteristics of income risk faced by different groups of farms in relation to their economic size and income structure. From an information viewpoint this is very demanding and is lack of information that is often the main obstacle for such preliminary analysis. The main assumption in the approach presented is that appropriate accounting data at the farm level are not available, as the most common approach to estimate income variability per farm. The approach presented utilises different sources of information, such as data at the farm level, national statistics and analytical models, in order to support the simulation process and to give greater insight into income losses at the sector level. The annual subsidy application is crucial information for each farm in the sector from which information about the main production activities could be gathered. On this basis, and with the support of other data sources, income structure for each farm analysed is reconstructed. To imitate income risk, potential from Monte Carlo Simulations is utilised. Possible different risks are entered as uncertain variables and are supported by different uncertain distributions, representing possible states of nature. In the current development stage they are mainly based on triangular random distributions. In such a manner income risk is simulated at the farm level; however results are summarised and presented for group of farms. Regarding this assumption, it is an example of a bottom-up approach. The tool developed is tested on data from the pig sector in Slovenia. The subsequent results suggest that this could be a useful approach for rough estimation of income risk and points out some limitations and drawbacks that could be further improved.

INTRODUCTION

Income risk is becoming an important issue in agriculture, especially in those sectors in which market liberalisation has had a significant influence. The pig breeding sector in Slovenia is definitely one of such sectors that additionally seems to be in permanent financial crisis. By setting new agricultural policies or measures to support such farms it is therefore considerably important to follow also income stability as an indicator of the production

[1] Similar paper was presented at the 19th Congress of the International Farm Management Association (IFMA), Warsaw (Poland), 21-26 July 2013.

conditions under which the farms operate. This means that it influences efficiency and stability of farms' production and also their capability to stay in business as well as their potential for further growth and development. Therefore it is important to have reliable information about the production conditions under which agricultural holdings operate. This is especially true for policy makers as important stakeholders of agricultural business.

Analysing income risk is from an information viewpoint very demanding. In many countries the desire to make in-depth income risk analysis hits on the problem of insufficient data sets for this purpose, especially for analyses of an holistic income risk management approach. Lack of fact-based knowledge about risk at the individual agricultural holding level could also be a significant problem in changing agricultural policies where risk management is becoming an important issue. Namely, risk assessment is a necessary first step to develop a good risk management strategy or tool [*Managing Risk*... 2011].

To follow trends and magnitude of income risk at the sector level, holistic analysis is needed. Already from the definition of risk it follows that we are interested in deviations from expected values, distributions of variables etc., which means that enough long data series are required. A common approach for such analysis is to use very accurate accounting data linked with other databases with enough long data series [Anton et al. 2011]. In the literature one can find many examples of how FADN data could be applied to analyse income risk and efficiency of income risk management as well as to make different studies to support policy makers. Such examples are Vrolijk and Poppe [2008], Severini and Cortignani [2011], *Managing Risk*... [2011], Majewski et al. [2007]. However, such holistic analysis is a big challenge if such on-farm accounting data are not available, or if the data quality is doubtful, which is quite a common occurrence in agriculture.

Our paper presents a possible theoretical simulation approach into how analyses of income risk at the sector level could be conducted without appropriate microeconomic data for each farm. The main idea is that we apply other sources of information available to policy makers. The crucial assumption is that we have some information of the actual production structure at the farm level and some information of income distributions based on national data sets and expert judgements. The aim of this approach is to get a rough estimation of income risk of the whole sector, or different groups of farms (e.g. merged through different economic size classes) and to estimate the magnitude of possible indemnities to compensate income losses. Beside a different methodological concept we are mainly interested in analysing characteristics of income risk. Through basic statistics, such as measures of central tendency and variation in relation to confidence intervals, risk measures and quintile measures, better insight into the analysed problem is provided. However, it has to be noted that the individual risk environment faced by a particular agricultural holding can significantly differ from sectorial or aggregate risk [*Managing Risk*... 2011, Kobzar 2006]. Consequently, the proposed approach is not appropriate for in-depth analysis of income risk for particular agricultural holdings.

The core methodology applied is based on Monte Carlo simulations (MCS) that have already proved to be a powerful method for conducting quantitative risk analysis. An approach of random sampling is especially beneficial when there are several sources of uncertainty that interact in the calculated outcome – income in our example. The principal idea is that uncertain variables, represented by random number generators (RNG), return sample value from a predefined distribution of possible values for each uncertain variable in each replication of the model. In the literature one could find numerous examples how the potential of

RNG has been utilised for risk analyses in the field of agriculture. For example Kimura and Anton [2011] utilized Monte Carlo simulation to analyse the effectiveness and efficiency of farm income stabilisation programs in Canada using AgriStability payments. Majewski et al. [2007] have utilised the MCS method in a static simulation model to estimate the level of volatility of farm incomes on six most frequent production types in Poland. Anton et al. (2011) utilised MCS to model a farm producing multiple crops under different uncertainties.

Based on this background, the aim of this study is to present a theoretical approach about how income risk could be analysed without accurate accounting information, on different levels of agricultural sector. The paper presents the development of a preliminary attempt to assess the soundness and applicability of the proposed simulation tool. It has been tested on Slovenian pig breeding sector, to consider its strengths and weaknesses and to identify further improvements needed. The paper continues with a description of an applied approach and developed simulation tool, which is followed by an in-depth description of setting uncertain variables as well as basic characteristics of the data-base. We conclude with the results obtained and a short discussion.

