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agris on-line

Papers in Economics and Informatics

http://online.agris.cz

ISSN 1804-1930
IV, 2012, 4

International scientific journal
Prague

Agris on-line Papers of Economics and Informatics

The international reviewed scientific journal issued by the Faculty of Economics and Management of the Czech University of Life Sciences Prague.

The journal publishes original scientific contributions from the area of economics and informatics with focus on agriculture and rural development.

Editorial office

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Publisher

Faculty of Economics and Management
Czech University of Life Sciences Prague
Kamýcká 129, 165 21 Praha 6 – Suchdol
Czech Republic
Reg. number: 60460709

ISSN 1804-1930

IV, 2012, 4

30th of December 2012

Prague

Agris on-line
Papers in Economics and Informatics

ISSN 1804-1930

IV, 2012, 4

Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

Perception of Poverty by Ethiopian Rural Households: Using a Self Reported approach

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Abstract

Recent quantitative studies on Ethiopia's rural households' poverty of the last decade indicated that poverty head count has reduced. Nevertheless, most qualitative studies witnessed the contrary to quantitative studies. This study assesses how the Ethiopian rural households perceive poverty using self reported data from the Ethiopian Rural Household Survey (ERHS). Moreover, it has examined whether poverty is actually reducing as claimed by official government reports. Our findings come up with mixed results. Majority of the respondents reported that health care, family housing, and credits have been improving compared to the last decade. Nevertheless, perceptions related to food consumption and comparisons of wealth rankings relative to their fathers' tend to show that the situation is worse though the sample size may not be sufficient to generalize about the whole country.

Key words

Food poverty, perception, rural households, Ethiopia, growth.

Introduction

Ethiopia is a rural economy where about 83 % of its population relies on agriculture for its livelihoods. For instance, in the year 2009 about 60 % of exports, 85% of total employment and 43 % of its gross domestic product was generated from the agriculture sector (Alem & Soderbom, 2011). The country is endowed with natural resources. However, poverty, hunger and starvation have remained big challenges to the country due to the sector's dependence mainly on rainfall and traditional farming practices.

Studies during the 1990's and the last half century in general have revealed that the country's economic growth was very low and even at some periods were negative (Diao & Pratt, 2007; Geda, Shimeles, & Weeks, 2009). Conversely, the country is one of the few countries in sub-Saharan Africa that have registered continuous economic growth for the last eight years. Official government reports indicate the country has been growing double digit growth. i.e., at an annual average growth of 11.4% in GDP from 2004/05 to 2010/2011 (Federal Democratic Republic of Ethiopia, 2010). In line with this, a recent interim report of the Ethiopian government has revealed that consumption poverty has dropped from 39.3 % in 2004/05 to 30.4 % in 2010/11 (Federal Democratic Republic of Ethiopia, 2012). Apparently, other studies witnessed that, even at times of fast economic growth, the country has suffered from continuous and high inflation. Due to this, different studies have been conducted to measure poverty and come with different results (Alem & Soderbom, 2011; Stefan Dercon, Hoddinot & Woldehana, 2011; Sabates-Wheeler & Devereux, 2010).

Nevertheless, this study is basically different from other studies due to the following three major reasons. In the first place most studies that have studied poverty focused on specific areas of the country such as the studies of Devereux & Sharp (2006) and Rahmato & Kidanu (1999). This study, unlike others, has tried to take more samples from the major regions of the country which operate most of the agricultural economy. Secondly, Ethiopia has never experienced such high inflation and growth simultaneously thus there is hardly any study that addresses the perception concerning poverty in these periods using qualitative method. Thirdly, though significant number of studies have been done on poverty status of the rural households, there is lack of studies that assess poverty using qualitative method.

Above all, the researcher is motivated by the contradicting evidences appearing in recent studies

concerning the status and trends of poverty in rural Ethiopia under the quantitative and qualitative approaches. For instance, qualitative studies such as Rahmato & Kidanu (1999), Devereux & Sharp (2006), show that poverty is increasing while quantitative research findings such as FDRE (2012), Dercon (2006), Bigsten & Shimeles (2008), Bigsten, et al., (2003), Dercon and Krishnan (1998) and Dercon & Krishnan (2000) revealed evidence that poverty has been reducing. Still some empirical studies such as (Stefan Dercon, et al., 2011) also show that poverty has been increasing particularly in the most recent years though they still show the country had experienced improvements in poverty in earlier periods. A large number of research is done on poverty status in rural areas and their results are different and inconsistent, particularly studies that measured poverty using qualitative and quantitative data (Devereux & Sharp, 2006).

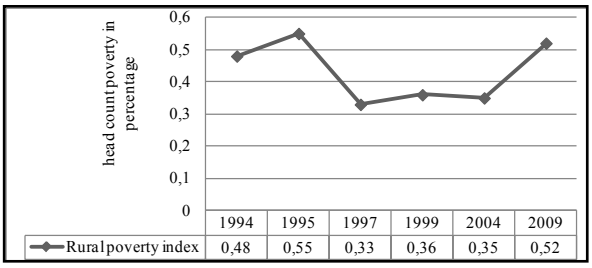
Even among studies that used quantitative data, especially government official report on the one hand and other panel surveys on the other hand, poverty head count discrepancies are common. As stated by Devereux & Sharp (2006) seasonal and other socio-cultural factors have impact on the variation of rural poverty head count index. The study of Dercon and Krishnan (1998) in agreement with Devereux and Sharp (2006) confirmed how erratic is the result of poverty due to seasonal variations. Moreover, Dercon and Krishnan (1998) have done studies during harvest and non harvest time. Their study has proved that poverty has reduced from 61 % in 1989 to 50 % in 1994 (using a pre harvest data) and to 33 % (during harvest times). Dercon & Krishnan (2000), in addition, reported that poverty head count index has reduced from 39 % in 1994 to 29 % in 1997.

Another study conducted by Bigsten et al. (2003) evidenced that rural poverty has reduced from 41.9 in 1994 to 37.6 % in 1995/96 and again it reduced to 35.5 % in 1997. Bigsten & Shimeles (2008) similarly shares the trend of poverty with Bigsten et al. (2003) and point out that poverty has dropped from 56 % in 1994 to 49 % in 1995 and to 39 % in 1997 then increased to 50 % in 2000 which latter again declined to 43 % by the year 2004. The Ethiopian government's Household, Income, Consumption and Expenditure (HICE) evidenced that poverty rate fall from 47.5 % in 1995/96 to 45.4 % in 1999/2000 (Federal Democratic Republic of Ethiopia, 2012).

Very recent study by Stefan Dercon et al. (2011) showed that the head count poverty increased from 48 % in 1994 to 55 % in 1995. And again in 1997 poverty lowered to 33 % only to increase to 36 % in 1999 in contrast to the previous study then reduced to 35 % in 2004 compared to period, too. Surprisingly Dercon's (2011) study revealed that the poverty rate jumped to 52 % in 2009 from 35 % of the previous study period [see figure 1]. However, HICE survey indicated that head count poverty has reduced from 47.5 % in 1995/96 to 45.4 % in 1999/00. Then in the 2004/05 poverty has reduced to 39.3 from the prior period and by 2010/11 reached 30.4 % [see figure two].

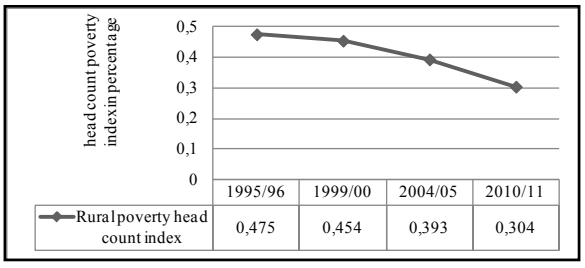
From these two studies it is evident that the rural households head count poverty figure up to 2004/05 was almost similar. But after 2004/05 as to Dercon's et al., (2011) head count poverty has increased from 35 % in 2004 to 52 % in 2009 showing an increase by 48.57 %. During the same period government HICE reported that head count poverty reduced from 39.3 to 30.4 % showing a 22.7 % reduction in head count poverty. In the same period, survey of HICE reported that food poverty in the rural households has only reduced by about 10 % which is an indication that the non food poverty were reducing at faster rate than food poverty.

When we see studies done on the rural areas using



Source Stefan Dercon, et al. (2011 , p. 20) using author's own analysis

Figure 1: Trends of rural Ethiopia households count poverty index.



Source: FDRE (2012, p. 9)using author's own analysis

Figure 2: Trends of rural Ethiopia households' count poverty index.

qualitative data the results are contrary to the results of the quantitative studies. The study of Rahmato & Kidanu (1999) found that majority of the respondents reported that they believe that they are in the lowest group of well-being than ten years ago. Similarly, they found that the total proportion of households who were in the highest category of well-being ten years ago also declined significantly. Another study by Devereux and (2006), using a qualitative data in the drought affected area of Wollo, northern highlands of the country found results contrary to the above quantitative results. Devereux and Sharp's (2006, p.606) study confirmed that poverty has rather increased in the study area and they concluded that "poverty reduction in rural Ethiopia is not uniform, it is not universal and it is not linear"

This study tried to examine how the Ethiopian rural households perceive poverty using self reported data from the Ethiopian Rural Household Survey. The finding has revealed mixed results. Health care, family housing and credit have been improving compared to prior years as reported by majority of the respondents. Nevertheless, perceptions related to food consumption and comparisons of wealth with their fathers' reveal the case to be worse.

Material and methods

This study used secondary data, from the Ethiopian Rural Households Survey (ERHS), a unique longitudinal data set collected from 2004 to 2009. These surveys have been supervised by the Economics Department, Addis Ababa University, the Centre for the Study of African Economies (CSAE), University of Oxford and the International Food Policy Research Institute (IFPRI) (Stefan Dercon & Hoddinott, 2011). According to Dercon & Hoddinott (2011), the ERHS is a comprehensive data set covering households in a number of villages in rural Ethiopia. Data collection started in 1989, when a team visited 6 farming villages in Central and Southern Ethiopia. Following 1989, additional rounds were conducted in late 1994 and expanded to cover 15 villages across the country with further rounds in 1995, 1997, 1999, 2004 and 2009. The nine additional communities were selected to account for the diversity in the farming systems in the country, including the grain-plough areas of the Northern and Central highlands, the enset (a root crop also called false banana) that is growing in southern parts of the country. Household characteristics, agriculture and livestock information, food consumption, income, asset, health, women's activities, poverty perception are some of the topics addressed by the survey.

Attrition rate, at the household level, is low. Only 5.2 % were lost from 1999 and 2004. The ERHS survey when addressing sampling, a list of all households was constructed with the help of the local Peasant Association (PA) officials. The sample is representative of the population since the populations are broadly consistent with population shares in three main sedentary farming. In addition landless samples were incorporated in all villages and it is possible to say good lists of the households in the villages were used as a sampling frame (ibid).

Though the survey collected data on perception of poverty, welfare and trust using about 39 questions, only 13 questions related with this study are selected. In 2004 from four major regions of Ethiopia 1369 men and 983 women a total of 2352 were included.1556 men and 1156 women a total of 2712 included in 2009.The four major regions of Ethiopia, Tigray, Amhara, Oromia and South Nations and Nationalities & peoples (SNNP), were represented with a sample of 240, 733,615 and 764 in the 2004 and in 2009 the same regions were represented with 222, 717, 1031 and 752 respectively.

In the ERHS, a sociological study of poverty was conducted alongside the household survey in both study periods aiming to collect qualitative data. My intention in this study has been to assess the perception of poverty by the Ethiopian rural households using data that were collected before and after food crisis or inflation. So from the nature of the data and the objective of the study, using qualitative approach is found more appropriate to assess the perception of the respondents through simple descriptive statistics.

Results and discussions

Perception of happiness, personal and community wealth ranking

Respondents were asked how they perceive their happiness, and about 54, 33 and 12 % in 2004 and in 2009 about 60, 23, and 17 % reported pretty happy, not too happy, and very happy respectively. Literatures such as by Dolan, Peasgood, and White (2008) stated that income both in absolute and relative terms, personal characteristics, attitudes and belief, wider political, social, and economical environments are among the variables that influence the subjective well-being. The study of Clark,

Frijters, & Shields (2008) empirically evidenced that happiness is affected by relative income among people who live in the richer countries than people live in poorer countries. Akay & Martinsson's (2011)study proved Clark's, et al. (2008) and who found empirical evidence, that the relative income does not affect subjective well-being among the very poor people in northern Ethiopia. This implies that the level of happiness could be related with absolute income of the rural households than relative income assuming the factors listed by Dolan, et al. (2008) which affect happiness of the rural households.

Asked to compare themselves in the village in terms of households circumstances or community wealth ranking, about 48 and 18 % of the respondents in the 2004 and about 55 and 17 % in 2009 compared themselves about average and a little poorer than most households who live in the village. The number of respondents who responded amongst the poorest is about 19 % in 2004 and 19 % in 2009. According to Philippa Bevan (2005), the Ethiopian rural households' consumption and expenditure is characterized by seasonal and annual variations due to weather, food aid, fasting and other festival cycles and measuring poverty consumption (P0) may not show the real poverty. In 1994 Bevan & Joireman (1997) taking one community, in Amahara region (North Wolo) attempted to compare their wealth against the community wealth ranking and showed that 78 % perceive they are poorer than the community. This shows how big the differences are concerning results of poverty situation of the rural households.

Perception on family food consumption, housing and loan

When asked how respondents perceive their households' circumstances or personal wealth ranking, in 2004 about 30 % responded comfortable, and can manage to get by each. While in 2009, 36 and 33 % responded for comfortable and can manage to get by. Respondents, who reported, never have quite enough, poor and destitute altogether account 30 and 22 % in 2004 and 2009 respectively. Compared with Bevan & Joireman (1997) where 71 % of them perceived being poor still show how conflicting results are.

Respondents were also asked if they can get 100 Birr when the household needs it for emergency, which 57 and 75 % reported yes in 2004 and 2009 respectively. During the same periods 43 and 25 % reported that they cannot get the stated amount of money respectively. Moreover, in 2009 big positive shift is shown from previous study period. Since 2005 the country has been hit by high inflation which still remain a big challenge to the Ethiopian government (Alem & Soderbom, 2011; Sabates-Wheeler & Devereux, 2010). Due to this, the value of the 100 Birr (currency of Ethiopia) has highly diminished in between the study periods and may become easy to get loan from friends, family, and other sources or may indicate an expansion of microfinance services to rural areas.

Asked about the source of the 100 Birr; 39 and 33 % of the respondents reported that sales of animals and loans for the year 2004. Similarly in the 2009, still sales of animals and loan account about 33 and 26 %. In both the study periods sales of animals took the major share showing the difficulty of getting less than ten US dollar for an emergency.

Asked concerning the family's food consumption over the past one month in 2004, nearly 39 % responded that it was less than adequate for the family and about 54 % responded that it was just adequate for the family. In the 2009, nearly 93 % reported that it was less than adequate and nearly 7 % reported it was more than adequate. This result contradicts to studies like FDRE (2012) that reported that poverty is reducing in the rural Ethiopia. However this result agrees with Dercon's et al. (2011) that evidenced poverty has increased after 2004. Literatures discussed that the consumption of the rural households is variable due to volatility of agriculture production and consequently high variability of rural incomes (Philippa Bevan, 2005; Bigsten, et al., 2003; Bigsten & Shimeles, 2008; Stefan Dercon & Krishnan, 2000). Specific study needs to be done why more than 90 % reported that consumption is less in 2009 compared to 2004.

Of respondents asked concerning family's housing in those days, about 53, 39 and 7 % reported for just adequate, less than adequate and more than adequate in 2004 and about 92 and nearly 8 % reported for just adequate and more than adequate in 2009. The percentage of respondents has highly increased in the 2009 in comparison to the prior study period. In this regard there is a big improvement in the households' in housing the family showing a positive relationship with the country's growth rate registered in the last eight years.

Perception of health, economic situation and comparison of wealth

About 50, 34, and 6 % reported for just adequate, less than adequate and more than adequate in 2004

when asked concerning health care the family gets. In 2009, nearly 91 and nearly 8 % reported for just adequate and more than adequate. In this regard, there is a big improvement in the households' health care that the family gets showing a positive relationship with the country's growth rate for the past eight years.

When respondents were asked to compare the overall economic situations of the households one year back, about 29, 28 and 26 % responded for a little better now, same and a little worse now in 2004. In 2009, however, 65 % reported a little worse now and about 18 and 16 % reported same and much worse now. This result is shared with Dercon, et al. (2011) which evidenced that head count poverty increased from 35 % in 2004 to 52 % in 2009.

Respondents were also asked how they may compare their wealth with the wealth of their fathers at the same age, i.e., whether they perceive richer or poorer in the study periods. In the 2004, majority of the respondents (58.39 %) reported that they perceive they are poorer, and about 17 and 11 % of them reported they are richer and about the same. In the 2009, study period still majority of the respondents (54.02 %) responded that they are poorer than their fathers, and nearly 24 and 8 % responded they are richer and a lot poorer. In both study periods majority of the respondents, i.e., above 50 % reported that they are poorer in comparison to their fathers' wealth. This result is also shared by Devereux & Sharp (2006, p. 1) which witnessed that rural households "perceive themselves to be poorer and more vulnerable than official poverty head count suggest"

Asked in relation to those who reported in 2004 why they are poorer in comparison to their fathers' wealth, majority (35 %) feel that their source of poverty is due to less land and the remaining 22 and 10 % perceived that they work less hard and times are harder. In 2009, still majority (49 %) perceived that shortage of land is the cause for their poverty. The remaining, nearly 13 and 10 % reported for harder times and work less hard. Early to this study periods, the study of Rahmato & Kidanu (1999) found that per capita landholdings are becoming smaller and the pressure on agriculture land is high which is similar with this study's findings.

To summarize, the result of this study can be divided in to three major categories. Health care families get, family housing and credit are among the first category that majority respondents perceived and reported that they are getting adequate and more than adequate. In the second category, for questions like household circumstances both in terms of personal wealth ranking and community wealth ranking, i.e., comparing wealth of a household with other households living in the same village, very few respondents reported for some change. Nevertheless, results of family food consumption, overall economic situation, and comparison of wealth with their fathers are negative and contrary to the results of quantitative studies. In 2009, unlike in 2004, large number of respondents reported that food consumption has become worse and this may be due to high food price. In general it can be concluded that the perception of households related to non food consumption is positive, despite perceptions related to food consumption and comparison of wealth with their fathers becoming worse which goes in line with the country's report that showed food poverty reduction is less than non food poverty reduction.

Conclusion

For the last two decades, government official reports and results of panel survey evidenced that rural Ethiopia's households' poverty reduced though the rate of poverty reduction vary among studies. Very recent interim report of the Ethiopian government, FDRE (2012) has indicated that poverty has reduced contrary to recent study of Dercon's (2011) that evidenced poverty has increased after 2004. However, most studies that measured poverty using self reported data indicated far behind the results that were witnessed by government reports and other panel surveys. So this study has tried to see how Ethiopian rural households perceive poverty at times of economic growth and high inflation despite the contradicting results of prior researches. Our finding shows that the perceptions of households related to non food are positive. However, perceptions related to food consumption tend to show worsening which is in line with the country's report that shows food poverty reduction is less than non food poverty reduction.

So the finding of this study (though the sample is not for the whole country representative) results indicate against the results obtained using quantitative approaches on the one hand and shows similarity other previous qualitative studies. Hence measuring poverty using one approach may mislead to develop polices and strategies targeting the rural areas, and when reporting about poverty both approaches is better to use before concluding whether poverty is really reducing or not.

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

Building Blocks for a Data Infrastructure and Services to Empower Agricultural Research Communities

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Abstract

The agINFRA project aims to provide the agricultural research communities with e-infrastructure and services for open data access, sharing and re-use. This paper introduces the project's objectives and data principles, presents the data resources that are covered, and illustrates agINFRA services with examples from the area of agricultural statistics. Finally, it summarises how agricultural research institutions and other stakeholders can participate in, and benefit from, the project.

Key words

Agricultural research, agricultural repositories, e-infrastructure, data infrastructure, open access, agricultural statistics.

Introduction

The agINFRA project (www.aginfra.eu) is an EU-funded project under the 7th Framework Programme (FP7). The project develops data infrastructure and services for sharing results of agricultural research communities that are managed by international, national, institutional and subject-based repositories. The project involves technology and content partners from Europe, China, Ecuador and India, while one of the lead partners is the Food and Agriculture Organization (FAO) of the United Nations. Moreover the project goals are aligned with the strategic initiative Coherence in Information for Agricultural Research for Development (CIARD) that mobilizes and supports institutions in making agricultural research results more accessible globally (Pesce et al., 2011).

Many agricultural research organizations already have content repositories and portals that serve scientists, information officers as well as educators and extension workers, ranging from national/ regional initiatives to global ones, like the Consultative Group on International Agricultural Research (CGIAR), one of the world's largest and most experienced global research organizations (Clark et al., 2011). What distinguishes agINFRA from these Web destinations can be illustrated with an analogy: The project will develop the infrastructure that helps passengers – information – get from place to place in an easy, secure and effective way. agINFRA does not develop the vehicles (e.g. cars and buses) that carry around the passengers. The main goal is to develop the infrastructure (road network, petrol stations etc.) that will allow others to transfer the passengers, i.e. exchange and share research information. Though agINFRA will also adapt and improve existing vehicles (e.g. Web content management systems and services) in order to show manufacturers how they can build better ones that will take advantage of the new infrastructure.

Materials and methods

e-Research infrastructures and services

Similarly to other infrastructures, agINFRA provides services that allow (research) communities to work together and the (data) economy to function. Research is becoming increasingly distributed, collaborative, ICT and information-intensive. As Hey and Hey (2006) note, e-science "is not a new scientific discipline in its own right: e-Science is shorthand for the set of tools and technologies

required to support collaborative, networked science. The entire e-Science infrastructure is intended to empower scientists to do their research in faster, better and different ways."

Widely used definitions of e-research infrastructure have been outlined in the first roadmap of the European Strategy Forum on Research Infrastructures (ESFRI, 2006) and by the US National Science Foundation Cyberinfrastructure Panel (NSF, 2007). The latter defines e-research infrastructure as "cyberinfrastructure" that "integrates hardware for computing, data and networks, digitally enabled sensors, observatories and experimental facilities, and an interoperable suite of software and middleware services and tools. Investments in interdisciplinary teams and cyberinfrastructure professionals with expertise in algorithm development, system operations, and applications development are also essential to exploit the full power of cyberinfrastructure to create, disseminate, and preserve scientific data, information, and knowledge". The term cyberinfrastructure has been used in the context of research infrastructures related to life sciences, like the one proposed by the iPlant Collaborative, a project funded by the United States National Science Foundation (NSF) which created an innovative, comprehensive, and foundational cyberinfrastructure in support of plant biology research (Goff et al., 2011).

The European High-level Expert Group on Scientific Data (2010) understands that scientific data infrastructure "must be flexible but reliable, secure yet open, local and global, affordable yet high-performance". Also particularly important are principles of collaboration, trust and sharing of various resources in the networked research environment (content repositories, databases, software, networks, computing and other resources). The need for infrastructures supporting the researchers in their tasks has been identified by other scholars in many disciplines (Androulakis et al., 2009; Descher et al., 2009; Michener & Jones, 2012; Thessen & Patterson, 2011;). In this paper, we present the case of a data infrastructure for agricultural research sharing, explaining the rationale for its set up as well as the expected benefits for its users.

Open data principles and values

Overall, agINFRA means getting agricultural research data out of its silos. Helping open up and interlinking the data of existing and newly built repositories is a core activity of the project. The Linked Open Data principles, as suggested by Tim Berners-Lee (2009), and further elaborated by Bizer et al. (2009) are an important basis for this activity:

In a broader perspective, agricultural research data that is shared through agINFRA will have to respect and serve the following desired values of scientific data:

Open – Data must be open and interlinked, not subject to barriers based on standard formats and, thereby, prevent data silos due to lack of interoperability and interrelatedness.

Meaningful – Data must be meaningful through explicit semantics, re-usable from available mature terminologies and ontologies that are exposed and interlinked through the Web.

Reliable – Data must be accessible with ensured provenance. Capability to express and trace the context of creation and re-use are important for building trust in research infrastructure services.

Actionable – Data must be actionable through services that empower research. The value of data is limited if researchers cannot act on it in the ways they need, using flexible and adaptable services.

Covering a broad range of data

Through agINFRA e-infrastructure and services many kinds of information relevant to agricultural

★	Make your data available on the web (whatever format), *but with an open licence, to be Open Data.*
★★	Make them available as machine-readable structured data (e.g. excel instead of image scan of a table).
★★★	As (2), but use non-proprietary formats (e.g. CSV instead of excel).
★★★★	All of the above, plus: Use open standards from W3C (RDF and SPARQL) to identify things, so that people can point at your stuff.
★★★★★	All the above, plus: Link your data to other people's data to provide context.

Table 1: Five stars of Linked Open Data (Berners-Lee, 2009).

sciences can be shared (Karampiperis et al., 2012). A review of content domains of direct relevance to agricultural research identified some priority areas that serve as a starting point to build the agINFRA shared data space. Additional ones are also expected to be covered in the future, for example, cross-domain areas such as agro-biodiversity and agro-ecology (Benckiser & Schnell, 2006; Jarvis et al., 2007; Wezel et al., 2009).

At this stage, agINFRA is targeting the integration of five domains that cover both areas of specific research focus (e.g. agricultural economics) and areas where a particular type of information provides a platform for research activity in general (e.g. bibliographic resources). Currently the following domains are covered:

- Bibliographic data on scientific and grey literature, for example, FAO's AGRIS database (http://agris.fao.org) containing over 4 million bibliographic entries and records (Fogarolli et al., 2011);
- Digital learning and training resources, for example, the Latin American Federation of Learning Object Repositories (LA FLOR - http://laflor.laclo.org) and the Organic.Edunet learning resources for organic agriculture and agroecology (www.organic-edunet.eu) (Dimitropoulos et al., 2011);
- Geospatial information systems offering maps of land cover and soils, GIS datasets and other data with an agricultural or environmental theme (Aditya & Kraak, 2007), for example, the FAO GeoNetwork (www.fao.org/geonetwork/srv/en/main.home) and national resources such as the Italian Soil Information System (ISIS - http://aginfra-sg.ct.infn.it/isis);
- Plant germplasm collections and genomics information, for example, the Chinese Crop Germplasm Research Information System (CGRIS - http://icgr.caas.net.cn/cgris_english.html) and other national and international collections (e.g. European National Inventories of germplasm as shared through the EURISCO data catalogue); databases of DNA sequences and DNA barcodes;
- Agricultural statistics, for example, FAOSTAT (http://faostat.fao.org - over 3 million statistical entries, time-series data, etc.), other United Nations databases and the World Bank open data catalogue (http://data.worldbank.org/data-catalog - providing access to over 8,000 indicators from World Bank datasets).

Examples of research data sharing in the area of agricultural statistics

Today agricultural statistical data are mainly available through major aggregated resources such as FAOSTAT and related United Nations' databases, the Organisation for Economic Co-operation and Development (OECD - www.oecd.org/statistics), World Bank (www.worldbank.org) and other international agencies as well as national economic data sources.

In comparison, the sharing of data collected by researchers working at universities and other research centers is rather limited. The main focus here is on providing access to research papers which, however, has reached considerable volumes. The research field avails of an increasing number of open access journals, many of which are covered by AgEcon Search (http://ageconsearch.umn.edu). AgEcon search is a free, open access repository of full-text scholarly literature from over 60 journals in agricultural and applied economics, including working papers, conference papers and journal articles.

A related European initiative has been the Network of European Economists Online (NEEO), coordinated by the Nereus Consortium (www.nereus4economics.info). The project developed the federated multilingual Economists Online portal (www.economistsonline.org/home) which draws on content repositories of 24 universities, including publications and datasets (Blake, 2009).

Probably the largest initiative is Research Papers in Economics (RePEc - http://repec.org), the collaborative effort of hundreds of volunteers in 75 countries to enhance the dissemination of research in economics and related sciences. RePEc provides a decentralized bibliographic database of working papers, journal articles, books / book chapters from over 1400 archives. In October 2012, RePEc comprised over 1.2 million records of 1500 journals and 3300 working paper series, of which 700,000 articles were available online. RePEc does not include research datasets, while AgEconSearch has a section on datasets that are freely available on the new AgEcon Search Dataverse (http://dvn.iq.harvard.edu/dvn/dv/AgEconSearch). However, since 2010 research groups only provided 5 datasets, which may illustrate the low level of preparedness for sharing of datasets in such ways.

Somewhat more advanced is the field of econometry.

Econometrica (http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1468-0262), the journal of the Econometric Society provides a website of supplementary material "to enable replication of empirical and experimental work and other material related to papers that appear in the journal" (http://www.econometricsociety.org/suppmatlist.asp). Since Volume 72 (2004), over 230 papers with such supplemental material have been published, however, only few papers in this journal relate to topics of agricultural economics.

The main question is: How can research institutes in the area of agricultural statistics on production and trade share and interlink their content and data more effectively?

Let us consider how an institute can open up its census, survey or time-series data by making them accessible to users through agINFRA-facilitated tools and services. As an example we use a Regional Fishery Body, the Secretariat of the Pacific Community (SPC - www.spc.int). SPC is a regional fishery body that monitors fish stocks in the South Pacific Ocean. It publishes yearly assessments of the fish stocks in its area of competence.

The SPC has already begun improving the dissemination of its data by participating in the Fishery Resources Monitoring System (FIRMS - http://firms.fao.org), a global network of regional fishery bodies sharing their assessments according to a common format. But they would like to go further, and make the survey data underpinning their assessments available as a global public good, thus allowing others to use it and making their assessments more transparent as well.

Step 1: Registration

The SPC data manager contacts the agINFRA consortium and makes a request to become a data provider. Once approved they are invited to register with the CIARD RING (http://ring.ciard.net), a global registry of agricultural data providers, datasets and services.

In the registry the data manager puts in not just the institution's contact details, but also describes the species capture production datasets that SPC would like to expose. To her delight, she finds that the ASFIS species classification (www.fao.org/fishery/collection/asfis/en) that SPC uses is already listed as an available dataset dimension in the agINFRA linked open data service that the CIARD RING accesses when users are defining their datasets. This simplifies the process as she does not have to describe or upload the scheme.

