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Households' Dietary Diversity, Farm Income and Technical Efficiency Correlates: Empirical Evidence from Small-scale Farming Households in Nigeria

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Abstract

This study examined the relationship among farming households' technical efficiency, dietary diversity and farm income in Kwara state, Nigeria. Respondents were randomly sampled from among the National Special Programe for food security (NSPFS) beneficiaries and non benficiaies across the 3 geo-political zones in the study area. Stochastic frontier model was used to estimate the respondents' technical efficiency while the dietary diversity score and farm income were analyzed with descriptive and inferential statistics. The Pearson Product Moment Correlation (PPMC) was used to assess the level of relationship among the indicators. The study revealed a significant linear relationship among households' dietary diversity, farm income and technical efficiency. While technical efficiency was inversely related to farm income ($r = -0.278$, $p = 0.01$) and dietary diversity ($r = -0.206$, $p = 0.05$) on one hand, dietary diversity was positively related to farm income ($r = 0.307$, $p = 0.05$). The study has two important implications; first, increasing farm income may be of relevance if the goal of enhancing food security is pursued and benefits of technical efficiency growth may not necessarily translate into enhanced farm income and dietary diversity. This study therefore suggests the provision of infrastructures that would enable the farmers to access the benefits of improved technical efficiency.

Key words

Correlation, technical efficiency, farm income, dietary diversity, Nigeria.

Introduction

Household food security is a necessary condition for nutrition security. To improve households' and community's food security situation, the efficiency of existing utilisation of resources may need to be improved through conserving and, where possible, enhancing the productive capacity of resources (Bokeloh, 2009). In addition, efficient use of agricultural resources can help in achieving certain desirable welfare indicators which are related ultimately with the goal of food security (Alene et al., 2006). Empirical evidences suggest that there are multiple pathways through which increases in agricultural productivity can reduce poverty, including real income changes, employment generation, rural non-farm multiplier effects, and food prices effects (Thirtle et al., 2003; Hazell and Haddad, 2001), and better nutrition (Irz et al., 2001; Timmer, 1995).

However such generalization may not necessarily hold true. The pathways through which efficiency gain can lead to sustainable development is complex and interrelated (Schneider and Gugerty, 2011) and growth may not necessarily lead to the desired outcome of food and nutrition security. This may be particularly relevant at the household level if there is a dearth of infrasuctural facilities and apparatus that could translate such growth into real and sustainable development. While technical efficiency growth may lead to increased output, it may not necessarily translate into enhanced farm income and dietary diversity. This is more if the additional income realized from such growth was spent on other consumer goods and not necessarily on staple food. In view of the various complicated pathways through which technical efficiency growth can result into, this study provides empirical evidence of the association among households' technical efficiencies, dietary diversity and farm income among small-scale farming households in Nigeria.

Specifically, this study tested the following hypotheses:

- There is no significant relationship between farmers' technical efficiency and household dietary diversity score

- There is no significant relationship between farmers technical efficiency and farm income

- There is no significant relationship between farm income and dietary diversity score

Materials and methods

The study was carried out in Kwara State, Nigeria. Specifically, the study was carried out in the three project sites of the National Special Program for Food Security (NSPFS), a World Bank supported agricultural intervention programme that aims at improving farmers' food security and technical efficiency. The programme is located in a site in each of the senatorial zones in Kwara state.

The senatorial zones are: Alapa site in Kwara central located along Ilorin Igbeti in Oyo state. Maize is usually intercropped with sorghum, cassava and groundnut in this zone. Small scale livestock rearing also takes place and there are many cattle Fulani settlers in the area (KWADP, 2006).

Lade is the site in Kwara north. It is located along the road from Ilorin to Patigi. The common crops grown here are millet intercropped with melon, sorghum intercropped with cassava or maize. Crops like rice and groundnut are usually planted solely. Osi site is in Kwara South. The farming systems practiced by the farmers include mix cropping of crops like maize/cassava, maize/yam, sorghum/yam, melon/maize; cashew cultivation is also popular. There are many Fulani cattle farmers in the village.

The respondents for this study comprised of both crop farmers who are beneficiaries and non-beneficiaries of the NSPFS intervention program in Kwara State. A two-stage sampling procedure was employed in this study.

The first stage involved random selection of 30 NSPFS beneficiary respondents in each of the three programme sites using the NSPFS beneficiaries listing provided by the NSPFS project heads in each of the project site. The second stage involved the random selection of 35 non-NSPFS beneficiary

respondents in each of the project sites using the household listing provided by the community head in each village were the programme site is situated. This study eventually used data obtained from75 NSPFS beneficiary respondents and 75 non-NSPFS beneficiary respondents in the three project sites. Primary data were used for this study. The data were collected through the use of structured questionnaire. Secondary data used for the study were sourced from journal publications and from the internet. To test for the variation in our sample data we carried out t-test on our two group of respondents.

1.1. Analytical techniques

Analytical tools employed include descriptive statistics, stochastic frontier model, Household Dietary Diversity Score (HDDS) and Pearson Product Moment Correlation (PMCC).

1.2. Technical efficiency estimation

The Battese and Coelli (1995) formulation of the stochastic production frontier was employed. This encompasses the estimation of technical efficiency and allows the inclusion of explanatory variables within a one-stage estimation procedure.

$$InQ_i = InQ_i (X_i, \beta) + V_i - U_i \qquad (1)$$

The stochastic frontier approach has found wide acceptance within the agricultural economics literature (Battese and Coelli, 1992; Coelli and Battese, 1995), because of its consistency with theory, versatility and relative ease of estimation. To derive the frontier, a production function can be estimated using a set of observations adopting a particular functional form for the production function (in the case of technical efficiency), such as the Cobb-Douglas or Translog Function. The model to be estimated in this study is shown in equation (2), where i denotes respondent households:

$$Q_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + V_i - U_i \qquad (2)$$

Where

Q_i represents the outputs (maize grain food energy equivalent of the total outputs in kg/kcal), and, (x = 1, 2...., 9) of the i-th beneficiary and non-beneficiary farming households;

X_1 = size of farm land cultivated (ha);

X_2 = hired labour (man days);

X_3 = family labour (man days);

X_4 = quantity of planting materials expressed in maize grain energy equivalent (kg);

X_5 = quantity of Fertilizer (kg);

X_6 = quantity of herbicide (liters);

β_0 = constant terms; β = parameter of production function model to be estimated

The statistical error is represented by V_i, which is assumed to be independent and identically distributed with mean zero and variance σ_v^2. The inefficiency term Ui is positive and assumed to be half normal distributed with variance σ_u^2 (Coelli et al., 2005). The estimation of equation (2) was carried out by the maximum likelihood method. This requires an assumption for the distribution of the inefficiency term, which was assumed to be half normal. Therefore, the entire error term is the sum of two random variables: a half normal (inefficiency part) plus a normal (noise part). As shown in Coelli and Rao (2005), the technical efficiency indicator for farm iis given by the ratio of the actual output to the output at the frontier such as in

$$TEi = \frac{Qi}{\exp\left[Q(Xi,\beta)+Vi\right]} = \exp(-Ui) \qquad (3)$$

We estimated the technical efficiencies for the two groups of respondents before pooling the estimates together.

1.3. Households' Dietary Diversity Score (HDDS)

To estimate dietary diversity, a measurement is usually done that include the summing of the number of foods or food groups consumed over a reference period (Krebs-smith et al., 1987). The reference period, in some instances, ranges from 1 to 3 but 7 is also often used (Drewnowski et al., 1997). According to Ruel (2003), measurement of dietary diversity measures consist of a simple count of foods or food groups, some scales developed in developed countries take into consideration the number of servings of different food groups in conformity with dietary guidelines. In developing countries, single food or food group counts have been the most popular measurement approaches for dietary diversity, probably because of their simplicity (Ruel, 2003) and the number of servings based on specific dietary guidelines were not considered (Taren and Chen, 1993; Arimond and Ruel, 2002; Tarini et al., 1999; Onyangoet al., 1998; Ferguson et al., 1993; Hatløy et al., 1998). Indeed the studies of Hatløy

et al., 1998 used both single food counts score (FVS) and a dietary diversity score (DDS).

Households' dietary diversity score used in this study was measured by summing the number of foods or food groups prepared and consumed by the household over a reference period of 24 hours separately for the two groups of respondents. Following Swindale and Bilinsky, (2006), the set of 12 food groups which captures all possible food groups household consumed was developed using the FAO food composition table for Africa. (Swindale and Bilinsky, 2006). The following set of 12 food groups was used to calculate the HDDS; Cereals, Fish and seafood, Root and tubers, Pulses/legumes/nuts, Vegetables, Milk and milk products, Fruits J., Oil/fats and oil palm, Meat and poultry offal, Sugar/honey, Eggs, Miscellaneous.

1.4. The Pearson Product Moment correlation (PPMC)

Correlation refers to a quantitative relationship between two variables that can be measured either on ordinal or continuous scales. The variables in this study were measured on a continous scale. The PPMC was therefore used to measure the correlation. The PPMC (denoted as *r*) as used in this study is multivariate and it quantified the relationship between household technical efficiency and farm income and the sum of the household dietary diversity on one hand, and the association between farm income and household dietary diversity score on the other hand. The PPMC can take any value between -1 and +1. A positive correlation implies co-movement in the same direction. A negative correlation implies co- movement in opposite direction. Zero correlation implies a complete absence of joint linear movement. Following (Weisstein, 1999),

$$rxy = \frac{n\,\Sigma xy - \Sigma x\,\Sigma y}{\sqrt{[\Sigma x2-(\Sigma x)2][n\Sigma y2-(\Sigma y)2]}} \qquad (4)$$

Where;

rxy = correlation between technical efficiency and farm income; technical efficiency and household dietary diversity score and farm income and dieatary diversity

N = number of sampled respondents (150)

xy are the variables of interest and they are technical efficiency, farm income and household dietary diversity score

Results and Discussion

1. Socio-economic distribution of respondents

The result of the distribution of respondents according to farm size in hectares of farmland cultivated, experience in years, and household size is presented in Table 1.

The study reveals that the respondents' average farming experience is 24 years (Table 1). Experience has been identified as an important determinant of efficiency. With a relatively higher farming experience, there is an accumulation of knowledge which could be put into practise to reduce cost, enhance efficiency and ultimately income which

is positively related to dietary diversity. The t-test further reveal that there is no statistical difference between the average farming experience of the NSPFS beneficiary and non beenficiaries (p < 0.8).

As revealed in Table 1, respondents' average farm size is 9.18 ha. from the Table, it is revealed that beneficiary farmers have larger farm sizes than non-beneficiaries (p = 0.01). Theoretically, farm size affects technical efficiency, technology adoption costs, risk perceptions, human capital, credit constraints, labor requirements, tenure arrangements and more. With small farms, it has been argued that large fixed costs become a constraint to technology adoption (Abara and

Socio-economic indicators	NSPFS Beneficiary households		NSPFS Non-beneficiary households		All households	
	Freq.	%	Freq.	%	Freq.	%
Farming experience						
<15	12	15.9	16	21.3	28	18.7
16-30	44	58.7	42	56	86	57.3
31-45	16	21.1	13	17.3	29	19.6
46>					7	4.8
Average farming experience (24 years)						
Std deviation 11.18						
T-test = 0.189; p = 0.85						
Farm size (ha)						
1.99-5.0	7	8	21	27.9	27	18.1
5.1-9.0	30	39.9	32	42.6	62	41.3
9.1-12.0	25	33.3	13	17.3	38	25.3
12.1-15.0	6	8	4	5.3	10	6.7
>15.0	8	10.6	5	6.7	13	8.7
Average farm size 9.18 ha						
Standard error 0.422						
(t = 2.4780, p = 0.0143)						
Household size						
5.III	16	21.3	27	36.1	43	28.6
8.VI	29	41.6	34	45.3	63	42
11.IX	12	16	13	17.3	25	16.6
14.XII	13	17.3	1	1.3	14	9.4
16-21	5	6.6	0	0	5	3.4
Minimum household size (3)	1	1.3	2	2.7	3	2
Maximum household size (26)	1	1.3	0	0	1	0.7
(t = 4.2341, p = 0.001)						

Source: Field survey, 2012

Table 1: Distribution of respondents according to experience, farm size and household size.