MATERIAL AND METHODS

DATABASE

The main information for a particular agricultural holding's characteristic (physical production) are annual data delivered from subsidy applications (IACS) collected by the Slovenian Payment Agency. For the purpose of this study we considered data for CAP 1st pillar payments and also for Less Favoured Areas payments (LFA). The main benefit of this database is that we can analyse all farms applying for subsidies regardless of whether they practice accounting or not. Consequently almost all agricultural holdings in the sector could be analysed.

From the IACS database it is possible to gather information about the physical production structure for each particular agricultural holding in given period. With the current tool we considered data for the 'subsidy' years 2010 and 2011. The principal assumption was that production remains fixed and that farmers cannot add additional activity into the production plan in a particular year (state of nature).

In this way we got some information about all agricultural holdings in a particular agricultural sector, although without necessary the accounting data needed for proper analysis of income risk. This is also the main disadvantage of an applied approach. Therefore it was the main challenge, besides estimating achieved revenues, gross margins and incomes for each agricultural holding, to encapsulate income risk. Further we present a possible conceptual approach about how different data sources could be merged to mitigate this challenge.

In the first step standard outputs (SO[2]) for all activities included in the model have been calculated. For this purpose we considered values already calculated from another study utilising the same source of data [Rednak 2012]. SO for each activity was calculated based on the average data for the period 2005-2009, derived from internal data sources prepared by the Agricultural Institute of Slovenia. Further SO at the level of agricultural holdings has been calculated based on the methodology proposed by the European Commission [Rednak 2012].

[2] The standard output of agricultural production means the monetary value of output corresponding to the average situation (average values over a reference period).

The database includes 59,632 agricultural holdings further divided into 22 farm types. For the purpose of this study and to demonstrate the approach developed we focus just on pig breeding farms. In this group 495 agricultural holdings have been identified. These farms are further divided into 13 economic classes that are determined in regard to the whole farm SO achieved.

The main disadvantage of this approach for risk analysis is of course that for all farms analysed in the model the same average productivity and average market prices are considered. To decrease the influence of this mistake, additional indices to adjust SO for crucial activities have been calculated. Such an example is SO that has been adjusted for crop activities. In this case we have considered that the total arable land of an agricultural holding influences the efficiency of production. Smaller plots of arable land per farm (smaller than the average national production significant for a particular sector) result also in lower SO and vice versa. In both examples five different indices were considered, ranging from -20% to +20%.

To get the total average revenues per agricultural holding, SOs were increased for eligible subsidies from the first and second pillar of the CAP. Since most subsidies are decoupled it was not possible to directly estimate revenues per activity. This was considered also by defining costs. Namely, variable cost and fixed costs are calculated in the model as a relative share of SO for each activity. This share has been denoted on an historical data set prepared by analytical Model calculations [*Model calculations*... 2013].

DEVELOPED TOOL AND SIMULATION MODEL

The main challenge was to estimate income risk for all agricultural holdings in the analysed sector. To assess the effect of different normal and catastrophic risks that holdings might face from farming, we developed a complex simulation toll reflecting income loss at the whole-farm level.

A simulation tool has been developed on a spreadsheet platform using MS Excel and Visual Basic. To run simulations, an additional professional simulation software package, Risk Solver Platform V 10.5.0.0 (RSP) from Frontline Systems has been applied. Beside advanced methods to perform simulations, it enables sensitivity analysis and parameterized simulations, creating a wide range of statistics and risk measures. The simulation is performed based on MCS that are often applied for studying different systems involving uncertainty. It relys on random sampling of values for the specified uncertain variables included in the simulation model, based on Latin Hypercube sampling.

So far static economic results for each agricultural holding are considered. For risk analysis this is not enough, since one is interested also in possible deviations from expected incomes within different states of nature. This uncertainty was included through additional random variables, based on frequency distribution analysis, representing possible states of nature for SOs and variable costs. Thus, simulations require probability distributions for their uncertain inputs, from which the simulation model randomly selects sample values.

Regarding the fact that this is a preliminary version of the tool and to keep it simple at this development stage, for all uncertain variables addressing farming activities, a common triangular uncertain distribution is considered. It is defined by minimum (X), maximum (Z) and most likely (y) values. A set of deflated historical data [*Model calculations*... 2013] was analysed to determine how SOs and variable costs for each activity change with time.

A simulation model simulating achieved income (I) for each agricultural holding (f) in different states of nature (j), could be defined as follows:

$$I_{f_j} = GM_{f_j} - FC * g_f$$

$$GM_{f_j} = \sum_{i=1}^{n} GM_{i_j} + SUB$$

$$GM_{ij} = SO_i e_i a_{i_s j} - SO_i * P * b_{i_{ss} j}$$

$$a_{i_s} = Triangular\ (x_{i_s}, y_{i_s}, z_{i_s})$$

$$b_{i_{ss}} = Triangular\ (cx_{i_{ss}}, cy_{i_{ss}}, cz_{i_{ss}})$$

$$s = Binominal\ (s_1, s_2, s_3; p_{S1}, p_{S2}, p_{S3})$$

$$ss = Binominal\ (ss_1, ss_2; p_{SS1}, p_{SS2})$$

where FC_f is presumed to be fixed without change in different states of nature. However, special calibrating coefficients g_f are added to the adjusted fixed costs regarding the size of total tillage area. GM_{f_j} represents the total gross margin achieved at the level of agricultural holding, which is the sum of all n activities' gross margins GM_{ij} that an agricultural holding operates, with different values between states of nature *j*. *SUB* includes all subsidies from the first pillar including historical payments as well as LFA payments. All subsidies are presumed to remain unchanged within the simulation process. a_{i_s} is an index generated from a triangular distribution to adjust SO_i, of activity *i,* for each state of nature *j* in respect to the selected scenario *s*. e_i is a static coefficient to adjust average SO_i of an activity to particular farm characteristics (e.g. crop – corn production). Variable cost is calculated as a percentage *P* share of SO_i and $g\ b_{i_{ss} j}$ is an index generated from a triangular distribution to adjust variable cost for each state of nature, regarding the scenario selected (*s*).