As SPC has no web service interface for the access of their statistics (one of the reasons they want to use agINFRA services) the data manager does not describe the service.

Step 2: Extract, Transform and Load (ETL)

The agINFRA ETL process allows the data manager to upload one CSV file per year of data, each containing two dimensions, species and area. These are automatically converted into RDF (Resource Description Framework) data cube format and stored in agINFRA's powerful triple store.

Step 3: Generation of multiple formats

Additional agINFRA transformation methods make the dataset available in several formats, including Statistical Data and Metadata Exchange (SDMX) and Google's Dataset Publishing Language (DSPL). SDMX defines representations of statistical data and respective metadata annotations, not only for single data items but also for full data sets (Gottron et al., 2011). The dataset is also indexed for efficient searching across the infrastructure both internally and externally through an open search API. Finally the CIARD RING data is updated making users aware that this new dataset is available.

Step 4: Attachment of data to relevant research publications

The data manager receives a unique resolvable URI for each dataset. She is now able to attach these URIs to the current year's fish stock assessments, thus linking the documentary assessment to the raw research data on which the conclusions are based. She also uploads metadata for the documentary assessments into the infrastructure so that the documents can be searched and discovered together with the datasets.

Step 5: Recommending statistics related to other information resources

Users of the agINFRA recommender widget will automatically find the results from these time-series data appearing in their web sites. Mashups using the statistics widget will automatically get tables of statistics generated when their pages match the dimensions attached to the statistical data.

Results and Discussion

How agricultural research institutions and other stakeholders can participate and benefit

agINFRA is designed as an open and collaborative initiative. Therefore it offers a number of ways for stakeholders to engage in the agINFRA ecosystem of infrastructure and service developers, repositories, research organizations and educational institutions. The degree of involvement is decided by each participant according to the principle "the more you contribute, the more you can get back". Some of the key benefits for participants and contributors include:

Opening up research results (open science)

There is a wealth of raw, processed, analyzed and published agricultural science data that is collected and stored every day. Finding the way to make them accessible to the wider community will ensure that the research efforts are recognized and acknowledged. Provision of advanced tools and services will allow research organizations better organize, publish and interlink information about their content and data collections. Opening up theses collections to the international scientific community will create more awareness of the research output and stimulate new collaborations.

Promoting data exchange

agINFRA's viability is tightly connected to the community of institutions and research groups that share through it new agricultural data sources and collections. Registering a collection as an agINFRA data source and publishing metadata for the resources in the collection ensures that they become part of a global pool of agricultural research results. Thereby research groups and individual scientists and educators will gain access to more relevant information for their work, also including other resource types than research papers and other documents.

Finding and re-using data

Agricultural research data of various types and formats will be made available by the agINFRA (meta)data pool. Different access protocols and formats are being put in place to allow this data to become searchable and consumable. Open search APIs, access protocols like OAI-PMH, and other types of add-on components and plug-ins will make it easier for existing systems to ingest data that reside in the agINFRA data pool. Simple solutions include harvesting the data of a particular type (e.g. bibliographic or economic information) and adding it to existing collections or search facilities.

Contributing software

agINFRA tools and services are being developed on an open-source code base, ensuring transparency, flexibility, and long-term viability of the software tools and applications that are being hosted, processed and empowered by the infrastructure. Software developers can use the agINFRA technical framework, components, add-on plug-ins and technical support for enhancing existing tools and services that are provided to agricultural researchers and data managers. Developers have the opportunity to participate in training events, plugfests and hackathons. These events will help gather their feedback and ideas and provide these back to the wider developer community.

Sharing Cloud and Grid infrastructure resources

An essential component of agINFRA is the availability of cloud and grid resources that various infrastructure partners are contributing. Access to the infrastructure is virtualized: clusters of servers are networked into an agINFRA Virtual Organization which is made available to the software tools and applications as a seamless infrastructure resource through a Scientific Gateway. Different middleware software components can be easily parameterized in order for a new infrastructure to contribute some of its cloud and grid resources to the agINFRA community.

Conclusions

The agINFRA project develops e-infrastructure and services that support sharing, access and re-use of open and linked data of agricultural research. It will allow research institutes in the area of agricultural statistics as well as in other areas of agricultural research open up their repositories of content and data and interlink and share them more effectively. The example related to agricultural statistics presented in this paper is only one of the numerous applications of the agINFRA products.

To achieve the aforementioned goals, current practices need to be overcome that produce information silos which lack accessibility and interoperability of the data resources. agINFRA promotes following Linked Data principles in order to remove such barriers. Furthermore the project devotes particular attention to the semantics of

shared data as well as criteria of reliability such as data provenance.

Acknowledgement

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 283770. We also thank all formal project partners and supporting organizations that combine their technologies, services and data in order to promote the open sharing of agricultural research results.

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4 - Special, 2012

Monitoring of infection pressure of American Foulbrood disease by means of Google Maps

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Anotace

Tento článek popisuje možnosti Google Maps jako nástroje pro podporu rozhodování při řešení prostorových problémů spojených s nemocí moru včelího plodu. Tato nemoc představuje vážný problém pro včelaře na celém světě. Jeho řešení vyžaduje použití všech dostupných dat a znalostí v příslušných rozhodovacích procesech. Prostředek Google Maps nabízí geografický přístup, který umožňuje použít stávající znalosti k modelování a analýze těchto problémů, a tak přispět k jejich řešení.

Klíčová slova

Prostorový rozhodovací problém, systémy pro podporu rozhodování, GIS, Google Maps, mor včelího plodu, infekční tlak .

Abstract

This article describes the options on Google Maps as a tool for decision support in solving spatial problems associated with the American Foulbrood disease. This disease is a serious problem for beekeepers world-wide. The solution to these problems requires the application of all available knowledge in the relevant decision-making processes. The Google Maps offers the geographical approach that represents a new way of thinking and solutions to existing spatial problems. This approach allows to apply existing knowledge to model and analyze these problems and thus help to solve them.

The Project Information and knowledge support of strategic control - MSM 6046070904 supports this work.

Key words

Spatial decision problem, decision support systems, GIS, Google Maps, American Foulbrood disease, infection pressure.

Introduction

We can say that only few animals are as important as honeybees. Without them, agriculture as it is now could not exist because crops mainly require pollination by bees in order to grow. By working to improve the welfare of bees, authors offer to use Google Maps. Honey bees, as they forage for nectar and pollen, play a vital role in the environment and in preserving biodiversity by pollinating both wild flowers and many agricultural crops. Honey bees are the most economically valuable pollinators. In 2005, they pollinated €153 billion-worth of human food, representing 9.5% of the total agricultural production value (Gallai et al., 2009). For example The economic value of pollination of such crops is estimated at Ł120m-Ł200m annually in the UK – and this is in addition to the production of honey, beeswax and other hive products. The essential and valuable activities of bees depend upon beekeepers maintaining a healthy population of honey bees.

Gallai's study also determined that pollinator disappearance would translate into a consumer surplus loss estimated between €190 to €310 billion. Without bees, many fruit, seed and nut yields would decrease by 90% (Klein et al., 2007). In fact, the value of beef and dairy products that come from forage legumes accounts for 7.6% of the total agricultural production value, about 80% of the pollinated production value (Gallai et al., 2009). "There has been widespread concern over status of bees worlwide in recent decades (Allen-Wardell et al. 1998, Kearns et al. 1998) with number of

publications documenting large scale declines...” (Abrol 2012, page 206). Animal pollination provides a critical service to ecosystems, both biologically and economically speaking. Insects are the most important animal pollinator groups, with approximately 70 percent of angiosperm (flowering plants) plants being insect pollinated (Free 1993, Schoonhoven et al. 1998). Among the pollinating insects, bees are one of the most important and specialised groups (Danforth et al. 2006). It is known that there are more then 19000 valid species of bee on the Earth described thus far. At the other hand there are likely to be many more species that are to be described.

Morphologically bees are adapted to collect, manipulate transport and store pollen very effectively and efficiently. Bees species exhibit both generalist and specialist foraging behaviour, thus making them very important economically and ecologically (Waser and Ollerton 2006). Highly specialized pollination systems, such as figs and their wasp or orchids that deceive bees in trying to make them mate with their floral organs, are intuitively appealing to most people and have, therefore, gained far more attention both in popular and scientific literature than the more generalized pollination systems. For a long time the dominant view was that many, or perhaps even most, plant–pollinator interactions were specialized. In 1996 Waser and his colleagues tried to stir things up by writing an article in which they argued that, in contrast to common belief, generalization was widespread in plant–pollinator systems.

Beekeeping is essential to modern agriculture for the many commercial crops. Currently, beekeeping however is complicated by the very dangerous disease - American Foulbrood Bee disease (AFB). The name is derived from the foul odor of the brood chamber in an infected colony. AFB is caused by the spore-forming bacterium known as Paenibacillus

Region	Cadastral	Village	GPS	Date of confirmation of an outbreak	Termination date of outbreak
České Budějovice	621919	České Budějovice	49°0'47.000"N, 14°22'57.000"E	5.4.2011	20.4.2011
Český Krumlov	622931	Český Krumlov	48°45'3.000"N, 14°12'49.000"E	22.4.2011	27.5.2011
Český Krumlov	622931	Český Krumlov	48°37'37.000"N, 14°18'24.000"E	2.5.2011	11.5.2011
Český Krumlov	622931	Český Krumlov	48°39'56.000"N, 14°10'4.000"E	10.3.2011	18.5.2011
Český Krumlov	622931	Český Krumlov	48°45'50.000"N, 14°10'48.000"E	18.8.2011	20.9.2011
Český Krumlov	622931	Český Krumlov	48°48'10.163", 14°18'30.585"E	8.3.2011	15.3.2011
Jindřichův Hradec	770230	Třeboň	49°00'53.28"N, 14°47'56.60"E	09.04.2009	27.05.2009
Jindřichův Hradec	624322	Lomy u Kunžaku	49°06'26.77"N, 15°09'31.28"E	10.08.2009	15.09.2009
Písek	700771	Maletice	49°14'21.14"N, 14°11'22.97"E	24.09.2009	29.10.2009
Písek	700771	Maletice	49°14'21.14"N, 14°11'22.97"E	24.09.2009	29.10.2009
Prachatice	608530	Budilov	49°05'11.66"N, 13°51'01.13"E	13.05.2009	17.06.2009
Strakonice	675181	Krty-Hradec	49°17'45.61"N, 13°51'01.73"E	22.04.2009	19.06.2009
Strakonice	675181	Strakonice	49°15'2.000"N, 14°0'55.000"E	11.4.2011	12.5.2011
Strakonice	675181	Strakonice	49°13'11.000"N, 14°1'51.000"E	17.3.2011	12.5.2011

Source: State Veterinary Administration of CR

Table 1 Existing spreadsheet of American Foulbrood disease in CR.

larvae. The Paenibacillus larvae endospor eis the contagion for AFB. AFB disseminates rapidly trough a colony and can result in significant losses in colony production and death of the colony (Hamdan 2010). This disease is a great problem for beekeepers world-wide and causes them considerable economic loss (Forsgren, et al. 2005). The appearance of the AFB in the colony of bees, has a huge economical impact on the bees market as through the diminution of the production of honey and wax, and an agricultural impact – because the bees are the main pollinator of the plants (Chirila et al. 2007).

It is quite understandable that the competent authorities and institutions take a range of measures. Prerequisite for the effectiveness of these measures is detailed evidence of this disease. The existing conventional spreadsheets no longer fulfil its purpose. However, few countries have either control programs for American foulbrood or tracing systems to allow certification of the origin of bee products. It is known that it is possible to test honey for P. l. larvae to estimate spore concentration, and to dilute contaminated honey with well honey so that the final concentration is less than the lowest reported to cause infection when fed to bees – that is, 50 million spores per liter. If an additional safety margin of two orders of magnitude were applied for spore levels in honey, then honey with less than 500,000 spores per liter could be considered safe. So called polymerase chain reaction protocols have been developed for the direct detection of P. l. larvae spores in honey samples, although these do not differentiate between P. l. larvae and P. l. pulvifaciens. (Lauro et al. 2003). At the other hand the offered use of discussed Google Maps can help to beekeepers better make spatial conditions decision in field of their own activities in the apiculture.

Material and methods

AFB is not only defined by its localization, but also intensity and time course. Decisions made in this matter are very serious and difficult. In connection with this disease, some authors also mention so-called infection pressure from the environment (Přidal, 2012). This pressure is specified by the distance to the nearest outbreak, its severity, current state and repeatability. The AFB is then also necessary with regard to these attributes to be analyzed and monitored (Shimanuki, et al. 2000). Decisions made in this context are very hard and can have very serious economic repercussions for beekeepers. Problems associated with the AFB belong to the category of spatial problems.

One of the tools, that can help us to analyze and deal with these problems, can be so called Decision Support Systems (DSS) (Power 2002). The DSS is a computer-based information system that supports business or organizational decision-making activities (Maxwell, 2008). A special categorie of DSS is called Spatial Decision Support Systems (SDSS). SDSS is an interactive, computer-based system designed to support a user or group of users in achieving a highest effectiveness of decision making while solving a structured spatial decision problem (Sugumaran, Degroote 2010, Ascough, et al. 2002). Typical SDSS provide a framework for integrating:

- analytical modeling capabilities,
- database management systems (DBMS),
- graphical display capabilities,
- tabular reporting capabilities,
- decision-maker‘s expert knowledge (Binda, Sharma 2008).

SDSS category includes primarily *Geographic Information Systems* (GIS). The possibilities of using these tools in solving spatial problems report a number of authors (Johnson 2005, Pandey, Harbor, Engel 2001). However, the financial costs of GIS are quite high. In this context, is offered as additional support options to solving these problems means Google Maps (Gibson, Erle, 2006). Google Maps is a web mapping service application and technology provided by Google which uses JavaScript extensively. Google Maps powers many map-based services, including the Google Maps website, Google Ride Finder, Google Transit. These services are focused mainly to car drivers. “*Google’s map interface allows users to integrate data using only ten lines of code”* (Butler 2006). The Google Maps API is free for commercial use in a case if the webservice is not generating more than 25 000 map accesses a day. At the other hand some persons have own reverse-engineered tool and produced client-side scripts and server-side hooks which allowed a user or website to introduce expanded or customized features into the Google Maps interface.

- Support in solving problems with AFB may be monitoring the form of a designed interactive map using Google Maps. The aim of such map must be the following:

- locate existing outbreaks of AFB,
- analyze of these outbreaks, in terms of severity and time.

If such an interactive map to perform the functions SDSS must offer other features than simply display of status, ie the occurrence of AFB. This function should be to objectify of potential decision to determine the place for beekeeping with respect to the intensity of the infection pressure.

Results and discussion

The process of creating interactive maps must be based on a thorough analysis of all available attributes. If it is not, there is a risk that the resulting maps will be biased. Most of the spatial problems are complex and require the use of analysis and models. Such problems are very frequently semi-structured or ill-defined because all of their aspects cannot be measured or modelled. The key issue of such a solution must be work with the so-called layers (Crampton 2011). Generally, these overlapping layers of vector data, attribute data combination can lead to the creation of a new data layer. This layer often provides more useful data to analyze the problem.

The possibility to work with layers is typical for GIS tools. This matter may be to some extent implemented in Google Maps by means of additional programming. The Google API allows other data to be fed to it and displayed as a Google map. (Crampton 2011). "*An API defines a standard way for one program to call code that lives within another application or library. The Google API defines a set of JavaScript objects and methods that you use to put maps on your own web pages."* (Gibson, Erle 2006).

Google Maps API is very well documented and thousands of examples of how to use them are available. Therefore, it is easy to write your own application. Because the tool can use XML, it is easy to integrate application with other data sources, and also allows easy export of data to other applications. Another advantage is that the Google Maps API is free for commercial use in a case if the webservice is not generating more than 25 000 map accesses a day.

Example of such corresponding source code may be next.

```
<!DOCTYPE html>
<html>
<head>
<title>Map demo</title>
<meta http-equiv="Content-Type"
content="text/html; charset=UTF-8">
<script src="http://maps.googleapis.com/
maps/api/js?sensor=false">
</script>
<script type="text/javascript">
var data = [
{ lat: 50.130586, lng: 14.373493, text:
„2005" },
{ lat: 50.284265, lng: 14.856271, text:
„2007" }];
var initMap = function()
{var map = new google.maps.Map(document.
getElementById(„map_canvas"),
{zoom: 10,center: new google.maps.
LatLng(50.130586, 14.373493),
mapTypeId: google.maps.MapTypeId.
ROADMAP});
for (var i in data) {
addMarker(map, data[i]);}}
var addMarker = function(map, obj)
{var marker = new google.maps.Marker({map:
map,position:
new google.maps.LatLng(obj.lat, obj.
lng)});
var infoWindow = new google.maps.
InfoWindow({
content: „<p>Rok: „ + obj.text + „</p>"});

google.maps.event.addListener(marker,
„click", function()
{infoWindow.open(map, marker);});};
window.addEventListener(„load",
initMap, false);
</script>
</head>
<body>
<div id="map_canvas" style="width: 800px;
height: 600px;"></div>
</body>
</html>
```

In the first part of the source code is adjusted a set of used variables that are applied in the API in this particular case. Another part of the source code is its own application logic that responds to the activity of the beekeeper, as shown below. In this logic applications are processed event caused by user actions. The output of this part of the program is required and appropriate information which is displayed on the map. The penultimate line

 </ div>

defines dimensions of the map.

The figure 1 below shows the use of layers in designed interactive map using Google Maps.

Beekeeper clicks on the place in which want to behave their beehives. The beekeeper deciding to place a hive to a new location has to take into account all the potential risks of such location, i.e. concrete infection pressure from the environment. Possibility to specify a concrete infection pressure in the selected place shows the following figure 2.

In this way the user (beekeeper) may find the other

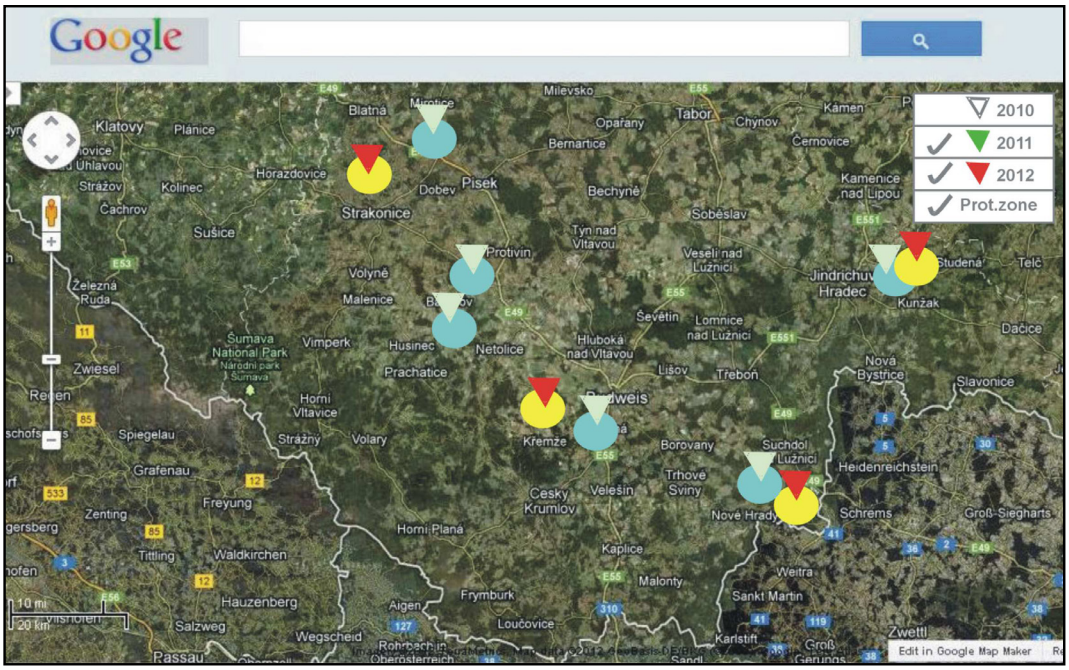

Figure 1: Work with layers (occurrences of the outbreaks in individual years - South-Bohemian Region) in the designed interactive map.

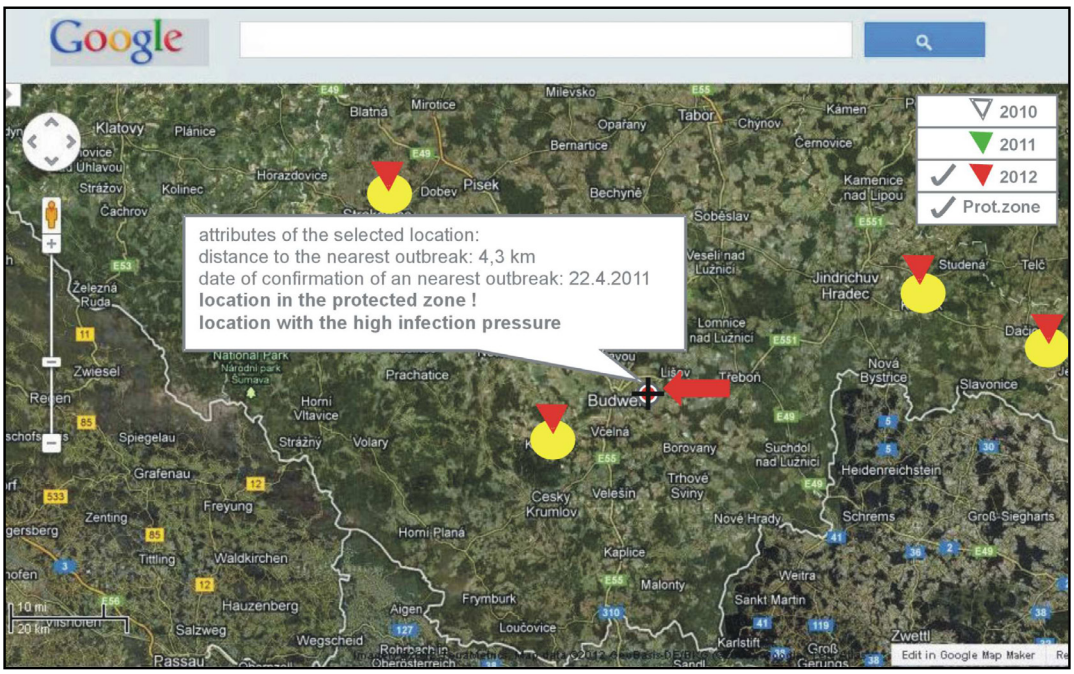

Figure 2: Representation of a concrete nfection pressure in the selected place.

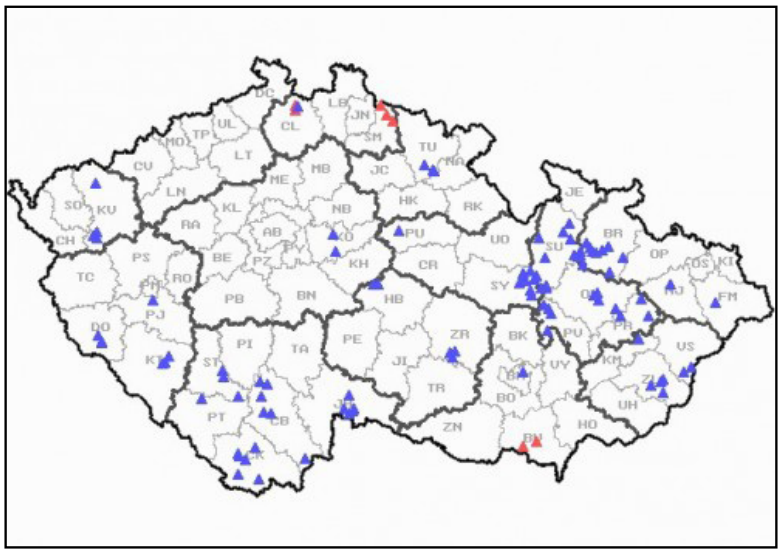

Figure 3: Outbreaks of AFB in Czech republic: status in 2011year (source: State Veterinary Administration CR) http://www.svscr.cz/?lng=en&cat=0.

important attributes of the selected place, which on help him to his final decision.

The situation about AFB, among other things monitors State Veterinary Administration of whose tasks are the following issues:

- Protection of Consumers from products of animal origin Likely to Be Harmful to human health.
- Monitoring of animal health situation and Maintaining it Favourable.
- Veterinary protection of the state territory of the Czech Republic.
- Animal welfare and animal protection.

One example of the outputs from information systems which are operated by the State Veterinary Administration CR is at the Figure 3.

Conclusion

The proposed solution can considerably help to effectively monitor the spread of the AFB in CR. The designed interactive map generated this way can only fulfill its purpose, i.e. to minimize considerable economic losses associated with this disease.

The creation of the such final interactive map should be implemented as in following steps:

- collection of available data (data from available records of the State Veterinary Administration CR, Czech Beekeepers union, Bee Research Institute at Dol),
- visualization of existing outbreaks in terms of its time and severity,
- location of corresponding protective zones,
- analysis of the current state by means of the layers,
- output: specification of appropriate recommendations.

Benefits of the proposed solution may be as follows:

- transparency of the specified recommendations in the form of maps,
- easily upgradeable,
- complete availability via the Internet.

Acknowledgements

The Project Information and knowledge support of strategic control - MSM 6046070904 supports this work.

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

Methodological Approaches to Costs Evaluation of Canned Feed

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Anotace

Příspěvek se zabývá metodickými přístupy hodnocení nákladovosti výroby konzervovaných krmiv zejména kukuřičné siláže a siláž ze zavadlých víceletých pícnin na orné půdě. Hlavně se jedná o úpravu doposud používaného způsobu kalkulace vlastních nákladů vybraných krmných plodin ve dvou fázích. V prvé fázi jde o kalkulaci nákladů vybraných krmných plodin při pěstování a sklizni a ve druhé fázi se kalkulují náklady na zpracování vybraných krmných plodin tj. na proces jejich silážování.

Výsledkem provedené metodické úpravy hodnocení nákladovosti výroby konzervovaných krmiv je souhrnná kalkulace vlastních nákladů spočívající ve spojení obou fází kalkulace tj. ve spojení počáteční fáze pěstování, sklizně krmných plodin a následné fáze zpracování a dopravy konzervovaných krmiv.

Příspěvek uvádí dílčí výsledky výzkumu řešeného v rámci výzkumného záměru č. MSM 6215648904.

Klíčová slova

Metodika kalkulací vlastních nákladů, náklady siláže, základní struktura nákladů, souhrnná struktura nákladů.

Abstract

The paper deals with methodological approaches of cost evaluation of canned feed production, especially cost evaluation of corn silage or silage from melted multiannual fodder on arable land. Mainly there is modification of the cost calculation method in two steps used for chosen fodder crops up to now. The first step is cost calculation of chosen fodder crops during cultivation and harvesting. The second step is cost calculation of chosen fodder crops processing, it means process of crops ensilage.

The result of methodological modification of cost evaluation of canned feed production is an aggregate of own cost calculation by combining both phases of calculation, i.e. connection in the initial phase of cultivation and harvesting of fodder crops and the subsequent phase of processing and transport of canned feed.

The paper is a partial output of a Research project of FBE MUAF Brno, (MSM No 6215648904).

Key words

Methodology of total costs calculation, costs of silage, basic cost structure, summary cost structure.

JEL: Q020, Q140

Introduction

Costs of canned feed significantly influence costs of milk production, beef production and production of other commodities and products. In the field of fodder crops cultivation on arable land there is highly quality production by expending appropriate costs and by corresponding prices of products as well. The quality of production and direct costs, that cultivator can influence the most, are connected especially with using of right cultivate technology (e.g. Jánský (2005), Jánský, Pospíšil (2010)). That goes also for fodder plants grown on arable land. Their economic connections are analyzed in this paper. The capacity of the machine and level of cultivate technology can

influence, better said reduce, the costs, especially timeliness costs. They are usually similar to labour costs and therefore need to be considered when looking at the total revenue of silage production (Gunnarsson, Spörndly, Hansson (2005)). Further with management in consumption of inputs such as fertilizers and seed, the benefit-cost ratio in corn silage production will increase (Pishgar Komleh, Keyhani, Rafiee, Sefeedpary (2011)). The goal of the paper is to suggest methodological approach to costs evaluation of canned feed. It includes calculation for chosen canned feed such as corn silage and silage from melted multiannual fodder on arable land. Corn silage is a widely used crop and popular forage for ruminant animals due to high yield, digestibility, palatability, storage ability and etc (Pishgar Komleh, Keyhani, Rafiee, Sefeedpary (2011)).

Material and methods

The basic condition of plants cultivation is corresponding production with high quality by acceptable costs and by appropriate prices as well. (e. g. Jánský, Létalová, Živělová (2009), Jánský, Živělová, Křen, Valtýnionvá (2007)). The quality of production and direct costs, that cultivator can influence the most, are connected with using of right growing technology. The great importance of technology and its influence on productivity of arable crops are mentioned by many authors (e.g. Bojnec, Latruffe (2009), Drozd, Hanusz (2009), Konno, Iwate-Ken (2009), Žák, Macák, Hašana (2012)). What is also important it is influence of silage corn on crops cultivated consequently (e.g. Žembery (2008)).

There are many economic indicators of performance evaluation (Hřebíček, Popelka, Štenc, Trenz (2012), Sedláček (2010)). Evaluation of fodder crops cultivation economy by using cost calculation, which is used in this paper, goes from evaluation of direct and overhead costs, i.e. full own costs. This cost structure follows in general calculation formula that is divided into following cost items (e.g. Poláčková (2010), Homolka, Mydlář (2011)).