Singh, 1993) especially if the technology requires a substantial amount of initial set-up cost. With some technologies, the speed of adoption is different for small- and large- scale farmers (Gabre-Madhin and Haggblade, 2001).

According to the study, the average household size for the respondents is 8 members. There is significant difference in the household number of the beneficiary and non-beneficiary household (p=0.01). Household size may have an implication on technical efficiency and food security. More hands may be available for farm labour as a result of higher household size which could be of assistance in farm work. Equally relevant is family size in determining the number of mouths to feed in the household which could affect the quality of food that would be eaten in the households.

2. Distribution of average annual farm income of respondents' households

The result of the distribution of the average annual farming income size is presented in Table 2.

The result of the distribution of the average annual farm income of households as presented in Table 2. As shown in the Table, the mean annual farming income of the household was N264,102, of which only 14.7% of the non-beneficiary household earned above this amount when compared to the 32% of the beneficiary households.

3. Technical efficiencies distribution of beneficiary and non-beneficiary respondents

Table 3 presents the result of the technical efficiencies distribution of the respondents in the study area.

The model parameters for the two respondent categories, the sigma squared and the gamma estimates were equally significant at 1% significant level. The significance of the sigma squared result indicate that the variables included in the estimation of our model fit into the model and correctly specified the distribution of the assumption of the composite error term. The gamma results indicate that the variation in the crop farmers' respondents' outputs were due to differences in their technical efficiencies.

The models estimated included 6 independent variables based on their relevance to NSPFS participation in the study area. For the NSPFS crop farmer participants, fertilizers, herbicides farm size and hired labour were all positive and significant at 0.01 significant level. Household size was also significant and positive at 0.10 significant level. However, for the non –beneficiary crop farmer respondents in the study area, it was only the farm size that was significantly positive at 0.01. These results indicate that the incentives assessed by the NSPFS in the form of fertilizers, herbicide and loan facilities contributed positively and significantly to their technical efficiency. However, for respondents who did not participate

Average annual farm income/household (Naira)	Beneficiary households		Non-beneficiary households		All household	
	Freq.	%	Freq.	%	Freq.	%
45,000-104,999	2	3.9	16	21.4	18	9.4
105,000-164,999	13	15.3	28	37.3	41	27.4
165,000-224,999	23	30.5	18	22.9	41	26.8
225,000-284,999	16	19.9	4	5.4	20	12.7
285,000-349,999	10	13.3	5	6.6	15	10.1
345,000-404,999	6	8	0	0	6	4
405,000-464,999	2	2.6	4	5.3	6	4.1
465,000-524,999	3	3.9	0	0	3	2.1

Mean Annual Farm Income

(N264,102)

Standard error (N23,258)

(t= 4.8965, p=0.01)

Source: Field survey, 2012

Table 2: Distribution of annual and mean farm income of NSPFS beneficairy and non-beneficiary households.

Variables used in stochastic frontier estimation model	NSPFS Beneficiary households			Non-beneficiary households		
	Coef	Std error	t-ratio	Coef	Std error	t-ratio
Constant	5.198664	0.9999	5.1987*	5.1563	1.2261	4.6911*
Farm size (ha)	3.2307	0.9857	3.2340*	3.6237	1.4059	3.1536*
Fertilizer	1.5759	0.7379	2.1356*	2.1121	1.4595	1.2439
Herbicides	4.10824	1.1968	3.5497*	2.9534	2.3738	1.255
Family labour	1.44928	0.512723	1.8869***	1.4754	1.2157	1.2204
Hired labour	3.1629	1.70047	2.2325*	1.6343	1.9149	0.6932
Planting materials	0.86235	1.2477	0.6912	-0.49097	0.9229	-0.5319
Sigma (δ^2)	10.1539	1.1	10.1539*	8.4076	1.1	8.407*
Gamma	0.9999	0.15508	6.4476*	0.5366	0.1125	4.7697*

*significant at 10%
**significant at 5%
***significant at 1%
Source: Field survey, 2012

Table 3: Maximum likelihood estimation of respondents' technical efficiencies.

Technical efficiencies distribution (%)	NSPFS Beneficiary households		Non-beneficiary households	
	Frequency	%	Frequency	%
< 20	0	0	15	20
21-30	1	1.3	11	14.6
31-40	3	4	5	6.67
41-50	5	7	7	9.3
51-60	4	5.3	3	4
61-70	7	9.3	2	2.7
71-80	13	17.3	2	2.7
81-90	25	33.3	17	22.7
90>	17	22.7	13	17.3
Average technical efficiency	70.1		60.2	
Overall average technical efficiency	65			

Source: Field survey, 2012

Table 4: Distribution of respondents' technical efficiency estimates.

in NSPFS and any other intervention programs, no inputs other than the farm size were significant. Although they equally had access to fertilizers, herbicides and labour, which contributed positively to their technical efficiency, they however were not significantly   related to technical efficiency in the study area. This could imply that agricultural interventions in whatever form might have an added benefits in form of extension services like training on how to apply these inputs which could confer additional unquantifiable benefits for farmers.

As shown in the Table, the average technical efficiency for all respondents was 65% the average technical efficiency of Beneficiary households was 70% while for the non-beneficiary household was 60% (Table 4).

4. Household Dietary Diversity Distribution

The result of the distribution of food diversity scores for the respondents is presented in Table 5.

According to the Table 5, the lowest food diversity score reported for the respondents was 2 and the highest was 9. However, the average food diversity score reported by the households was 6.4. The food diversity score for this study represents the number of different food types consumed by the households within the last 24 hours of administering the questionnaire and it was

Food diversity count	NSPFS Beneficiary households	Non-beneficiary households	All households
Lowest food score	5	2	2
Highest food score	9	9	9
Mean food score	7.2	5.74	6.4
Standard deviation	1.23	1.74	1.49

Source: Field survey, 2012

Table 5: Distribution of household dietary diversity estimates.

	Farm Income	Dietary Diversity Score	Technical Efficiency
Farm Income (Pearson Correlation) Sig. (2-tailed), (N=150;)	1		
Dietary Diversity Score (Pearson Correlation) Sig. (2-tailed), (N=150;)	0.307**	1	
Technical Efficiency (Pearson Correlation) Sig. (2-tailed), (N=150;)	-0.278*	-0.206**	1

Note: correlation coefficient (r) is significant at 5% level ** and at 1% level *.
Source: Field survey, 2012

Table 6: Correlation Analysis of Household Dietary Diversity Score, Farm Income and Average Technical Efficiency among Small-scale Farming Households in Kwara state.

based on the 12 food groups defined by Swindale and Bilinsky (2006). The number of food groups eaten within households has been theorised to be a function of certain socio-economic variables and food diversity has been identified as a proxy for measuring how well food secured households are.

5. Correlation analysis of household dietary diversity score, farm income and average technical efficiency

The result of the Pearson correlation analysis among household dietary diversity, household farm income and technical efficiency is presented in Table 6.

The result in Table 6 shows that while technical efficiency score is negatively associated with household farm income ($p < 0.05$) and household dietary diversity score ($p < 0.01$); dieatary diversity and farm income are positively associated at $p < 0.01$. These relationships therefore suggest an inverse relationship between technical efficiency and farm income and dietary diversity estimates among the respondents and conversely affirms a positive linear relationship between average farm income and household dietary diversity score (Table 6).

This implies that as technical efficiency estimate increases, farm income and household dietary diversity decrease, on one hand, and on the other, as farm income increases, household dietary diversity increases. It may be that the negative relationship between income and technical efficiency was as by putting in place efficient processing and market facilities for farmers to store and preserve their outputs, they may all take it to the market at the same time. This could lead to reduced price given the inelastic nature of supply (excess supply). Thus the productivity gain has resulted into a reduction in output prices which is brought about by a glut in market due to lack of efficient processing and marketing facilities. This is further corroborated by the findings of Thirtle et al. (2001) which suggests that productivity gains may not result in poverty reduction if the decline in output prices outweighs the gain from increased productivity. Raising farm income has been suggested as an effective tool to increase dietary diversity (Gonder, 2011), which is further emphasized in this study.

Conclusion

The study revealed the existence of a positive and significant linear relationship between farm income and household dietary diversity, however, the linear relationship between technical efficiency and households' farm income and dietary diversity are negative. This negative relationship could have

been brought about by lack of efficient processing and market facilities that would enable farmers optimally utilize the benefits of increased output resulting from productivity gains.

In view of this, this study recommends that while several developmental efforts are towards enhancing farmers' productivity and technical efficiencies, developmental efforts should on the other hand assist farmers in value addition and agricultural processing so that they would optimally utilize the gains accrued from such efficiency gains. Also in the same line, efforts at increasing households' food and nutritional securities should indentify efforts at increasing farmers' income as this is shown to have a direct and positive influence on dietary diversity.

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Modeling the Determinants of Domestic Private Investment in Ethiopia

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Abstract

The study examined the determinants of domestic private investment in Ethiopia using a time series data over the period 1992-2010. The study employed an Autoregressive Distributed Lag (ARDL) model and applied the bounds test approach in modeling the long run determinants of domestic private investment. The study found exchange rate, domestic saving and domestic credit as key factors having negative and significant impact on domestic private investment. External debt and government expenditure are found to have significant and positive effect on domestic private investment. The results imply that government expenditure stimulates domestic private investment while domestic credit and domestic saving have a constrained effect on the sector.

Key words

Domestic private investment, Ethiopia, bounds test approach, determinants, Autoregressive Distributed Lag Model.

Introduction

During the Dergue Regime (1974-1991), Ethiopia's private sector hardly existed. The socialist regime provided little rooms for the private sector to flourish until the period it vanished in 1991. Following the fall of the Dergue regime in 1991, a shift in policy from command economy to free market economy was introduced in the country. This shift has opened opportunities for the private sector to have an active role in various sectors of the country's economy. Since then, a lot of efforts have been exerted and various forms of incentive packages have been provided by the government to encourage domestic private investment in the country. Despite the incentives taken by the government, the sector's contribution towards the economy of the country has remained very poor by international standards, even when compared with Sub-Saharan countries (WB, 2004)

The trend of domestic private investment as a percentage of gross domestic products (GDP) is a good evidence of how low the sector's contribution to the economy is. For instance, from 1992-2000 and 2001-2010 domestic private investment as a percentage of GDP were 2.6 and 1.2 respectively. Particularly, in the last five years

domestic investment has been reduced though the country's economy was growing continuously. For instance, from 2006-2010 the average domestic investment as percentage of GDP was only 0.5% while average economic growth for the same period was about 11%. Similarly while the country's domestic private investment to GDP is low, the resource gap between savings and domestic investment is very high. For instance, the resource gap between savings and investment in 2009/10 was 19.4 % which is very high in comparison to the international standard (FDRE, 2010; Gillis, Perkins, Roemer, & Snodgrass, 1987). Understanding this problem, the government has prepared a strategy document namely Growth and Transformation Plan (GTP) in 2010 that addresses many issues of the country including domestic investment and its constraints as one agenda(FDRE, 2010). Low per capita income of citizens, limited saving behavior, poor and limited financial institutions and lack of infrastructure are some of the factors identified by the government in its GTP as bottlenecks to the country's domestic private investment

Therefore, this is one factor that motivated us to identify the determinants that may help policy makers. Second, there is no uniformity on empirical

evidences on the determinants of domestic private investment across studies. i.e., there is variation on the empirical studies from country to country as well as from region to region. So the result of this study may contribute to the existing theory. Third, in estimating the investment function, we use the recent advance in time-series econometrics, that shows the co-integration relationship of the variables.