Within a simulation process, the different scenarios representing different levels and type of risk (normal/catastrophic, correlated/uncorrelated, systemic etc.) at the level of SO_s and variable costs is presumed. Two uncertain variables (*s* and *ss*) are plugged into the model to randomly select the scenario which is in place in a particular state of nature for the SO and variable costs for each agricultural holding analysed. A common binominal distribution was assumed in both cases with defined probabilities of occurrence. Consequently five uncertainty coefficients were defined for each parameter of activities' triangular distribution in the model: three different for the SO scenarios (*s*) and two different for the variable costs scenarios (*ss*).

The first scenarios in both cases include 'normal risk' or most likely deviations. This means that minimum and maximum values are in the range for a 'normal' ten year period. The second scenario was defined only for SO and includes the greater possibilities of extremes (positive correlation between risks) from the first scenario and the range of possible outcomes (min and max) is widened. The third scenario of SO and second scenario for random variable costs anticipates catastrophic or extreme events, with significantly higher frequencies of very bad as well as very good outcomes. In most cases this means that the outcome (revenue – in our case expressed as SO) could also be zero or something close to zero, and less likely that the outcome would be something very good. Just vice versa holds in defining uncertain indices for variable costs. Which scenario is selected in a particular state of nature depends on a discrete uncertain variable, based on a binominal distribution.

In the proposed analysis simulation includes 5,000 states of nature, which means that outputs for each activity and agricultural holding was calculated for 5,000 randomly sampled values.

RESULTS

The paper presents aggregated results for the pig sector. Table 1 summarizes the main characteristics of the farms analysed and an insight into income risk and eventual indemnities is given in Table 2. Since simulation always yields a whole range of possible outcomes, it is very important how the results are analysed and interpreted. In the tool developed in-depth analysis of this viewpoint is conducted. In the first step measures of the central tendencies as mean, median and mode for expected income are calculated. In both cases we present average results per group of farms and also average results per farm showing also the difference within and between groups.

In Table 1 we present the main characteristics of farms analysed, classified into the pig fattening sector. There are 495 farms that have been classified into 9 economic size classes (ESC), regarding achievement of annual SO at the farm level (ESU). As is apparent from Table 1 the majority of farms cultivate on average between 10.4 and 41 ha of tillage area, with SO between 50,000 and 250,000 €. However, relatively high CV shows also in high heterogeneity of groups from the viewpoint of cultivated land. Especially in ESC 7, 8 and 9, there are some farms with very little or no tillage area. In these cases, feed needs to be purchased on the market and consequentially conditions from the arable sector are transposed into this sector. As it is apparent from Table 1, estimated average incomes are relatively low for all groups of farms. As it could be noticed from Table 1 in all groups of farms, relatively large variation in income within groups is observed. This especially holds for groups with lower SO, where variation between farms is larger. From Table 1 it is apparent that, except in the last group (ESC 9), all groups contain farms with negative average income. High CV of income, which is lower in higher economic size classes, shows on a big difference between achieved average incomes per farm within the group. Average income plays a significant role in estimating income losses and also eventual compensa-

Table 1. Basic characteristics of analysed pig farms

ESU		ESC	Farms	Cultivated land		Income				ECO 0 + LFA	
1,000 €				avg	CV	avg	min.	max.	CV	avg	CV
From	to		no.	ha			1,000 €			€	%
0	2	1	7	0.58	0.61	0.07	-0.01	0.17	0.93	181	63.5
2	4	2	16	0.91	0.48	0.08	-0.13	0.40	1.92	278	70.1
4	8	3	31	1.98	0.34	0.20	-0.64	0.66	1.31	681	45.1
8	15	4	55	3.93	0.33	0.61	-0.55	1.43	0.67	1469	36.9
15	25	5	71	6.18	0.26	1.20	-1.12	2.79	0.70	2219	32.0
25	50	6	154	10.38	0.36	3.32	-1.79	10.75	0.69	3856	42.1
50	100	7	114	17.81	0.39	6.15	-1.96	14.70	0.61	6459	42.6
100	250	8	43	41.04	0.48	16.57	-7.53	40.72	0.68	15325	55.9
250	500	9	4	97.49	0.48	51.06	13.79	94.13	0.65	44358	56.7

Source: own study.

tion, presented in Table 2. In this regard one should also consider CAP measures from the first and the second pillar. Thus, more detailed analyses shows a significant influence of subsidies (ECO 0 and LFA) on incomes that are closely related to tillage area. Even though there are big differences (CV) between farms regarding acquired subsidies, it is apparent that on average the sum of subsidies per farm is greater than the average income achieved per farm. This shows in two phenomena typical for this sector. The first is the problem of permanent crises of the sector in Slovenia (very low incomes), with downstream effects due to high variable costs and low pig meat prices. And the second is that high payments per arable land, which is supposed to change after the current CAP reform. However, at the moment in some cases they have an important income stabilising effect and income risk is thereby reduced.