Items of calculation formula

1. Purchased material	seeds, seedlings, fertilizers, agents of plants protection and other direct material
2. Inputs of own production	seeds, seedlings, fertilizers and other own products
3. Other direct costs and services	external services, energy, insurance, rent and tenancy, estate tax and others
4. Labour costs in total	wage costs and other personnel costs, including health and social insurance allowance
5. Costs of auxiliary activities	costs of own machinery operation, repairs and maintaining (fuel consumption, depreciation of long-term tangible and intangible assets, tractors, combines, machines for crop farming, road tax and other costs
6. Production overhead	common costs of all around crop farming, e.g. depreciation (silage holes, mows), rent, spare parts and material for production objects repairs, other costs
7. Administration overhead	costs common for the whole company, e.g. electric energy, communication, depreciation (administrative building), rent, interests and other common costs

Although this formula isn´t obligatory most of Czech companies use it (e. g. Synek, Kislingerová (2010)). The items 1, 2, 3 are calculated as direct costs to particular outputs. In the item 4 of total labour costs there methodology prescribes to include direct costs calculated to particular outputs as well as relevant part of wages from costs of auxiliary activities and from overheads. The item 5 includes especially costs of own machinery operation. These costs are classified to particular outputs in accordance with ïncompany principles. The items 6 and 7 are dissolved overhead (indirect) costs.

Cost calculation has two problems. The first one is question of cost allocation to outputs. The second one is choice of suitable content and extent of calculation and structure of calculated items. Classification of cost as unit and overhead costs follows classification costs as technological costs (unit and overhead too) and costs of operation and control (always overhead) (e.g. Král (2010)).

There are cost calculation that are not to usable in agriculture, especially calculation of incomplete costs and moder methods of cost management, e.g. Activity Based Costing (ABC). Or it is possible to use them only in limited measure Létalová (2008). For example Nekvapil (2007) shows

that importance of break even poing is generally overestimated because of limited applicability. This approach is possible to use only in fast estimates. For example Petřík (2007) further states that increasing indirect costs are typical currently, especially in field of auxiliary and overhead costs. That´s why he considers cost method ABC as an instrument of process and value management that is able to provide practical answer to very topical and important problems of these costs, their control and planning.

Data base for evaluation of canned feed product economy

Data of sample survey about costs and revenues of farm products (data from Institute of Agricultural Economics and Information (IAEI)) in years 2007 - 2009 are adapted to information about costs of canned feed (corn silage, silage from melted multiannual fodder on arable land). In the case of corn silage there selection respondents' assemblage included 146-164 businesses and in the case of silage from melted multiannual fodder it was 144-154 businesses. Costs of canned feed are made from this assemblage.

Indicators acreage of harvested areas, included in processing of survey results, and their share on total acreage of harvested areas of relevant crops in the Czech Republic are important for review of representativeness of selection assemblage. From the point of mentioned share of harvested areas on total acreage of harvested areas of relevant crops the results of sample survey are representative. As the table 1 shows the share of silage crops in survey is in excess of 10 %, which uses to be usually considered as sufficient for ensuring of representativeness.

Results and discussion

In interior company accounting there are costs of canned feed monitored in special outputs – so called auxiliary activities silage (corn silage) and haylage (silage from melted multiannual fodder on arable land). To these outputs there are concentrated costs connected with canning of green fodder and storing of canned feed. Costs of green fodder cultivation are monitored on relevant outputs of crop farming (corn for silage, multiannual fodder on arable land). Green fodder enters into costs of canned feed as own intermediate product and constitutes essential part of these costs.

Costs of corn silage production

Own costs of corn silage in monitored period are shown in the table 2.

Own costs per 1 hectare of harvested area of corn for silage increases in particular production areas as well as in average of total costs of survey. Increase in hectare yield influenced decreasing of cost per 1t of corn for silage; decrease was 11.2 %. Situation in particular production areas progressed similarly. Own costs of silage as canned feed for cattle farming and fattening are on average 102 % higher (average costs are 628 CZK per t) than green fodder of corn for silage.

The basic structure of cost items connected with ensilage of green fodder of corn is shown in the figure 1. The greatest share on the total costs of corn silage have costs of own products consumption (green fodder), it is 83.9 %. Share of other cost items is from 2 to 4 %.

So called summary structure of costs mentioned in the figure 2 enables to better analyze and after that influence height of particular cost items. On the average own costs of corn silage production (628 CZK per t) there is in monitored period share of seed 13.3 %, fertilizer 14.1 % and chemical protective agents 7.4 %. Labour costs (18.0 %), costs of own machinery operation (16.8 %) and overhead (15.1 %) reached the highest share on total costs.

Crop	Acreage of harvested areas in survey (hectare)			Share of survey areas on total acreage of harvested areas in the Czech Republic (%)		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Corn for silage	35 576	30 543	32 539	17.2	14.3	16.9
Multiannual fodder crops on arable land	25 060	23 936	25 303	10.3	10.8	11.5

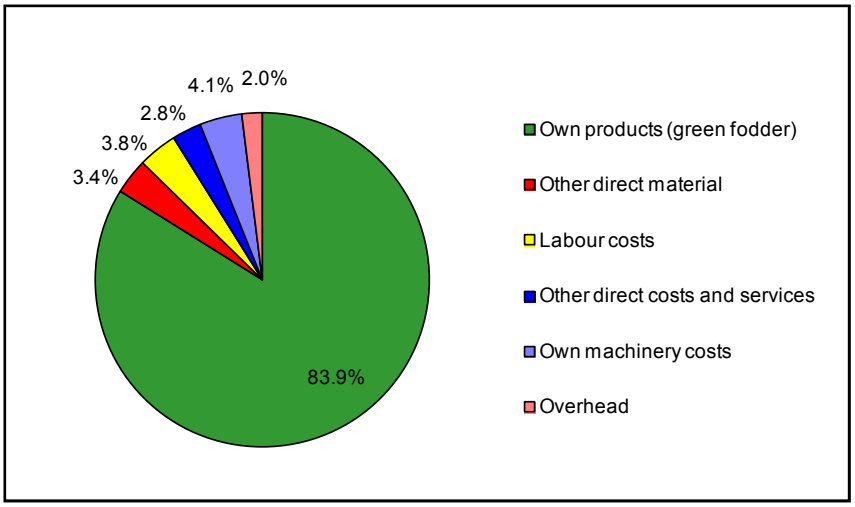
Source: Sample survey of costs and revenues of farming products IAEI

Table 1: Acreage of harvested areas of fodder crops in the sample survey and their share on the total acreage of fodder crops harvested areas in the Czech Republic.

Indicator	Year of survey	Production area			Average of survey
		C and B	P	PO and M	
Own costs of corn for silage (CZK per hectare)	Year 1	15 853	14 201	13 806	14 621
	Year 2	18 057	15 797	15 383	16 233
	Year 3	18 379	17 023	17 725	17 536
	Average	17 430	15 674	15 638	16 130
Hectare yield (ton per hectare)	Year 1	27.05	24.62	28.26	26.30
	Year 2	31.64	31.05	29.10	30.65
	Year 3	34.56	36.25	35.06	35.53
	Average	31.08	30.64	30.81	30.83
Own costs of corn for silage (CZK per ton)	Year 1	586	577	489	556
	Year 2	571	509	529	530
	Year 3	532	470	506	494
	Average	563	518	508	526
Own costs of silage (CZK per ton)	Year 1	695	686	586	663
	Year 2	664	605	615	623
	Year 3	660	571	586	597
	Average	673	621	596	628

C and B ... corn and beet production area
P ... potato production area
PO and M ... potato-oat and mountain production area
Source: Sample survey of costs and revenues of farming products IAEI

Table 2: Costs of corn for silage and corn silage.



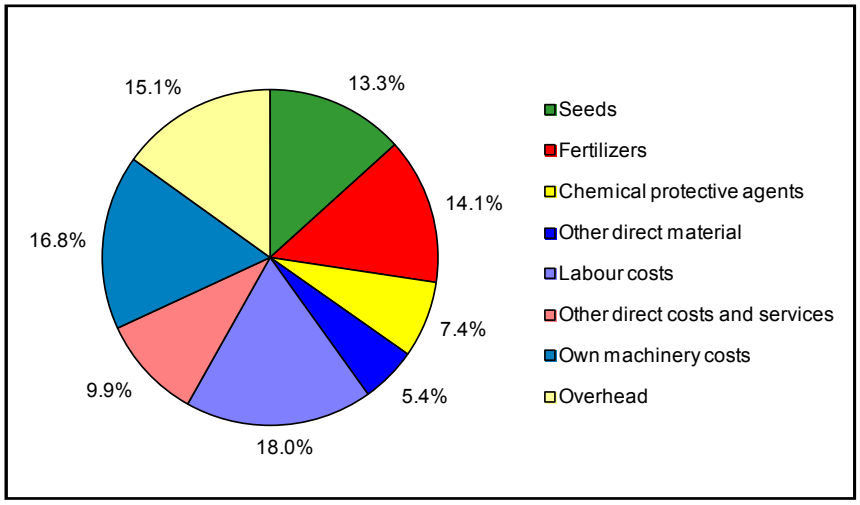
Source: Sample survey of costs and revenues of farming products IAEI

Figure 1: Basic structure of corn silage costs .

Costs of silage from melted multiannual fodder production

Own costs of silage from melted multiannual fodder on arable land in monitored period, their dividing according to types of production area and average of whole search assemblage are mentioned in the table 3.

Own costs per 1 hectare of harvested area of multiannual fodder on arable land increased all the time, 19.6 % on average, 14.1 % in potato-oat and mountain production area, 21 % in corn and beet production area and the most 23.5 % in potato production area. Hectare yield of multiannual fodder permanently increased as in the case of corn for silage. Increasing of hectare yield influenced decreasing of costs per 1t of green fodder of multiannual fodder. Coefficient 1:3 was used for



Source: Sample survey of costs and revenues of farming products IAEI

Figure 2: Summary structure of corn silage costs.

Indicator	Year of survey	Production area			Average of survey
		C and B	P	PO and M	
Own costs of corn for silage (CZK per hectare)	**Year 1**	6 570	5 693	5 789	6 052
	Year 2	6 788	6 448	6 322	6 526
	Year 3	7 941	7 031	6 606	7 239
	Average	7 100	6 391	6 239	6 605
Hectare yield (ton per hectare)	**Year 1**	26.75	19.99	24.14	23.52
	Year 2	28.21	32.14	28.75	29.98
	Year 3	30.08	32.30	28.36	30.54
	Average	28.35	28.14	27.08	28.01
Own costs of green fodder of multiannual fodder on arable land (CZK per ton)	**Year 1**	246	285	240	257
	Year 2	241	201	220	218
	Year 3	264	218	233	237
	Average	250	234	231	237
Own costs of haylage[1)] (CZK per ton)	**Year 1**	1 162	1 110	910	1 025
	Year 2	1 113	821	812	875
	Year 3	1 173	936	922	992
	Average	1 149	956	881	964

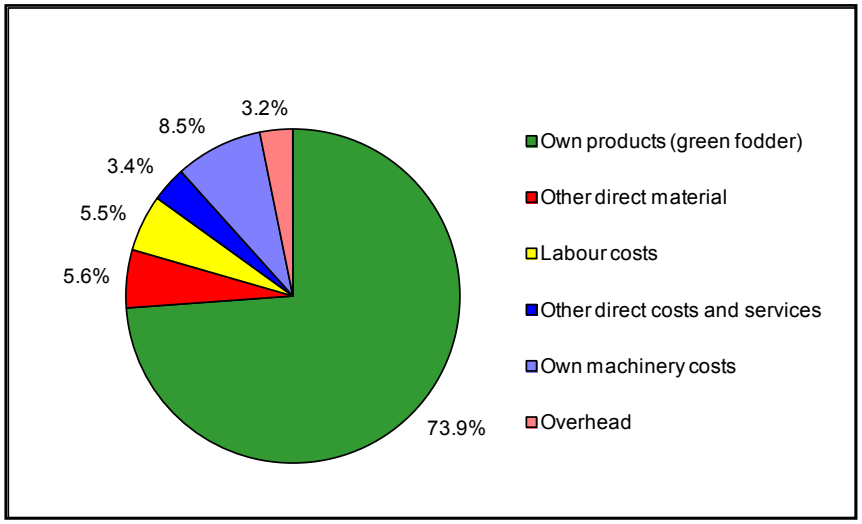
[1)] Coefficient for recalculation of green fodder into haylage
C and B ... corn and beet production area
P ... potato production area
PO and M ... potato-oat and mountain production area
Source: Sample survey of costs and revenues of farming products IAEI

Table 3: Costs of multiannual fodder on arable land and costs of silage from melted multiannual fodder.

recalculation of costs of this green fodder into costs of silage. Costs per 1 t of silage from melted multiannual fodder are on average 252 CZK higher (average costs are 964 CZK) than triple costs of 1t of green fodder used for silage production.

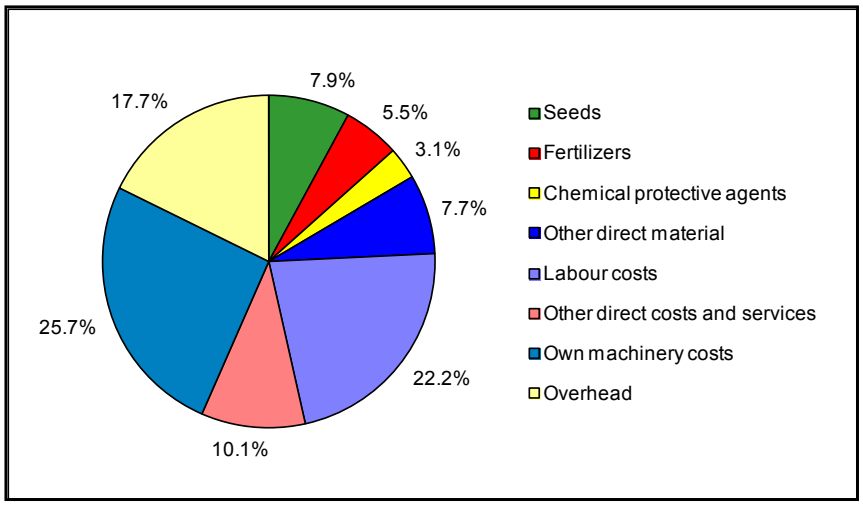
Basic structure of cost items that are connected with production of silage from melted multiannual fodder cultivated on arable land is shown in figure 3. The greatest share on total costs of silage from melted multiannual fodder has consumption of own products, it is 73.9 %. The second greatest item is costs of own machinery operation with share 8.5 % on total costs. Share of other cost items ranges from 3.2 to 5.6 % on total costs.

The figure 4 shows summary structure of particular cost items that are connected with silage from melted



Source: Sample survey of costs and revenues of farming products IAEI

Figure 3: Basic costs structure of silage from melted multiannual fodder.



Source: Sample survey of costs and revenues of farming products IAEI

Figure 4: Summary structure of costs of silage from melted multiannual fodder.

multiannual fodder production. On the average own costs of this silage production (964 CZK per 1t) in monitored period there is relatively low percentage share of seed (7.9 %), fertilizer (5.5 %), chemical protective agents (3.1 %) and other direct material (7.7 %). The highest share on production of silage form melted multiannual fodder accounts costs of own machinery operation (25.7 %), labour costs (22.2 %), overhead (17.7 %) and other direct costs and services (10.1 %).

Conclusion

The result of methodological modification of cost evaluation of canned feed production is an aggregate of own cost calculation by combining both phases of calculation, i.e. connection in the initial phase of cultivation and harvesting of fodder crops and the subsequent phase of processing and transport of canned feed.

Summary structure of costs enables to better analyze and after that influence level of particular cost items. On the average own costs of corn silage production (628 CZK per 1t) in monitored period there is share of seed 13.3 %, fertilizer 14.1 % and chemical protective agents 7.4 %. Labour c osts (18.0 %), costs of own machinery operation (16.8 %) and overhead (15.1 %) accounted the highest share on total costs.

On the average own product costs of silage from melted multiannual fodder (964 CZK per 1t) in monitored period there is relatively low percentage share of seed (7.9 %), fertilizer (5.5 %), chemical

protective agents (3.1 %) and other direct material (7.7 %). The highest share on production of this silage accounts costs of own machinery operation (25.7 %), labour costs (22.2 %), overhead (17.7 %) and other direct costs and services (10.1 %).

Acknowledgement

The paper is a partial output of a Research project of FBE MUAF Brno, (MSM No 6215648904) „Czech economy in the process of integration and globalization, and the development of agrarian sector and the service sector under the new conditions of an integrated marked“ as a part of thematic direction 05 „Social-economic context of sustainable development of multifunctional agriculture, and actions of agrarian and regional policy“.

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

The Assessment of the Effects of Investment Support Measures of the Rural Development Programmes: the Case of the Czech Republic

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Anotace

Investiční podpory jsou považovány za principiální nástroj pro posilování konkurenceschopnosti českého zemědělství od prvních let ekonomické transformace. Doposavad byla věnována malá pozornost hodnocení současných efektů odpovídajících dotačních programů. Cílem příspěvku je tedy zhodnotit ekonomické a další efekty vyplývající z opatření 121 „Modernizace zemědělských podniků“ v rámci Plánu rozvoje venkova na období 2007-2013 na případu českých zemědělských podniků. Byl uplatněn přístup kontrafaktuální analýzy za účelem vyhodnocení situace, která by nastala, kdyby se podpořené podniky neúčastnily v programu, což je ilustrováno na výsledkových indikátorech. Kvantitativní analýza přínosů programu je doplněna o kvalitativní výzkum na případu 20 podniků, které obdržely investiční podporu mezi roky 2008 a 2010. Kvantitativní analýza potvrzuje významné přínosy investiční podpory v případě rozvoje podnikání (měřeno hrubou přidanou hodnotou) a zlepšením produktivity práce. Tyto výsledky jsou potvrzeny i kvalitativním výzkumem. V příspěvku je také diskutována otázka tzv. mrtvé váhy investičních dotací: údaje o velmi nízké úrovni čistých investic vyjádřené relativně k poskytované podpoře na sektorové úrovni a odpovědi respondentů naznačují možný významný efekt mrtvé váhy.

Klíčová slova

Investiční podpora, kontrafaktuální analýza, propensity score matching, přímé a nepřímé efekty.

Abstract

Investment support has been considered a principal vehicle for enhancing the competitiveness of Czech agriculture since the early days of economic transition. However, thus far, little attention has been paid evaluating the actual effects of corresponding support programmes. The objective of this paper is to assess economic and other effects of Measure 121 “Modernisation of Agricultural Holdings,” of the Rural Development Programme (RDP) 2007-2013 on Czech farms. The counterfactual approach is adopted to investigate what would have happened if the supported producers had not participated in the programme; the resulting indicators are than compared. The quantitative analysis of programme effects is complemented by a qualitative survey on 20 farms that received investment support between 2008 and 2010. The quantitative assessment showed significant benefits of investment support in terms of business expansion (Gross Value Added) and productivity (GVA/labour costs) improvements. These results were confirmed by the qualitative survey. Finally, the issue of deadweight as related to investment support is discussed: the figures on very low net investment relative to the provided public support at the sector level, as well as answers of respondents both indicate possible significant deadweight.

The presented results refer to the research carried out in the two projects – “Multifunctional agriculture for the benefit of society and rural development“(MZe RO0911) conducted by Institute of Agricultural Economics and Information“ and “ The Czech Republic in the European Research Area” (MŠMT LM2010010) conducted by Technology Centre ASCR.

Key words

Investment support, counterfactual analysis, propensity score matching, direct and indirect effects.

Introduction

The paper´s objective is to assess the economic and other effects of Measure 121 "Modernisation of Agricultural Holdings" of the Rural Development Programme (RDP) 2007-2013 as well as the Operational Program - Agriculture (OP), 2004-2006 on Czech farms.

Investment support has been considered a principal vehicle for enhancing the competitiveness of Czech agriculture since the beginning of economic transition (Janda and Ratinger, 1997; Medonos 2007). However, thus far little attention has been paid to evaluating the actual effects of corresponding support programmes. In the 1990s, success of the interest subsidies for investment credits was justified practically only by the high participation rate and the "improved" level of the sector´s gross fixed capital formation (Trzeciak-Duval, 2003, Janda, 2006, Čechura, 2008). The need for a more rigorous assessment arrived with EU development programmes: SAPARD, OP Agriculture and RDP 2007-2013. The considered quantitative indicators for programme assessment are stated in the Common Evaluation a Monitoring Framework (CMEF) (EC 2006; Bradley et al. 2010). These indicators are structured according to the intervention logic concept in input, output, result and impact indicators (Dwyer et al. 2008).

There are two serious problems with CMEF and the EU evaluation guidelines which eventually might lead to incorrect conclusions on regarding success of the programme: i) it is impossible to associate the result and impact indicators (as GVA/GDP) only with policy intervention, since there are a number of other factors and circumstances affecting the results; ii) usually, policy measures either target or are exploited by only some groups of producers/regions, etc., which makes simple comparisons between supported and non-supported groups methodologically problematic (Michalek, 2007, Psaltopoulos et al. 2011). To deal with these shortcomings we adopted a counterfactual approach to investigating what would have happened if the supported producers had not participated in the programme and we then compared the result indicators (Khandaker et al. 2010). Since it is impossible to observe the effects of participation and non-participation in the measure on the same farm, one has to choose or to construct a control farm with identical characteristics from the pool of non-participating producers. To do this we follow a propensity score matching approach (Caliendo and Kopeinig, 2005; Pufahl and Weiss, 2009).

The paper is structured as follows. In the next section we will review the investment support policy of the Czech Republic. Section 3 is devoted to the adopted methodology and in Section 4 we present the quantitative assessment results. To gain an understanding of the actual investment projects and to learn about their effects on farmers, as well as about problems with their implementation, we carried out 20 case studies; they are described in Section 5. Afterwards, both results are compared and conclusions are drawn (Section 6).

Investment support

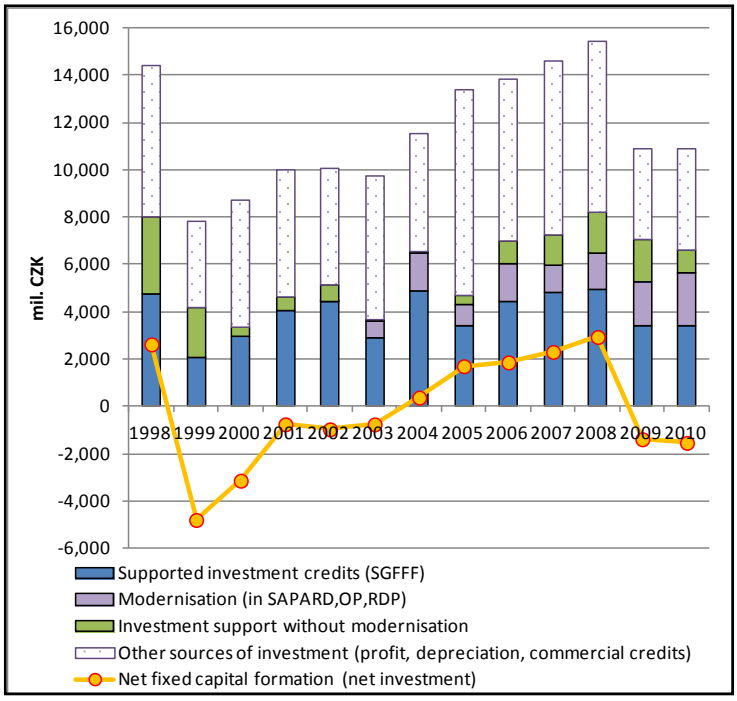
From the beginning of agricultural transition it was clear that there farm had insufficient funds to assure the sector´s prompt recovery. In the early 1990s, the Czech government provided generous investment grants mainly to emerging family farms. Later, the policy concentrated on improving farm´ access to credits by providing interest subsidies and guarantees. The latter addressed the problem of lacking collateral; most of the assets were of doubtful value if the sector declined, while land was owned by external restituents or by the state (Janda and Ratinger 1997). The interest rate subsidy was a principal investment support measure until EU accession, but remains ongoing.

Gross fixed capital formation (GFCF) is a basic indicator of investment activity in the economic accounts for agriculture. Indeed, GFCF the agricultural sector has varied substantially in absolute and relative[1] terms over the last decade (Figure 1). It can also be seen from Figure 1 that agricultural GFCF is correlated with credit support of the Support and Guarantee Fund for Farms and Forestry (SGFFF) at least until EU accession. It is also worth noting that the amplitudes of agricultural GFCF are larger than those of SGFFF support. This can have two explanations: first, the public support (SGFFF) also encouraged private investment activity; and second, investment activities also reflects the sector´s and the overall economic situation: post-privatisation stabilisation in the late-1990s, accession expectations[2] from 2001-2003 and the recent financial crisis of 2008-2009.

New impulses for investment activity have gradually accompanied EU accession: new market

[1] With respect to total GFCF.

[2] Including the need to comply with the "acquis communataire", production expansion for creating a solid reference base, etc. One should also note that during these years farmers received generous compensation for bad harvests caused by disastrous weather.



Source: CzSO (EAA), PGRLF, SZIF

Figure 1: Investment activity in agriculture 1998-2010.

opportunities resulting from joining the common market, financial stabilisation of farms given by increasing direct payments, and finally, investment grants provided by the rural development programme.

According to Bašek et al. (2010) integration in the common market can be seen as a driving factor of markedly increasing farm specialisation: growing specialisation in field crops can be observed in good soil and climatic conditions. The growing concentration of dairy cow herds can also be noticed - not necessarily in specialised dairy farms, which are usually a mixed production system. However, dairy units are large and usually one of the main enterprises on the farm. Pig production has lessened on common farms and nowadays is concentrated in large specialised pig production companies; overall pork production declined continuously and dramatically over the last decade. In contrast, beef cattle saw increases in mountainous and sub-mountainous grasslands. However, these are truly a product of the policy; market opportunities merelydetermine the intensity. This specialisation trend has also been reflected in investment activities.

Direct payments have stabilised farm income. As a consequence, direct payments enabled corporate farms to pay off their restitution liabilities. Thus, they improved the financial credibility of family and corporate farms vis-à-vis banks and input suppliers. They are also likely behind the increased investment activities between 2004 and 2008 (see Figure 1). We can see that during this period, farms invested above the reproductiontreshold (net investment – yellow line in Figure 1), while in most other years capital stocks declined.

Investment grants returned with SAPARD[3], but funds were rather limited. Since EU accession they have become the main form of investment support; from 2004-2006, investment support was included in the Operational Programme for Agriculture, in the current period, it is the main tool of Axis 1 of the Rural Development Programme (measures 121, 123, and 124). While measure 121 (Modernisation of agricultural holdings) has attracted farmers to the extent that its budget has twice been increased; the other two measures 123 - (Adding value to agricultural and forestry products) and 124 (Cooperation for development of new products, processes and technologies in the agriculture and food sector and the forestry sector have been considered as too demanding, and their potential has somehow been hidden from farmers.

[3] Special Accession Programme for Rural Development

Returning to Figure 1 it is evident that the investment support might havestimulate investment over the reproduction of capital only in 1998, and in the period shortly after accession (2004-2008). Given that in the best of years, net investment might constitute only about one-third of supported investments (thus the rate of public co-financing) we can conclude there was no or only very little additionality achieved by the policy. In 1990, the policy´s objective was to assure the reproduction of agricultural capital. Thus, since EU accession additionality has been deemed as achieved.

Most of the investment (more than 40%) goes to machinery and equipment (post-harvest processing, milking cooling equipment etc.). Investment in buildings dropped from almost 50% in 1998 to less than 30% in recent years; farmers' investments in breeding animals account for 20 - 30 % (Figure 2). The emphasis on machinery and equipment in the investment structure might indicate that farmers are more concerned about labour productivity than about the other possible effects of modernisation through investment. Nevertheless, it would be hard to assert that the other two main directions of investment are undervalued; rather we can stress that the sector might have become saturated in terms of agricultural buildings (storages, sheds) and that breeding animals are regularly replaced.

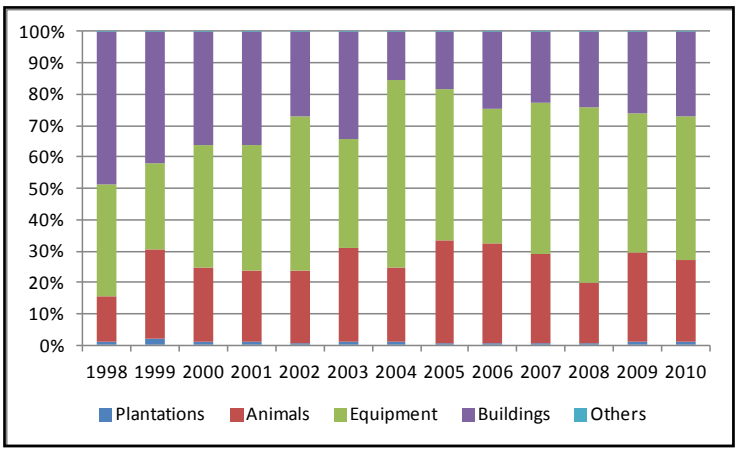
In spite of the contraction of Czech livestock production, most modernisation support went into livestock sectors, particularly dairy enterprises (2008-2010) – see Table 2. This is because there were essential needs (welfare, manure storage and treatment) and because there are significant immediate and tangible benefits from modernisation (higher yields, higher quality, reduction of (hired) labour, improved health of animals – and thus lower variable costs).

Linking investment support (of all kinds) to the performance of the agricultural sectors will provide a preliminary notion about its effect (see Figure 3).

Initially (on the left chart), there is no evident effect of the support programme on the sectoral GVA. The simple statistical analysis (linear regression in the right chart) indicates that there might be about 10% of investment support projected immediately in the agricultural GVA. However, the model is not statistically significant. Also, one should consider a delay of an investment effect. A simple shift of the effect by two or three years, however, does not lead to a significant relationship. It is evident that the sectoral approach is insufficient for assessing the investment programme.