Hence, the objective of this study is modeling determinant factors of the domestic private investment in Ethiopia. To analyze the determinants, Auto-Regressive Distributed Lag (ARDL) model has been used. To model the long run determinants Pesaran, et al., (2001) bounds test approach has been employed.

Materials and Methods

Theoretical and empirical evidences of the variables

We use domestic private investment as dependent variable and nine explanatory variables. The explanatory variables that may affect to decision making of domestic private investment in the literatures are very wide and only variables having sound theoretical explanations and complete data are selected. In this section we attempt to describe the theoretical explanations and empirical evidences of the explanatory variables selected for this study.

Real GDP growth rate is one of the most commonly variable used as explanatory variable to measure its effect on domestic private investment. Some literatures such as Fielding (1997), Serven and Solimano (1992) and Greene and Villanueva (1991) explained that private investment is positively related with real GDP growth of one country. This is because countries with higher income level inclined to allocate more of their wealth to domestic savings which could be then used to help in financing private investment. Empirical results such as Ajide and Lawanson (2012) from Nigeria, Outtara (2004) from Senagal and Asante (2000) from Gahana have evidenced that real GDP growth rate helps domestic private investment. Ghura and Goodwin (2000) on their part revealed that real GDP growth has stimulating effect on private investment in Asia and Latin America though its effect in Sub Sahara Africa was found insignificant. But Ndikumana and Verick (2008) found the positive and significant relationship in Sub-Sahara Africa(SSA) which

contradicts the findings of Ghura and Goodwin (2000).

Inflation is the second variable that we use in the study as a proxy to measure macroeconomic stability of the country. There is no uniformity on the theoretical explanation of the variable and its effect on domestic private investment. Some models such as the cash-in-advance models (e.g. Stockman, 1981) forwarded that inflation raises the cost of acquiring capital which then lowers capital accumulation. This model further states that the existence of high inflation may make it difficult and costly for economic agents to extort the right relative price which could then lead to misallocation and inefficient resources. However, other models like the Tobin-Mundell model argues that higher anticipated inflation lowers the real interest rate which then causes to be made portfolio adjustments away from real money balances to real capital which then expected higher inflation to raise real investment (Ghura & Goodwin, 2000). Empirical studies such as Bakare (2011), Ndikumana (2000), and Asante (2000) reported that inflation has a negative effect to private investment.

Real exchange rate, another explanatory variable, is also used as a proxy to measure macroeconomic stability. In most literatures the effect of real exchange rate, either devaluation or appreciation of local currency on domestic investment is ambiguous. Branson (1986) and Buffie (1986) discussed that a real depreciation of local currency increases the real cost of new capital goods relative to domestic goods which then depress the investment in non-tradable activities. Jongwanich & Kohpaiboon (2008) on their part described that depreciation of the exchange rate could lower the real income and wealth of citizens and then could reduce the aggregate demand which in turn reduce private investment. Jongwanich & Kohpaiboon (2008) from Thailand, Ndikumana & Verick (2008) from Sub-Sahara Africa (SSA) found a significant negative relationship though Asante (2000) from Gahana reported positive relationship.

To measure whether the country's domestic private investment is constrained by debt overhang or not, we use external debt stock as a percentage of GDP as one explanatory variable. It is almost agreed that a county that have large external debt have a strong discouraging impact on private investment (Borensztein, 1990; Faruqee, 1992). Borensztein (1990) described that the presence of high

debt ratios to GDP leads economic agents to anticipate future tax liabilities for its servicing which may have negative effect on domestic investment. Empirical evidences like Ghura and Goodwin (2000), and Ndikumana (2000) revealed the positive relationship between external debt stock and domestic private investment.

Gross domestic saving as a percentage of GDP is another important explanatory variable included to see its effect on domestic private investment. Saving behaviors of individuals are determined by different factors like income, growth of income, expectation of future income, interest rate, population (workforces and dependence), liquidity constraint, and inflation (Jongwanich 2010; Loayza, Schmidt-Hebbel, & Serve´n, 2000). Unlike its theoretical explanations, the empirical results of previous studies are not the same. For instance, Giannone and Lenza (2008) reported the existence of high correlation between saving and investment in members of Organisation for Economic Co-operation and Development (OECD) countries; while Vamvakidis and Wacziarg (1998) evidenced the insignificance of the variable in non OECD countries.

To examine the relationship between financial development and private investment, we used domestic credit to private sector as a percentage of GDP as a proxy. Theoretically, it seems plausible that the effect of giving more credit to the private sector encourages domestic investment. As Serven & Solimano (1992) described most private investors' source of income for investment in developing world is credit and thus, the existence of low financial services in such countries may affect the private sector negatively. Unlike the theoretical explanations, most empirical studies like Jongwanich and Kohpaiboon (2008), Ouattara (2004) and Ghura and Goodwin (2000) evidenced the negative relationship of the variable. Nevertheless, studies like Ajide and Lawanson (2012), and Asante (2000) confirmed the positive relationship of the variable with domestic private investment.

We also used government expenditure as a percentage of GDP to see whether it has a crowding-in or crowding-out effect on domestic investment of the country. Theoretically there is an ambiguous and divided argument on the effect of government expenditure on private investment. Literatures like that of Aschauer (1989), Blejer and Khan (1984), and Greene and Villanueva (1991) described that if government expenditure is spent

in provision of infrastructures like communication, energy, transport, health, and educational services, it complements the private investment. But there is also a possibility of private investment to be crowd-out by government expenditure if the latter competes with the private sector, or if government expenditure is financed by a deficit (Rossiter, 2002). Like the theoretical arguments, empirical evidences on the topic also do not show uniformity. Some empirical studies like Ajide and Lawanson (2012) and Acosta and Loza (2005) revealed that government expenditure has a crowd-out effect in Nigeria and Argentina respectively. On the other hand empirical evidences such as Greene & Villanueva (1991) and Aschauer (1989) reported a complementary relationship.

Foreign direct investment as a percentage of GDP is also used as one explanatory variable to see whether it has positive impact in promoting domestic private investment of the country. Since the 1990s FDI inflow to Africa has been increasing (Ndikumana & Verick, 2008; UNCTAD, 2008). Similarly the FDI inflow to Ethiopia has been rising in the last decade though not consistent. In the literatures the impact of FDI on domestic private investment is still debatable whether it has crowds-in or crowds-out effect. For instance, the findings of Mutenyo, Asmah and Kalio (2010) from Sub-Sahara Africa and Misun & Tomsik (2002) from Poland showed FDI crowds-out domestic private investment. On the other hand studies like Ndikumana & Verick (2008) from Sub-Sahara Africa and Misun & Tomsik (2002) reported the positive effect of FDI on domestic investment. Lastly we used gross fixed capital formation a percentage of GDP to see the role of infrastructure on domestic investment of the country. Though there are not sufficient empirical evidences on the role of gross fixed capital formation, there is plausible theoretical explanation on the positive role of gross fixed capital formation in promoting domestic investment of developing countries.

Model specification

As we discuss in the above section, the theoretical and empirical evidences suggest that there is no one model that specify the determinants of domestic private investment. Models such as Keynesian, neoclassical and neo-liberal alone cannot determine the domestic private investment. Hence, we use an eclectic time series model that was adopted by Asante (2000) which is also applied by previous studies like Ajide and Lawanson (2012) and Acosta & Loza (2005).

The theoretical explanations and previous empirical evidences suggest that past performance of the independent variable (DMPI) affects the current or past performance of the explanatory variables. Hence, the nature of the model that we use is an Autoregressive Distributive Lag Model (ARDL). To regress the determinants we have used Stata 12 and to identify the long-run determinates we apply Pesaran, et al. (2001) bounds testing approach since this approach has some econometric advantages over other approaches. Some of the advantages of this approach are: first, tests can be conducted whether they are purely co-integrated at (I(0)), (I(1)) or mutually co-integrated (Pesaran, et al., 2001, p. 290). Second, it reduces serial correlation and endogeneity problems. Third, in small sample properties (like our study), using ARDL bound test has the ability to minimize deficiencies related with a mixture of different integration levels. Fourth, ARDL bound test approach estimate the long and short-run parameters of the model simultaneously and empirical results can be estimated using Ordinary Least Squared (OLS). Therefore, we specify the general ARDL model as follows:

$$Y_t = \alpha + \sum_{i=0}^{p} B_i Y_{t-1-i} + \sum_{i=0}^{p} B_j X_{i,t-i} + \mu_t \qquad (1)$$

Where, α is a constant, Y_t is endogenous variable, $X_{i,t}$ is the i th explanatory variables, p is the maximum lag number to be used, B_i and B_j are parameters, and μ_t is the white noise error. So when we apply the variables in to equation (1), the function becomes in the form of:

$$\ln DMPI_t = \alpha_0 + \sum_{i=0}^{p} \beta_1 \ln DMPI_{t-1-i} + \sum_{i=0}^{p} \beta_2 GDP_{t-i} + \sum_{i=0}^{p} \beta_3 INFL_{t-i}$$
$$+ \sum_{i=0}^{p} \beta_4 \ln ERT_{t-i} + \sum_{i=0}^{p} \beta_5 \ln EDBT_{t-i} + \sum_{i=0}^{p} \beta_6 \ln GDSG_{t-i}$$
$$+ \sum_{i=0}^{p} \beta_7 \ln GFCF_{t-i} + \sum_{i=0}^{p} \beta_8 \ln DCPR_{t-i} + \sum_{i=0}^{p} \beta_9 \ln GOE_{t-i}$$
$$+ \sum_{i=0}^{p} \beta_{10} \ln FDI_{t-i} + \mu_t \qquad (2)$$

Where:

ln is a natural logarithm that we include to reduce hetroskedacity. DMPI is domestic private investment as a percentage of GDP. GDP is real GDP growth rate annual in (%). INFL represents annual inflation rate in %, GDP deflator. ERT is real exchange rate, local currency unit per US Dollar, period average. EDBT is external debt stock as

a percentage of GDP. GDSG is gross domestic saving as a percentage of GDP. GFCF is gross fixed capital formation as a percentage of GDP. DCPR is domestic credit to private sector as a percentage of GDP. GOE is general government total expenditure as a percentage of GDP, and FDI is net foreign direct investment as a percentage of GDP.