The main aim of the presented toll is to estimate and to analyse income risk. In this regard we have analysed the probability of income losses and eventual indemnities paid to farmers. We considered the WTO rule, which assumes that eventual income loss could be compensated for only if the loss is greater than 30 % of the average income and in such a case the indemnity can be up to 70 % of the total income lost. Calculated indemnities (Tab. 2) present the sum for all farms in a group. In modelling for each particular agricultural holding all possible states of nature (5,000) imitating possible situations are considered. However, we presumed that only probabilities with occurrence higher than 20% are considered. This means that we are interested when a threshold for indemnities is reached in each particular state of nature. In 80 % of cases indemnities would equal or be lower than the calculated sum. As it could be noticed from Table 2, the average frequencies are relatively high, ranging from 33.21 up to 43.22, while lower average frequencies are typical for higher ESC, where also slightly greater differences between farms within the group are observed. This definitely shows the high riskiness of this sector, especially in regard to other analysed sectors not presented in this paper.

Indemnities presented in Table 2 are calculated per group of farms within a pig sector. However, it could be expected that total indemnities will be lower than calculated per group as well as per sector (approx. 1.04 million €). This holds especially if we consider that in

Table 2. Income losses and indemnities per group of farms and per farm

ESC	Income loss for more than 30%				Entitled farms	Indemnity total	Indemnity per farm			
	avg	min.	max.	CV			avg	min.	max.	CV
	%				%	€	€			
1	41.99	35.34	51.04	0.15	71	374	68	14	109	0.47
2	43.22	30.90	52.86	0.15	69	1,529	142	104	202	0.20
3	41.74	29.26	63.18	0.16	77	6,358	276	152	505	0.30
4	38.73	29.48	53.86	0.12	96	25,840	494	319	714	0.20
5	38.30	24.10	54.20	0.16	93	60,245	942	618	1,712	0.27
6	35.01	18.18	54.28	0.22	90	241,342	1,780	0	3,271	0.31
7	35.33	21.20	50.34	0.21	92	353,355	3,494	2,132	6,662	0.27
8	33.21	17.22	51.22	0.25	88	279,799	7,500	0	15,461	0.38
9	30.68	24.74	41.22	0.24	100	71,485	17,871	12,630	25,896	0.33

Source: own study.

the analysed case the only condition when farms participate in such a scheme was when average income is at least zero. Total indemnity obtained assumes that all farms fulfilling this condition and experiencing income loss greater than 30% would participate and from Table 2 it is apparent that a high proportion of farms fulfil this condition (in total almost 90% of farms). This is definitely not the case in practice, namely much less farms would participate. If we increase the minimum level of average income, as one of the possible parameters that influence a farmer's decision to participate or not, the total indemnity rapidly decreases. In the case that condition is set to an average income of 12,000 €, total indemnities decrease down to 0.585 million €, representing only 10 % of entitled farmers. In Table 2 also information on indemnities per farm are presented. Those would range between a few cents up to 25,896 € or an average between 68 and 17,630 €.

DISCUSSION AND CONCLUSIONS

The focus of this study was to present a conceptual approach of systematic income risk analysis for different groups of agricultural holdings specialised in pig production with a bottom-up approach. A complex simulation model is applied to analyse the individual farm risk income situation with respect to information of a production plan, based on subsidy applications. This applied approach proves useful, since with simulations and analysing the results one can better understand income issues at the sector level and also get some information about the eventual magnitude of potential indemnities.

The approach described could give a sufficiently reliable first estimate of income risk for a group of agricultural holdings (e.g. sector level, group of agricultural holdings with similar economic size etc.). It seems that with further developments this could be a promising holistic approach to give additional information about income risk exposure at the farm level. Policy makers, as one of relatively important farmers' stakeholders, could get some basic information about what is going on in a particular sector.

Due to the applied approach of utilising only information from subsidy applications it is expected that the tool developed has several limitations for income risk analyses. In this regard how standard outputs and gross margins per activities and per agricultural holding were estimated are the most critical components. In further development it will be necessary to put more focus on this part. Where possible it is necessary to include additional information from other available data sources at the micro level. FADN data for different groups and types of farms could be analysed and information could be included as a calibration index. In such a manner for different groups of agricultural holdings as well as for activities more precise random distributions could be defined. Where microeconomic data would be available, they should be included through empirical distributions. For other uncertain variables more attention should be put to define more sophisticated functions of random distributions.