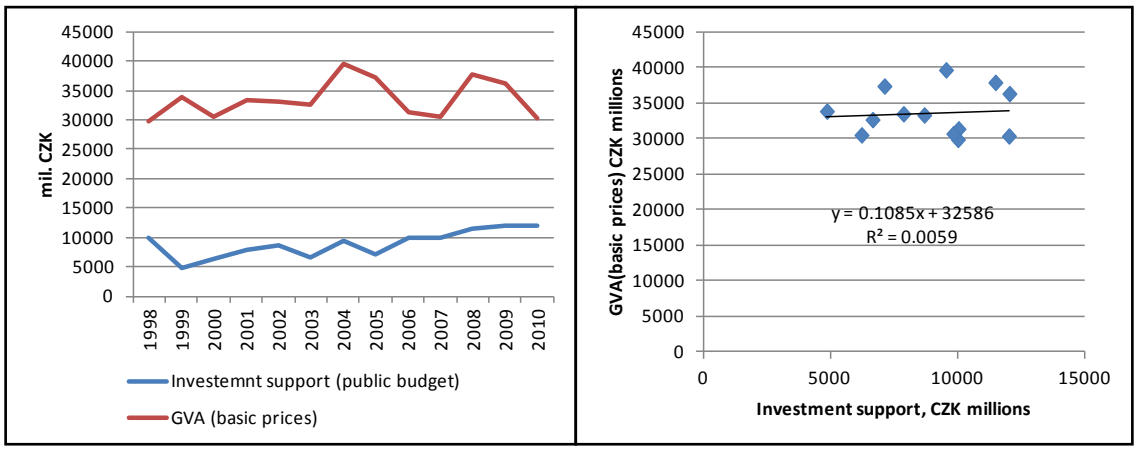
Material and methods

The above figures on the support programmes and the sectoral GVA indicate the difficulties (ambiguity) of judging the policy´s effectiveness and efficiency. Therefore, there exists a need for methods and approaches that enable the evaluator preciselx to assess the mechanisms through which beneficiaries are responding to the intervention. These mechanisms can include links through markets or improved social networks as well as tie-ins with existing policies (Khandker, et al. 2010). To prove that changes in targets are due only to the specific policies undertaken the counterfactual approach is needed (illustrated in Figure 4). The performance of farms participating in an investment



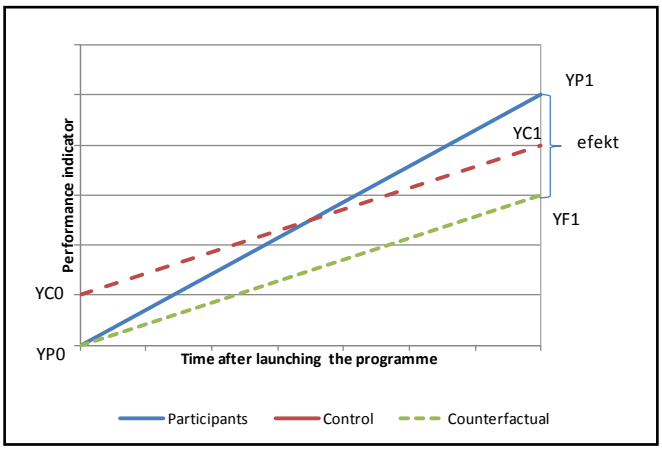
Source: CzSO (EAA)

Figure 2: Investment structure.



Source: CzSO (EAA)

Figure 3: Investment support and sectoral GVA.



Source: Khandker et al. (2010)

Figure 4: The idea of the counterfactual.

support programme (treated) improved from YP0 to YP1. The simple "before and after" comparison (YP1 – YP0) can hardly be accounted only to the programme - if there are changes in the performance independent of the programme - as witnessed by the performance of non-participating (control) farms that also changed from YC0 to YC1 over during the same period. However, the difference between YP1-YC1 does not necessarily represent a correct judgement of the effect of the programme, because it is likely that participating and non-participating groups differ in their structures and pre-programme situations (Khandeker, et al. 2010). The real effect can only be obtained if we know the counterfactual outcome YF1 i.e. what would happen if there were no programme. However, this is principally impossible hence one has to find an estimate.

The standard framework in evaluation analysis that formalises the above problem is provided by the Roy-Rubin-model (Caliendo, Kopeinig, 2005). Let Di denotes a treatment indicator which equals one if individual i receives treatment and zero otherwise. The potential outcomes are then defined as Yi(Di) for each individual i, where i = 1…N and N denotes the total population. The average treatment on the treated (ATT) effect is defined as follows:

$$\tau\_ATT=E[\tau \mid D=1]=E[Y(1) \mid D=1]-E[Y(0)|D=1] \quad (1)$$

The second term on the right-hand side of Equation (1) is the counterfactual; however, it is unobservable. Instead, we have to use E[Y(0)|D=0]. The effect of τATT is truly identified if and only if:

$$0=E[Y(0) \mid D=1]-E[Y(0)|D=0]. \quad (2)$$

The right-hand term of Equation (2) is called the self-selection bias. In non-experimental data, the condition of zero self-selection bias is usually not achievable, and statistical methods must be used

to estimate the average treatment effect on treated (τATT). In this paper we have adopted propensity-score matching (PSM).

Assume that there is a set of observable variables X that are not affected by treatment and that potential outcomes are independent of treatment assignment, i.e.:

$$Y(0), Y(1) \perp D|X, \ \forall X; \quad (3)$$

This condition is known a "unconfoundedness" or the conditional independence assumption. Let us defime the propensity score as P(D = 1|X) = P(X), i.e. the probability for an individual to participate in a treatment given his observed variables, X. The unconfoundedness condition can be rewritten as:

$$Y(0), Y(1) \perp D|P(X), \ \forall X; \quad (4)$$

as it was shown by Rosenbaum and Rubin (1983). Aside from independence, a further requirement is the common support or overlap condition:

$$0<P(D\_i=1 \mid X\_i)<1, \text{ for some i}; \quad (5)$$

which ensures that there are persons with which have positive probabilities to participate as well as to stay outside. The PSM estimator of the treatment effect on treated is then defined as

$$\tau_{ATT}^{PSM} = E_{P(X)|D=1}\{E(Y(1)|D = 1, P(X)) - E(Y(0)|D = 0, P(X))\}; \quad (6)$$

We can understand the PSM estimator of τATT as a mean difference in outcomes over the common support, appropriately weighted by participantś propensity score distribution (Caliendo, Kopeinig, 2005). From the number of methods available for construing the PSM estimator we have chosen nearest neighbour (NN) matching and kernel matching (KM).

Nearest neighbor matching is the most straightforward approach; the individual from the comparison group is chosen as a matching partner for a treated individual that is closest in terms of propensity score. One of the disadvantages of NN matching is that only a few observations from the comparison group are used to construct the counterfactual outcome of a treated individual. Kernel matching (KM) is a non-parametric matching estimator that uses weighted averages of all individuals in the control group to construct the counterfactual outcome. Following Smith and Todd (2005), the ATT effect estimator (6) can be rewritten as:

$$\tau_{ATT}^{PSM} = \frac{1}{N_T}\left[\sum_{Di=1} Y_i(1) - \sum_{Dj=0} w(i,j) Y_j(0)\right] \quad (7)$$

where N_T denotes the number of treated (participating in the programme). In the case of KM the weights w(i.j) are defined as follows:

$$w(i,j) = \frac{K\left(\frac{P(X_j)-P(X_i)}{a}\right)}{\sum_{D_k=0} K\left(\frac{P(X_k)-P(X_i)}{a}\right)}; \quad (8)$$

where *K* is a kernel function and α is a bandwidth parameter. Note that kernel-matching is analogous to regression on a constant term (Khandker et al. (2010)). The main advantage of this approach is the lower variance due to more information used. A drawback is that used observations are possibly bad matches. Therefore, good overlap is of major importance for KM.

The quantitative analysis of effects was completed through the use of 20 case studies. The qualitative survey (interviews with the farm manager) concentrated not only on the manager's subjective assessment of economic benefits from investment support but also on non-economic effects such as improved animal welfare or working conditions, the farm´s business development strategy and how the supported investment fits in, as well as motivations and information-gathering for the given investment project, the use of advisory services, and cooperation with research programs.

We used several sources of data on farm characteristics and performance: - Creditinfo database; LPIS; and data on agricultural supports published by SZIF[4]. The main source was Creditinfo, which is a database built on the annual reports of companies (large legal entities) which are obliged by the Commercial Code to publish their economic and book keeping figures. Creditinfo includes only large farms and only financial indicators. From LPIS we incorporated information on utilised agricultural area and on land use.

All calculations were done in STATA 11.

To gain insight into the process and effects of investment support, we selected 20 representative projects with respect to investment size, legal form, and type and direction of supported investment. Using this sample we conducted qualitative research aimed at business and investment strategies, the importance of the support for implementing the strategy, business environment and effects of the investment for modernisation. We created a questionnaire which included 28 questions structured in 7 blocks (Table 1). The respondents

[4] State Intervention Fund for Agriculture - the paying agency.

were asked to state their qualitative judgement on the investigated issue either on a 3 or 5 point scale[5], or by ordering pre-defined judgments or lines of reasoning.

Besides completing the questionnaire, the interview included open discussion on the implementation process, and lessons learned, and a physical observation of the investigated investment. While the questionnaire was usually completed by the top manager, during the excursion we also met other management staff and workers associated with the given investment.

Results and discussion

The analysis concentrated on Measure 121 of the current Rural Development Programme[6]. The targets of modernisation (investment directions) are summarised below in Table 2. Most of the support was directed towards the livestock sector in terms of volume (57%) as well as amount of funds (72%). This bias against the livestock sector results from the needs of applicants (see section 2) as well as from policy preferences – for example, projects for modernising livestock production received additional points in the evaluation score. The structure of applicants follows the structure of farming and its geographical distribution; livestock production is concentrated more in less favoured areas and applicants make up a similar proportion. Surprisingly, there is higher share of young farmer applicants for crop production projects than in the case of livestock production.

In the Creditinfo database we identified 844 agricultural businesses with all their economic figures for the period 2007-2010. About one-third of these businesses (291) were awarded an investment grant from the Czech RDP (Measure 121) during this period; more precisely, they were

5 1-poor, 3 or 5 – excellent.

6 i. e. RDP for period 2007-2013.

Block	Questions	Content
I	A	Characteristics of the project holder
II	B-G	Current and past investment strategy
III	H-L, P	Project description including motivations
IV	M-N	Preparation of the project and of the application for a support
V	O, Q-Z	The assessment of project benefits, of fulfilments of expectations, …
VI	AA	Future investment strategy
VII	BB-CC	Business environment for investment

Source: own survey

Table 1: Structure of the questionnaire for a qualitative survey.

Investment object	Completed projects	Support budget	Applicants			
	#	CZK million	Individual	Corporate	in LFA	Young
Livestock	972	2149	32%	68%	69%	20%
Buildings	593	1363	33%	67%	67%	22%
of it dairy cow sheds	122	410	40%	60%	64%	11%
Technique and technology	126	195	27%	73%	63%	14%
Storages for secondary products	105	212	21%	79%	70%	12%
Crop prodution	392	779	39%	61%	27%	32%
Buildings	266	582	43%	57%	23%	37%
Machinery and equipment	126	197	29%	71%	33%	24%
Other	21	52	38%	62%	62%	10%
Total	1385	2980	34%	66%	57%	24%

Source: SZIF

Table 2: Investment objects of measure 121 “Modernisation of agricultural holdings” 2008-2010.

awarded between 2008 - 2010, because no project was completed in 2007[7]. We lack details about the investment directions of 291 supported farms included in the Creditinfo database; however, it is very likely that their supported modernisation follows the same pattern as those farms participating in Measure 121 (Table 2).

There are significant differences between participating and non-participating farms in the Creditinfo sample: the average utilised agricultural area of participating farms is substantially greater (1,826 ha) than tthat of non-participants (1,084 ha)[8]. In terms of assets[9], the difference is even greater: the average value of assets is more than two times higher in the sample of participants than in the sample of non-participants, and the figures per hectare are CZK 83,882 and CZK 58,518 on participating and non-participating farms respectively. This indicates that participating farms are on average not only substantially larger but also much more capital and labour intensive than non-participating farms (see Table 3 for details). On the other hand, we can show that variation in both sub-samples is quite high and among non-participants significantly higher (for example the coefficient of UAA variation[10] is 0.71 for participants and 0.82 for non-participants). In fact, this high variation is positive for matching, since we likely find similar farms in both sub-samples.

For calculating propensity scores we applied probit regressions (Gujarati, 1988) on a set of structural variables (UAA, revenue, the share of grasslands, cash flow, depreciation and credits to total assets ratio). These structural variables are commonly considered factors affecting investment and thus they are deemed as possible determinants of farm participation in the modernisation programme. The first two variables represent size of the business; the share of grasslands indicates whether a farm is located in the less favoured area (LFA); the remaining variables refer to financial sources for investment. The probit regression showed that size variables are poor insignificant determinants of participation (Table 4). Note, however, that the multicoliearity of structural variables might be behind that. The distribution of estimated propensity scores is illustrated in Figure 5; a good overlap is evident.

We tested two matching algorithms: nearest neighbour matching (in Stata attnd) and kernel matching (attk and psmatch2). In this paper we present kernel matching with the standard Gaussian kernel ($K(u) = \exp(-u^2 / 2)$), and with the standard and Mahalanobis metric (Rubin, 1980, Stata – psmatch2). That is, in Equation (8). Pj – Pi is replaced by the metric d(i,j) = (Pj – Pi) S-1(Pj – Pi), where P refers to the 2x1 vector of propensity scores and S is the pooled within-sample (2×2) covariance matrix of P based on the sub-samples of both the participating and non-participating farms. Standard errors of the average treatment effects are calculated using bootstrapping.

We chosen 6 performance variables (Table 5) on which we measured the results of the investment support programme. Four of these variables relate to value added and productivity in both: their state and their dynamics. In addition we examined profit and the cost/revenue ratio.

[7] We consider only completed projects.

[8] The both figures for 2010

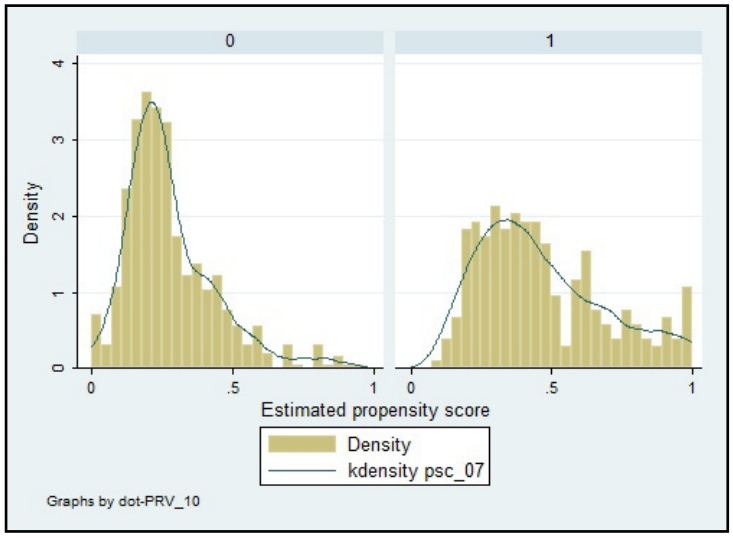
[9] Of the balance sheet

[10] Coefficient of variation = standard error/mean

Indicator	Unit	2007		2010		Index 2010/2007	
		Participating	Non-particip.	Participating	Non-particip.	Participating	Non-particip.
Total assets	CZK '000/farm	146,633	63,082	153,188	63,405	104.5	100.5
UAA	ha/farm	1,831	1,100	1,826	1,084	99.8	98.5
The share of grasslands	%	21.2	23.7	21.8	24.2	102.8	102.0
Total assets/UAA	CZK '000/ha	80.1	57.4	83.9	58.5	104.7	102.0
Gross cash flow	CZK '000/farm	16,419	7,631	13,851	5,757	84.4	75.4
Cash Flow/UAA*	CZK '000/ha	9.0	6.9	7.6	5.3	84.6	76.6
Labour cost/UAA*	CZK '000/ha	12.0	8.9	11.2	8.5	93.9	95.5
Bank credits/total assets*	%	13.0	11.7	16.2	12.2	123.9	103.9

*weihgted average
UAA - Utilised Agricultural Area
Source: CreditInfo (2011), LPIS (2011), SZIF(2011)

Table 3: Characteristics of participating and non-participating farms in the Creditinfo sample.



Source: own calculations using STATA procedure pscore (probit regression)

Figure 5: Distribution of propensity scores of participation in the measure 121 of the Czech RDP.

dotprv_10	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
UAA_07	-8.720E-05	8.380E-05	-1.04	0.298	-0.0002514	0.000077
Grasslands_07	3.637E-01	1.955E-01	1.86	0.063	-0.0195112	0.7469707
cash_flow_07	2.230E-05	1.140E-05	1.95	0.051	-8.76E-08	0.0000447
revenue_07	2.180E-06	2.630E-06	0.83	0.407	-2.97E-06	7.34E-06
depreciation_07	7.060E-05	2.210E-05	3.19	0.001	0.0000272	0.0001141
cf/LC_07	-1.046E-01	4.799E-02	-2.18	0.029	-0.1986166	-0.0105046
credits/TA_07	2.038E-01	4.814E-01	0.42	0.672	-0.739722	1.147386
_cons	-1.045E+00	1.280E-01	-8.16	0	-1.295746	-0.7939477

Source: own calculation (STATA)

Table 4: Results of probit regression.

Acronym	Description	Applied by
GVA_	Gross Value Added	Božík et al. (2011)
GVA/LC	Productivity measured by the ratio of GVA over labour costs	
dGVA_	Change of GVA over 2007-2010	
d (GVA/LC)	Change of producivity over 2007-2010	
Profit	Profit	Michalek (2009)
Cost/rev	Cost Revenue ratio	

Source: own proposal

Table 5: List of performance (result) variables.

The effect of Measure 121 "Modernisation of agricultural holdings" based on kernel matching is summarised in Table 6. Both metric approaches provide similar results; the main difference is in significance levels. The average treatment effect differs substantially only in the case of productivity change.

With the exception of profits, all variables exhibit a significant effect of the investment support to modernisation in one or the other matching models; creation of GVA and labour productivity are significant in both models. In the case of the profit variable, the extremely high variation results in the large differences of averages between participants

	Total	Treated	Controls
Farms	837	290	547

attk (standard metric)

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat	P	sig.
GVA_10	Unmatched	21051	7173	13877				
Gross Value Added	ATT	21051	15035	6016	1275	4.717	0.000	***
GVA/LC_10	Unmatched	0.859	0.952	-0.093				
Productivity	ATT	0.859	0.636	0.223	0.066	3.403	0.001	***
dGVA_07_10	Unmatched	-5624	-3792	-1832				
Change of GVA	ATT	-5624	-7080	1457	773	1.884	0.068	*
d (GVA/LC)_07_10	Unmatched	-0.211	0.474	-0.685				
Change of productivity	ATT	-0.211	-0.273	0.062	0.086	0.714	0.309	
Profit_10	Unmatched	3060	1425	1635				
	ATT	3060	2126	934	1439	0.649	0.323	
Cost/Revenue_10	Unmatched	0.953	0.975	-0.023				
	ATT	0.953	0.984	-0.031	0.015	-2.072	0.047	*

psmatch2 (Mahalanobis metric), 837 observations

Variable	Sample	Treated	Controls	Differ.	S.E.	T-stat	P	sig.
GVA_10	Unmatched	21051	7173	13877	1218	11.39	*1.77813E-24*	
Gross Value Added	ATT	21051	14491	6560	1788	3.670	0.001	***
GVA/LC_10	Unmatched	0.859	0.952	-0.093	0.787	-0.120	0.396	
Productivity	ATT	0.859	0.644	0.215	0.114	1.880	0.068	*
dGVA_10_07	Unmatched	-5624	-3792	-1832	634	-2.890	0.006	
Change of GVA	ATT	-5624	-7063	1439	948	1.520	0.126	
d (GVA/LC)_10_07	Unmatched	-0.211	0.474	-0.685	1.318	-0.520	0.348	
Change o productivity	ATT	-0.211	-0.443	0.232	0.096	2.410	0.022	**
Profit_10	Unmatched	3060	1425	1635	889	1.84	*0.073638428*	
0	ATT	3060	1941	1119	1258	0.890	0.268	
Cost/Revenue_10	Unmatched	0.953	0.975	-0.023	0.019	-1.170	0.201	
0	ATT	0.953	0.965	-0.012	0.011	-1.100	0.217	

Treated = participating in mesure 121 of RDP
Controls= non-participating
Source: own calculation (Stata 11)

Table 6: Results of matching (attk and psmatch2 in Stata).

and constructed controls (CZK 1.1 million) to be statistically insignificant.

Case studies

The sample includes 7 individual and 13 corporate farms. All surveyed farms received support from the present rural development plan (2007-2013), which includes Measures 121 and 123. These investment projects comprised 7 farms that were oriented towards crop production, 10 farms towards animal production, and 3 farms towards food processing products. The average size of total investment expenditures of the examined projects reached 15.7 mil. CZK, with the average amount of support 4.2 mil. CZK. That is, the rate of support was 39% on average. All projects were already realised at least one year before the interview, and mostly run under full operation.

In terms of farm strategies and objectives of investment, 75% of the projects[11] were qualified by respondents as development investments, i.e.

[11] There was possibility to label more possibilities therefore sum gives more than 100%.

investments intended to increase a farm´s ability to produce and sell products or services. The remaining; 25% of projects indicated replacement investments or greater operational efficiency. Moreover, 15% of all projects were required to comply with legislative (environmental) requirements on production and 30% were realised in animal production to increase animal welfare standards.

Investments during the 5 years that were realised in the context of farm development strategies were aimed at; growth (60% of cases); quality improvement (55%); and increased specialisazion (10% of respondents focused solely on increased specialisation, and a further 15% of respondents invested in additional specialisation).

These strategies obviously result not only from market opportunities and opportunities to provide public services, but also from internal conditions. Market opportunities were identified as the most significant factors by half of the respondents, with the average score being 4.5 on a 5-point scale. On the other hand, factors indicating a surplus or absence of capacity were designated as less important (only 1/5 of the respondents indicated a lack of land (average score 2.0) or a shortage of qualified employees (average score 1.0) as the most important factors.

Most information on possible innovations was acquired by supported investors from farmer' organisations and internet sources. Both of these knowledge sources are considered as two basic levels in the present conception of knowledge transfer (KT) in agriculture[12]. Specialised advisory services (the uppermost-level of the KT system) were not included among the predefined answers, but were also not mentioned as a source of information in any case study. Also, from the other questions and informal interviews it was clear that using publicly-supported farm advisory services is restricted only to preparing the investment support application, and that cooperating with research institutions is done quite seldom. This conforms with findings from other sources that indicate the knowledge transfer from research to farm practices is weak. The actual investment decision is based on advice from input suppliers, and often on the experience of other farmers who have already invested in the new technology[13].

From the perspective of motivation to participate in the programme, the measure oriented towards farm modernisation and increasing value added is firstly considered as an opportunity to receive support for realizing one´s own innovation plans by 80% of respondents (45% of respondents had only this type of motivation). For approximately one-third of the investigated supported farms, their participation in the programme was also considered exclusively an opportunity to receive additional financial means for investment. For another one-third of the respondents, one motivation to participate was a need to meet legislative requirements for farm operations.

The importance of investment support is also possible to evaluate with an assessment of implications in cases where support would not be received by a farm - the-so-called-"deadweight effect"- of investment support. Interview results show that in 35% of cases, the investment project would not be realised without further support. Further, 30% of respondents would invest in a reduced size, (on average 42%, with a range of 30-60%) of the financial framework of the actually-realised supported investment. On the other hand, 35% of projects would be fully launched without investment support. However, two-thirds of respondents in this group would carry out investments later, or at the expense of other investments on the farm that would not be realised under these circumstances.

The average economic size of farms in the second group that would realise investment without support but at a reduced size; is the highest (155,000 CZK of total assets), and received 10 % more endorsed projects compared to the others two; also, the average size of investment costs per project was about 20 million CZK. Farms that would not undertake a project at all are on average by one-quarter smaller (measured by total asset value) compared to the second group and the average size of their projects is 16 million CZK. The third group of farms that would realise a project even without support varies in economic size between two mentioned groups, but the average size of authorised projects is the smallest at – 12 million CZK. For these farms the supported investment projects are relatively more important, so they would realise them without support at the expense of other investments. It is

[12] So called "introductory advice" provided by farmers' organisations was co/financed from public funds between 2005 and 2009, the reason for stopping co/financing were budget cuts of the Czech government.

[13] Thus it depends on farmer's network.

possible to conclude that the deadweight effect of the RDP is not so high because only 12% of respondents would realise an investment project without any restrictions. Moreover, projects on these farms were only halfway realised.

When we attempt to evaluate the effects of investment support, it is necessary to know how important the supported investment was for the farm. For 47% of respondents, this supported investment stood for a strategic project influencing the prosperity of the farm. This importance is also underlined by the fact that the realised investment caused an increase of farm revenue (production) by 90% on awerage and the share of revenues from this supported activity comprised an average of more than one-third. These projects are especially oriented towards animal production and storage capacities. Surveyed farms also had projects that they rated as middle-important (42%) ans less important (11%). These projects had primarily non-economic objectives, e.g. improving animal welfare, or smaller investment projects of all types and do not induce a dramatic production increase (with the exception of one project).

The average pay-off period of supported projects is estimated to be seven years, but varies considerably, from 4 to 15 years. Mostly the supported projects contributed to an improvement of total farm revenues by an average of 18% and/oran average 12 % total cost reduction. The most common and the most significant cost reduction was in labour costs, followed by costs of repairs and maintenance, energy cost, and medicine and feedstuffs. More than half of the respondents agree that supported projects help them increase, in principal, the stability of their income; for an other one-quarter of the farms, this benefit is less important. From the non-economic effects, quality improvement and production security were mentioned first, followed by improvements in animal welfare and animal production efficiency.

Conclusions

Our quantitative assessment showed significant benefits from investment support in terms of business expansion (GVA) and productivity (GVA/labour costs) improvements. These results were confirmed by the qualitative survey, which showed that production expansion and productivity increases were primary investment objectives (and strategies) on most of the farms. Thus, public support enabled farms to achieve their strategic objectives.

Respondents from the survey of 20 supported farms declared that the supported investment was important for their prosperity. However, we could not prove this in the quantitative assessment in terms of profit and cost/revenue ratio; ATT are in favour of participating (treated farms), but the variances are too high to have statistical significance.

We learned that most of the investigated farms have a business development strategy and that investment support enabled the farmers to accomplish their goals more timely and to a greater extent than would be possible without it. It can be seen in Table 3 that the ratio of bank credits to total assets increased dramatically on participating farms over the investigated period while on non-participating farms this ratio was almost the same in 2010 as it was in 2007. This indicates that the policy (Measure 121 of RDP) encouraged farms to take credits, and that some credit constraints exist for farms, which might prevent them from participating in the investment support programme.

The case studies reveal that supported investments allow farms to realise increased income. This overall improvement stems from increase in animal production efficiency, overall revenue increase, and also the relatively important reduction of operational costs, especially labour costs. Moreover, respondents indicated a range of other qualitative non-economic benefits such as impriving the quality and security of products, decreasing losses, and improving animal welfare.

The issue of deadweight as it relates to investment support was also discussed: the figures on very low net investments relative to the provided public support at the sector level indicate possible significant deadweight. However, this insight is incomplete since it does not take into account any post-accession restructuring of the sector and multiannual and multi-enterprise character of investment at the farm level. According to respondents from the case studies, the deadweight effect of the RDP does not seem to be so high because only 12 % of respondents would realise an investment project without any restrictions. Moreover, these projects were on average only halfway realised.

Acknowledgements

The presented results refer to the research carried out in the two projects – "Multifunctional agriculture for the benefit of society and rural development"(MZe RO0911) conducted by Institute of Agricultural Economics and Information" and " The Czech Republic in the European Research Area" (MŠMT LM2010010) conducted by Technology Centre ASCR.

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

Diagnostic Analysis of Spatial and Temporal Variations in Crop Water Productivity: a Regional Scale Analysis of the Rain Fed Wheat

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Abstract

Water productivity is a suitable indicator in water potential analysis at a location in a region. In this study, changes in water use productivity are studied in spatial and temporal scale simultaneously. To evaluate temporal changes in water productivity in Hamadan region (Iran), Standard Precipitation Index (SPI) was analyzed and evaluated for drought, wet and normal conditions. To estimate regional water productivity, GIS and Kassam methods were coupled to estimate the Potential yield of rain-fed wheat in a developed rasterized grid network with 30×30 -km resolution. Results of this study indicate that the amount of water productivity in drought condition in comparison with the other two conditions was higher and from geographical point of view the southern parts of the region have higher potential production with compare to other locations of the province. The analysis shows the variation in amount of active radiation received by the earth surface is causing these differences.

Key words

SPI, Drought, Kassam method, water productivity.

Introduction

The world‘s population has increased from 2.5 billion to more than 6 billion during the last 50 years (Billib and et al. 2009).The population in Iran has increased with the same rate from 6 million in 1956 to about 65 million in the beginning of 2001 and it is expected with the implementation of all population control programs to reach to about 100 million in 2022 (Ehsani and Khaledi, 2003). Due to increasing population and consequently water consumption in current situation, the water requirement will increase to about 266 billion cubic meters in 2022. Hence, the water resources will not be adequate to fulfill the required volume (Jahani, 2001). In order to respond to increasing demand and achieve food security of the society a comprehensive study on agricultural planning is required to reach the maximum economic use in different climatic regions of Iran and promote water productivity from 0.7 to 1.8 (to 2) kg per cubic meter of water (Nazarifar and et al. 2007). Generally speaking, the term ‘water productivity’ refers to the magnitude of output or benefit resulting from the input quantum of water as applied on a unit base. In the domain of agriculture, it is expressed as the net consumptive use efficiency in terms of yield per unit depth of water consumed per unit area of cultivation (Kjine, and et al. 2003). Agricultural water productivity can be expressed either as a physical productivity in terms of the yield over unit quantity of water consumed (tonnes per ha.cm of water or kg yield per kg water consumed) in accordance with the scale of reference that includes or excludes the losses of water or an economic productivity replacing the yield term by the gross or net present value of the crop yield for the same water consumption (rupees per unit volume of water) (Molden Sakthivadivel, 1999).