According to Pesaran, et al. (2001) the dependent variable must be (I(1)), but the explanatory variables can be either (I(0)) or (I(1)). Hence, equation (2) can be reformulated in terms of differences and lagged levels. In addition, to separate the short-run and long-run multipliers of the model, we add vector error correction model (VECM). Therefore, the error correction version of the ARDL model is.

$$\Delta \ln DMPI_t = \alpha + \sum_{i=1}^{p} \beta_1 \Delta \ln DMPI_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta GDP_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta INFL_{t-i}$$
$$+ \sum_{i=0}^{p} \beta_4 \Delta \ln ERT_{t-i} + \sum_{i=0}^{p} \beta_5 \Delta \ln EDBT_{t-i} + \sum_{i=0}^{p} \beta_6 \Delta \ln GDSG_{t-i}$$
$$+ \sum_{i=0}^{p} \beta_7 \Delta \ln GFCF_{t-i} + \sum_{i=0}^{p} \beta_8 \Delta \ln DCPR_{t-i} + \sum_{i=0}^{p} \beta_9 \Delta \ln GOE_{t-i}$$
$$+ \sum_{i=0}^{p} \beta_{10} \Delta \ln FDI_{t-i} + \lambda_1 \ln DMPI_{t-1} + \lambda_2 GDP_{t-1} + \lambda_3 INFL_{t-1}$$
$$+ \lambda_4 \ln ERT_{t-1} + \lambda_5 \ln EDBT_{t-1} + \lambda_6 \ln GDSG_{t-1} + \lambda_7 \ln GFCF_{t-1}$$
$$+ \lambda_8 \ln DCPR_{t-1} + \lambda_9 \ln GOE_{t-1} + \lambda_{10} \ln FDI_{t-1} + \gamma ECM_{t-1} + \mu_t$$
$$\qquad (3)$$

Where:

Δ is the first difference of a variable; $\beta_1 ... \beta_9$ represent the short-run coefficients; $\lambda_1 ... \lambda_9$, represent to the long-run coefficients; ECM correspond to error correction model, and γ represents the speed of adjustment process of the ECM. The coefficient of the lagged error correction model is expected to be negative and statistically significant to support further the existence of a co-integrating relationship.

In time series data, trends in the data can lead to spurious (false) regressions due to the stationarity problem of the data. i.e., time series data have a time varying mean or a time varying variance of the residuals (Wooldridge, 2011). The null hypothesis to test the stationarity is, the time series data have a unit root and the alternative hypothesis is it has no unit roots or has less than one, i.e. if the critical statistic in absolute value is greater than the t value, we reject the null hypothesis and if it is less than one we accept the null hypothesis. Since the model we specify is

an Autoregressive Distributive Lag Model (ARDL), we apply Augmented Dickey– Fuller (ADF) test to test stationarity of the time series data.

After conducting the stationarity test, we use Pesaran, et al. (2001) bounds testing approach, in modeling the long run determinants of domestic private investment between the dependent variable and the explanatory variables, According to Pesaran, et al. (2001), the bound test assumes that if the F-statistic lies above the upper-bound of critical value for a given significance level, we conclude that there is a non-spurious long-run level relationship of the explanatory variables with the dependent variable. On the other side, if the F-statistic lies below the critical value of the lower bound, we can conclude that there is no long-run level relationship between the explanatory variables with the dependent variable. Nevertheless, if it lies in-between the lower and the upper limits, there is inconclusive result. To compute the Wald test (F-statistics), we restrict the long-run coefficient and apply the OLS. The computed F-statistic is evaluated with the critical values tabulated in Table CI (iii) of Pesaran, et al. (2001, p. 300). The general hypothesis of the co-integration is as follows:

$$H_0: \lambda_{GDP} = \lambda_{INFL} = \lambda_{ERT} = \lambda_{EDB} = \lambda_{GDSG}$$
$$= \lambda_{GFCF} = \lambda_{DCPR} = \lambda_{GOE} = \lambda_{FDI} = 0$$

Against

$$H_a: \lambda_{GDP} \neq \lambda_{INFL} \neq \lambda_{ERT} \neq \lambda_{EDBT} \neq \lambda_{GDSG}$$
$$\neq \lambda_{GFCF} \neq \lambda_{DCPR} \neq \lambda_{GOE} \neq \lambda_{FDI} \neq 0$$

After we indentify the co-integration level between variables from the above bound test, we conduct the long-run as well as short-run relationship between the variables. To estimate the long run elasticity we divided the coefficient of one lagged explanatory variable (multiplied by a negative sign) to the coefficient of one lagged dependent variable (Bardsen, 1989).

Data source

For analyzing the data we used secondary data from National Bank of Ethiopia (NBE) and World Bank's, World Development Indicators (WDI) data sets. The time period of the data covers from 1992-2010. The data for domestic investment is taken from National Bank of Ethiopia since there is no data about this in the World Bank development indicators. Since the data about domestic investment is stated in Birr (the local currency), we have converted in to US Dollar using year 2000 average exchange rate (1US Dollar = 8.3Eth Birr) approximately.

Results and discussions

Results of the ADF unit roots are reported in Table 2. As we can see results of unit root tests from Table 2, domestic private investment(DMPI), real GDP growth(GDP), inflation (INFLN), exchange rate (ERT), gross fixed capital formation (GFCF), and domestic credit given to private sector (DCPR) are co-integrated at (I(0)). Domestic credit given to private sector (DCPR) is integrated at (I(1)). The remaining variables; gross domestic saving (GDSG), government expenditure (GOE), and foreign direct investment (FDI) co-integrated

Variables	Obs	Mean	Std.Dev.	Min	Max
100*(DMPI /GDP)	19	1.879427	1.61105	0.11298	7.42115
GDP(%)	19	6.42	6.20571	-8.67	13.57
INFL(%)	19	8.456679	9.335458	-5.75464	30.3125
ERT	19	8.007406	2.49576	2.8025	14.4096
100*(EDBT/GDP)	19	73.91147	44.54272	10.7981	148.295
100*(GDSG/GDP)	19	7.332305	4.066607	0.408	13.5138
100*(GFCF/GDP)	19	21.31984	3.25714	14.3586	28.1283
100*(DCPR/GDP)	19	17.79081	5.474746	6.1546	24.5599
100*(GOE/GDP)	19	20.44879	4.015596	13.472	27.018
100*(FDI/GDP)	19	1.95343	1.833744	0.0012058	5.434666

Note: These are raw data before transformations
Source: own processing

Table 1: Descriptive Statistics of Main Regression Variables (1992-2010).

Variables	t-statistics for level without time trend	t-statistics for level with time trend	t-statistics for first differnce
DMPI	-3.218 **I(0)	-5.469 ***I(0)	-8.556 *** I(0)
GDP	-4.895 ***I(0)	-5.062 *** I(0)	-7.123*** I(0)
INFL	-3.604**I(0)	-4.065** I(0)	-6.643 *** I(0)
ERT	-3.276 **I(0)	-5.650*** I(0)	-7.435***I(0)
EDBT	-0.798 I(0)	-4.258**I(0)	-3.794*** I(0)
GDSG	-0.390 I(1)	-2.648 I(1)	-5.560*** I(0)
GFCF	-2.708 *I(0)	-4.558 *** I(0)	-6.934*** I(0)
DCPR	2.968*(1)	-1.990 I(1)	-3.757*** I(0)
GOE	-2.22 I(1)	-1.381(1)	-3.699***I(0)
FDI	-1.859 (1)	-1.484 (1)	-4.914***(0)

Notes: ***, **, and * denote the rejection of the null Hypothesis for unit root at 1%, 5% and 10% level of significance, respectively. Numbers in parentheses are lagged differences.
Source: own processing

Table 2: Augmented Dickey–Fuller test for unit roots (1992–2010).

neither at (I(0)) nor at (I(1)) even including the time trend. After we differenced, all variables have become stationary at the same order of integration, (I(0)).

We described the result of the co-integration test in Table 3. First we find the value of Johansen tests for co-integration rank. The computed F-statistic is 3.54 which show above the upper bound critical value at 10% significant level. So we have enough evidence to reject the null hypothesis. This implies that there exists a long-run equilibrium relationship between domestic private investment and the explanatory variables.

Critical values	Lower bound (K=5)	Upper bound (K=5)
10%	2.26	3.35*
5%	2.62	3.79
1%	3.41	4.68

Notes: Computed F-statistic = 3.54 (significance level at 5% critical value).The critical values are obtained from Pesaran et al., (2001, p.300), Table CI (iii). Case III: unrestricted intercept and no trend.
Source: own processing

Table 3: Bound test result for co-integration analysis.

Regression result of short run error correction model is described in Table (4). Out of the nine explanatory variables, five of them are statistically significant. Exchange rate (EXR) has a negative and significant (at 5%) relationship with domestic private investment both in the short and long run. Gross domestic saving (GDSG) also has as a negative sign and significant (at 10%) relationship both in the short and long-run. Domestic credit given

to private sector is found statistically significant at 10% with negative sign only in the long run. Government expenditure has a positive and significant relationship with domestic investment. This variable is statistically significant at 10% in the short run and at 5% in the long-run. External debt is the other variable found significant at 10% with positive sign only in the long run.

Real GDP growth (GDP), inflation (INFL), gross fixed capital formation (GFCF) and foreign direct investment (FDI) are variables that we find statistically insignificant at any conventional level. The one year lagged domestic private investment with positive sign is insignificant which shows past performance of domestic investment is not significant to the current performance of the explanatory variable. Statistically insignificant variables in the short-run like external debt stock (EDBT) and domestic credit to private sector (DCPR) turned to statistically significant in the long run. This may indicate the existence of time lagged effects. The positive sign of gross domestic saving (GDSG) in the short-run turned to negative sign in the long-run. This may indicate the role of error correction model (ECM). The significance of the ECM becomes at 15% which is in line with our expectations. The study finds the coefficient of ECM negative to be 0.3643 and shows that the model predicts 36.43% of the gap to be adjusted in one year. This means it takes longer period if some corrections are to be made by policy makers.

As we see from Table (4), the coefficient attached to the exchange rate (EXR) is negative and significant. This implies that exchange rate is

Variables	Coefficients	Std.Error	T-Ratio	P-value
$\Delta DMPI_{t-1}$	0.2701511	0.3969646	0.68	0.526
ΔGDP_{t-1}	0.0419961	0.0287309	1.46	0.204
$\Delta INFLt-1$	-0.0179319	0.0188029	-0.95	0.384
ΔERT_{t-1}	-5.935117**	1.699632	-3.49	0.017
$\Delta EDBT_{t-1}$	0.5965486	0.5962197	1	0.363
$\Delta GDSG_{t-0}$	.36058*	0.1683251	2.14	0.085
$\Delta GFCF_{t-1}$	2.427484	1.677713	1.45	0.208
$\Delta DCPR_{t-1}$	-1.197818	0.7867628	-1.52	0.188
ΔGOE_{t-1}	2.267804*	1.105005	2.05	0.095
ΔFDI_{t-1}	0.0115136	0.1401598	0.08	0.938
ECM_{t-1}	-0.3642532	0.2003448	-1.82	0.129
Constant	0.2912735	0.1752835	1.66	0.157

Specification Tests

R^2 = 0.8862	Adjusted R2 = 0.6360
HETTEST, χ^2 (1) = 0.83 (p-value= 0.3630)	RESET, F (3, 2) = 7.45 (p-value= 0.1206)
VIF (Mean) = 4.06	LM, χ^2 (1) = 0.306 (p-value= 0.5800)
B.Godfrey, χ^2 (1) =0.342 (p-value= 0.5584)	D, χ^2 (1) =0.082(p-value= 0.7743)

Long run model

lnDMPI = 6.22+0.017(GDP) - 0.018(INFL) - 2.34(lnERT)**+ 0.64(lnEDBT)* - 0.34(lnGDSG)*+ 1.144(lnGFCF) - 0.773(lnDCPR)*+ 2.08(lnGOE)** +0.057(lnFDI)

Note: The level of statistical significance is denoted as *** = at 1%, ** = 5%, * = 10%.
Test Statistics:
HETTEST = Breusch-Pagan test for heteroskedasticity.
RESET = Ramsey regression specification-error test for omitted variables.
VIF = Variance inflation factors for the independent variables.
LM = LM test for autoregressive conditional heteroskedasticity in the residuals.
B.Godfrey = Breusch-Godfrey LM test for autocorrelation.
D= Durbin's alternative test for autocorrelation
Source: own processing

Table 4: OLS regression results of the short run model (ECM) for the years (1992-2010) using ΔlnDMPI as dependent variable.

playing a negative role in promoting domestic investment in the country. The coefficient of the variable tells that appreciating the exchange rate of the local currency (Ethiopian birrr) with America's dollar by 1%, leads to the reduction of domestic private investment in the country by 5.94% and 2.34% in the long and short-run, respectively. The magnitude of the variable reduces in the long run and this may indicate that domestic investment could be encouraged in the long run by depreciating the local currency. This result suggests that high value of the local currency with US Dollar has negative relationship with domestic investment. The finding supports the government's decision that devalues the value of Birr in 2010 by 17 %.