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Jaka Zgajnar

SZACOWANIE RYZYKA DOCHODOWEGO DLA SEKTORA TRZODY CHLEWNEJ

Streszczenie

Zaprezentowano podejście teoretyczne dotyczące sposobu analizy pośredniej ryzyka dochodowego na poziomie sektora. Przedstawione podejście wykorzystuje różne źródła informacji, takie jak: dane na poziomie gospodarstwa, statystyki krajowe i modele analityczne, które mają pomagać w prowadzeniu prawidłowej symulacji i dawać lepszy wgląd w straty w dochodach na poziomie sektora. Kluczową informacją z każdego gospodarstwa w sektorze jest aplikacja rocznych dotacji, na podstawie której udało się zgromadzić informacje dotyczące głównych działań produkcyjnych. Na tej podstawie, a także poprzez potwierdzenie innych źródeł danych, zrekonstruowano strukturę dochodów każdego analizowanego gospodarstwa. Do symulacji ryzyka dochodowego wykorzystano metodę Monte Carlo. Ryzyko dochodowe jest symulowane na poziomie gospodarstwa, jednak wyniki przedstawione są dla grupy gospodarstw. Jest to przykład podejścia oddolnego. Symulacji dokonano wykorzystując dane sektora trzody chlewnej w Słowenii. Uzyskane wyniki sugerują, że może to być przydatne podejście do szacowania ryzyka dochodowego i wskazują na pewne ograniczenia i wady, które mogą być dalej poprawiane.

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UNDERSTANDING GLOBAL AGRICULTURE THROUGH AGRI BENCHMARK[1]

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Key words: economics of production systems, cost of production, FADN, structural change in agriculture
Słowa kluczowe: ekonomia systemów produkcji, koszty produkcji, FADN, zmiany strukturalne w rolnictwie

A b s t r a c t. Understanding global trends and perspectives in agriculture is challenging. This paper presents the concept and some selected findings from *agri benchmark* regarding the perspectives of European sugar beet production, Latin American beef production and specialty crops in Kazakhstan. These case studies illustrate that the *agri benchmark* approach allows the identification of the drivers of growers' decision making and their relevant options. Hence it is possible to assess likely future developments under changing economic framework conditions. In contrast, projections based on previous trends do not seem to yield meaningful results. In addition, the case studies demonstrate the value of having access to reliable farm level data which have been derived from a production system approach. At least in crops, FADN based cost of production estimates seem not to add value.

INTRODUCTION

Policy makers as well as investors and farmers around the globe are keen to understand the perspectives for agricultural production: "Will we be able to produce enough food (and biofuel)? Who will or should produce the crops and livestock needed and how?"

Global agricultural production is the result of millions of farmers' decisions on what type of product they produce and how. Hence, understanding economic conditions and options available to farmers is a prerequisite to understanding global agriculture. Detailed knowledge of the profitability of production for individual crops and livestock products is an important ingredient.

But when it comes to assessing possible structural change within a country between different farming systems or products (e.g. beef vs. crops; corn vs. wheat) a detailed understanding of the profitability of individual products alone will not allow for a realistic projection; the reason being that the system "farm" is rather complex. Assuming there is an increase in relative output prices for a certain commodity, farmers are faced with the following options in order to react:

[1] Paper was presented at the 19th Congress of the International Farm Management Association (IFMA), Warsaw (Poland), 21-26 July 2013.

– depending on the current status of production systems, there may be room for an increase in input usage leading to a growth in supply;
– a shift from extensive crops such as barley to a more intensive crop such as corn can become a viable option. However, this shift itself is subject to non-linearity because there may be an interaction between crops leading to non-monetary effects;
– farmers can move from one production system (in terms of economic theory: production function) to another.

Against this background it becomes obvious that a detailed understanding of the options for and determinants of farmers' decision-making is key to understanding the future of global agriculture. Forecasting based on previous trends and farmers' reactions to market signals very often will not yield meaningful results. This is particularly true in a situation where major commodity prices increased by 100% and more compared to the pre-boom period before 2008.

In an ideal world, agricultural economists could set up a large number of trials in order to measure and analyze the physical and economic effects from a variation in intensity, crop mix, changing production systems and the like. When looking for global trends in agricultural production, these trials would have to be run at all major sites around the world. Obviously, due to financial constraints this is not a realistic option.

Alternatively they could (a) run large scale interviews of growers in order to capture farmers' reactions to changing framework conditions on a regular basis or (b) collect and monitor extended enterprise (not farm) accounting data. In reality both options are also extremely – very often prohibitively – expensive. Furthermore, option (b) – as far as many emerging and developing countries are concerned – is frequently not available at all. Therefore the *agri benchmark* concept of typical farms has been developed as a feasible compromise. A comprehensive analysis of the different options regarding the creation and use of different types of farm level data can be found at Isermeyer [2012].

OBJECTIVE

This papers attempts to illustrate the value of *agri benchmark* in understanding global agriculture and its perspectives. Case studies will be used to illustrate that it is possible to capture the complexity of farming in order to come up with reliable and meaningful projections regarding future agriculture production.

One case study will look at the EU sugar beet production in a more liberalized environment; the other will analyze the perspectives of beef production in Latin America. Finally, the competitiveness of Kazakhstan as a global player in legumes will be looked at. As an introduction to the case studies, in the next section a short introduction to the concept of *agri benchmark* will be provided.

KEY CHARACTERISTICS OF THE AGRI BENCHMARK CONCEPT

Agri benchmark is combining farm production system data with site specific expertise of producers and advisors on a global scale. Data collection is based on so-called "typical farms" which are case studies. They are established by production economists in regional hot spots for a certain product. Detailed figures on quantities and prices for variable inputs,

land, machinery and labor describe the prevailing production system in a region which is the origin of a major share of the national output in a given agricultural product. Respective farm data is validated in so-called "focus groups" which consist of growers who run a farm similar to the stylized typical farm and a regional advisor. However, focus groups are not only used to explore the status quo but also to identify and validate options for future changes in the farming system and outputs. The whole initiative is independent and jointly managed by the Thünen-Institute, which is working under the German Federal Ministry of Agriculture and DLG. A more comprehensive description of the concept and principles can be found at www.agribenchmark.org.