One of the researches carried out on water use efficiency for various agricultural crops in regional scale is that of Heinemann et al. (2001) in Tybajy River Basin. They combined GIS methods with plant growths models. They showed that linking the crop growth simulation models to GIS can be an effective tool determining irrigation requirement and water productivity for river basin and large catchments. Amor et al. (2001) applied crop growth simulation models coupled with geographic information system to analyze water productivity in Laoag River Basin in the Philippine in spatial and temporal dimensions, for three crops: rice, corn and peanuts, in both existing and potential

agricultural areas. The results showed that temporal and spatial analysis of water productivity could provide substantial information for water saving opportunities and, hence, strategies in irrigated Agriculture. Oweis and Hachum (2004) carried out researches for Improved Water Productivity of Dry Farming Systems in West Asia and North Africa. The results showed that substantial and sustainable improvements in water productivity can only be achieved through integrated farm resources management. On-farm water-productive techniques are coupled with improved irrigation management options, better crop selection and appropriate cultural practices, improved genetic make-up, and timely socioeconomic interventions will help to achieve this objective. Conventional water management guidelines should be revised to ensure maximum water productivity instead of land productivity. Ahmad et al. (2004) carried out diagnostic analysis of spatial and temporal variations in crop water productivity for a field scale analysis of the rice-wheat cropping system of Punjab, Pakistan. to sustain and/or enhance water productivity, the management of uncontrollable factors such as climatic variability along with the improvements in controllable factors such as agronomic and water management practices need careful planning and actions. The application of a comprehensive set of water balance and water productivity indicators for spatial and temporal analysis could help in performance evaluation of irrigated crops and devising strategies for improving food production and water productivity. Hussain et al. (2007) provided an overview of the issues and approaches on measuring and enhancing the value of agricultural water in large irrigated river basins. They developed a framework and a set of indicators for valuing agricultural water by looking into various dimensions and underlying key factors that influence the value of water at micro, meso and macro levels. In addition, the research compiles recent estimates of the value of agricultural water, and it outlines measures for enhancing the value of agricultural water. Singh et al. (2006b) focused on the identification of appropriate strategies to improve water management and productivity in the Sirsa district, India. The field scale eco-hydrological model SWAP, in combination with field experiments, remote sensing and GIS, has been used in a distributed manner generating the required hydrological and biophysical variables to evaluate alternative water management scenarios at different spatial and temporal scales. Improved crop husbandry in terms of improved crop varieties, timely sowing, better nutrient supply and more effective weed, pest and disease control, will increase crop yields and water productivity in this region. The scenario results further showed that reduction of seepage losses will improve significantly the long term water productivity, halt the rising and declining groundwater levels, and decrease the salinization in Sirsa district.

There are various methods to determine water productivity to estimate the actual yield which can identify the amount of actual yield for different regions. One of the most appropriate methods is that of Kassam which has been improved by the International Institute of Reclamations (Kassam, 1977) based on land and water relation. They have calibrated and tested the method using the measured data collected from field experiments. They have extracted a linear regression model to determine the dry biomass of crops: alfalfa, corn, sorghum and wheat and proposed mathematical relationships to convert the dry biomass into marketable product. But in the modified linear model while maintaining the previous assumptions another assumption for inclusion of maximum dry biomass in maximum evapotranspiration was introduced and by applying simple correction factors the marketable crop yield could be calculated.

The purpose of this research was to study the variations in water productivity in spatio-temporal scales. In order to analyze the temporal variation of water productivity standardized precipitation index (SPI) was used and with the development of coupled GIS and combining Kassam method the spatial and temporal variations in water productivity were investigated in the region.

Methods

Hamedan province lies between longitudes 48° 28′ 30″ and 49° 1′ E and latitudes 34° 36′ and 35° 9′ N and is shown in Figure 1. The area occupies about 944 km2, with a mean altitude of 1950 m.a.s.l. The climate of the study area is considered to be semi-arid, the annual average precipitation being approximately 300 mm, of which about 37% occurs during winter. Another feature characterizing the precipitation in the study site is its irregular yearly distribution. The mean air monthly temperature is highest during August (23.45 °C) and lowest during January (−1.91 °C) with an annual average of 10.88 °C. The annual potential evaporation far exceeds the annual rainfall (Figure 2) with a mean annual amount of approximately 1505 mm (1975–2001)

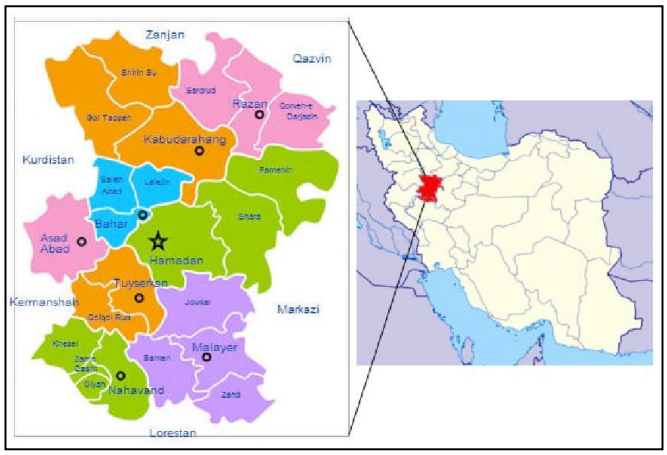

Figure 1: Location of study area.

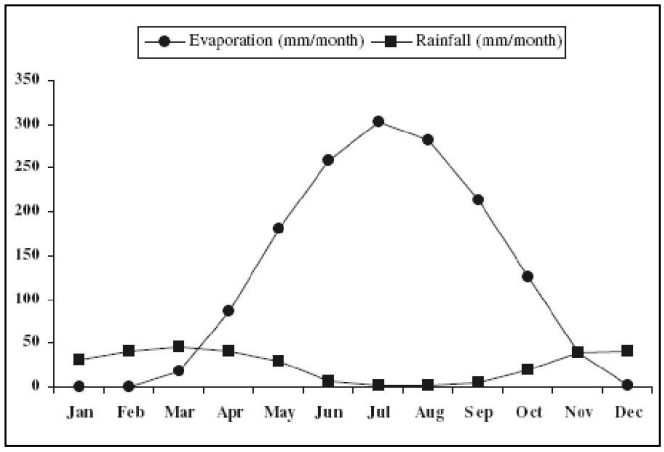

Figure 2: Monthly rainfall and evaporation in the study area.

(Zare abyaneh, 2004). The area has complicated land use characteristics, mainly consisting of agricultural and urban/residential areas. Groundwater has been used for various purposes, such as drinking, agricultural, domestic and industrial needs. The most important economic activity of the area is agriculture, the chief crops are garlic (Allium sativum), potato (Solanum tuberosum L.) and wheat (Triticum aestivum L.), with actual irrigation being lower than total theoretical demand, as there is a considerable deficit in relation to the amount of irrigated land.

The standardized precipitation index (SPI) was used for monitoring of drought, wet and normal conditions. In this study 29 years (1973-2002) precipitation data of 13 stations has been used. These stations are monitored by two separate organizations: Meteorological department and the Regional Water Company in Hamedan province. The data of seven additional adjacent meteorological stations were used as complementary data for further analysis. Annual precipitation homogeneity was confirmed through Run test.

For the reconstruction and completing the sequence of data the SPSS software was used for correlating the stations through regression analysis (Yazdani et al., 2005).

SPI was calculated for 12-month time scale. The results were analyzed to clarify the boundary conditions for “drought, wet, normal”.

To estimate regional water productivity in the region, GIS and Kassam method were coupled to estimate the Potential yield of rainfed wheat in a developed rasterized network with 30×30 -km resolutions in the region. This method, based on eco-physiological principles, is outlined below (Fischer and et al, 2001):

In order to calculate the net biomass production (B_n) of a crop, an estimation of the gross biomass production (B_g) and respiration loss (R) is required:

$$B_n = B_g - R \qquad (1)$$

The equation relating the rate of net biomass production (b_n) to the rate of gross biomass production (b_g) and the respiration rate (r) is:

$$b_n = b_g - r \quad (2)$$

The maximum rate of net biomass production (b_{nm}) is oteined when the crop fully covers the ground surface. The period of maximum net crop growth, i.e., the point in time when maximum net biomass increments occur, is indicated by the inflection point of the cumulative growth curve. When the first derivative of net biomass growth is plotted against time the resulting graph resembles a normal distribution curve. The model assumes that the average rate of net production (b_{na}) over the entire growth cycle is half the maximum growth rate, i.e., $b_{na} = 0.5b_{nm}$. The net biomass production for a crop of N days (B_n) is then:

$$B_n = 0.5b_{nm}xN \quad (3)$$

The maximum rate of gross biomass production (b_{gm}) is related to the maximum net rate of CO_2 exchange of leaves (P_m) which is dependent on temperature, the photosynthesis pathway of the crop, and the level of atmospheric CO_2 concentration.

For a standard crop, i.e., a crop in adaptability group I (FAO, 1978-81) with P_m = 20 kg ha -1 hr -1 and a leaf area index of LAI = 5, the rate of gross biomass production b_{gm} is calculated from the equation:

$$b_{gm} = Fxb_o + (1 - F)\, b_c \quad (4)$$

where:

F = the fraction of the daytime the sky is clouded, $F = (A_c - 0.5R_g) / (0.8A_c)$, where A_c (or PAR) is the maximum active incoming short-wave radiation on clear days (de Wit, 1965), and R_g is incoming short-wave radiation (both are measured in cal cm^{-2} day^{-1}).

b_o = gross dry matter production rate of a standard crop for a given location and time of the year on a completely overcast day, (kg ha^{-1} day^{-1}) (de Wit, 1965).

b_c = gross dry matter production rate of a standard crop for a given location and time of the year on a perfectly clear day, (kg ha^{-1} day^{-1}) (de Wit, 1965).

When P_m is greater than 20 kg ha^{-1} hr^{-1}, b^{gm} is given by the equation:

$$b_{gm}=F(0.8 + 0.01P_m)b_o + (1 - F)(0.5 +0.025\, P_m)b_c \quad (5)$$

When P m is less than 20 kg ha -1 hr -1 , b gm is calculated according to:

$$b_{gm} = F(0.5+0.025P_m)\, b_o + (1 - F)\, (0.05\, P_m)\, b_c \quad (6)$$

To calculate the maximum rate of net biomass production (b_{nm}), the maximum rate of gross biomass production (b_{gm}) and the rate of respiration are required. Here, growth respiration is considered a linear function of the rate of gross biomass production (McCree, 1974), and maintenance respiration a linear function of net biomass that has already been accumulated (B_m) When the rate of gross biomass production is b_{gm} , the respiration rate (r_m) is:

$$r_m = kb_{gm} + cB_m \quad (7)$$

where k and c are the proportionality constants for growth respiration and maintenance respiration respectively, and B_m is the net biomass accumulated at the time of maximum rate of net biomass production. For both legume and non-legume crops k equals 0.28. However, c is temperature dependent and differs for the two crop groups. At 30 °C, factor c_{30} for a legume crop equals 0.0283 and for a non-legume crop 0.0108. The temperature dependence of c_t for both crop groups is modeled with a quadratic function:

$$c_t = c_{30}\, (0.0044+0.0019T+0.0010T^2) \quad (8)$$

It is assumed that the cumulative net biomass B_m of the crop (i.e., biomass at the inflection point of the cumulative growth curve) equals half the net biomass that would be accumulated at the end of the crop‘s growth cycle. Therefore, we set $B_m = 0.5\, B_n$, and using (3), B_m for a crop of N days is determined according to:

$$B_m = 0.25b_{nm}xN \quad (9)$$

By combining the respiration equation with the equation for the rate of gross photosynthesis, the maximum rate of net biomass production (b_{nm}) or the rate of net dry matter production at full cover for a crop of N days becomes:

$$b_{nm} = 0.72b_{gm}/(1 + 0.25\, c_tN) \quad (10)$$

Finally, the net biomass production (B_n) for a crop of N days, where $0.5b_{nm}$ is the seasonal average rate of net biomass production, can be derived as:

$$B_n = (0.36b_{gm}xL)/(1/N + 0.25c_t) \quad (11)$$

where:

b_{gm} = maximum rate of gross biomass production at leaf area index (LAI) of 5

L = growth ratio, equal to the ratio of b_{gm} at actual LAI to b_{gm} at LAI of 5

N = length of normal growth cycle

c_t = maintenance respiration, dependent on both crop and temperature according to equation (8)

Potential yield (Y_p) is estimated from net biomass (B_n) using the equation:

$$Y_p = H_i x B_n \quad (12)$$

where:

H_i =harvest index, i.e., proportion of the net biomass of a crop that is economically useful.

Thus, climate and crop characteristics that apply in the computation of net biomass and yield are: (a) heat and radiation regime over the crop cycle, (b) crop adaptability group to determine applicable rate of photosynthesis P_m, (c) length of growth cycle (from emergence to physiological maturity), (d) length of yield formation period,.(e) leaf area index at maximum growth rate, and (f) harvest index.

Biologically crops consume water for evapotranspiration (ET), and the rest of supplied water does not participate in the yield formation. In order to assess the productivity of ET, the following formula (13) is used (Abdullaev et al,2003):

$$Wp = \frac{Crop\,Yield}{ET} \quad (13)$$

The maps related to the geographical and political Complications of the area were digitized and georeferenced using Er mapper software. Arcinfo software was used to change the Coordinate system. For the meteorological stations, which were identified earlier within and adjacent areas, all the required parameters were estimated. For this purpose the guide lines reported by FAO (1994b) and other standard methods were used at regional scale. To calculate B_n according to equation (1) the variables F and R_g based on radiation data should be calculated. Parameter n is the measured actual radiation, measured period in hours per day. The values of this parameter are calculated from meteorological station data. At this stage, after evaluating the values of the parameter n, as the average monthly for each station, the relevant database was created. After linking the database to Arcview software and producing the station-point layer, a monthly grid map was prepared. Finally, after determining all the required information, R_g layer of the region was created as monthly through interpolation with IDW method with 12 neighborhoods with the power 2. The next step, the data layer for the parameter F was created and after extracting the parameters bo, bc from relevant tables, B_n layer was formed. Then, the appropriate correction factors should be applied for b_O layer. In order to apply the correction factor to incorporate the crop variety and temperature, average monthly temperature of meteorological stations in the area were called from Arcview software environment and the functions comprising map calculator, map Query and Reclassify operators were used to separate the different temperature zones, create relevant layers, and other correction factors, and the layer of spatial extent of Potential yield (Y_p) for winter wheat production in the region level were produced.

To determine the productivity of water use, in addition to the actual yield which is the numerator of equation (13), the denominator of the same equation which is actual evapotranspiration has to be determined. Thus the area was delineated into the areas covered by each station using Thiessen method with Arcinfo software (Dartiguenave and Maidment, 2005). Later, potential evapotranspiration was calculated using Cropwat software (FAO, 1993) for each of these areas. These were converted into actual evapotranspiration using proposed FAO method (1998). The maps of the actual evapotranspiration were prepared by the map calculator operator. These maps were overlapped with the spatial map of actual yield and the final map of spatial zones of water productivity of wheat crop in the Hamadan region was produced.

Results and Discussion

Figure (3) shows a sample diagram of the temporal variation of SPI for 32 years span for Novejeh station. Analysis of the calculated SPI for all the stations shows that, in general, in recent years (past 10 years), the region has experienced a drought state (C1) in 1999, and wet condition (C2) in 1992 and state closed to normal in 1989 (C3).

Figure (4) shows comparative statistics of water productivity in the area for the three conditions C1, C2, C3. Figure (5) is the spatial distribution map of water productivity for drought condition.

For the condition C1, the maximum WP is 0.67

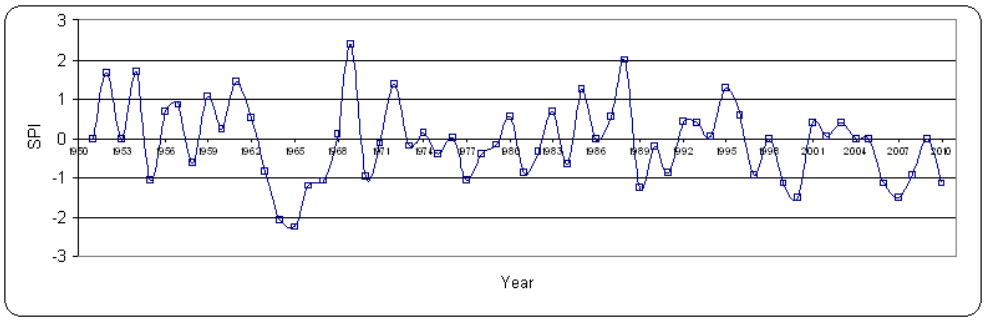

Figure 3: A sample diagram of the temporal variation of SPI for 32 years span for Novejeh station.

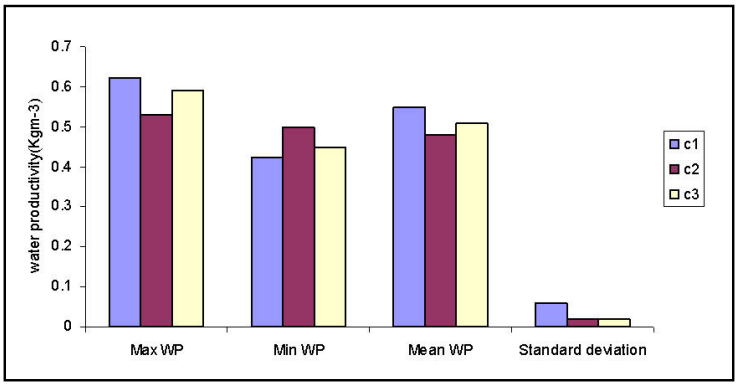

Figure 4: Comparative statistics of water productivity in the area for the three conditions C1, C2, C3.

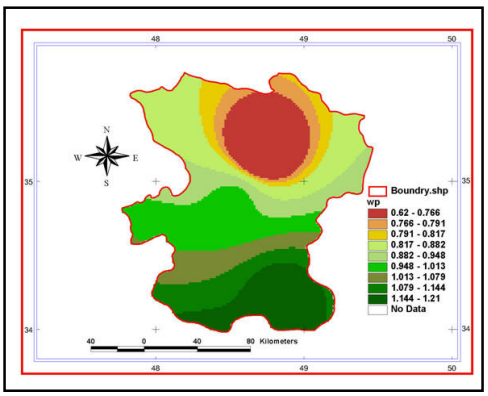

Figure 5: The spatial distribution map of water productivity for drought condition.

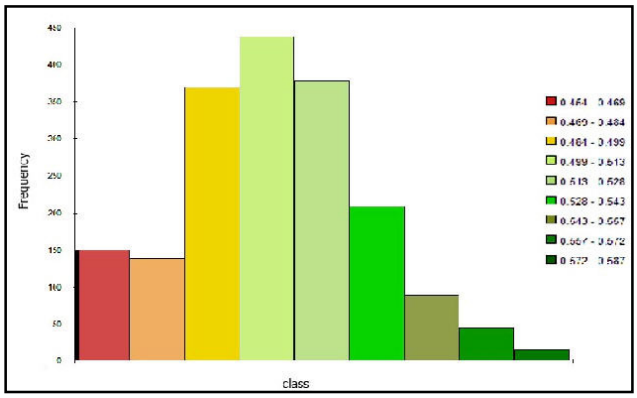

Figure 6: Frequency of water productivity in the area for drought condition.

kg/m^3 and South and South-east of the region has higher WP than the northern part. It should be noted that the standard deviation fo the WP was the highest under C1 conditions the region. Figure (6) shows that the major part of the region has forth class water productivity (0.51 to 0.49). For C2 condition, the north-east and east regions have the maximum water productivity; 0.57 Kg/m3 and most of the regional area enjoys the forth class of water productivity (0.47 to 0.48). Maximum water productivity; 0.61 Kg/m3 for the C3 condition is observed in extreme east and west of the region. These parts are placed in forth class of productivity (0.49 to 0.51).

In dry conditions, like C1, average and maximum productivities are placed at a higher level than the other two conditions, contrary to what was expected in advance. But minimum WP in wetter condition

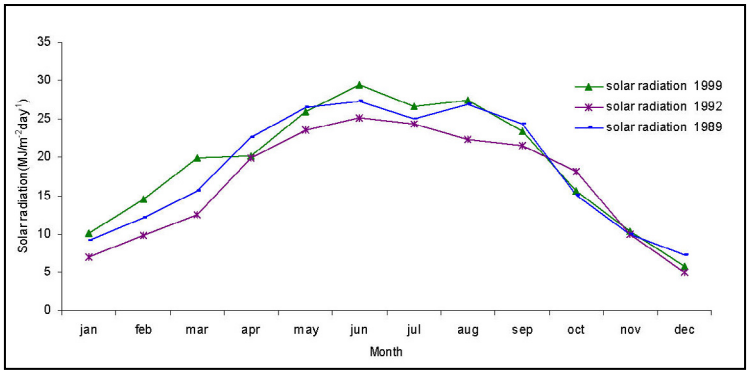

Figure 7: Variation of active Solar Radiation (SRAD) received by the earth's surface in the three conditions.

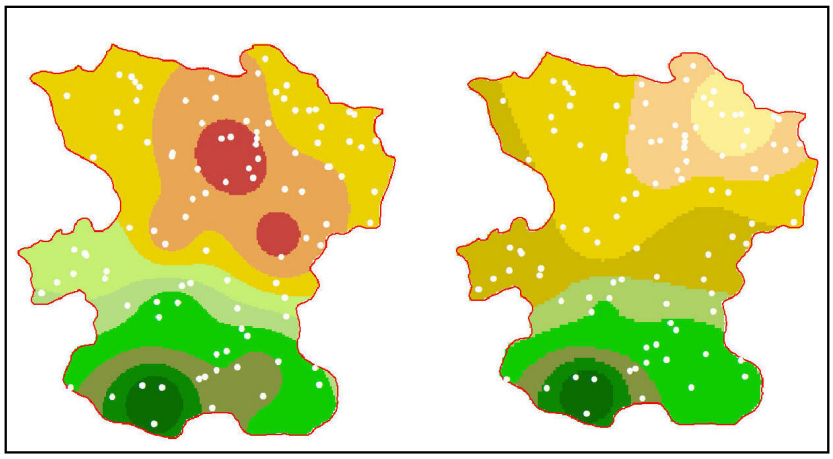

Figure 8: The extracted information from 100 randomly selected points on the two maps of WP and SRAD.

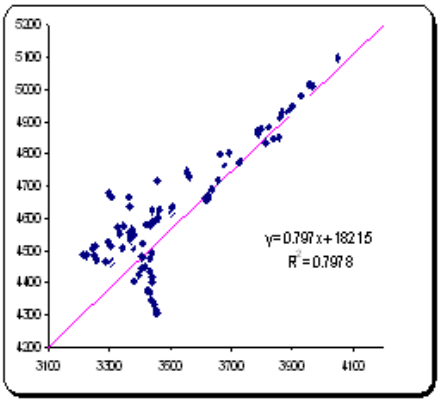

Figure 9: The regression line between Water Productivity and SRAD maps.

is higher than dry condition. The reason is that in C1 the average solar radiation is higher than the other two conditions as it is observed in Figure (7). This has affected greatly crop yield. In other words, during the drought condition, maximum level of production is higher than in other conditions due to higher amount of active Solar Radiation (SRAD) received by the earth's surface in the growth period.

Further, the analysis showed that spatial variation of WP is a function of spatial variations of solar radiation. The extracted information from 100 randomly selected points on the two maps (Figure 8)

of spatial distribution of WP and spatial distribution of the active radiation as short wave reached to the Earth's surface shows a good correlation ($R^2 = 0.8$). The regression line is shown in Figure (9).

Conclusion

The simultaneous investigation of the spatial and temporal dimensions of WP leads to a more effective analysis, comprehensive and in depth understanding of the condition of resources for planning and decision making. In addition, the results of such an analysis will provide more information to adopt suitable techniques for saving water in agriculture. It is clear that WP is sensitive to solar radiation and its spatial variations.

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4 - Special, 2012

Factors Determining the Entry of Agricultural Farms into Agritourism

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Anotace

Cílem článku je identifikovat motivy rozhodující při vstupu farmy do agroturistiky v oblasti České republiky. Dílčím cílem je analyzovat stupeň naplnění vstupních motivů. Součástí výzkumu byla identifikace rozdílů motivů pro vstup farmářů do agroturistiky v ČR s výsledky studie provedené na agroturistickém trhu v USA. K dosažení cílů byly využity deskriptivní statistiky a neparametrické testování prostřednictvím Wilcoxonova testu. Bylo zjištěno, že narozdíl od USA v ČR převažují ekonomické motivy pro vstup do agroturistiky. Výsledky srovnání postojů reflektujících vliv dosavadních zkušeností s agroturistikou se změnou postojů ke vstupním motivům.

Článek vznikl za podpory interní grantové agentury (IGA) České zemědělské univerzity v Praze, registrační číslo: 20121074.

Klíčová slova

Agroturistika, podnikatelské motivy, farma, sociální motivy, ekonomické motivy.

Abstract

The aim of this paper is to identify the motives of the decisions to join the agritourism business in the Czech Republic and the degree of fulfilment of these input motives. The research also identified the differences in motives for the entry of farmers into agritourism in the Czech Republic as compared to the results of a study on agritourism in the USA.

In order to achieve the aims, descriptive statistic methods and non-parameterized testing through Wilcoxon test were used. It was found out that unlike the USA, in the Czech Republic the most dominant motives for joining agritourism are economic motives. The results also included a comparison of the approaches reflecting the impact of existing experience with agritourism with the change of approaches to the input motives.

The article originated as a part of the Internal Grant Agency (IGA) of the Czech University of Life Sciences in Prague, Registration Number 20121074.

Key words

Agritourism, entrepreneurship motivation, farm, social motives, economic motives.

Introduction

The main aim of the article is to confirm or refute the assumption that in the Czech Republic the economic and social factors for joining agritourism are balanced. The sub-aim is to identify the differences of motives for joining between the Czech Republic and the USA and compare the approaches reflecting the impact of existing experience with agritourism with the change of approaches to the input motives. With the influence of experiences as a factor of changing motives in time, the research compare decision-making motives weighing by entrancing the agritourism business and current farmer view at the structure of those determining motives.

Today agriculture climate is changing (Barbieri et al., 2009) as the Czech agriculture showed a significant decline until 2010. This decline has been turned into the best overall profit in agriculture after 1998 gained in the year 2011 (Denik, 2012). With the number of 47 233 of all the farm types (CSO, 2012), these changes can encourage farmers in searching for new possibilities to find alternative

strategies stabilize or increase the income for economic survival of farmers and their families (Barbieri et al., 2008; Barbieri et al., 2009) Previous empirical works have concluded, that diversification can be used as a farm adjustment strategy (Barbieri et al., 2009). According to Chaplin et al (2004), diversification is a process of decreasing of the farmers' households' dependence on the agricultural activities.

The traditional view of diversification is based on the new-income sources search (Bowler et al., 1996) Such farms were defined in the literature as alternative farm enterprises (Gasson, 1988; Ilbery, 1991). It is possible to diversify into different complex areas, than just to expand with related agricultural activity (Barbieri et al., 2009). Recent researches have changed the view at the diversification areas (McGehee et al., 2007; Maye et al., 2009). The previously published typologies as it is defined by Bowler et al (1996) and Bowler (1992) divided farm businesses into agriculture, non-traditional and non-agricultural with the regard to output of products and services provided by farms. A division used in this paper is based on the farm diversification typology developed by Ilbery (1991) and cited in later researches (Mace, 2005; McGehee et al., 2007; Maye et al., 2009) varies between farm-related (on-farm) activities such as specialist products, livestock, organic or crop products; food processing; direct marketing and non-farming activities such as sports/leisure facilities, accommodation services and hire/ contract services. Recent researches have shown perceptible growth of farm diversification both on- and off-farm businesses (McGehee et al., 2007; Maye et al., 2009).

The second type was defined as agritourism business, including recreation, tourism and hospitality field (Barbieri et al., 2009; Bowler et al., 1996). There are two perspectives for agritourism studies. The definition within sociological perspective understands agritourism activity as a part of the complex farm structure. Tourism perspective shows the agritourism much more as the unique activity attracting public (Che et al., 2005; Barbieri et al., 2008). According to both perspectives Václavík (2008) defines agritourism as a form of complex agricultural farm or ranch business, aimed at seizing visitors, in order to bring additional income to farmers. Previous researches aimed at identification of farmers' entrepreneurial development motives defined the economic and social dimensions of farmers´ intentions (Ollenburg et al., 2007; Barbieri et al., 2008; Tew et al., 2012).

In recent studies, the intention to choose agritourism as a new resource for generating income and for adding a value, were presented as generally most common economic decision-making motives (Ollenburg& Buckley, 2007; Tew et al., 2012).In the Czech Republic, the economic motives are presented as determining. According to the Ministry of Agriculture, almost 250 projects aimed at agritourism were recorded since 2007 (FinancniNoviny, 2012). Academics suggested that the social motives as community and social contribution are believed to be valued as economic motives (Barbieri et al., 2008; Tew et al., 2012).

There were five economic motives determined in this research. The first motive is to assure the economic survival of the farm (Bowler et al., 1996). Most discussed motive especially in times of economic distress, such as a poor harvest, to start with an alternative activity as agritourism, is gaining additional income for the farmer, as well as the subsistence for the farmer and his family (Tew et al., 2012). According to Bowler et al. (1996) to maintain farm-related (on-farm) activities is one of the income resource that allows farmer to implement the venture within the farm property (McGehee et al., 2007). The subsidy gaining motive was included as a farm income adjustment, because of on-going state support. The State Agricultural Intervention Fund (MZE, 2009) as an administrator of financial subsidies both from the European Union and the national financial funds control programs as Axis IV, Leader - implementing local development strategies (quality of life/diversification) and the programming period was set for 2007 - 2013.

As farming and affiliated activities provide farmers the identity and the sense of achievement (Rob & Burton, 2004), the significance of social motive has to be evaluated. The preference of the satisfaction from the activity itself can be considered as a motive rather than to maximize income (Barbieri et al., 2009). The contribution to the farmers' family and his tight community (such as employees) has also been valued as an important rational by previous researches (Getz & Carlsen, 2000; McGehee et al., 2007) The social interaction, social bonding such as bringing new people into farmers' life, was also evaluated in this research (Tew et al., 2012) as it is specified bellow. The evaluation of motives is crucial in the identification of the agritourism development intentions.