It is theoretically agreed that large external debt discourages domestic private investment (Borensztein, 1990). The positive and significant relationship of the findings seems inconsistent with the theoretical explanations. The magnitude tells that domestic private investment increases by 0.64% when external debt increases by 1%. Previous empirical evidences of Ghura and Goodwin (2000) from Malasia supports our findings.

Gross domestic saving as a percentage of GDP is statistically significant with negative sign. This implies that domestic saving has negative role in encouraging domestic investment of the country. The magnitude of this variable shows that when gross domestic saving increases by 1%, domestic private investment reduces by 0.36% and 0.34% in the short and the long-run respectively. Theoretically higher domestic saving means there is sufficient source of finance for the investors which then lead to higher domestic investment. Contrary to the theory, the findings negative relationship may be related

with the low level of domestic saving. Since gross domestic saving as a percentage has been reducing particularly after 2005.

In the literatures there are different variable (e.g. income, interest rate, population, inflation, etc) that affect domestic saving (Jongwanich 2010; Loayza, et al., 2000). We expect that inflation and large number of dependent population may affect the reduction of saving in the country. After 2005 the rate of inflation in the country has been rising and this may contribute to the reduction of domestic saving though it needs further study (Jongwanich, 2010). According to Jongwanich (2010) large numbers of dependent population also may have a negative effect on saving. According to CSA (2007) Ethiopia's dependency ratio is 0.91 (which mean for every 100 working persons, there are 91 who are nonworking or age group younger than 15 and older than 64 years). We expect this may also add to the reduction of domestic saving. In general the finding suggests that the government has to work more on understanding or realizing why saving is reducing particularly at times of the country's continuous economic growth.

Domestic credit given to private sector is the other variable that we find having a strong negative impact with domestic private investment of the country. Thus, it implies that increasing credit to the private sector does not boost private investment as the theory suggests. Theoretically it is argued that giving more credit to the private sector affects domestic private investment positively (e.g.,Serven & Solimano, 1992). Nevertheless, the negative sign of this variable seems against the theoretical explanations. Surprisingly, most of previous empirical evidences like Jongwanich & Kohpaiboon (2008), Ouattara (2004), Ghura and Goodwin (2000)confirmed our findings. This result may suggest that the credit taken is used more for non-productive what policy makers need to address the overall banking provision and other related issues.

Government expenditure as a percentage of GDP is the other variable that has significant and positive relationship with domestic private investment. The finding is confirmed with previous studies like Jongwanich & Kohpaiboon (2008), Ouattara (2004), and Asnate (2000) who reported that government expenditure has a crowd-in effect. The significance of this variable could be due to the fact that in the last decade the country has invested heavily in infrastructure (e.g. energy, transport, health, and educational services).

The coefficients of the variable tells that as government expenditure increases by 1%, domestic private investment increases by 2.27% and 2.08% in the short and long-run respectively. The result suggests that the government has to invest more on infrastructure to boost investment of the private sector.

Unlike most empirical evidences from Africa, our findings reveal that growth of real GDP has insignificant and positive relationship with domestic private investment which is inline with neoclassical investment theory (Fielding, 1997; Greene & Villanueva, 1991; Serven & Solimano, 1992). Most empirical studies like Ajide and Lawanson (2012) from Nigeria, Ouattara (2004) from Senegal, and Asante (2000) from Gahana revealed the significant positive relationship with domestic investment. Inflation is the second variable that we find insignificant with negative sign. The negative sign of inflation is an indication of unstable economic environment though it has no significant impact. Foreign direct investment (FDI) and gross fixed capital formation (GFCF) are the other variables that we find insignificant with positive sign at any conventional levels.

Conclusion

To identify the potential determinants of domestic private investment in Ethiopia, we perform Ordinary Least Squares (OLS) estimations using an autoregressive distributed lag models (ARDL) for the period 1992-2010. We use Pesaran, et al. (2001) bounds test approach to test the co-integration relationship of the dependent variable and the explanatory variables.

When we summarize the regression results: external debt and government expenditure have significant and positive relationship with domestic private investment while exchange rate, domestic credit and domestic saving have significant and negative relationship with domestic private investment.

These empirical findings have key policy implications for Ethiopia. First, high value of local currency constrained domestic investment. The negative relation of exchange rate and domestic private investment suggests that appreciation of the real exchange rate discourages domestic private investment or vice versa. So this finding may support the government's decision that devalues the local currency in 2010 by 17%. From this it may be possible to conclude that depreciation of the local currency attracts domestic private

investment in the country.

Second, domestic credit given to private sector reduces domestic private investment and this may suggest the credit is diverted to non-productive activity. Third, domestic investment is constrained by gross domestic saving. This result is in line with the descriptive statistics that shows saving has been reducing drastically for a long period of time particularly after 2005. The finding suggests to policy makers to address why saving is reducing. Fourth, the significant positive relationship between government expenditure and domestic private investment indicates crowding-in effect of government expenditures to domestic private investment. This suggests the government has been investing more on infrastructures of the country and has to be increased to stimulate the low rate of private domestic investment-GDP ratio.

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Appendix

Variables	Coefficients	Std.Error	T-Ratio	P-value
DMPI(-1)	-1.387388***	0.2395799	-5.79	0.001
GDP(-1)	0.0231068	0.0270838	0.85	0.422
INFL(-1)	-0.0251491	0.0212098	-1.19	0.274
ERT(-1)	-3.239737**	1.181213	-2.74	0.029
EDBT(-1)	.8832317*	0.4029112	2.19	0.064
GDSG(-1)	-.4705232*	0.2415594	-1.95	0.092
GFCF(-1)	1.587626	1.828933	0.87	0.414
DCPR(-1)	-1.072372*	0.566782	-1.89	0.1
GOE(-1)	2.888846**	1.009828	2.86	0.024
FDI(-1)	0.0795453	0.124875	0.64	0.544
Constant	-6.223297	6.767448	-0.92	0.388

Note: The level of statistical significance is denoted as *** = at 1%, ** = 5%, and * = at 10%. All dependent variables are lagged by one period. Except GDP and INFLN are in logarithm form.
Source: own processing

Table 5: OLS regression results of the long-run model (ECM) for the years (1992-2010) using ΔlnDMPI as dependent variable.

Year	DMPI as a % of GDP	GDP growth (%)	Inflation rate (%)	Exchange rate (%)	EDBT as a % of GDP	GDSG as a % of GDP	GFCF as a % GDP	DCPR as a % of GDP	GOE as a % of GDP	FDI a % of GDP
1992	1.59	-8.67	15.53	2.8	66.77	6.31	14.36	11.4	13.92	0
1993	4	13.14	13.38	5	112.12	7.91	15.87	6.15	13.47	0.04
1994	2.05	3.19	2.93	5.47	148.3	9.4	19.28	8.03	17.24	0.25
1995	7.42	6.13	12.71	6.16	136.8	11.92	19.47	9.27	17.01	0.19
1996	1.88	12.43	0.24	6.35	119.58	9.59	16.87	14.22	18.38	0.26
1997	1.75	3.13	4.52	6.71	114.75	13.25	21.73	16.93	17.43	3.24
1998	1.7	-3.46	-0.44	7.12	129.45	13.51	22.78	20.11	20.5	3.23
1999	1.68	5.16	0.66	7.94	71.47	9.6	22.51	24.56	26.03	0.89
2000	1.44	6.07	6.88	8.22	67.68	8.34	20.28	23.07	25.78	1.65
2001	1.56	8.3	-5.75	8.46	70.69	9.73	20.73	21.45	22.61	4.28
2002	2.43	1.51	-3.62	8.57	84.44	9.93	22.99	21.18	25.06	3.27
2003	1.63	-2.16	12.77	8.6	85.87	7.75	21.25	20.31	27.02	5.43
2004	1.5	13.57	3.91	8.64	66.69	8.79	23.18	19.35	23.35	5.42
2005	2.58	11.82	9.88	8.67	50.59	2.61	21.04	22.99	23.08	2.15
2006	1.1	10.83	11.55	8.7	15.05	1.52	22.47	23.84	22.24	3.6
2007	0.47	11.46	17.22	8.97	13.39	4.16	25.49	18.67	20.68	1.14
2008	0.37	10.79	30.31	9.6	10.8	0.44	22.63	17.85	18.89	0.41
2009	0.46	8.8	24.15	11.78	15.76	4.14	28.13	-	17.23	0.69
2010	0.11	9.94	3.86	14.41	24.13	0.41	23.99	-	18.61	0.97

Source: National bank of Ethiopia and World development indicators

Table 6: List of economic indicators of the study.

Some Notes to Income Disparity Problems of Agriculture

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Anotace

Cílem článku je ověřit platnost některých hypotéz, které vysvětlují příjmovou disparitu zemědělství v podmínkách současného evropského modelu zemědělství a dále navrhnout možný přístup ke kategorizaci tohoto fenoménu. Nejedná se o všechny hypotézy, které byly v souvislosti s příjmovou disparitou vysloveny, ale pouze o hypotézy, které jsou orientovány nákladově. Poptávkově orientované hypotézy budou předmětem dalšího výzkumu. Na základě dosaženého stupně poznání je analyzována současná platnost hypotéz, které vysvětlují příjmovou disparitu zemědělců pomocí zvláštností zemědělské výroby, alternativních nákladů a zaváděním technického pokroku (Teorie šlapacího mlýna). Tam, kde hypotézy v současné době nejsou zcela platné, je upozorněno na příčiny, proč tomu tak je.

Klíčová slova

Zemědělství, příjmová disparita, nákladově orientované hypotézy, zvláštnosti zemědělské výroby, alternativní náklady, teorie šlapacího mlýna, kategorizace typů příjmové disparity.

Abstract

The aim of paper is to verify validity of some hypotheses which explain income disparity of agriculture under conditions of the current European agricultural model, and further to suggest a possible approach to categorization of this phenomenon. It is not dealt with all hypotheses which were expressed in connection with the income disparity, but also with those oriented to costs. Demand-oriented hypotheses will be a subject of further research. On base of the reached grade of knowledge, the present validity of hypotheses explaining farmers´ income disparity by the help of specialities of agricultural production, alternative costs, and introduction of technical progress (Theory of treadmill) is analyzed.

Key words

Agriculture, income disparity, cost-oriented hypotheses, specialities of agricultural production, alternative costs, theory of treadmill, categorization of types of income disparity.