EXAMPLE 1: FUTURE OF EU SUGAR BEETS PRODUCTION

European sugar production is faced with a number of economic challenges. Not only does the EU envisage phasing out the quota system, but more importantly due to a significant reduction of minimum prices for beet and a sharp increase vin other commodity prices, the issue of on-farm competitiveness of sugar beets is becoming vital. Therefore, *agri benchmark* Cash Crop headquarters launched a PhD project to analyze the on-farm competitiveness of sugar beets [Albrecht 2012].

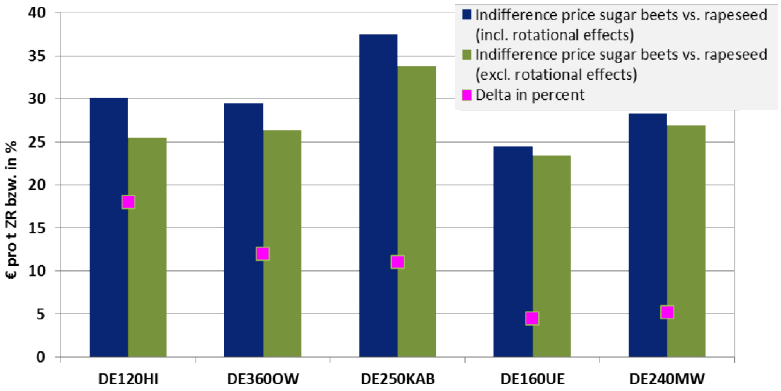
In order to understand the complexity of possible on-farm adjustments the following key questions have been addressed in a series of focus group discussions:

1. What crops are relevant alternatives to sugar beets? Given the diversity in cropping patterns in sugar beets producing regions in Europe, this is not a trivial question.
2. Will there be any yield effects for the competing crop if this crop is grown on land previously devoted to sugar beets. This effect may be relevant because sugar beet tend to be extremely demanding in terms of soil quality, hence where farms operate on rather mixed land it is reasonable to assume that they have reserved prime land for a sugar beet rotation.
3. Compared to crops alternative to beets, what are the effects on yield and cost of production (e.g. use of fertilizers and crop protection products or machinery use) for the subsequent crops.

In order to analyze the on-farm competitiveness of sugar beets, indifference prices have been calculated: What price for sugar beet has been necessary for the grower in order to make them economically indifferent when choosing between sugar beet and the alternative crop "rapeseed". As displayed in Figure 1, this indifference price has been generated twice: Once without taking rotational effects into account and once including those non-budgetary benefits associated with a reduction of beet acreage. The respective average rapeseed prices realized at the typical farms range from 360 to 400 €/t and represent the economic situation for 2010 and 2011.

Figure 1 reveals the following:

1. Taking into account rotational effects leads to a significant increase in indifference prices for sugar beets. That means any forecast about future sugar beet production which includes rotational effects will systematically be too optimistic as far as the competitiveness of sugar beet goes.
2. Depending on the region, the gap between the two indifference prices differs quite a lot.
3. When comparing the conclusion that would be drawn from the analysis without rotational effects with the one including them, it appears that the former concept would suggest that in all relevant German sugar beet regions, a relatively low and uniform



* The abbreviations on the x-axes should be read like this: the first two letters indicate the country where the typical farm is located, the figure stands for the size of the farm in hectares; in the beef section (see below) the figure indicates the number of beef animals produced per year

Figure 1. Estimates for on-farm indifference prices for sugar beets w/wo rotational effects for selected typical *agri benchmark* farms* (ø = average 2010 and 2011)
Source: [Albrecht 2012].

sugar price of about 25 €/t is needed in order to keep beet in the game. From the latter approach one would conclude that in general, much higher sugar beet prices of about 30 €/t are needed to sustain beet production.

What cannot be seen from the graph is the fact that even though some other rotational effects play a role, the major impact stems from the improved yield for the subsequent crop when sugar beets are replaced by rapeseed. The other important driver is the effect that, as of today, rapeseed tends to be grown on the less fertile soils of the typical farms. When replacing sugar beets, rapeseed will move to the better sites and thereby become more profitable than is currently the case.

Critics sometimes argue that *agri benchmark* figures – in contrast to FADN – are based on a rather small and statistically not sound database. Therefore FADN based cost estimates will be used as a benchmark. In a study on the future of European sugar beet production Kleinhanss [2012, p. 21] demonstrated results from such an approach. When looking at the figures presented, the following observations can be made:

1. The method generates very strong fluctuations for total cost estimates between years (up to 1,000 €/ha).
2. When comparing evolution of variable cost estimates between neighboring European countries, totally different trends will be found. This is extremely unrealistic because fertilizer, crop protection and seed – which are the main items in the variable cost – are purchased from highly competitive, global markets. Hence, major differences in prices between countries are not very likely. Since the quantities applied by growers tend to be rather stable, these fluctuations are most likely an artifact derived from cost estimation.
3. In a number of cases estimates for variable cost are only as high as actual seed prices alone, which would imply that no fertilizers and no crop protection products have been applied.
4. Even though sugar beets are an intensive crop, estimated energy costs are often either extremely low – less than 10 €/ha – or even negative.

All in all, one has to draw the conclusion that at least in crops[2], this attempt to generate cost of production figures from FADN data does not yield very meaningful results. And of course it is not possible to detect the complex interactions between crops and the management implication of different crops.