Material and methods

The Factors Motivating Agritourism Entrepreneurs (Mace 2006) questionnaire, translated independently by two authors of the article, was used to evaluate the economic and social motives for joining the agritourism. The differences in translations were subsequently consulted with a native speaker. The questionnaire consisted of 18 questions. 9 questions were focused on expressing agreement with economic and motives before joining agritourism using a 5-point likert scale.

The following 9 questions were focused on the evaluation of approaches reflecting the impact of the existing experience with agritourism.

Data for the motive analysis were obtained by contacting 225 farms involved in agritourism by the electronic form to e-mails that were obtained through a fulltext search on internet search engines (seznam.cz and Google.cz). The questionnaire return rate was 32.4% (72 farms). The questionnaire was addressed to the farm owners, which was stressed in the accompanying letter of the electronic inquiry. Characteristics of respondents: 21.3 % of the farmers are in agrotourism less than two years. 26.4 % of respondents 2-5 years and 52.3 % of the farmers are in agrotourism longer than 5 years. Farm size in hectares is divided as follows: up to 50 hectares - 24.6 %, from 51 to 250 ha 40.3 %, over 250 hectares - 35.1 %.

In order to be able to subsequently compare the results with the research on agritourism in the United States, the significance of factors influencing joining agritourism was evaluated using the percentage enumeration method for the frequency of agree and strong agree answers (Mace, 2005). The latent factors (group of economic and social factors) were evaluated using the arithmetic average of the sum of all evaluations in the given factor groups. Non-parameterized Wilcoxon pair test was used to analyze whether expectations were met, due to its suitability for testing ordinal variables. Wilcoxon pair test was also used to evaluate the change of approaches reflecting the experience gained from running business.

Results and discussion

Based on the analysis of the frequency of agreements, the most significant motive was identified: "joining agritourism because of the need of new income" (E2), with which 76 % of respondents agreed or strongly agreed. Second most significant motive was identified as "the possibility to expand the farm with the advantageous option to work on own farm" (E4). 72 % of respondents agreed or strongly agreed with this motive (see Table 1).

As far as social motives are concerned, the most significant factor reflected the importance of joining agritourism in order to sustain the farm community.

Motives			%	Mean
X2	Economic	E2	76.39	3.97
X4	Economic	E4	72.22	3.88
X9	Economic	E5	70.83	3.81
X5	Social	S1	68.06	3.82
X6	Social	S2	51.39	3.38
X3	Economic	E3	31.94	3.09
X1	Economic	E1	19.44	2.65
X7	Social	S3	18.06	2.55
X8	Social	S4	15.28	2.08

X1 My economic survival depends on the success of my agritourism business.
X2 My interest in agritourism is driven by my need for new income sources.
X3 Farming and ranching alone are not generating enough to make a living nowadays.
X4 Agritourism allows me to work at home instead of getting an off-farm job.
X5 Agritourism is important for my community's economic survival.
X6 My interest in agritourism is driven by my desire to see my community prosper.
X7 Operating an agritourism business provides me more satisfaction than the extra income generated.
X8 An agritourism business brings new people into my life, which is more important than the money I make.
X9 My interest in agritourism is driven by possibility of obtaining grants.

Source: own calculation, questionnaire survey, 2012

Table 1: Motives for Agritourism.

68 % of respondents agreed or strongly agreed with this motive. Second most significant motive was identified as the need to see the farm community satisfied. 51 % of respondents agreed or strongly agreed with this motive.

In order to be able to compare the economic and social motives, the individual variables were merged into two groups of latent factors: E6 – economic motives (E1 – E5) and S5 – social motives (S1 – S5). The economic motives can be considered as the more significant latent factor, since in average 54.17 % of respondents agreed or strongly agreed with the motives. On the other hand, 38 % of respondents agreed or strongly agreed with the social motives (see Table 2).

The obtained motive values for joining agritourism were compared with the values measured in the „Factors Motivating Agritourism Entrepreneurs" research (Mace, 2005). The following table represents the comparison of measured values. Factor E5 was excluded from the comparison, since it was included in the research in the Czech Republic

Motives			%	Mean	
X1	Economic	E1	19.44		
X2	Economic	E2	76.39		
X3	Economic	E3	31.94		
X4	Economic	E4	72.22		
X9	Economic	E5	70.83	54.17	Economic
X5	Social	S1	68.06		
X6	Social	S2	51.39		
X7	Social	S3	18.06		
X8	Social	S4	15.28	38.19	Social

X1 My economic survival depends on the success of my agritourism business.
X2 My interest in agritourism is driven by my need for new income sources.
X3 Farming and ranching alone are not generating enough to make a living nowadays.
X4 Agritourism allows me to work at home instead of getting an off-farm job.
X5 Agritourism is important for my community's economic survival
X6 My interest in agritourism is driven by my desire to see my community prosper.
X7 Operating an agritourism business provides me more satisfaction than the extra income generated.
X8 An agritourism business brings new people into my life, which is more important than the money I make.
X9 My interest in agritourism is driven by possibility of obtaining grants.

Source: own calculation, questionnaire survey, 2012

Table 2: Social and Economic Motives for Agritourism.

Motives		CZ	USA	Difference
Economic	E2	76	66	10
Economic	E4	72	63	9
Social	S1	68	82	-14
Social	S2	51	63	-12
Economic	E3	32	71	-39
Economic	E1	19	24	-5
Social	S3	18	47	-29
Social	S4	15	55	-40

X1 My economic survival depends on the success of my agritourism business.
X2 My interest in agritourism is driven by my need for new income sources.
X3 Farming and ranching alone are not generating enough to make a living nowadays.
X4 Agritourism allows me to work at home instead of getting an off-farm job.
X5 Agritourism is important for my community's economic survival
X6 My interest in agritourism is driven by my desire to see my community prosper.
X7 Operating an agritourism business provides me more satisfaction than the extra income generated.
X8 An agritourism business brings new people into my life, which is more important than the money I make.

Source: own calculation, questionnaire survey, 2012 and Mace (2005)

Table 3: Social and Economic Motives for Agritourism in USA and the Czech Republic.

Motives		Before		After		Difference
X2	Economic	E2	76	E2p	85	-9
X4	Economic	E4	72	E4p	81	-9
X9	Economic	E5	71	E5p	65	6
X5	Social	S1	68	S1p	65	3
X6	Social	S2	51	S2p	49	2
X3	Economic	E3	32	E3p	40	-8
X1	Economic	E1	19	E1p	22	-3
X7	Social	S3	18	S3p	21	-3
X8	Social	S4	15	S4p	14	1

X1 My economic survival depends on the success of my agritourism business.
X2 My interest in agritourism is driven by my need for new income sources.
X3 Farming and ranching alone are not generating enough to make a living nowadays.
X4 Agritourism allows me to work at home instead of getting an off-farm job.
X5 Agritourism is important for my community‘s economic survival
X6 My interest in agritourism is driven by my desire to see my community prosper.
X7 Operating an agritourism business provides me more satisfaction than the extra income generated.
X8 An agritourism business brings new people into my life, which is more important than the money I make.
X9 My interest in agritourism is driven by possibility of obtaining grants.

Source: own calculation, questionnaire survey, 2012

Table 4: Reflection of the Agritourism Motives in Time.

	E1p - E1	E2p - E2	E3p - E3	E4p - E4	E5p - E5	S1p - S1	S2p - S2	S3p - S3	S4p - S4
Z	-1.414	-0.24	-1.949	-1.279	-2.08	-1.342	-1.3	-1.342	-0.478
Asymp. Sig. (2-tailed)	0.157	0.811	0.073	0.201	0.061	0.18	0.194	0.18	0.633

For explanations of „E“ see table 4
Source: own calculation, questionnaire survey, 2012

Table 5: Wilcoxon Pair Test Analysis.

due to its high influence on joining agritourism.

The highest difference was found for factor S4 (40 %), which corresponds with the influence of economic factors for joining agritourism in the Czech Republic and points to a high orientation of farmers on income. Significant difference was also recorder for motive E3, which indicated that in the Czech Republic the entry of farms into agritourism was not decisive for the survival of the farm.

Another part of the research discovered approaches reflecting the impact of existing experience with agritourism on the change of approaches to input motives. The Table 4 shows the change of approaches reflecting the experience gained from running the business.

The Wilcoxon pair test was used to analyse the differences between approaches. Calculated p-values ranged within the interval (0.061 – 0.811), which is higher than the defined value 0.05 (see Table 5).

Therefore no statistically significant difference was found between the approaches.

Conclusion

The research results confirmed the assumption that economic motives are more significant for Czech farmers when deciding whether to join agritourism. The research identified two dominant economic motives: “joining agritourism because of the need of new income” and “the possibility to expand the farm with the advantageous option to work on my own farm”.

When comparing approaches reflecting the impact of existing experience with agritourism with the change of approaches to input motives, no statistically significant difference was found. The results may indicate that farmers had realistic expectations, which were fulfilled.

While in the Factors Motivating Agritourism entrepreneurs research (Mace, 2005) the economic

and social motives were balanced, in the Czech Republic the economic factors significantly exceeded the social motives (54 % and 34 %). Significant orientation of farmers on economic income can be explained by the funding policy. The question for further research can be the change of motive structures as a consequence of the change of EU fund program structure.

Acknowledgements

The article originated as a part of the Internal Grant Agency (IGA) of the Czech University of Life Sciences in Prague, Registration Number 20121074.

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

Rural Economies and ahe Pillar 2 Budget Debate: A Regional Perspective

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Anotace

Následně po legislativním návrhu nařízení k rozvoji venkova pro období 2014 – 2020 (COM(2011) 627/3) přišla Evropská komise také se svojí představou rozpočtu Pilíře 2. Snaha Komise dosáhnout spravedlivějšího rozdělení fondů Pilíře 2 povede zřejmě k redukci rozpočtu pro Českou republiku. Tento článek se zabývá dopady takového snížení rozpočtu na zemědělství a venkovský rozvoj. K tomu je použit regionální model obecné rovnováhy. Výsledky regionálního modelu jsou poté srovnány s výsledky národního modelu. Článek ukazuje, že důsledky snížení rozpočtu a přesunu z pilíře 1 do pilíře 2 SZP jsou středně závažné pro zemědělství, naproti tomu vliv na venkovskou a národní ekonomiku je zanedbatelný. Je také ukázáno, že výsledky obou modelů jsou konzistentní, avšak jsou zde i diference vyplývající jak z rozdílných ekonomických struktur na různých geografických úrovních, tak z rozdílných specifikací modelů.

Klíčová slova

Model obecné rovnováhy (CGE) model, regionální ekonomika, venkov, venkovská politika, zemědělská politika.

Abstract

Following the legislative proposal of the Rural Development Regulation for the period 2014 – 2020 (COM(2011) 627/3) the Commission also issued its notion about the budget allocation for Pillar 2. The Commission effort to achieve a more balanced distribution of Pillar 2 fund among member states will lead to a cut of the budget for the Czech Republic. This paper investigates the consequences of such cuts for agriculture and rural areas using a regional CGE model. The results of the regional model are than compared with the results of a national model. The paper shows that the consequences of the budget cut as well as the reallocation from Pillar 1 of the CAP are moderately serious for agriculture, whereas the rural and the national economy remain mostly unaffected. It is also shown that the results of the both applied models are consistent; nevertheless, they differ due to structural differences at various geographical levels as well as due to differences in model specifications.

Research presented in this paper is the result of a research grant MSM 6046070906 “Economics of Czech agricultural resources and their efficient usage within the framework of multifunctional agri-food systems”, the Research Task TÚ 4241/2011of UZEI “Podklady pro pozici MZe pro vyjednávání o finanční perspektivě EU na období 2014 – 2020” conducted for the Ministry of Agriculture and CZERA project of the Ministry of Education, Youth and Sports (2010-2015, LM 2010010).

Key words

General equilibrium model, regional economy, rural area, rural policy, agricultural policy.

Introduction

Following the legislative proposal of the Rural Development Regulation (RDR) for the period 2014 – 2020 (COM(2011) 627/3) the Commission also issued its notion about the budget allocation for Pillar 2. Unlike to Pillar 1 of the CAP[1], the legislative proposal of the RDR includes only the total EU

[1] Common Agricultural Policy

budget outlay without its further distribution among Member States (MS). It might indicate that the Commission is keen on redistributing Pillar 2 allocations among MS. The ideas about the possible reallocation are given in the Fiche 14 of the MFF issued in November 2011.

The proposals on the MFF[2] 2014-2020 assume a „nominal freeze" of the CAP amounts (both pillars) at the 2013 level. For rural development, the 2013 amount corresponds to 14,817 million EUR. After some adjustments including the UK's voluntary modulation and the shift of the cotton restructuring program the final proposed amount for Pillar 2 is 14,455 million EUR per year. The MFF Fiche 14 with the reference to the impact study (SEC(2011) 1153) argues that there are obvious disparities in the current Pillar 2 allocations among member states. Both the impact study (SEC(2011) 1153) as well as the Fiche 14 of the MFF presents several alternatives of the budget allocations among Member States: for example *the integration scenario, the refocus scenario* or *a redistribution scheme* in the interval ±10% of the current level. The first two reallocation options correspond to shifts in priorities between the three objectives of the rural development policy (Table 1): the integration scenario emphasizes a stronger alignment with Europe 2020 priorities and targets, while the refocus scenario drives the rural development policy to concentrate entirely on environment and climate change issues. The redistributions of the financial envelopes are calculated o n the corresponding (proposed) indicators/criteria as presented in Table 1 (SEC(2011) 1153).

The budget allocation formula for the integration scenario is quite complex weighing the agricultural sector viability, environmental concerns and the importance of rural areas: *[1/3 [(½ UAA[3] + ½ Labour) x labour productivity inverse index] + 1/3 (1/3 NHA[4] area + 1/3 Natura 2000 + 1/6 Forest + 1/6 Permanent pasture) + 1/3 Rural population] x GDP inverse index*; for the refocus scenario the formula is significantly reduced to only environmental indicators: *(1/3 Area + 1/3 Natura 2000 + 1/6 Forest + 1/6 Permanent pasture) x GDP inverse index*; the ±10% redistribution scheme combines by 50% the total envelope on the basis of the current distribution key and by 50% the new distribution key of the integration scenario.

The mentioned three scenarios assume a cut of the budget for the Czech Republic between 10 and 30 percent. The cut of 30%, however, seems unlikely to happen since this scenario ("refocus") is too restrictive for rural development policy and only would introduce new inequalities. While the cut of Pillar 2 envelope can be expected, the legislative proposal on Pillar 1 (direct payments) allows for shifting some resources (directly 10%) from Pillar 1 envelope to the Pillar 2 budget (Article 14, COM(2011) 625/3). In addition, Pillar 2 budget can be strengthen by covering some of the payments for areas with natural constraints (NHA) in Pillar 1, i.e. up to 5% of the Pillar 1 envelope (Article 34, COM(2011) 625/3).

The objective of this paper is to show how various Pillar 2 budget options and so called flexibilities between pillars affect agriculture and rural economies. Since the rural economy is deeply integrated with the urban one, the additional objective of the paper is to assess spill-over effects i.e. how changes in the agricultural and rural policy can affect the urban economy and non-agricultural sectors.

[2] Multi-annual Financial Framework

[3] Utilised Agricultural Area

[4] Naturally Handicapped Areas

Objective 1 – competitiveness	UAA#, labour, inverse index of labour productivity (reflecting the extent of the farming sector and if it lags behind)
Objective 2 – sustainable management of natural resources and climate change activities	UAA, area of NATURA 2000, naturally handicapped areas, forest, permanent pasture areas (reflecting both environmental pressures and the potential to provide environmental public goods)
Objective 3 – balanced territorial development	Rural population (reflecting potential beneficiaries of support), with a GDP inverse index used across the board to reflect cohesion considerations

Utilised Agricultural Area
Source: Fiche 14 of the MFF 2014-2020

Table 1: Three main objectives of the rural development policy and the corresponding indicators.

To perform this analysis in a greater detail we have chosen a regional CGE model which distinguishes rural and urban economies. This approach and particularly the model are explained in the following section. In Section 3 we translate the above discussion on the Pillar 2 budget allocation in scenarios to be later assessed by the model. Then we present results in Section 4. In the final section we bring together results of this research with the results of the similar modelling exercise at the national level (Křístková, Ratinger, 2012).

Material and methods

Description of the applied methodological approach

1. Review of possible approaches

A range of economic models has been applied to assess agricultural and rural policy impacts. At least three methodological streams can be identified: i) programming models (sectoral or farm level, e.g. the supply module of CAPRI (Britz et al., 2008) or FSSIM (Louhichi et al., 2010)); ii) econometric market models (partial or general equilibrium, i.e. sectoral (Capri, Britz et al., 2008) or economy-wide (CZNATEC, Křístková, Ratinger, 2012); and iii) agent based models aimed at structural change, AgriPolis (Happeet Al., 2006) or social networks (Henning, Saggau, 2010).

Economic models for agriculture and rural development also differ in terms of agents involved (if sub-sectors or types of farms are considered, other sectors and stakeholders are included) and geographical level of analysis, which ranges from very local, regional to multinational applications (Harvey, 1990).

In more complex policy assessments, methodologies, levels of detail and geographical levels are combined usually by adopting a hierarchical structure of model approaches. Good examples of these efforts are the already mentioned CAPRI model, SEAMLESS-IF (Van Ittersum et al., 2010) or SIAT of the SENSOR project (Helming et al., 2008).

In our research on the ex-ante assessment of the proposals of the new Common Agricultural policy for the period 2014-2020, we have also adopted a multi-model approach combining farm level, regional and national models (Ratinger et al., 2011). However, for the particular analysis of the impacts of the Pillar2 budget allocation options on agriculture and rural areas we are excluding the farm level model as being too restrictive in its focus only on agriculture. Both the national and regional models are computational general equilibrium (CGE) models. In addition to CGE models' ability to capture policy-specific direct, indirect and induced effects, they can also account for possible displacement effects in factor and product markets. In recent years, the construction and use of CGE models to agricultural policy analysis has been widely applied to the investigation of trade policy issues (Tongeren et al., 2001). However, several CGE studies have also investigated the impacts of changes in farm support at the EU or national level (e.g. Keyzer et al., 2002; Gohin and Latruffe, 2006, Křístková 2011). Albeit, few studies have explored the general equilibrium effects of changes in agricultural support at regional level or sub-regional level.

The model applied in this paper is rather embedded in the regional policy assessment tradition originating in Leontief's input-output analysis (Armstrong, Taylor, 2000). Regional Input-Output (e.g. Psaltopoulos and Thomson, 1993; Gilchrist and St. Louis, 1994) and SAM models (e.g. Roberts, 2000; 2003; 2005; Psaltopoulos et al., 2004; Psaltopoulos et al., 2006) have already become popular for analyzing rural development policies. CGE applications at the regional level might still be regarded as rather scarce, however, they are growing in importance. While Psaltopoulos et al (2011) only demonstrated the possible usefulness of the CGE approach at the regional level distinguishing rural and urban areas (sub-regions), the JRC/IPTS[5] project Rural-ECMOD (Psaltopoulos et al., 2012) already dealt with relevant options of the EU rural development policy (see also the already mentioned CAP 2020 impact study SEC(2011) 1153) in the EU wide context.

The regional CGE model of the Rural-ECMOD project which is adopted for the analysis in this paper is a dynamic – recursive CGE model, originating in the standard static CGE model developed by IFPRI, (Lofgren et al., 2002). The recursive dynamic part is taken from Thurlow (2008).

2. Main characteristics of the Rural-ECMOD model applied in this study

Production and consumption behaviour follows that of the IFPRI model; however, a number of modifications have been carried out in order to capture rural-urban linkages and the small regional

[5] Joint Research Centre of the European Commission, Institute for Prospective Technological Studies, Seville

nature of the study areas. Production activities are spatially disaggregated, i.e. they are explicitly based in either the rural or urban part of the region. While activities are spatially differentiated, commodities are not, so that the small scale of the regions under analysis is reflected. In particular, the market integration of the rural and urban areas in the study regions is very high so that assuming, a priori, the existence of separate rural and urban commodity markets in each study area suggests a more complete isolation of urban and rural space than is the case. Similar to production activities, households are disaggregated according to their rural/urban status. As rather typical, government represents the combined function of local and national government in each region. Finally, regarding the Rest of the World, this is assumed to capture both economic relationships with the rest of the national economy and third countries. By aggregating across the rest of the country and rest of the world, the models ignore certain trade relations and balances between the region and other parts of the country. To address this, a multi-regional model would be necessary, however this was beyond the resources of this effort.

As already noted, the update of the model parameters between periods draws on the extension of the static IFPRI model undertaken by Thurlow (2008). First, a number of exogenous dynamic adjustments can be imposed so that model produces a projected base path against which policy changes may be judged. The systematic exogenous adjustments in parameters such as total or factor-specific productivity or government spending growth (cuts) means the projected base path of the model should be able to produce "realistic" trends in key variables in the base path solution. Population and labour supply are exogenous between periods. The approach might be ignoring intra-regional migration and associated effects on the labour market, but, as with the treatment of the Rest of the World, a more comprehensive treatment was beyond our resources. In contrast to the other model parameters, capital adjustment for each sector between periods is typically endogenous, with investment in the solution of the model in period t-1 used to update capital stocks before the model solution in period t. The allocation of investments to sectors is translated into demand for producing investment goods. As in the Thurlow model, to map investment commodities in activities the simple assumption that the commodity composition of capital stock is identical across activities is employed. Effectively, the allocation of new capital across activities then uses a partial adjustment mechanism, with those activities where returns are higher than average obtaining a higher than average share of the available capital. This then determines, after accounting for (exogenous) depreciation, for the adjustment in capital stock in each activity. Alternatively, the growth rate of capital stock in a specific sector may be set exogenously. In this case, the amount of investment required for this sector is calculated and then the amount of investment available for endogenous allocation reduced accordingly.

The SAM (Social Accounting Matrix) table for the study region (South Moravia) was constructed through a four-stage process. Stage 1 involved the regionalization of existing national Input-Output Tables for year 2005, through the use of location quotient and RAS procedures. This was followed by the rural-urban disaggregation of sectors and households, performed here through the utilization of secondary data (for example, employment data to split sectors, population data to split households). A key issue required at this point was the definition of rural and urban boundaries in the region. In the particular case of South Moravia it was rather straightforward: Brno and its surrounding were considered as the urban area while the rest of the NUTS3 region was taken as rural[6]. This possibility to define geographically compact rural and urban areas was one of the reasons why we had chosen the region of South Moravia as the case study.

Stage 2 mainly involved the disaggregation of agricultural activity and commodity entries (through the use of FADN[7] information on farm-types) and then, the conversion of the regional Input-Output Table into a SAM structure by filling in the inter-institutional transactions of the SAM table. The latter was carried out via the utilization of regional household income and expenditure data and information from key informants (regional agencies) and local government. In Stage 3, initial SAM entries were corrected by expert knowledge. Finally, Stage 4 involved the application of the cross entropy optimization procedure (Robinson et al., 2001) in order to balance SAM accounts.

SAM construction was followed by model calibration, which required the specification of elasticities, (exogenous) region-specific trends and closure rules. The choices of model elasticities (Table 2) resulted from literature review (e.g. from

[6] In this particular case "intermediate" districts are considered as rural

[7] Farm Accountancy Data Network

Production Block		Trade Block		Household Consumption	
Top Level	0.4 for all sectors	*Armington*	2.0 for all	*Frisch*	-1
Bottom Level	0.6 for all sectors	*CET*	1.6 for all	*Market*	0.33-1
Output aggregation	1.3				(transport 0.001)

Source: own specification

Table 2: Specification of elasticities for the Rural-ECMOD model of South Moravia.

		S0BSL (baseline)	S1P1inP2	S2P2-10	S3P2-20	S4P1inP2-20	S5AGRINV
Pillar 1							
Envelope	EUR millions	890.7	890.7	890.7	890.7	890.7	890.7
Transfer to Pillar 2			10%			10%	
Direct payment (SPS)	EUR/ha	253	228	253	253	228	253
Pillar 2							
Reduction of EAFRD bufget in respect to 2013				10%	20%	20%	
Modernisation of agricultural holdings		the share as in 2007-13					increase
AEM, NHA		the share as in 2007-13					a drop by 30%
Investment in the rural economy		the share as in 2007-13					a drop by 50%

Source: own proposal

Table 3: Scenarios.

Psaltopoulos et al., 2011, Lofgren et al., 2002), expert opinion and finally some experiments. Concerning the latter, several sets of elasticities were used and then assessed how well the model replicated the past (2006-2010). The model closure rules follow the notion that regions are small open economies: in the government account balance it is assumed that savings adjust endogenously and tax rates are fixed; in the external balance, real exchange rate are set as endogenous and the current account deficit as fixed; finally in the savings-investment balance, investment is taken as fixed and savings are assumed to adjust (i.e. investment driven economy). Regarding labour markets we assume an upward-sloping labour supply function for skilled workers (i.e. both labour and wages are flexible) while the unskilled labour market assumes neoclassical adjustment (total unskilled labour is fixed).

Description of the applied scenarios

To achieve the objectives of our research specified in Chapter 1 we defined a baseline and five alternative policy scenarios. In all scenarios Pillar 1 is introduced in the extent of the legislative proposal COM(2011) 625/3.

The baseline (S0BSL) assumes Pillar 2 in the extent and structure of the current programming period, more precisely on the basis of the regional use of the budget in the period 2007-2010. The national co-financing is made at 20%. The level of co-financing affects the amount of additional/subtracted financial means for Pillar 2 – stating it at 20% expands the finances of Pillar 2 slightly (the minimum level is 15% for all Czech regions except Prague).

Various options of budget cuts and a budget transfer from Pillar 1 to Pillar 2 are presented the first four scenarios: S1P1inP2 represents only budget transfer from Pillar 1 (at its maximum level of 10%), S2P2-10 and S3P2-20 only the cut of the Pillar 2 budget by 10% and 20% respectively and S4P1inP2-20 is a combination of the first and third scenario. In addition, we defined a fifth scenario (S5AGRINV) which is financially identical with the baseline (S0BSL) but gives higher priority to agricultural competitiveness. Most of the Pillar 2 means go to the modernization of agricultural holdings. Scenarios are summarized in Table 3.

The Pillar 2 budget is distributed in three priority areas/support targets: i) modernization of agricultural holdings, ii) support to agriculture

in NHA, organic farming and environmental conservation (agri-environmental measures, AEM), and iii) support to rural areas. The latter priority area is further sub-divided the support to diversification, undertaking in rural areas and rural infrastructure. In Table 4, there is demonstrated the structure of CAP expenditure (the left part of the table) as well as the deviations from the baseline structure in the individual scenarios (the right part of the table). The actual expenditures for the South Moravian region are presented in Appendix. This region is specific by relatively low expenditure to environmental conservation and NHA payments comparing to the country average. This is mainly due to smaller extent of landscape protected areas and the share of grasslands. The expenditure to modernization accounts about a half of the Pillar 2 budget.

Results

As it has been mentioned above, the analysis presented in this paper is narrowed to effects of increasing or decreasing investment supports and in their consequence investment activities in general. In this exercise, the investment support is targeted to agriculture, energy (biogas stations, other renewable energies), rural tourism and rural services (including infrastructure). It means that the budgets of "axes"[8] and measures are further translated into actual target sectors: agriculture, rural energy, rural hotels and restaurants and rural services. The distribution of supports to these target sectors is based on the expenditure structures in the period 2005-2010.

Table 5 displays the effects of different pillar 2 measures on GDP as an average deviation from baseline. It can be noted that the effects on total regional GDP are relatively negligible as they range between 0.11% to -0.08% against the baseline. A more detailed inspection of the GDP growth rates in the sectoral disaggregation shows that, in general, the scenarios that reduce support to agriculture (S1 – S4) have moderately positive effects on the non-agricultural sectors and negative effects on agriculture. The reallocation of funds from direct payments to investment subsidies results in negative

[8] In terms of the current Rural Development Regulation (EC 1695/2005) and thus in terms of Table 3.

	S0BSL - the share		S1P1inP2	S2P2-10	S3P2-20	S4P1inP2-20	S5AGRINV
	on CAP	on Pillar 2	Budget changes in respect to baseline (S0BSL)				
Pillar 1 (DP)	**64%**		**-10%**			**-10%**	
Pillar 2	**36%**	**100%**	**21%**	**-10%**	**-20%**	**0.1%**	
Modernisation of agricultural holdings	19%	53%	21%	-10%	-20%	0.1%	62%
AEM, NHA payments	7%	20%	21%	-10%	-20%	0.1%	-30%
Support to rural areas	10%	27%	21%	-10%	-20%	0.1%	-50%
Diversification	4%	11%	21%	-10%	-20%	0.1%	-50%
Undertaking in rural areas	3%	8%	21%	-10%	-20%	0.1%	-50%
Rural infrastructure	3%	8%	21%	-10%	-20%	0.1%	-50%
Total CAP	**100%**		**1%**	**-4%**	**-7%**	**-6%**	**0%**

Source: own calculations

Table 4: Budget changes in the scenarios.

	S1P1inP2	S2P2-10	S3P2-20	S4P1inP2-20	S5AGRINV
TOTAL - regional	0.08%	0.04%	0.06%	0.11%	-0.08%
Rural	0.08%	0.00%	0.00%	0.06%	-0.05%
Urban	0.09%	0.08%	0.13%	0.15%	-0.12%
Agriculture and forestry	-0.71%	-1.28%	-2.11%	-1.87%	2.91%
Rural Secondary	0.17%	0.11%	0.16%	0.23%	-0.30%
Rural Tertiary	0.09%	0.05%	0.08%	0.12%	-0.16%
Urban Secondary	0.14%	0.14%	0.23%	0.26%	-0.23%
UrbanTertiary	0.08%	0.07%	0.12%	0.14%	-0.12%

Source: own calculations

Table 5: Average GDP deviations from baseline (S0BSL) over 2014-2020.

effects on GDP in agriculture, which suggests that the reallocation favours mainly non-agricultural sectors (more than a quarter of investment subsidies is allocated to non-agricultural rural activities)[9].