Introduction

An income disparity can be defined in a very general way as a disparity in achieved incomes. In case of agriculture, the income disparity is currently monitored as a ratio of incomes in agriculture and incomes in other branches of the national economy (co called external income disparity). This procedure then becomes very often an argument for adoption of agrarian-political measures, mainly in the area of support financial tools used in agriculture.

From the monitoring and analyses of income disparity, an existence of several significant problems results. Among the most important of them are: causes of genesis of income disparity of agriculture (in connection with other departments it not spoken so much about the income disparity), delimitation of disparity, and methodology of its monitoring, and last but not least possibilities and tools of its reduction.

Since the 1950´s agrarian economists have been concerned with the income disparity of agriculture as an empirical phenomenon. It means that they looked for causes why production factors in agriculture, above all labour force and capital, do not bring a comparable effect – an income in comparison with other branches (Cochran, 1958, Johnson, 1958, Schmitt, 1972). In other words, they looked for an explanation why the target

behaviour of agricultural producers, i.e. to achieve the maximal effect (profit), does not correspond with revenue (effectiveness) of the above mentioned production factors just as it is in other departments. Older works of agrarian economists from the 1950´s (see above), but also newer ones (Koester, 1981, Blanken, 1981) start in principle from a presumption that for farmer (just as somewhere else) the priority is maximization of sale. If the efficiency of production factors does not represent a support element, vice versa the effect from their use decreases, then, they look for factors which are the cause of it. The second opinion stream which tries to explain causes of the income disparity of agriculture (Dalton, 1961, Vergopulos, 1978, Gardner, 1992) refuses the priority of maximal sale and tries to explain the income disparity by the help of various behaviour models. It sees the cases in a degree of adaptability of agricultural producers to changing market condition and in a speed of reaction to these changes.

If we start from the current degree of knowledge in the area of theories explaining the income disparity of agriculture, regarding the above mentioned we can respects a traditional dividing of theoretical approaches into two kinds of hypotheses, a supply-oriented hypothesis, and a demand-oriented hypothesis. In this already classical division, on the supply-oriented hypotheses explaining the income disparity of agriculture are introduced above all: special features of agricultural production (e.g. Henrichsmeyer, Witzke, 1991, Gardner, 1992), already a classical Theory of "Treadmill" – Technological Treadmill Thesis formulated by Cochran already in 1958 (Cochran, 1958), a Theory of Alternative Costs (Johnson, 1972, and an explanation is searched also in the course of inversion supply curve. The side of demand-oriented hypotheses includes then above all well-known findings of German statisticians E. Engel formulated in so called "Engel´s law" and "the Theory of imbalance of farmers´ position on the market compared to supplier and customers" A complex "Hypothesis of market-economic explanation" tries to then explain the demand and supply (Koester, 1972, 2011). Also other authors were concerned with income disparity (for example Hermann, 2000; Stejskal, 2010; Becu, 2012),

The contribution does not deal with all hypotheses explaining the income disparity. It is focused only to hypotheses oriented to the supply, i.e. special

features of agricultural production, the theory of alternative costs, and the Theory of Treadmill.

Special features of agricultural production

It is unquestionable that agricultural production in contrast to other branches of national economies is influenced by specific factors resulting from both its biological character, and the environment in which it takes place. Some authors (Henrichsmeyer, Witzke, 1991) distinguish specific features of the production and social-economic specific features. Among the specific features of agricultural production for example the following are introduced: dependence on natural conditions, dependence on land, a significantly associated character of agricultural production, dependence on the weather, and others. The authors consider as social-economic specific features for example a close interconnection of enterprises and households on family farms, obstacles in labour mobility (special education, unfavourable age structure), branch-specific capital estates etc. The mentioned specific features are a centre of gravity of problems invoking, among others, the income disparity. According to Gardner (1992), the classical agrarian economics works with a consensus that the specific features of agriculture lead to a creation of "agrarian problem" and it is projected also in low and instable incomes. The classical economics (neoclassical standard models) works with several limiting factors. These are entrepreneurial behaviour with the aim of profit maximization, a free competition, a mobility of production factors, and sector homogeneity. Newer views of these problems orientate above all to production factors and their role in relation to income generation. A Theory of fixed factors (called "High profit trap") is well-known. The subject of this theory is an explanation of inelastic aggregated supply (in price decrease) in connection with investment and non-investment behaviour of agricultural producers. In investment behaviour the expected revenue from the investment is higher than acquisition costs. In non-investment behaviour the expected revenue is lower that a value of resale (salvage value). If the expected revenue is lower than the acquisition costs, but higher than the resale value, then capital investment can be consider fixed in such sense that the capital is "entrapped" in agriculture (Johnson, 1972).

Theory of opportunity costs

The Theory of opportunity costs, closely connected with the above mentioned theory, orientates

to production factor labour. A conception of opportunity costs relates not only to agriculture, but is generally applicable (Hagedorn, 1996). An opportunity load of production costs is considered revenue in its alternative use (Hentichmeyer, 1978). The Theory of opportunity costs in relation to labour forces in agriculture starts from the fact that labour forces which stay in agriculture are not appreciate (rewarded) to reach a high of average reward in the national economy. A cause of that is considered above all a specific qualification of agricultural labour forces. Labour forces with agricultural education are not demanded in other departments and moreover possibilities of obtaining employment outside agriculture are limited. To this it is added also an information deficit, financial costs connected with the change of employment (housing, transport) as well as also psychological factors can take effect (leaving a family enterprise and so on). Even if the Theory of opportunity costs is introduced most often in connection with labour forces, it can be also applied to the production factor capital and the production factor land.

Theory of treadmill (Technological treadmill thesis)

Price development of American producers showed generally a permanent decreasing trend and the income disparity deepened in the twentieth century. Causes and connections why this happened were searched. W. Cochran brought a theory, today already classical, when he described a connection between a long-term decrease in prices and consequent growth of income disparity and technical progress (Cochran, 1958). He starts from the fact that technical innovation will reduce costs per unit of output. If it is moreover connected with an increase in production volume (however, the increase is not essential), in constant prices it lead to the following effects. The first users of technical progress achieve a temporary profit (windfall profit). A pressure on decrease of prices appears on agrarian markets. Other producers stay in front of a decision, they will either also accept the technical progress or they will refuse it. In the first case they stay able to compete; in the second one they can have living problems. In time the first users lose the advantage of "primacy" and achieve no longer higher profits against the others. The situation repeats with other technical or technological innovation. Cochran´s theory has been developed by Koester (Koester, 1972). A technical progress was defined and categorized (new production procedures, creation of a new product; improvement of quality of product in unchanged exercise of production factors) and a relation of technical progress was analyzed on one side and of price changes of agrarian products on the other side.

Materials and methods

The main aim of the paper is validation of the mentioned supply-oriented hypotheses explaining the income disparity of agriculture. As it is obvious from the above mentioned degree of knowledge, the first hypotheses come into being in the 1950´s, some of them we completed later, enlarged, but also criticized, or partially refused. It is evident that their authors expressed them under certain conditions of a country, under certain condition at this time existing agrarian policy, within a certain agrarian structure, in a certain development of supply, demand, producers´ behaviour etc. Therefore it is interesting to analyze whether the mentioned theory are applicable also in current conditions of "European agriculture" defined e.g. for state of the European Union by the Common Agrarian Policy. In this connection, a secondary objective is to define and categorize the income disparity as a social-economic phenomenon. The reason for this aim is a fact that some theories trying to explain the income disparity are not generally applicable for all entrepreneurial forms in agriculture today. What was framed for family farms cannot be completely applied to enterprises of cooperative type and trade companies.

Considering the methodological side, above all elementary analytical methods are used – a horizontal analysis (trend analysis) and a vertical analysis (analysis of structures). Also, a method of comparison was used. Quantitative and comparative analyses stem from Eurostat, the Czech Statistical Office, Reports on state of Czech Agriculture, and German and Austrian "Grüner Bericht" in time series.

Results and discussion

Specialities of agricultural production

Specifics of *agricultural production* which results from the own character of production and from conditions under which the production is realized are unquestionable. Regarding the significance of agriculture for nutrition of inhabitants and considering the fact that agriculture has very close relation

to creation and maintenance of landscape and the countryside, it is really necessary to approach this sector "protectively" concerning the incomes of agricultural producers. Under the term "protection" it is possible in simplified way to imagine specific financial tools connected with biological and climatic influences, and which have a character of income support. Without these tools the farmers´ incomes would be exposed to fluctuation and the disparity would deepen both in the relation to other branches and mutually among farmers.

In the case of **social-economic** specialities the situation is not so unambiguous. Authors started here partly from specific properties of agricultural labour forces and specifics of agricultural farms. In labour force the role is played by low qualification, unfavourable age structure, conservatism, a difficult requalification and so on. In agricultural farm in connection with the income disparity, an interconnection between the own business and farmers´ household is pointed out.

Concerning the **specific character of labour forces**, it is possible to agree with the above mentioned.

Agricultural population grows old more quickly than other groups of inhabitants; a generation exchange is still more and more difficult. A relation between young (up 35 years) productive labour forces and post-productive workers in agriculture (over 65) is more favourable in "old" member countries of the EU-15 than in "post-communistic" member countries of the EU-12. While in countries which accessed the EU in 2004 and 2007 one farmer in post-productive age is at average "replaced" by a young farmer in height 0.2, in countries of the EU-15 it is in the height 0.60. Hereat, there are significant differences among the countries (from 0.07 – Italy, Bulgaria, 0.08 Great Britain, to 1.1 Germany, 0.8 Poland) (Boháčková, 2011). The cause of more favourable situation in the EU-15 is the different structure of agricultural businesses in favour to family farms where the property is inherited "from father to son" and where there are closer emotional ties to the family property also in the next generations. In the EU-12, where the base (except Poland and Romania) is cooperatives and other trade companies, these businesses are moreover employers and the interest of employees in their sustainability has a personal character (to keep the job).

Also it holds that an education structure is different in that partly it is dealt with a specific type of education (except economic orientation

a difficult requalification and possibility to find a job of the labour market) and regarding the character of work the education structure in relation to the income disparity is incomparable with other sectors of the national economy. A problem in this connection is obtaining quantitative data about the education structure in agriculture. In the CR, the last year providing its data is 2003; in Eurostat this information is not available. However, it is possible to assume on base of older data that the unsatisfactory situation has not significantly changed.

Regarding an **interconnection of a farm with a household**, it is not possible to generalize this interconnection in the connection with income disparity. It concerns only family agricultural businesses; it is not hold in case of trade companies of any type. As it was pointed out by Sokol (Sokol, 1994), an account of family business and family is identical; moreover, within determination of income disparity would be necessary to adjust methodology of income calculation. In this methodology the incomes should take into account also the fact that the family has not costs for some foods, partially for housing, etc. The incomes should be higher by these sums.

Speaking about the influence of specialities of agriculture (production and social-economic) on the income disparity, at the first sight it can be seen insufficiencies in the present approach to classification of the income disparity:

- production agricultural specifics concern all agricultural enterprises without difference;

- the specific character of labour forces refers to the wage disparity, not to the income disparity of businesses (the relation between education of labour force and costs of the business on this labour force);

- a problem of determination of incomes of a family farm and working members of the family in this enterprise with interconnection of the management, of "wages" of owners and family members and, a budget and costs of the family.

Theory of alternative costs

The Theory of alternative cost reacts to problems of production factors in agriculture regarding their alternative use and working of production factors on agricultural producer´ incomes. Also here the authors do not distinguish much whether it is dealt with a disparity in relation to the labour

force (wage) or the disparity of business incomes. The theory deals above all to labour force and compares the evaluation (wage) of labour force in agricultural businesses with a wage in other sectors. It sees the causes of wage disparity in specific properties of agricultural labour forces (see above).