EXAMPLE 2: PERSPECTIVES OF BEEF PRODUCTION IN BRAZIL AND ARGENTINA

In the last 10 years, global beef prices have gone up significantly. In many countries increases were more than 100 % [Deblitz et al. 2012]. As a consequence, economic incentives to expand beef production are significant. However, grain prices saw a similar increase in the same period.

Beef production of important beef producers such as Argentina and Brazil used to be based on grassland systems. In economic terms, these systems are characterized by a very low use of purchased inputs such as grains for feed or fertilizers and thus they are to a wide extent "disconnected" from global markets – be it agricultural commodity markets or input markets.

What becomes obvious from Figure 2 is that animal purchase is the single most important cost component in the pasture based system. The relatively high proportion of labour cost in the pasture based system is a result of low daily weight gains and subsequently rather old animals which consume a relatively high proportion of labour during their life time. The land costs are also important in the pasture system. The main reasons are (a) low land productivity, (b) long finishing periods of more than two years and (c) high land rents in regions where cattle land competes with crop land.

Without detailed farm level information on new options for farmers, a projection regarding the future of beef production would most likely come up with the forecast that additional grassland – which is readily available in both countries – will be established for

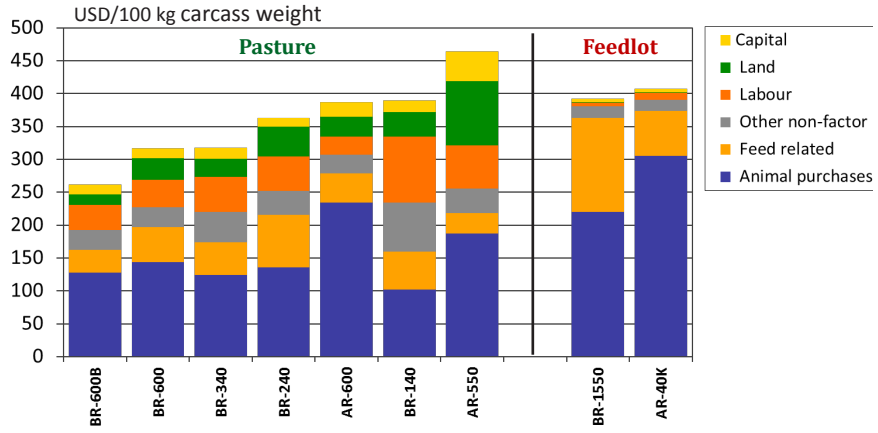


Figure 2. Cost of beef production for *agri benchmark* farms in Argentina and Brazil (2011)
Source: [Debltiz et al. 2012].

[2] Since the situation might be rather different in one-product companies such as dairy farms this restriction on crop production is important. See also Isermeyer [2012].

additional beef production. Furthermore, one would conclude that – once production has been expanded significantly – beef prices would go down to previous levels again because grassland is extremely cheap.

However, what is really happening is something rather different. Due to the possibility of converting large parts of the current grassland into arable land, the overall increase in grain prices has led to a sharp increase in the opportunity cost of land. For example, ground rents on arable *agri benchmark* farms in Argentina and Brazil went up between 100 and more than 500 USD/ha from 2008 to 2011. This equals to an increase of 30% to more than 100% [Zimmer et al. 2012]. The change is particularly remarkable because compared to previous years, 2008 was a rather profitable year as far as grain prices and ground rents were concerned.

This sharp increase in opportunity cost for land in turn induces beef producers to switch from one production function to another or – in more applied terms – producers establish feedlots to finish cattle on grains rather than on grassland. This process is much more advanced in Argentina where an estimated share of 40% of total beef production is derived from feedlots while in Brazil this share is in the range of only 6%.

The main reasons for the minor importance in Brazil are (a) the pressure on land prices in the traditional cattle producing regions is lower than in Argentina, (b) expansion of agricultural production to so-called frontier regions in the north of the country and South of the Amazon region was much more pronounced than expansion in Argentina and (c) feedlot ting is still, a rather strategic tool during seasonal droughts.

As Figure 2 shows, such a move to another production system does not necessarily imply an increase in total cost of production. What, however, is obvious is that such a system is much more dependent on animal purchase.

Table 1 shows that the characteristics of the output are changing, too. An increase in carcass weight of 25% implies a significant change, given the fact that processors and consumers have been used to much smaller carcasses. Furthermore, it is likely that higher carcass yields and possibly better carcass conformation result in higher beef prices.

Table 1. Output characteristics of pasture, feedlot and mixed beef fattening systems

	Pasture	Feedlot	Mix	Mix vs. Pasture
Weight at start [kg LW]	190	414	190	
Weight at end [kg LW]	495	577	577	
Finishing period [days]	730	100	636	-13%
Daily weight gain [g/days]	418	1630	609	+45%
Dressing [%]	53	57	57	+8%
Cross weight [kg]	262	329	329	+25%

Source: [Deblitz et al. 2012].

This case study on structural change in Latin American beef production yields the following conclusion:

1. Changing economic framework conditions are creating a whole set of new options for farmers which, at least in some cases, may change incentives and drivers fundamentally.
2. Those new options are neither obvious nor can they be explored through existing data, be it statistics or cost of production figures.