Concerning the fifth scenario (S5AGRINV), in which the funds are concentrated on agricultural modernization under a baseline budget, the GDP growth in agriculture is noticeably higher (almost 3% compared to baseline), whereas the non-agricultural sectors and urban areas are worse-off.

Similar conclusions as for the GDP can be derived for the gross production per sector (Table 6). It can be observed that the production of rural sectors of energy, tourism and services slightly declines as a consequence of subsidies reduction. On the other hand, the production in these sectors is positively stimulated by the reallocation of funds from the first to the second pillar, if the original distribution of funds between rural development and modernization is maintained. When more funds are allocated to modernization, the development of agricultural sector is favoured at the expense of the non-agricultural sectors.

Discusion and conclusion

This part concentrates on compiling the results of the two exercises: the first using the regional CGE model (Rural ECMOD) presented in this paper and the other using a national CGE model (CZNATEC) conducted at the national level and presented in Křístková, Ratinger (2012). To simplify the comparison and the synthesis we concentrated only on scenarios S1P1inP2 and S3P2-20[10] and on a few indicators: namely the sectoral GDP, employment and land rent. It is clear that one has to be careful when comparing the results of the two different models. In this respect it is important that these models come from the same family of the CGE models, use similar functional forms and their static and dynamic structures are designed on the same principles. We have also run the identical scenarios. In spite of the great level of consistency there are also certain modelling differences concerning investment allocation methods, labour supply functions, base years (2005 for Rural-ECMOD and 2006 for CZNATEC), differences in function parameters resulting from calibrations and the different aggregation levels of activities and commodities.

The both models indicate that the transfer of financial resources from Pillar 1 to Pillar 2 of the CAP (S1P1inP2) will have a positive response in the economy (national, regional, rural and urban) in terms of GDP (Table 7). However, these effects are negligibly small. This is without doubts due to a tiny share of agriculture in the national and regional levels. Although South Moravia has a good soil and a suitable climate and its agricultural production belongs to the most important in the country, it is also an industrial and services region - thus the share of agriculture in the regional and even the rural economy is comparably small to the national level. Cutting the Pillar 2 budget by 20% (S3P2-20) will also produce negligible total effects (perhaps with the exception on the South Moravian urban economy). The opposite signs

[9] It should be noted that biogas stations and other bio-energy activities are included in energy sector.

[10] Scenario 3 and Scenario 2, respectively in Křístková, Ratinger, 2012.

Domestic Production	S1P1inP2	S2P2-10	S3P2-20	S4P1inP2-20	S5AGRINV
Agricultural and forestry prod.	-0.68%	-1.26%	-2.09%	-1.84%	2.91%
Manufacturing products	0.15%	0.13%	0.21%	0.26%	-0.27%
Services	0.09%	0.07%	0.11%	0.14%	-0.15%
Total	0.10%	0.07%	0.11%	0.15%	-0.14%
Grapes , Fruits & Veg.	-0.63%	-1.48%	-2.50%	-2.11%	3.58%
Other Agricultural Products	-0.86%	-1.52%	-2.49%	-2.23%	3.43%
Wine, Procesed Fruits&Veg.	-0.08%	-0.16%	-0.27%	-0.23%	0.35%
Other Food	-0.09%	-0.17%	-0.27%	-0.24%	0.36%
Rural Energy	0.42%	-0.19%	-0.38%	0.03%	-0.97%
Rural Tourist Serv.	0.63%	-0.26%	-0.53%	0.08%	-1.40%
Rural Civil Serv.	0.02%	-0.02%	-0.02%	0.01%	-0.03%

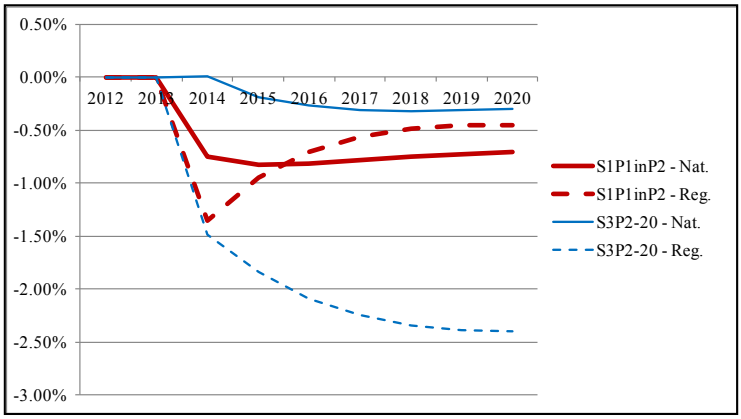
Source: own calculations

Table 6: Average production deviations from baseline (S0BSL) over 2014 - 2020.

		National	South Moravia		
			Regional	Rural	Urban
S1P1inP2	Secondary	0.04%	0.16%	0.17%	0.14%
	Tertiary	0.02%	0.08%	0.09%	0.08%
	Total	0.03%	0.08%	0.08%	0.09%
S3P2-20	Secondary	0.00%	0.19%	0.16%	0.23%
	Tertiary	-0.01%	0.10%	0.08%	0.12%
	Total	-0.01%	0.06%	0.00%	0.13%

Source: own calculations

Table 7: A comparison of the national and regional results: GDP deviations from S0BSL over 2014-2020.



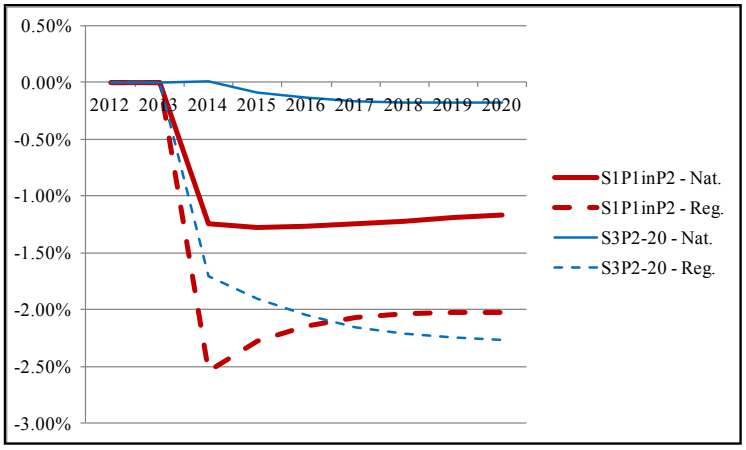
Source: own calculations

Figure 1: A comparison of the national and regional results: Agricultural GDP deviations from S0BSL over 2014-2020.

between the national model (negative GDP effects) and the regional model (positive GDP effects) are remarkable concerning both total economy and the tertiary sector. The explanation is not straightforward: it seems that while the regional economy benefits from releasing any resources from agriculture in the Rural-ECMOD model, the same does not hold for CZNATEC, and the similar tiny reduction of support to the services is not offset by the release of resources from agriculture there. Another interesting observation relates to the different responses on the sectoral level. It is apparent that the Rural-ECMOD generates slightly more pronounced effects than CZNATEC for the both scenarios.

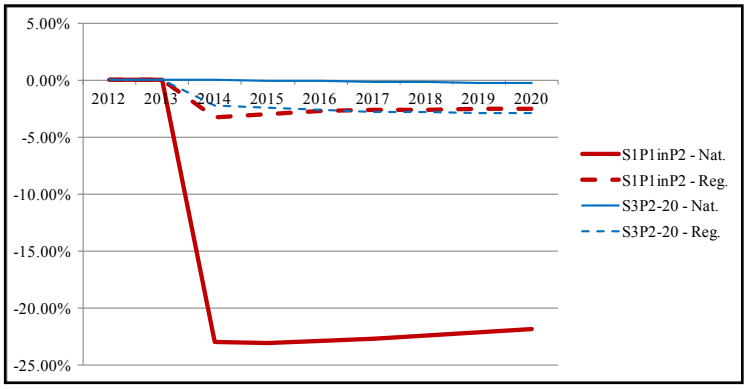
The effects on the agricultural GDP are more significant. Looking at Figure 1 we can see well similarities and differences in results of both models. Cutting direct payments is a shock for agricultural production which is not compensated by an increase in Pillar 2 budget (bold red lines). However, farmers gradually adjust to the loss of the direct payments and both models converge to the same long run effects in terms of the relative deviations from the baseline (S0BSL). Thus we can say that in the Rural-ECMOD model, investment activity compensates losses of direct supports rapidly, while in the CZNATEC, the process of adjustment is much slower. In contrast, in the budget cut scenario the results depart significantly in terms of the magnitude of the impact, while the curves exhibit very similar shapes. We can also see that CZNATEC reaction to the policy shock is delayed in the S3P2-20 scenario.

An interesting question is how do factor markets such as labour and land perform in the two models. Due to the flexible labour mobility among sectors, employment effects are of a higher importance than wages (their variations are absolutely negligible in both scenarios). The responses to the policy shocks are showed in the chart in Figure 3. The shapes of the response curves are similar to those in Figure 2, only magnitudes are different: for S1P1inP2 the deviations from baseline (S0BSL) are twice bigger in absolute terms for agricultural labour than for agricultural GDP; in contrast in S3P2-20, the deviations contract at the national level, while they stay almost constant at the regional level if we move



Source: own calculations

Figure 2: A comparison of the national and regional results: Agricultural employment deviations from S0BSL over 2014-2020.



Source: own calculations

Figure 3: A comparison of the national and regional results: Land rent deviations from S0BSL over 2014-2020.

from agricultural GDP to employment. This cannot be explained simply by the differences between the national and South Moravian economy, it rather indicates that shocks are treated differently in each of the applied models.

Since land is fixed in agriculture, only land rents respond to the farming sector performance. If direct payments are reduced by 10%, land rents drop – in the CZNATEC calculations really dramatically (Figure 4): almost nine times more than in Rural-ECMOD; again in terms of deviations from the baseline. In respect to Pillar 2 reductions, the land rent fall is very moderate in CZNATEC.

In the above comparison we could see some differences in the results of the models and the geographical levels of analyses. Some of these differences can be attributed to structural differences between the national and regional economies some of them are due to the model specifications. However, it does not seem that the results are inconsistent. In contrary, we can assert that applying these two models we can better mark the range of possible impacts of the planned policy.

The analysis also indicated that it is important to take into account regional differences when designing agricultural and rural development policies. From this point of view it will be very useful to carry out at least one additional regional model of the region which differs more substantially from the national average (e.g. Vysocina region).

Another challenge for the future will be to bring closer both models in respect to the response to investment shocks. Also, the over-sensitivity of CZNATEC in the land rent should be dealt with.

Acknowledgments

Research presented in this paper is the result of

a research grant MSM 6046070906 "Economics of Czech agricultural resources and their efficient usage within the framework of multifunctional agri-food systems", the Research Task TÚ 4241/2011of UZEI "Podklady pro pozici MZe pro vyjednávání o finanční perspektivě EU na období 2014 – 2020" conducted for the Ministry of Agriculture and CZERA project of the Ministry of Education, Youth and Sports (2010-2015, LM 2010010).

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Appendix

	S0BSL	S1P1inP2	S2P2-10	S3P2-20	S4P1inP2-20	S5AGRINV
Pillar 1 (DP)	106047	95442	106047	106047	95442	106047
Transfer to Pillar 2		10605			10605	
Pillar 2	60606	73493	54545	48485	60680	60606
Pillar 2 reduction			*10%*	*20%*	*20%*	
Modernisation of agricultural holdings	32094	38919	28885	25675	32133	52048
AEM, NHA payments	12225	14825	11002	9780	12240	8557
Support to rural areas	16287	19750	14658	13029	16307	8143
Diversification	6446	7817	5802	5157	6454	3223
Undertaking in rural areas	5116	6204	4604	4093	5122	2558
Rural infrastructure	4725	5729	4252	3780	4730	2362
Total CAP	166652	168935	160592	154531	156122	166652

Source: own calculations

Table 8: Policy expenditure in ,000 EUR - the region of South Moravia.

Name	NACE		Rural/Urban
Agriculture	1	A	U
Permanent crops, vegetable - family farms	1.2, 1.1.3	A	R
Permanent crops, vegetable - large farms	1.2, 1.1.3	A	R
Other agriculture, family farms	1 (the rest)	A	R
Other agriculture, large farms	1 (the rest)	A	R
Forestry	2	A	R/U
Processing and preserving of fruit and vegetables, wine production	10.3, 11.0.2	D	R/U
Other food processing and beverages	10, 11 (the rest)	D	R/U
Machinery, metal prod., electric.	24-31	D	R/U
Other manufacturing	13-23, 32, 33	D	R/U
Energy	35, 36	E	R/U
Construction	41-43	E	R/U
Trade (whole- and retailsale)	45, 46, 47	G	R/U
Hotels, restaurants	55-56	I	R/U
Transport and communications	49-53, 58-63	H	R/U
Financial, real estate and renting services,	64-82	K, L, M, N	R/U
Public administration, education, health and social security	84-87	O	R/U
Other services	90-96	R,S	R/U

Source: own calculations

Table 8: Policy expenditure in ,000 EUR - the region of South Moravia.

Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

Using Metadata Description for Agriculture and Aquaculture Papers

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Anotace

Článek pojednává o nejpoužívanějších metadatových formátech a tezaurech, které jsou vhodné pro popis vědeckých, výzkumných a odborných článků z oblasti zemědělství, potravinářství, vodohospodářství, životního prostředí a venkova. Jedná se o Dublin Core (DC), Metadata Object Description Schema (MODS), Virtual Open Access Agriculture and Aquaculture Repository Metadata Applicaton Profile (VOA3R AP) a AGROVOC. Na základě analýzy metadatových formátů v souladu s životním cyklem vědeckovýzkumného nebo odborného článku autoři doporučují, že každý takový článek by měl být bezprostředně po jeho publikování popsán metadaty, která efektivně charakterizují jeho obsah a vlastnosti. Jedním z nejvhodnějších metadatových formátu je VOA3R AP, vycházející částečně z DC, v kombinaci s tezaurem AGROVOC. Tím bude dosaženo efektivního popisu, zpřístupnění a automatické výměny dat mezi lokálními a centrálními repozitáři.

Klíčová slova

Metadata, element, článek, popis, tezaurus, AGROVOC, Dublin Core, VOA3R AP.

Abstract

The paper deals with the most used metadata formats and thesauri suitable for describing scientific and research papers in the domains agriculture, food industry, aquaculture, environment and rural areas. These include the Dublin Core (DC), Metadata Object Description Schema (MODS), Virtual Open Access Agriculture and Aquaculture Repository Metadata Application Profile (VOA3R AP) and the AGROVOC thesaurus. Having analyzed the metadata formats and research paper lifecycle, the authors would recommend that each paper should entail metadata description as soon as it is published. The metadata are to describe the content and properties of the paper. One of the most suitable metadata formats is the VOA3R AP that is partially patterned on the DC and combined with the AGROVOC thesaurus. As a result, an effective description, availability and automatic data exchange between and among local and central repositories should be attained.

The knowledge and data presented in the present paper were obtained as a result of the following research programs and grant schemes: the Grant No. 20121044 of the Internal Grant Agency titled „Using Automatic Metadata Generation for Research Papers“, the Grant agreement No. 250525 funded by the European Commission corresponding to the VOA3R Project (Virtual Open Access Agriculture & Aquaculture Repository: Sharing Scientific and Scholarly Research related to Agriculture, Food, and Environment), http://voa3r.eu and the Research Program titled „Economy of the Czech Agriculture Resources and their Efficient Use within the Framework of the Multifunctional Agrifood Systems“ of the Czech Ministry of Education, Youth and Sport number VZ MSM 6046070906.

Key words

Metadata, element, paper, description, thesaurus, AGROVOC, Dublin Core, VOA3R AP.

Introduction

Nowadays information and knowledge society is characterized by a growing number of information resources in all spheres of human activity. Therefore, the need for a systematic metadata description of the information content and properties has been increasing together with the need for making relevant metadata available. Metadata can be used to describe all electronic objects or database systems.

It means we can provide a description of a book, a picture, a piece of music, SW, a website or a research document. Metadata should describe objects in an unambiguous and appropriate manner (however, in some cases, it is not possible) (Ardo, 2010). Global metadata use is driven by technical or working teams and groups in industry, at universities, research bodies and institutes etc. Agriculture is a good example of application development and integration of the systems requiring structured data (Santos, 2012).

Aggregating metadata from various resources raises practical problems such as incompatibility of different metadata application profiles (AP) or metadata quality (Protonotarios, 2011). Local repositories containing scientific papers on agriculture, food industry, aquaculture, environment and rural development face more or less the same problems. In order to fulfil their mission and maintain a high quality standard, these local repositories have to seek and implement innovations in compliance with the latest technologies and information resources development so that their content can be unequivocally identified and meta-described with a view to content distribution.

Thanks to a dynamic computer and information science development, the field of ontology has been recently gaining popularity in research. In agriculture, the Food and Agriculture Organization of the United Nations (FAO) launched the Agricultural Ontology Service (AOS) in 2001. The AOS strives to serve as a reference initiative in the domain of agriculture (Wei, 2012). Ontology in agriculture should provide both scientists and farmers with the required level of information. The AGROVOC thesaurus serves as a starting point (basic vocabulary) for the creation of domain specific ontologies (Bansal, 2011).

Material and methods

There exist a lot of metadata formats and domain-specific thesauri describing various objects by specific elements. These have been developed within the framework of research projects, by communities or standardising bodies themselves. The following metadata formats and thesauri are the most used: Dublin Core (DC), Metadata Object Description Schema (MODS), Virtual Open Access Agriculture and Aquaculture Repository Metadata Application Profile (VOA3R AP) and AGROVOC.

Dublin Core

The Dublin Core is a metadata format that was primarily created for the sake of simple and general web resources description by authors themselves. The original set of 15 metadata elements was extended and refined within the Open Archive Initiative – Protocol for Metadata Harvesting (OAI-PMH) (Open Archive Initiative, 2008). It was then ratified as IETF RFC 5013, ANSI/NISO Z39.85-2007 standard and ISO 15836:2009 standard. The DC elements describe the most important data and properties of the document (Dublin Core Metadata Initiative, 2010).

Term name: Contributor	
Label:	Contributor
Definition:	An entity responsible for making contributions to the resource.
Comment:	Examples of a Contributor include a person, an organization, or a service. Typically, the name of a Contributor should be used to indicate the entity.
Term name: Coverage	
Label:	Coverage
Definition:	The spatial or temporal topic of the resource, the spatial applicability of the resource, or the jurisdiction under which the resource is relevant.
Comment:	Examples of a Contributor include a person, an organization, or a service. Typically, the name of a Contributor should be used to indicate the entity.
Term name: Creator	
Label:	Creator
Definition:	An entity primarily responsible for making the resource.
Comment:	Examples of a Creator include a person, an organization, or a service. Typically, the name of a Creator should be used to indicate the entity.

Figure 1: Overview of 15 DC elements metadata set (source: DCMI).

Term name: Date	
Label:	Date
Definition:	A point or period of time associated with an event in the lifecycle of the resource.
Comment:	Date may be used to express temporal information at any level of granularity. Recommended best practice is to use an encoding scheme, such as the W3CDTF profile of ISO 8601 [W3CDTF].
Term name: Description	
Label:	Description
Definition:	An account of the resource.
Comment:	Description may include but is not limited to: an abstract, a table of contents, a graphical representation, or a free-text account of the resource.
Term name: Format	
Label:	Format
Definition:	The file format, physical medium, or dimensions of the resource.
Comment:	Examples of dimensions include size and duration. Recommended best practice is to use a controlled vocabulary such as the list of Internet Media Types [MIME].
Term name: Identifier	
Label:	Identifier
Definition:	An unambiguous reference to the resource within a given context.
Comment:	Recommended best practice is to identify the resource by means of a string conforming to a formal identification system.
Term name: Language	
Label:	Language
Definition:	A language of the resource.
Comment:	Recommended best practice is to use a controlled vocabulary such as RFC 4646 [RFC4646].
Term name: Publisher	
Label:	Publisher
Definition:	An entity responsible for making the resource available.
Comment:	Examples of a Publisher include a person, an organization, or a service. Typically, the name of a Publisher should be used to indicate the entity.
Term name: Relation	
Label:	Relation
Definition:	A related resource.
Comment:	Recommended best practice is to identify the related resource by means of a string conforming to a formal identification system.
Term name: Rights	
Label:	Rights
Definition:	Information about rights held in and over the resource.
Comment:	Typically, rights information includes a statement about various property rights associated with the resource, including intellectual property rights.
Term name: Source	
Label:	Source
Definition:	A related resource from which the described resource is derived.
Comment:	The described resource may be derived from the related resource in whole or in part. Recommended best practice is to identify the related resource by means of a string conforming to a formal identification system.
Term name: Subject	
Label:	Subject
Definition:	The topic of the resource.
Comment:	Typically, the subject will be represented using keywords, key phrases, or classification codes. Recommended best practice is to use a controlled vocabulary.

Figure 1: Overview of 15 DC elements metadata set (source: DCMI) - continuation.

Term name: Title	
Label:	Title
Definition:	A name given to the resource.
Comment:	Typically, a Title will be a name by which the resource is formally known.
Term name: Type	
Label:	Type
Definition:	The nature or genre of the resource.
Comment:	Recommended best practice is to use a controlled vocabulary such as the DCMI Type Vocabulary [DCMITYPE]. To describe the file format, physical medium, or dimensions of the resource, use the Format element.

Figure 1: Overview of 15 DC elements metadata set (source: DCMI) - end.

Apart from the original 15-element metadata set, a few more elements (also called qualifiers) can be employed. These include:

- Accrual Method,
- Accrual Periodicity,
- Accrual Policy,
- Audience,
- Mediator,
- Instructional Method,
- Provenance
- Rights Holder.

Since 2000, the DC community has been aiming at the Application Profiles (AP) so that metadata records could employ the DC together with other specialized vocabularies. At the same time, the World Wide Web consortium (W3C) has been finalizing the generic metadata data model - Resource Description Framework (RDF). The DC has become one of the most spread and popular data vocabularies used with the RDF.

Metadata Object Description Schema

Metadata Object Description Schema (MODS) is a metadata schema developed and maintained by the specialists of the Library of Congress and MARC Standards Office. It entails a bibliographic element set that is designed primarily for library applications but may be also used for other different purposes.

The schema creation was incited by digital libraries and other communities that required a rich XML description, maintaining complex digital objects and integrating digital libraries metadata databases using MARC with different schemas. Firstly, the schema was intended as a kind of MARC subset using just different element names. In the end, an independent schema was born, carrying key elements from the MARC record but not entailing all MARC fields. On the other hand, it comprises some new elements.

MODS 3.4 entails 20 top level elements with optional attributes. These include (The Library of Congress):

titleInfo	note
name	subject
typeOfResource	classification
genre	relatedItem
originInfo	identifier
language	location
physicalDescription	accessCondition
abstract	part
tableOfContents	extension
targetAudience	recordInfo

Source: the Library of Congress)
Figure 2: Overview of 20 MODS 3.4 elements.

Virtual Open Access Agriculture and Aquaculture Repository Metadata Application Profile

Virtual Open Access Agriculture and Aquaculture Repository Metadata Application Profile (VOA3R Metadata AP) format is a European research project, based partially on the DC, striving to improve the description, spread, sharing and application of agriculture and aquaculture open access research results (N. Diamantopoulos, 2011). It comprises 31 elements in 9 categories. The VOA3R AP elements can be compulsory, strongly recommended, recommended or optional.

VOA3R platform is represented by XML and own terminological thesauri created in line with the recent semantic standards. One of the main VOA3R assets is a direct determination of abundant data

i.e. bibliographic citations. It also allows users to access a complete list of personal details (e.g. author-related) taking the vCard form.

AGROVOC

AGROVOC is a thesaurus that contains more than 40,000 entries in 22 languages and covers topics related to food, nutrition, agriculture, fishery, forestry, environment and other related domains. The AGROVOC is maintained by a global community of editors comprising librarians, terminologists, information managers and software developers. The AGROVOC is expressed in Simple Knowledge Organization System (SKOS) and published as Linked Data. The whole thesaurus is expressed in the concept system SKOS which is a data model for structured controlled vocabularies. The AGROVOC thesaurus schema employs three levels of representation:

- concepts represent abstract meanings and are often identified by URIs, e.g. corn as a cereal is identified by „Concept12332“,
- terms are language-specific forms e.g. corn, maïs, 玉米, or maize
- terms integrate special variants such as spelling variants, singular or plural form e.g. hen, hens, cow or cows.

This is how the abstract concepts/terms and the concrete meanings are related. The AGROVOC is therefore suitable for the description of research papers, information or news in the agrarian sector - Agricultural Information Management Standards.

Results and discussion

In the domain of research and science, the need for both metadata description and metadata access has been constantly growing. One of the main DC advantages is that it allows digital documents authors to make a semantic description of their documents, websites and other digital objects without being specialist in the field and without mastering other purpose-related methods and standards.

The MODS metadata format is suitable for describing publications and library repositories categorisation. The MODS format has the following advantages over other schemes: it is compatible with other tools, especially with the library system MARC 21 and the Dublin Core. It also allows the conversion of these tools to MODS, which removes potential barriers. It also eliminates (by means of a suitable combination) the inconveniences of MARC 21 (excessive complexity, lack of syntax as numeric tags are used) and at the same time extends the Dublin Core (it entails a range of basic elements and a number of sub elements).

VOA3R Metadata Application Profile with an integrated AGROVOC thesaurus is one of the most suitable and viable metadata formats for the paper description in agriculture, aquaculture, food industry, environment and rural development.

Title Info

Title

The Title element should clearly represent the paper as an electronic resource. This element is compulsory. Obviously, it is a name given to papers, a name by which the resource is formally known. In this element, the name should be introduced in the language of origin, including all the translations. If the paper title includes more languages at the same time, there is an independent element with the language marked introduced. The subtitle should be also saved in the Title element while using a gap hyphen gap format, i.e. „ - „ between the title and subtitle.

Alternative title

The Alternative Title element should be used only in case the paper is also known under a different name, including abbreviations or acronyms. However, this element should not be used for translations of the title or subtitles. This element is optional. Nevertheless, when the content exists, it should be considered compulsory.

Responsible body

The Responsible body category comprises all elements containing information about persons that exercise their influence on the paper content during any phase of its lifecycle. These include the creator (author), contributor and publisher.

Creator

The present element describes the author of paper‘s intellectual content. Therefore, it can be a person, an institution or a service. The Creator element should include author‘s name, or as the case may be organization‘s name and/or author‘s URI and/or a reference to the resource describing the author. In case of concrete persons, we always start with their surname, comma and then the first name (full or initials) or other names, e.g. „Šimek, Pavel“ or „Šimek, P.“.

In case there are more authors, the order of elements should reflect their formal hierarchy, i.e. the first author is considered as the main one and the others as co-authors.

VOA3R AP regards the Creator element as strongly recommended and as compulsory in case of research papers.

Contributor

The Contributor element characterizes the persons, institutions or services that contributed to the paper content. In case there are more contributors, the element is repeated and can include e.g. students' tutors, readers, reviewers etc. This element is recommended for research papers.

Publisher

The Publisher element saves information on the person, service or institution that provides access to the paper, respectively published the paper. The element is strongly recommended in order to identify the publishing entity (both commercial and non-commercial), not to identify the author's institution. In case of Publisher research papers, the element should be compulsory.

Physical characteristics

Physical characteristics of a published paper should be described with a view to the date of publishing, identifier, languages and paper resource format.

Date

The Date element (compulsory) entails time information related to paper publishing. When this entry is not available, a date when the paper was made accessible should be indicated. The format is to be in line with the W3C Date Time Format (W3CDTM):

- year format YYYY, e.g. 2012,
- month and year format YYYY-MM, e.g. 2012-09,
- a complete date format YYYY-MM-DD, e.g. 2012-09-30,
- a complete date, including the hour and minute format YYYY-MM-DDThh:mmTZD, e.g. 2012-09-30T08:30+1:00,
- a complete date, including the hour, minute and second format YYYY-MM-DDThh:mm:ssTZD, e.g. 2012-09-30T08:30:25+1:00 a
- a complete timestamp format YYYY-MM-DDThh:mm:ss.sTZD, e.g. 2012-09-30T08:30:25.45+1:00

(World Wide Web Consortium, 1997)

Language

The Language element is compulsory and saves information on all languages used in the paper. If there are more languages used, this element is repeated for each and every language. The language is expressed according to ISO639-2, e.g. eng for English or cze for the Czech language.

Identifier

The Identifier element saves a string, an unambiguous reference to the paper resource. For indentifying the resource, formal identification systems can be used, i.e. Uniform Resource Identifier (URI), including Uniform Resource Locater (URL), Digital Object Identifier (DOI) an International Standard Book Number (ISBN). This element is strongly recommended. However, for a research paper, it should be compulsory.

Format

The Format element identifies information on the medium (file format) used to make the paper content available. If a paper is available in multiple formats, a separate Format element is used. The element content is encoded according to Internet Media Types MIME, e.g. application/pdf format for PDF, text/html for an HTML format, text/xml for XML etc. This element is strongly recommended and it should be considered compulsory in case of open access or after publishing the paper.

Location

The resource location is important in order to retrieve the paper for the sake of information exchange.

isShownBy

This element includes an unambiguous URL referring to a paper resource and enabling the user to read it or play it. This element should be independent of the fulltext version location.

isShownAt

The isShownAt element is used to save the unambiguous URL referring to the fulltext paper in a concrete format. Both elements (isShownBy and isShownAt) are strongly recommended and at least one of them should be considered compulsory in case of open access publishing.

The differences between the two elements are the following:

isShownBy: http://www.domena.cz/archiv/2012/01

isShownAt: http://www.domena.cz/archiv/2012/01/clanekXY.pdf

Subject

The Subject category comprises only one element of the same name. This category deals with information connected to the topic of the resource. Typically, the subject is represented using paper topic, classification, keywords or key phrases.