It can be assumed that a basic mistake of this approach is that the wage disparity is watched as a *disparity of average wages*. Hereat, it is obvious that various sectors of national economy have regarding to various character of work also various demand for education structure, so inevitably the employees have to have also a different height of wages. In this connection there is a justified question why incomparable is compared? If we consider an extreme: what sense does it have a comparison of monthly or yearly average wages in agriculture (18 092 CZK) with an average wage in information and communication activity (43 513 CZK), in banking and insurance business (45 638), in water supply and waste management (39 928 CZK) and other economic activities which are not included in the average wage and influence it significantly? The character of work is different; demands for the education structure are different; the higher education degree is evaluated with higher wage and so on. It is possible to take the amount of wages as information, but decisively it is necessary to refuse conclusions from their comparison. If we want to compare purposefully, then a comparison of wage according to profession is offered (e.g. by the help of CZ-ISCO) where it is possible - for example a repairman in agriculture with an average wage of repairmen, a wage of bookkeeper in agriculture with the average wage of bookkeepers, a wage of managers in agriculture with managers in other branches and so on.

This approach would then confirm (or would not confirm) an existing wage disparity in those professions which are applicable both in agriculture and other departments. In professions which are not applicable outside agriculture, there only a requalification is possible in connection with alternative use. However, such professions are also in other branches and we cannot see in it only agriculture speciality.

Alternatively it is possible to use also other production factors – land and capital. With respect to the main production mean for agricultural business – land, an inequality is known in prices of this factor in various usage. In the alternative use, in some cases it is dealt with a one-shot

income e.g. from sale; in other cases with incomes from alternative business which can serve for a comparison within monitoring of the income disparity. However, it is essential to be aware of that it is not dealt with incomes of an entrepreneur who changed a field of its business. In case of success, these incomes can be higher than from agricultural enterprise, however, they can be also lower. The alternative usage by itself does not have to always bring higher incomes than the original incomes from agricultural activity were.

In alternative use of capital it is necessary to distinguish whether it is dealt with tangible capital or financial one. The tangible capital is in some extent specific in that a part of it is usable only in agriculture (sprayers, silos, milking equipment etc.) However, agricultural enterprises have also a tangible capital (buildings, means of transport and so on) which can be used alternatively. Even here it is necessary to approach a statement that capital is agriculturally specific, and it is actually one of causes of the income disparity, very carefully. It is proved also by the present rational approach of agricultural enterprises in looking for an alternative use of property when within the agricultural business so called inseparable secondary gainful activities are introduced. The financial capital can be used both for agricultural activities, and alternatively outside agriculture. Hereat, again it is not possible to assert that investment outside agriculture will always bring higher revenue.

The theory of opportunity costs (it would be more suitable marking of opportunity revenues) as an explanation of income disparity in agriculture cannot be confirmed in the whole extent, it is hold only in certain connections and it is referred only to a concrete type of production factors.

Theory of treadmill

Maybe, the most widely known theory is Cochran theory of "treadmill" which gives in connection the technical progress, prices and volumes of agricultural commodities, and the income disparity. Growth of the income disparity is explained by price decrease. A defence against this is introduction of progress technologies decreasing costs or increasing production volumes. The theory arose at half of the last century on example of situation in American agriculture. If we apply it for example to the present EU agriculture we would have to take into account differences which can be seen in graphs 1 to 3.
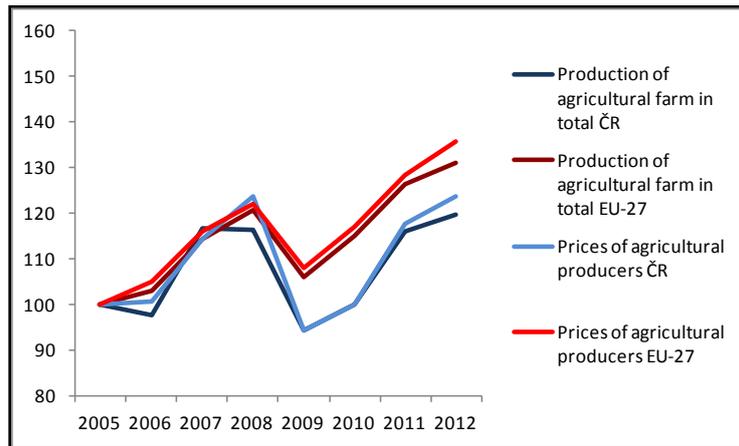
Source: Eurostat

Graph 1: Development of production of agricultural farms and prices of agricultural producers (index, 2005 = 100) in the CR and the EU-27.
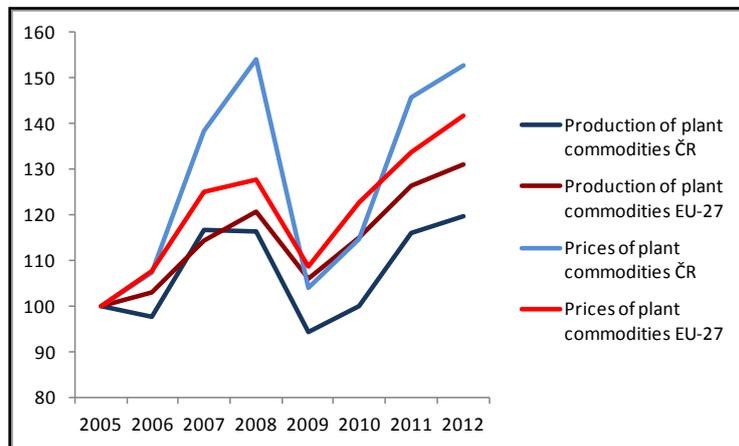
Source: Eurostat

Graph 2: Development of production of plant production and prices of agricultural producers (index, 2005 = 100) in the CR and the EU-27.
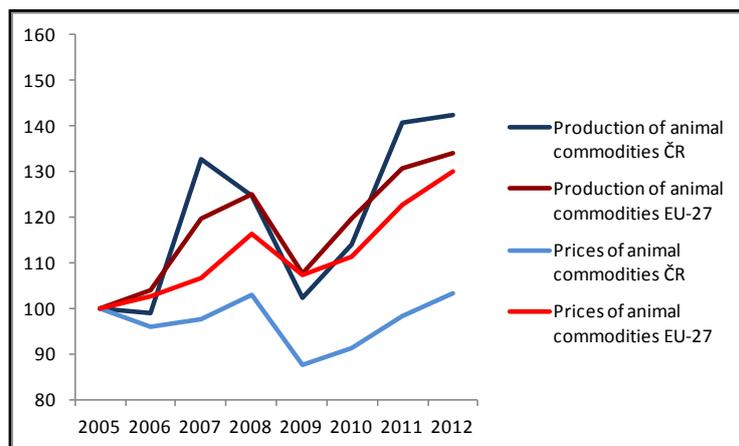
Source: Eurostat

Graph 3: Development of production of animal production and prices of agricultural producers (index, 2005 = 100) in the CR and the EU-27.

It not hold in the EU agrarian sector that in growth of demand prices decrease and vice versa with decreasing supply prices grow. The cause of this phenomenon is agrarian-political interventions of regulation type both of production volume and a price policy within the Common Agricultural Policy. As it is obvious in the graphs, except a sharp decrease in prices and production volumes in 2008 – 2009, both the production volumes and price of agricultural producers grow (for agricultural farm generally, and separately for products of plant production and agricultural production). The influence of technological process is not insignificant. Still it is hold that a new engineering and new technologies lead to cost savings and thereby also to growth of financial effect. However at present, investments are not for European farmers so difficult to reach like in American agriculture when the theory of "treadmill" arose. Within the Common Agricultural Policy and Rural Development Policy there are many financial supports which enable farmers entrepreneurial activities for which they would not have means without the supports. Thereby their competitiveness grows. Cochran theory unambiguously deals with the income disparity of "internal type", i.e. a disparity among producers.

Conclusion

From the above mentioned two relevant conclusions result, among others:

1. It is necessary to carry out clear and factually correct categorization of particular types of income disparity.

2. It is necessary to re-value validity of some traditional approaches to explanation of income disparity causes.

With regard to *categorization of income disparity*, at present an already traditional classification to the internal disparity and the external disparity. The internal income disparity is monitored within agriculture, the external disparity regards the relation agriculture and average values of the national economy as the whole, or a relation between agriculture and selected branches. In this division other dividing border often disappears; whether it is dealt with an income disparity of character of wage disparity, so the difference in the level of wages, or an income disparity among enterprises. And, there is other problem, a problem of factual comparability.

In categorization of income disparity (e.g. according to the scheme 1) it is necessary to proceed according to the following steps:

- *to delimit what is the subject of income disparity*, so to determine whether it is dealt with a wage of employees in agriculture, or with an income of agricultural enterprise (for comparison re-calculated e.g. per one employee, per an area unit, and other possibilities). If the subject of income disparity is *evaluation of labour force*, then it is necessary to distinguish whether it is dealt with a wage of labour force or a reward of owner of the agricultural enterprise or members of his/her family. In comparing wage, it is not possible, as it has been mentioned above, to accept the present approach and to compare the average wage in agriculture and the average wage in the national economy on base of branch approach because the character of activities in particular branches differs and also demand for labour forces differ. It would be possible to compare only comparable profession. If the subject of comparison is a reward of owner (eventually of family members), the situation is complicated regarding the fact that the household of the owner and the enterprise are an aggregated unit; financial means are spent both for the enterprise, and the needs of family members. Moreover, as it has been mentioned, even if the amount of reward is determined (even this it is hardly realizable because e.g. the owner carries out both the managerial and a simple manual work), it is necessary to add to this reward also financial benefits resulting from owns foods, own housing and other. If the subject of monitoring is *the income disparity of agricultural enterprises* (in the form of indicator an income per a unit of comparative base), then it is necessary to methodically delimit this income (all income, income from agricultural activity). The compared enterprises can be divided according to an entrepreneurial orientation (oriented to animal production, to plant production, mixed, or specialized and so on), or according to a legal form of enterprise, or according to regions. Regional approach is preferred also by some other authors (Sakamoto, 2010; Tamasue, 2013; Itoh, 2011). Decisively it is not purposeful to compare with enterprises outside the agricultural department.

- *To determine a level at which the monitoring of income disparity will take place.* In this context it is dealt with to decide whether it will concern monitoring of incomes in agriculture at the level of agriculture as a branch, or at the level of national economy. At present, a regional dimension is marginalized, although it would be very interesting to found out whether the situation in regions is moreover identical or differs. If it is dealt with a disparity within agriculture (internal disparity), it is possible to monitor both the wage disparity and the business and regional ones. If the comparison is realized at the national economy level, then only "comparable" can be compared, it means wages of professions which occur both in agriculture and in other branches.

In *the analysis of validity of traditional hypotheses explaining* the income disparity of agriculture, the subject of analysis were supply-oriented hypotheses. In the hypothesis stemming from a presumption that a cause of income disparity are specialities of agriculture a division of these specialities to production and social-economic character can be accepted. Specialities influencing production process are unambiguous. As well as the influence of specific character of labour force. Nevertheless, the interconnection of enterprise and owner´s household is typical only for a form of family farms; it is not possible to argue in this way in the case of trade companies.