3. Rather, those new options can only become apparent to the public through analysis including in-depth cooperation with farmers and advisors.
4. The realization of those new options does not only change the input side, but at the same time and in various ways it has an impact on the output side. In the case of beef production one might even argue that "new" products in terms of meat types (more marbling) will be on offer. Those changes will normally also affect revenues, which is why just looking at the cost side of any of those changes may be totally misleading.
5. Given the strong increase in productivity figures and in beef produced per head, it is by no means obvious that the overall cost of beef production will change much.
6. Furthermore, given the high importance of purchased feed cost in the feedlot system, it is likely that future beef production in Latin America will be tied much closer to global grain prices than it used to be.

EXAMPLE 3: SPECIALTY CROPS – A FUTURE FOR KAZAKHSTAN?

In technical terms, Kazakhstan has a huge potential to produce and export crops. However, a major challenge stems from the fact that it's a land-locked country. The closest harbor is about 3,000 km away from the main grain producing region in the north. This leads to very high domestic transport and logistics' cost which in turn imply rather low farm gate prices. Kazakhstan is rather similar to Canada in this respect as well as the arid climate is concerned. Therefore the question arises, whether specialty crops, in which Canada is the major global player [Zimmer and Börsch 2013, p. 11] could be an option to Kazakh growers as well?

A proper analysis of the economic viability of this option consists of two steps: At first it has to be checked whether pulses are competitive at the farm level. Given the arid climate in Kazakhstan, wheat yields – as all other major grains – are relatively low (1 to 1.5 t/ha). Since pulses tend to be low yielding as well they should have a competitive edge over

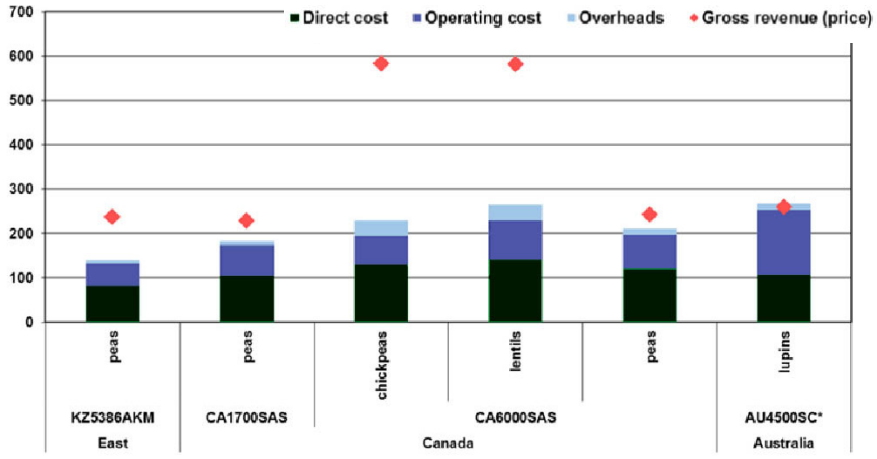


Figure 3. Cost of production for specialty crops for typical farms in Kazakhstan, Canada and Australia (ø 2008/9 – 2011, USD/t)
Source: [Zimmer, Börsch 2013].

wheat. And indeed *agri benchmark* figures for a typical farm in Kazakhstan indicate that in recent years pulses generated higher gross margins than wheat [Zimmer and Börsch, p. 8].

In order to assess Kazakhstan's competitiveness on global pulse markets a comparison of cost of production was carried out for farms in Kazakhstan, Canada and Australia. As can be seen in Figure 3 it seems that Kazakhstan may indeed become a relatively competitive producer of those crops. Whether or not this will come true finally depends on transport and logistics' cost, which are not included here. This topic is one which *agri benchmark* is intensively working on as well.

CONCLUSIONS

With regard to the design of agricultural economic research on the future development of global agriculture, the following conclusions can be drawn from these case studies:

1. At least in the two cases of beef and sugar beet presented here, the complexity of structural change is rather high. An attempt to make projections derived from previous trends alone will most likely not yield realistic outcomes.
2. The *agri benchmark* concept allows the disclosure of the complexity of farm economics and farmers' decision making and the drawing of meaningful conclusions about future trends and changes in agricultural production. The building blocks for the concept are production system based farm data from typical farms and the involvement of farmers and advisors for exploring likely future changes.
3. In order to assess the international competitiveness of farms and products, cost of production as well as transport and logistics' cost have to be generated and analyzed. In the framework of a case study on Brazilian soy exports [Fliehr 2013] a first attempt to capture transport and logistics was developed and successfully tested.
4. Global projections on future agricultural production and trade can of course not be made by *agri benchmark* alone, cooperation with market modeling is highly advisable.

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Yelto Zimmer

OBJAŚNIANIE GLOBALNEGO ROLNICTWA PRZEZ AGRI BENCHMARK

Streszczenie

Rozumienie globalnych tendencji i perspektyw rozwojowych w rolnictwie stanowi wyzwanie. Artykuł prezentuje pojęcie i kilka wybranych wniosków z agri benchmark dotyczących perspektyw produkcji buraka cukrowego w Europie, produkcji wołowiny w Ameryce Łacińskiej oraz produkcję upraw specjalnych w Kazachstanie. Przeprowadzone badania wskazują, że podejście agri benchmark pozwala identyfikować czynniki powodujące podejmowanie decyzji przez hodowców. Umożliwia to także oszacowanie przyszłego rozwoju w zmieniających się warunkach struktury ekonomicznej.

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