Subject

The Subject element serves to describe the paper topic by means of classification codes, keywords or key phrases. Keywords that are not created or controlled by thesauri are separated using a semicolon character. While writing a research paper related to the domains of agriculture, food industry, aquaculture, environment and rural areas, the AGROVOC thesaurus should be used for keywords. Each keyword from the AGROVOC thesaurus has its own Subject element that is compulsory for papers. URIs to concrete AGROVOC identifiers or keywords corresponding to the AGROVOC thesaurus are inserted in this element.

Description of content

The Description element characterizes the description of two main kinds. These are:

- description related to the content, i.e. description, abstract, references
- description related to the nature or genre of content resources.

Description

The Description element entails a complementary paper description by means of a text describing the paper resource or content or a link to a graphic representation, audiofiles etc. This element is recommended.

Abstract

This element includes the paper abstract and should not be confused with the Description element. From the point of view of a research paper, this element is compulsory.

Type

The Type element is related to the nature/genre of the resource referring to the paper. The present element is compulsory and it can take the following forms:

- Publication Collection
  - Book
  - Journal
  - Conference proceedings
  - Magazine
- Publication Item
  - Book section
  - Journal contribution
    - Article
    - Review
    - Editorial
    - Letter
    - Note
  - Conference contribution
    - Paper
    - Poster
    - Presentation
  - Magazine article
  - Thesis
    - Bachelor thesis
    - Master thesis
    - Doctoral thesis
  - Research report
  - Standard
- Resource
  - Learning resource
  - Multimedia resource
  - Data set
- Event
  - Conference
  - Project
- Other

In case of a paper published in a scientific journal, we deal with the Article Type (Publication item – Journal contribution – Article).

Bibliographic citation

This element is used to encode information concerning bibliographic citations. The recommended best practice is to use the BibTex. Nevertheless, the APA or OpenURL ContextObject can be also used following the Guidelines for Encoding Bibliographic Citation Information

in Dublin Core Metadata DCMI. The VOA3R AP rates the Bibliographic citation element to the recommended ones. However, in case of a research paper, this element is to be compulsory.

Rights

The Rights category comprises information about intellectual property rights held in and over the resource, including the resource use and access.

Access rights

This element contains information concerning access rights after the paper was published (open access, closed access, paid or restricted access). In order to describe the access rights, the recommended practice is to use the Eprints AccessRights Vocabulary Encoding Scheme. After the paper was published, the Access Rights element should be compulsory, taking the following effects:

- Open Access (the paper/article is freely available on the Internet)
- Restricted Access (the paper/article is available on the Internet but the access to fulltext version is restricted or controlled)
- Closed Access (the paper/article is available on the Internet but the access to fulltext version is restricted or controlled)

License

The License element contains detailed information concerning the terms of use and distribution. The Creative Commons license is considered to be the best practice for the purpose given. It entails the following CC licenses and their combinations:

- Attribution
- Share Alike
- No Derivatives
- Non-Commercial
- Non-Commercial Share Alike
- Non-Commercial No Derivatives

Rights

The Rights element includes the name of a copyright holder, e.g. name of a publisher. The copyright statement is a legal measure concerning the terms of use. While publishing a research paper, this element can be considered compulsory.

Status

This category entails information on article properties related to the review and publishing process.

Review Status

This element – compulsory for research papers - informs users on the review process using the following statuses:

- Non-reviewed (the paper has not been reviewed)
- Peer Reviewed (the paper went through the review process)
  - Accepted (paper accepted for publication in the review process)
  - Rejected (paper rejected in the review process)
- Community Reviewed (paper reviewed by a community of practice)
  - Commented (paper commented by a community of practice)
  - Rated (paper was community rated)

Publication status

The present element gives information on the publication status and should be considered compulsory for publishers. It entails the following statuses:

- Working Draft
- Final (final version)
- Submitted (pre-print version)
- Published

Relation

Data saved in the Relation category are important for resource location and content information retrieval. Properties related to resource location are represented by the isShownBy and isShownAt elements (see above). Other metadata elements regarding various relations are incorporated in the Relation category.

Relation

This element relates articles to other resources by means of relevant references. Related resources are indentified using a string or a number conforming to a formal identification system, e.g. URI, URL, DOI etc. These relations can be used also for identifying different versions, translations etc. The Relation element is optional.

Conforms to

The Conforms element was designed to enhance relations and is used to describe references to

a document informing on the standard used while creating an article or the standard referenced in the content. This element is optional.

References

The References element also strives to enhance or refine relations. It is used for references, in-text citations or other resources used in the article. This element is optional too.

Is referenced by

An optional element used for the sake of relating a published article as a resource for other articles that quote it or draw from its content.

Has part of

The „Has part of" element saves URIs to identify the resource the parts of which (physical or logical) were inserted in the article. This element is optional.

Is part of

The „Is part of" element saves URIs to identify the document that includes a part or parts of the published article (physical or logical). This element is optional.

Has version

The „Has version" optional element saves URIs to identify different versions, modifications, adaptations etc. of the article described.

Is version of

If the article described in VOA3R is a certain version, modification or adaptation of a different document, the URI to identify the latter document should be saved in this element.

Has translation of

This optional element describes URIs identifying different article translations.

Is translation of

If the article, i.e. a research paper, described in VOA3R is a translated version, the URI identifying the original document is saved in the „Is translation of" element.

Has meta-metadata

The „Has meta-metadata" element identifies (by means of URIs) the source of metadata for the article described. Unlike all other elements in this category, it is recommended according to VOA3R AP specification.

Metadata for agents

While talking about research papers or specialist articles, the recommended best practice is to describe also entities that are involved in the paper lifecycle and exercise their influence on it. These are the so-called agents, including concrete persons, institutions, organizations or services.

Name

The „Name" element (compulsory) describes the name of an agent or an organization that is part of agent's description – an author, a contributor or a publisher.

Person

If this agent is a concrete person, his/her surname, name, or as the case may be also his/her mailbox should be introduced. Name and surname elements are strongly recommended while the mailbox one is recommended. In case of a research paper, the description would take the following form:

```
<dcterms:creator>
    <foaf:Person>
        <foaf:firstName xml:lang="en">Pavel</
          foaf:firstName>
        <foaf:lastName xml:lang="en">Simek</
          foaf:lastName>
    </foaf:Person>
    <foaf:Person>
        <foaf:firstName xml:lang="en">Vanek</
          foaf:firstName>
        <foaf:lastName xml:lang="en">Jiri</
          foaf:lastName>
    </foaf:Person>
</dcterms:creator>
```

MARC Relation Properties

The above-mentioned Metadata for agents can be replaced by edt, rev and trl MARC Relation Properties in Dublin Core Metadata.

MARC Relation Properties

The above-mentioned Metadata for agents can be replaced by edt, rev and trl MARC Relation Properties in Dublin Core Metadata.

Edt

This recommended element describes editor's relation to the intellectual content of an article. The information is expressed by means of a vCard or a URI.

Rev

This recommended element describes reviewer's relation to the intellectual content of an article.

The information is expressed by means of a vCard or a URI.

Trl

This recommended element describes translator's relation to the intellectual content of an article. The information is expressed by means of a vCard or a URI.

Research

In order to both enhance and refine the description of research and scholarly papers, the Research elements characterising in detail the domain, procedures, methods, instruments etc. are the most suitable and recommended.

Object of interest

The „Object of Interest" element is used in order to specify the research domain or field of the paper. This element is recommended. However, it should be considered compulsory for research papers and the best practice is to use the AGROVOC thesaurus. The present element comprises URIs to concrete AGROVOC identifiers or keywords corresponding to the AGROVOC thesaurus.

Variable

The „Variable" element describes research objects (or measurement objects) that constitute the topic of the paper. The information can be text-based or vocabulary or thesaurus-based, e.g. the AGROVOC can be used. The description is similar to the „Object of Interest" element.

Method

The „Method" element (recommended) describes the procedures and methods used in the research the paper deals with. It is recommended to use a free text form e.g. weighted sum approach.

Protocol

„Protocol" is a recommended element that – by means of a free text – provides information on standardised methods used to create and process research data.

Instrument

This recommended element provides information on data mining tools and instruments used in the research described.

Techniques

The present recommended element provides descriptions of the data mining and data processing techniques that were used in the research the paper aims at.

Conclusion

Recently, a number of central repositories, e.g. citation databases, have been implementing various metadata harvesting mechanisms and it can be assumed that these mechanisms will be strictly required in near future. Moreover, it is very likely that local repositories will be forced to employ a quality metadata content description and metadata harvesting system. Most leading citation databases consider metadata, or as the case may be metadata harvesting systems, conditional for integrating or monitoring the repository.

Based on the analysis of metadata formats related to the lifecycle of a research paper in agriculture, food industry, aquaculture, environment or rural development, the authors would recommend to describe each paper by metadata that clearly identify its content and properties. This meta-description should be done as soon as the paper is published. VOA3R AP is one of the most suitable metadata formats in this domain. It is partially patterned on the Dublin Core and combined with the AGROVOC thesaurus. The first metadata set should be created by paper authors themselves (e.g. abstract, keywords etc.) while publishers should be in charge of the second metadata set (information on the review process status, publisher, copyright etc.). An overview of metadata creators, element statuses and AGROVOC thesaurus use is given in Fig. 3 – Fig. 6 below.

Element	Source	Note	Status
abstract	dcterms		comp.
bibliographicCitation	dcterms		comp.
creator	dcterms		comp.
description	dcterms		comp.
objectOfInterest	voa3r	AGROVOC	comp.
subject	dcterms	AGROVOC	comp.
title	dcterms		comp.
variable	voa3r	AGROVOC	comp.
edt	marcrel		recom.
hasMeta-metadata	voa3r		recom.
instrument	voa3r		recom.
method	voa3r		recom.
protocol	voa3r		recom.
techniques	voa3r		recom.

Figure 3: Compulsory and recommended elements – author.

Element	Source	Note	Status
alternativeTitle	dcterms		opt.
conformsTo	dcterms		opt.
hasPartOf	dcterms		opt.
hasTranslationOf	voa3r		opt.
hasVersion	dcterms		opt.
isPartOf	dcterms		opt.
isTranslationOf	voa3r		opt.
isVersionOf	dcterms		opt.
references	dcterms		opt.

Figure 4: Optional elements – author.

Element	Source	Note	Status
accessRights	dcterms		comp.
date	dcterms		comp.
format	dcterms		comp.
identifier	dcterms		comp.
licence	dcterms		comp.
publicationStatus	voa3r		comp.
publisher	dcterms		comp.
reviewStatus	voa3r		comp.
rights	dcterms		comp.
type	dcterms		comp.
isShownBy	ese		recom.
rev	marcrel		recom.

Figure 5: Compulsory and recommended elements – publisher.

Element	Source	Note	Status
language	dcterms		comp.
contributor	dcterms		recom.
name	foaf		recom.
person	foaf		recom.
isReferencedBy	dcterms		opt.
relation	dcterms		opt.
trl	marcrel		opt.

Figure 6: Shared elements - authors and publishers.

If all authors and publishers add at least compulsory (or as the case may be also recommended or optional) elements during the research paper lifecycle, these papers or articles will be very well meta-described from the viewpoint of their content and properties. As a result, the searching efficiency over local repositories and automatic metadata harvesting for the sake of central repositories or citation databases will improve significantly.

Acknowledgements

The knowledge and data presented in the present paper were obtained as a result of the following research programs and grant schemes:

Grant No. 20121044 of the Internal Grant Agency titled „Using Automatic Metadata Generation for Research Papers“.

Grant agreement No. 250525 funded by the European Commission corresponding to the VOA3R Project (Virtual Open Access Agriculture & Aquaculture Repository: Sharing Scientific and Scholarly Research related to Agriculture, Food, and Environment), http://voa3r.eu.

Research Program titled „Economy of the Czech Agriculture Resources and their Efficient Use within the Framework of the Multifunctional Agrifood Systems“ of the Czech Ministry of Education, Youth and Sport number VZ MSM 6046070906.

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

Determinants of Ruminant Meat Demand among Different Income Groups in Maiduguri, Borno State Nigeria

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Abstract

This study analyzed the determinant of meat demand among income groups, using multiple regression. Data for the study were obtained from 180 respondents, selected in six (6) wards through stratified random sampling, representing the three income groups, namely low, middle and high earning ≤ N15000, N15, 001-N30, 000 and ≥ N30, 001 respectively. Further more, 30 households each were purposively selected from the six (6) areas making a total of 180 households for the study. This study was restricted to ruminant meat products (cattle, goat and sheep) demand among households in Maiduguri Urban area and covered the period of May-June, 2010. The findings showed that 89.02% of the households were male headed, with 38 years as the mean age, while 77% had one form of formal education or another. The mean household size was eight, while the mean monthly income was N23,843. The multiple regression results revelled that gender was insignificant determinant of expenditure on ruminant for all the income groups, and was negatively related to high income group. However, the coefficients of gender were positive for low and middle income groups. Household size and income had positive coefficients and were significant at 1% level for all the income groups. Age had positive coefficients for all the income groups and was significant at 1% for middle income group. On the contrary it was not significant for low and high income. Educational level of the respondents had positive coefficients for all income groups and was significant at 1% level for low and middle income groups but was insignificant for high income group. The study recommended policies to improve improved income redistribution and the enhancement of the purchasing power of the poor.

Key words

Determinants, ruminant meat demand, income groups.

Introduction

Meat has always stayed as a rich source of food in terms of taste, nutrients and also medicinally at times. The advantages of having meat are helpful to younger people in the process of growth and they reach the elder ones as well. The invaluable source of food, has been serving the people from times immemorial. The alarming sources of the health, nutrients etc can find answers in meat eating. Out of a large number of health benefits of eating meat, its contribution as a fabulous source of high quality proteins is remarkable and it is to be noted. This cannot be given or substituted by even a single vegetarian food. Meat holds all the required amino acids that the body needs to maintain a balance (Asai, 2007).

The pattern of meat demand has been undergoing dramatic changes over the years worldwide (Eales and Unnevehr, 1988; Molina, 1994). The demand for goat meat outpaces the supply in the United States of America. Producers simply cannot keep up as demand has currently doubled the domestic production (Coffey, 2006). This is thought to be triggered by the influx of new immigrants into the United States of America in recent years. Similarly Abdulai et al (1999) reported that recently demand for meat has increased among urban educated household heads with small family size in India. Contrary to this Malaga, et al (2009), asserted that meat demand has increased among household with large families in Mexico. This is because as the number of members living in the household increased, purchases for all types of meat also increases.

In Africa livestock raising in many areas of sub-Saharan Africa (SSA), is an important economic activity from which food (meat, milk) and non-food commodities (manure, traction, hides and skins, wool etc.) and cash income are derived. Meat is one of the most important livestock products. In 1975, meat accounted for about 47% of the gross

value of total SSA livestock output (Addis Anteneh et al, 1988). In Nigeria, ruminant animals serve as a good source of protein in humans, foreign exchange earning, employment opportunity and contributes to Gross Domestic Product (GDP) of the country (Okoruwa, Chebe and Amaza, 1999).

Borno state is one of the major livestock producers in Northern Nigeria and a producer of about twenty five percent (25%) of the livestock population in Nigeria (Balami, et.al., 1999).Out of the estimated population of 12 to 15 million cattle in Nigeria, the state produced 3.1 million in 1995 (Borno state directorate of statistics, 1998).

Olayemi (1998) revealed that food demand and energy intake in the northern part of Nigeria (Borno state inclusive) revolve largely around cereal group, livestock and fish products. Most households demand more beef, then fish, milk, egg, chicken, mutton and goat's meat. Most households in the higher income group demand mostly chicken, eggs and milk, while the poorer households demand more fish and beef. Despite the high supply of ruminant meat by the state and its importance to humans, it was still reported by Zongoma (2003) that consumption of beef is low in Maiduguri. It is clear that many factors have influenced meat demand pattern such as (gender, age, educational level of household head, household size, income level etc). An understanding of these factors is very important for assessment of the agricultural products market. A lot of research works have been done in the study area on beef expenditure and socio-economic factors affecting beef consumption.

This study was a deviation because it was designed to capture the determinants of ruminant meat demand among different income groups in Maiduguri, Borno state Nigeria. The specific objectives of the study were to:

i. examine the socio-economic characteristics of the respondents in the study area; and

ii. determine the effects of the respondents' socio-economic characteristics on ruminant meat products demand.

Materials and Methods

Both Primary and secondary sources were used for the study. The primary data were collected through the use of structured questionnaire. Data were collected on socio-economic characteristics of households such as gender, age, educational level, household size and monthly income. The secondary sources of information used included journal articles, conference proceedings and seminar papers. These were used for the compilation of the work.

Sampling Procedure

The population for the study included all the households in Maiduguri. The study area was stratified according to high, medium and low residential areas. These represent the three income groups of the households. Six (6) wards were purposely selected (Shehuri north and Hausari representing low income group, Federal low-cost of Bolori 1 ward and Dagash quarters of Gamboru ward representing middle income group, while New GRA of Mesandari and Unimaid quarters of Mairi ward represented high income group). The monthly income was grouped into earners of ≤ N15000, N15,001- N30,000 and ≥ N30,001 respectively. Thirty (30) households each were purposively selected from the areas, making a total of 180 respondents for this study.

Analytical Techniques

The analytical techniques employed for the study include descriptive statistics such as mean, frequency distribution and percentages, to present the socio-economic characteristics of the respondents while multiple regression technique was used to determine the effects of socio-economic characteristics affecting ruminant meat demand. The model is implicitly specified as:

$Y = f(X_1, X_2, X_3, X_4, X_5, U)$,

where,

Y = Value of meat products demanded by households measured in Naira (N) per month

X1 = Gender of respondents measured by dummy variable (male = 1, female = 0)

X2 = Age measured in years

X3 = Level of education measured in number of years spent in formal school

X4 = Household size measured in number of people in the house

X5 = Income level measured in Naira (N)

U = Error term.

Different four functional forms, namely, linear, semi-log, double-log and exponential were fitted.

Double-log function was chosen as the most fitted for the analysis for all the three income groups, based on the coefficient of determination (R^2) significance and signs of the a priori expectations. The explicit is specified as:

$\text{Log } Y = a_0 + b_1\text{log}x_1 + b_2\text{log}x_2 + b_3\text{log}x_3 + b_4\text{log}x_4 + b_5\text{log}x_5 + e$,

where,

Y = dependent variable

a_0 = Intercept

b_i = Regression coefficients of the independent variables

X_i at $_i$ = 1, 2,3,4,5.

X_1 = Gender of respondents measured by dummy variable (male =1, female =0)

X_2 = Age measured in years

X_3 = Level of education measured in number of years spent in formal school

X_4 = Household size measured in number of people in the house

X_5 = Income level measured in Naira (N)

e = Error term.

Results and Discussion

Socio-economic characteristics of the Respondents

Socio-economic characteristics differ significantly among households and income groups and have strong influence on ruminant meat demand. The socio-economic characteristics studied include gender, age, years spent in formal education; household size and monthly income. The results are presented in table 1.

The findings reveal that a total of 89.2% were male respondents in the three income groups, suggesting male dominance as household heads in the study area. This is not surprising considering the fact that the study area is located in the northern part of the country, where it is viewed as a conservative society, with family structures that are largely patrilineal. More so, the males dominate marketing due to the cultural factor that encourages them to

Socio-economic Variables	Income Groups (%)			Total (%) Mean	
Gender	**Low**	**Middle**	**High**		
Male	30.06	29.48	29.48	89.02	0
Female	2.89	2.89	5.2	10.98	
Age					
18-30	7.51	8.09	4.01	19.61	38
31-43	21.4	17.35	15.61	54.36	
44-56	3.47	5.78	14.45	23.7	
≥ 57	0.58	1.17	0.58	2.33	
Formal Education					
No formal education	7.51	6.94	8.67	23.12	0
Primary education	10.41	11.56	5.2	27.17	
Secondary	8.67	11.56	3.47	23.7	
Tertiary education	5.78	2.31	17.92	26.01	
Family Size					
≤ 6	16.76	17.34	14.45	48.55	8
7-13	13.29	11.56	12.72	37.57	
14-20	0	3.47	5.78	9.25	
≥ 21	2.89	0	1.74	4.63	
Monthly Income					
N5,000- N15,000	34.95	0	0	0	N23, 843
N15,001-N30,000	0	32.54	0	0	
N30,001-N45,000	0	0	12.01		
≥ N45,001			20.51		

Table 1: Socio-economic characteristics of the Respondents (n=180).

go out to purchase materials needs of the family Akinleye (2009).

The results also show that the mean age of the respondents was 38 years. Majority of the respondents 54% were in the age group of 31 to 43 years. A total of 82% of the respondents were in their active age to support demand for ruminant meat in their respective households. This falls within the range of active age identified by FAO (1992). Food intake and expenditure vary with age because of physical activities. This implies that age is directly related to the ability of household head to demand for ruminant meat for the older the household head the higher the possibility of the household to have low access to ruminant meat. Younger-headed households are expected to be more aware of the importance of the ruminant meat as a source of protein in the body due to reading health columns in the news papers, listening to health programmes on radios etc.

Analysis of the educational background reveals that a total of 76.88% had one form of formal education or the other. A similar range was reported by (Adeoye et al., 2010). The educational background of consumers is a very important determinant for ruminant meat demand. High literacy level could impact significant influence and variation on ruminant meat demand among households as well as a guide to the consumer on the nutritional importance or its health consequences.

Household size with the highest frequency was between zero and six persons constituting a total of 49% for the three income groups. Similar range was reported by Lesiba and Robert (2007). This suggests that household size is expected to vary directly with ruminant meat demand. The larger the household size, the more ruminant meat is demanded. Taste and preferences of household members could also determine the quality of meat demand. Thus, demand of different families based on different income groups are likely to vary with taste and other specific characteristics. In addition, married households with children are more likely to purchase meat items than all other households, indicating a greater preference for the family meal-eating occasion (Raghavendra et al., 2009).

From table 1, households earning N5,000- N15,000 monthly constituted the highest (34.95%). The mean monthly income was N23.843. Those earning low income were higher when compared with those in the other income groups, reflecting the generality of wealth inequality in the study area. Income is one of the major determinants of demand and budget share allocation among households. Income is expected to have a positive and significant effect on ruminant meat expenditure. However, the effect of income on meat expenditure decisions is expected to decline over time. This is because the more income increases the more income effect declines in magnitude.

2. Effects of Socio-economic Characteristics on Ruminant Meat Products Demand

Multiple regression technique was also used to determine the socio-economic factors that affect ruminant meat expenditure among the three income groups. Double-log function was chosen as the lead equation because it had the highest value of magnitude (R^2) and conformed to the a priori expectations, for all the three income groups. The coefficients and the significant levels are presented in table 2.

Analyses of the results show that gender of the respondents (X_1) was an insignificant determinant of expenditure on ruminant meat for the three income groups. The coefficient of gender for high income group was negative. This suggests that ruminant meat expenditure by male household head was less when compared with other income groups. It also means that the higher the income of the household head in this group the less he expends on ruminant meat. The reason for this could be because as income increases, the income effects declines in magnitude considering the fact that the income in this group is high. It is also not necessary for the household head in this group to increase demand for ruminant meat when income increases, he could switch to other healthier substitute goods or save the money for future purposes. On the other hand, the coefficients for the low and middle income groups were positively related to expenditure on ruminant meat items. This implies that the male household heads in these income groups expend more on ruminant meat. This also means the higher the income level of the household head the more his expenditure on ruminant meat demand. This is still attributed to the fact that ruminant meat is a normal good which means its demand increases with increase in income and if the household head has constant flow of income, it could encourage him to increase his expenditure on ruminant meat.

The coefficients of age (X_2) for low and high income groups were insignificant, while it was significant at 1% for middle income group. On the other hand, positive relationship existed between age and expenditure on ruminant meat for all the three income groups. The positive relationship implies

Variables	Coefficients	Std. Err.	T-value	P-value
Low Income Group				
Constant	5.402596	0.7381425	7.32	0.000*
Gender	0.00226	0.0303646	0.07	0.941^{NS}
Age	0.0142609	0.0150642	0.95	0.351 ^{NS}
Education	0.1121605	0.0213709	5.25	0.000*
Household size	0.2629077	0.0878595	2.99	0.005*
Household Income	1.204605	0.2658198	4.53	0.000*
R^2				**0.87**
Middle Income Group				
Constant	1.141156	0.4157775	2.74	0.007
Gender	0.0185755	0.0145515	1.28	0.205 ^{NS}
Age	0.0723262	0.0132219	5.47	0.000*
Education	0.0713327	0.0070999	10.05	0.000*
Household size	0.0364076	0.0120139	3.03	0.003*
Household Income	0.4030929	0.0461745	8.73	0.000*
R^2				**0.96**
High Income Group				
Constant	9.267709	0.5479867	16.91	0.000*
Gender	-0.0462203	0.04507	-1.03	0.315 ^{NS}
Age	0.0669441	0.0930184	0.72	0.478 ^{NS}
Education	0.0766754	0.060189	1.27	0.214 ^{NS}
Household size	0.0483136	0.0154305	3.13	0.004*
Household Income	0.2510018	0.0635965	3.95	0.000*
R^2				**0.96**

* = Significant at 1%; NS = Not significant at the specified level

Source: Regression Extract, 2010

Table 2: Regression estimates of Socio-economic Factors affecting Ruminant Meat Demand.

that as age increases ruminant meat expenditure increases too. The reason for this could be due to the fact that most (17.35) which is equivalent to 53.57% of the respondents in the middle income group were between the age group of 31 to 40 years as seen from Table 1. Hence, they could support expenditure on ruminant meat. This means that for the household heads to be economically in-active it would take a very long time and if the household heads in this group have constant flow of income and are well informed about the importance of ruminant meat to health they would expend more on it. However, support for ruminant meat demand decreases with increase in age, when the consumers are no longer in their active productive age. The insignificance of the coefficient could be attributed to the fact that low income group expend less giving their income level, while the high income group expend less or small fraction of their income when compared with their total monthly earnings.

The results reveal that educational level (X_3) was a good determinant of expenditure on ruminant meat for low and middle income groups at 1% level, but contrary for high income group. Positive relationship, however, existed between literacy level and expenditure on ruminant meat for all the three income groups. This means that as the level of education of the consumer increases, expenditure on ruminant meat also increases. Ceteris paribus, a literate consumer would likely be conscious of the nutritional importance of ruminant meat hence, demands more. The insignificance means educational level was not a determinant of expenditure for high income group. From table I, it can be seen that about 17.92% which is equivalent to 50.82% of the respondents in this group had tertiary education, this could mean there are health conscious and have negative perception of the consequences of ruminant meat. Hence, less was expended on ruminant meat.

Analyses of the results show that resident household size (X_4), for all the income groups were

positively related to expenditure on ruminant meat and significant at 1% level. This implies that the more the resident household size of the consumer, the more likely his expenditure on ruminant meat would increase. All things being equal, household size varies directly with expenditure on ruminant meat. A household with many residents would probably expend more on ruminant meat, leading to a positive relationship. From table 1, it can be seen that about 48.55% of the respondents had family size between six (6) and below, an addition of one or more persons could not affect them, with or without increase in income or fall in prices of ruminant meat in question. In addition, ruminant meat is an important source of protein and when compared with chicken it is a bit cheaper in terms of per Naira price and more in terms of quantity, it's demand would add to the body nutrients. Therefore, a family with educated household head would demand for ruminant meat in other to benefit from such nutritional importance. Also taste and preferences of household members could determine the type of meat to be demanded.

Household income (X_5) was positively related to expenditure on ruminant meat at 1% level for all the three income groups. This implies that the higher the income level, the higher the expenditure on ruminant meat. Ceteris paribus, income is one of the major determinants of budget share allocation among households. Ruminant meat is a normal good; therefore, the positivity of the coefficients means consumers will increase their expenditure on ruminant meat so long as incomes increase. The coefficient of income for low income group was the highest followed by middle then high income group. This is attributed to the fact that ruminant meat is a luxury good which is a bit costly, however, low income group allocated greater fraction of their income on ruminant meat demand , hence a greater portion of their income is taken by it's demand. For middle income households there income is a bit reasonable, therefore, the fraction of their income dedicated was not as high as that of low income group. However, high income group allocated small fraction of their income when compared with their actual monthly earnings, hence the coefficient for this income group was low. The decline in the high income group suggests that there is a limit to the amount of extra money consumers spend on food (ruminant meat inclusive), when their incomes increase, they are to budget some portion of their income for other necessities of life including savings.

Conclusion and Recommendations

It is evident from the results of the study that socio-economic characteristics vary differently among income groups and have strong influence on variation of ruminant meat demand. The results indicate that low income group is characterized by household heads (56.4%) that are between the age group of 18-43 years. Also with majority (87.7%) having either no formal education or only primary certificate and a Family size of six and below constituting about (50.88%). The middle income group is characterized by household heads that are between the age group of 18-43 years , which constitute 78.57% with majority (57.15%) having either no formal education or only primary certificate and have a Family size of six and below constituting about (52.6%). However, the high income group is characterized by large families of seven and above, mostly literate (60.66%) having either secondary or tertiary certificates with the majority in the age of 18-43years.

On the effects of socio-economic characteristics on meat expenditure, the results reveal that about 87%, 96% and 96% variations for the three income groups respectively have been explained by the independent variables. Household size and income level had positive relationship for all the income groups. However, the results indicated that the respondents in the higher income group were majority literate and very conscious of the negative consequences of ruminant meat demand. With regards to income distribution the study revealed that there is wealth inequality in the study area.

Government should design efficient strategies of enhancing the low income group through taxes and so on. This could increase ruminant meat demand, due to improved income redistribution. Non governmental organizations and cooperative societies should also enhance the purchasing power of the poor; this could increase their demand for ruminant meat. This could be done through skills acquisition programmes.

Household size is positively related to expenditure on ruminant meat, this means demand for ruminant meat will increase with increase in income government should subsidized animal feeds to the farmers and more easy access to credit. This will encourage the livestock farmers to increase supply, subsequently it will result to fall in retail prices and in turn lead to equilibrium of demand and supply for ruminant meat products in question in the market.

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Agris on-line Papers in Economics and Informatics

Volume IV Number 4, 2012

Agris on-line Papers in Economics and Informatics

The international reviewed scientific journal issued by the Faculty of Economics and Management of the Czech University of Life Sciences Prague.

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ISSN 1804-193