The hypothesis of alternative costs arises from that the income disparity results from a lower evaluation of production factors in agriculture. In the case of labour force (wage disparity), a wide-spread mistake is that average wages in agriculture are compared with average wages in other sectors, or with the average of national economy regardless the fact that incomparable is compared in this way (branches factually differ, demands for labour forces – education differ). It is possible to compare only wage in the same professions. The separate problem is also a determination of entrepreneurial reward of the owner of the enterprise or family members working here. In the case of capital and land the alternative use is certainly possible; however, not always it is sure that alternative revenues will exceed the original revenues. Moreover, in land the alternative possibilities of usage outside agriculture are limited (scheme 1).

The theory of treadmill is valid under condition when farmers´ incomes depend on production volumes, commodity prices, and expenses for these commodities. Than a technological progress is a factor which can invoke, moderate or deepen the income disparity. However, it has only a temporary effect for the given enterprise or enterprises. At present in European agriculture, volumes of most commodities are influenced by quotas or restrictions; an influence of commodity verticals shows in the price height. Then the technological progress shows mainly in the cost area. Within the present support
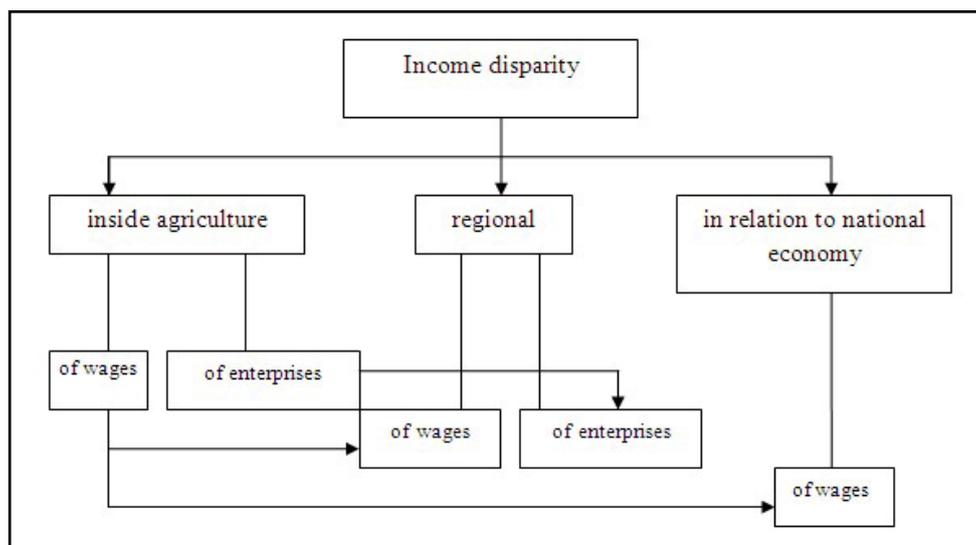
Source: own processing

Schema 1: Possible categorization of income disparity.

of investment activities from the side of Common Agricultural Policy and the Rural Development Policy, introduction of technological process in agricultural enterprises is available moreover for all producers.

From the analysis of cost-oriented hypotheses an unambiguous conclusion results. Factors which are presented as causes of income disparity in agriculture are not all constant. Some, like for example influence of production specialities, have permanent validity, other change in dependence

above all on agrarian-political measures. Search for factors which invokes the income disparity today will be the subject of next research.

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Collaboration in the Czech Dairy Chain

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Anotace

V souvislosti s procesem deregulace byl sektor mléka v EU posílen o tzv. Mléčný balíček, který obsahuje sadu opatření směrovaných k organizacím zemědělských producentů s cílem povzbudit jejich účast na řízení výrobně-spotřebního řetězce mléka. Cílem článku je zodpovědět otázku, zda organizace producentů mléka v České republice vykazují znaky, aby mohly být článkem, který podporuje stabilitu řetězce a jaký potenciál pro ekonomiku farem představují. Jsou zjišťovány hlavní rysy vybraných organizací producentů a s využitím konceptu modelů mlékařských družstev je konfrontuji s podnikatelským prostředím. Většina organizací producentů vykázala v interní organizaci vestavěné transakční mechanismy, které by mohly být nositelem regulační funkce, ovšem organizace producentů namísto podpory řetězce jej narušují vyjednávacími strategiemi. V závěru jsou uvedeny argumenty pro změnu strategií zejména ve smyslu kapitálového zapojení do zpracování mléka. Racionální chování organizací producentů by mohlo zlepšit rentabilitu farem s produkcí mléka.

Klíčová slova

Mléko, organizace producentů, strategie, vyjednávání, přidaná hodnota, vertikální integrace, rentabilita farem.

Abstract

In the context of the market deregulation process the EU dairy sector has been reinforced by the Milk Package, comprising a series of measures addressed to producers´ organizations to encourage them to participate in the dairy chain conduct. The aim of the paper is to explore if milk producers organizations in the Czech Republic dispose with characteristics to become supporting element of the sector´s stability and what a potential for the farm economics they may have. The characteristics of a spectrum of organizations are examined and confronted with the business environment using the concept of dairy cooperative model. Most of organisations showed inbuilt transactions related mechanisms which might carry the regulative function, however instead of support they disrupt the chain by bargaining. It is argued for the change of their strategies with a focus on capital involvement in milk processing. Their rational functioning might improve dairy farms profitability.

Key words

Milk, producers´ organizations, strategies, bargaining, value added, vertical integration, farm profitability.

Introduction

Dairy farmers in Europe are increasingly more pushed to make their own effort to assist the dairy market equilibrium and to support the sustainability of the chain. Having this aim in the focus, the European dairy sector has been reinforced by the Regulation (EU) Nº 261/2012 of the European Parliament and of the Council of 14 March 2012, the so-called Milk Package, comprising a set of tools to make the dairy sector more stable by the self-help of it´s agents especially by producers organizations.

Czech milk producers in the context of the Milk Package are in the focus of the paper. In the Czech Republic almost 70 % of raw milk produced is negotiated by milk producers´ organizations (MPOs), mostly with cooperative status. The objectives of the article is to investigate if the MPOs have characteristics, which will help them to reflect the market deregulation and to be

an element supporting the stability of the sector and what a potential for the economics of dairy farms they have. For this purpose the main characteristics of chosen MPOs are examined and confronted with the market environment. The article is divided into four parts. After a survey of the literature dealing with the response of the milk cooperatives to the market deregulation given in this part, in the second part the methodology, based on the cooperative models, considering the farm policy reforms, is explained. The results in the third part contain a short view to the milk sales distribution in the Czech Republic, the characteristics of external and internal structure of chosen MPOs together with their potential to improve the farm economics. In the same part the options are outlined how the market organization change can be reflected in the collaboration among the MPOs and milk processors in order to realize milk on the market effectively. Conclusions are made in the final part.

In the literature the ongoing role of dairy cooperatives under changing business environment is emphasized, however the need of a reflection in the cooperatives strategy and their internal structure is highlighted to stay a functional and a sustainable body. Van Bekkum (2001) refers to the close interlink between the agricultural policy and cooperative strategies. If access to commodity markets is easy, e.g. if exports are subsidized, large milk volumes, related to commodity kind of cooperatives, may be attractive. If policy measures favour domestic sales rather than international marketing, the coops are expected to move to value-added strategy as the products traded on domestic markets tend to be in the value added category. Moreover, Nilsson (1998) argues that the opening of market by a liberal policy makes downward pressure on prices (lowers the price towards the most competitive country) and favours to the value added strategy as a possibility to create the opportunities to find market niches and to increase the profitability of the cooperatives.

While a collective character of the internal structure is satisfactory for the commodity (thus more or less bargaining) strategy, the shift to more individualized structure is being recommended if investments in facilities for value added products are needed. In accordance to Nilsson (1998) idea about the relation of liberalization and value added Nilsson and Ohlsson (2007) argue that more liberalized and open markets require cooperative organizational models with more

individualized traits. According to Nilsson (1998) by establishing a cooperative firm, the traditional model is a superior solution for recruiting farmers to join the coop. The open membership, collective ownership, equal voting power, principles of equality and solidarity, ideological motivation and other are relevant when the cost curve is declining with size and when the price is not affected by the individual firm´s sales volume – either due to agricultural policy or due to small size of the coop in comparison to the market size. Cook (1995) emphasizes that the need to make substantial investments calls for the individualization of the governance as collective ownership weakens the incentive for members to supply additional equity capital. Typically the allocation of income rights and decision rights, the supply of equity capital, the assignment of ownership title and the owners´ control of the management are subject of the internal organization (Bijman, 2000). A number of internal structure designs was introduced with different levels of individualization. Cook and Chaddad (2004) defined categories of traditional form (1), proportional investment coop (2), member investor coop (3) and new-generation coop (NGC, 4). While in the proportional investment coop the members invest in proportion to their patronage, in the third mentioned scheme the returns to members are distributed in proportion to shareholdings in addition to patronage. In the NGC the ownership rights are in the form of tradable and appreciable delivery rights either restricted to members or opened to non-members as well. The last mentioned model includes coops with capital-seeking companies, investor share coops and coops which converted to an investor-driven ownership structure. Even the examples of the exit of the cooperative status to an IOF model are quoted. (Cook and Chaddad, 2004; Chaddad and Iliopoulos, 2013). Similarly to the NGC model, Nilsson (1998) referred to empirical examples of a new coop model, where the secondary processing (means consumer goods production) was performed in private companies, jointly owned by the cooperatives and external investors, which moved the conduct of such firms to investor-owned firms.

The literature dealing with the empirical experience shows that once the market comes through the deregulation process, the role of cooperatives in the market control is confirmed either as a top down effect of getting more competencies within the policy, or as a bottom up response

of farmers to the reduction of their protection. Szabó and Popovics (2009) even mention as intermediate form of cops establishing initiated by the processor. At the same time, the internal structures of coops are being accommodated to the new market regimes

The Swiss experience with quota withdrawal (Chavaz, 2012) combines both the top down and the bottom up effects. During the transition period the farmers were encouraged by the policy to enter the coops by providing them a chance of production increase, while after the quota abolition the Swiss Farmers´ Union initiated the foundation of the vertical Inter-branch Organisation (IOM) to face the market distortions. The IOM associated milk producers organizations, milk processing companies, cheese dairies, milk traders and retailers, which covered 95 % milk production and processing. It´s internal organization is based on the volume control and price recommendations. In Australia, after the milk market was fully deregulated, the traditional model of farmers owned cooperatives covering milk production, manufacturing and marketing, became uncomfortable for a part of farmers (ADIC, 2010). To free up their capital and to dispose more flexibility and a short run certainty over the milk price, part of farmers withdrew the traditional coops and formed the independent bargaining groups. The market balance is being reached by parallel operations of traditional coops, bargaining groups and direct contractual relations between farmers and processors. There is to mention that there are regions with supply shortage, which favours to bargaining, and on the other hand, ADIC remarks, that not every bargaining group has been successful. In New Zealand, one and half decade after the milk market deregulation, the Fonterra coop, collecting round 92 % milk, introduced the reform of the coop´s internal structure (New Zealand Government, 2010). Under the New Zealand Dairy Industry Restructuring Act 2001 free and anytime entry/exit regime was implemented with the redemption of co-operative shares at fair value. Moreover, part of milk purchased was allowed to be supplied to independent processors. Thus a mobility of farmers´ capital and their risk responsibility have been amplified.

Materials and methods

The methodological approach exploits from the concept of dairy cooperative models introduced by Onno-Frank V. Bekkum (2001). In this concept, by a combination of different institutional environment (generally diversified to regulated and liberalised markets) and different cooperative strategies (generally diversified according to final milk product characteristics) the diverse types of cooperatives with a specific internal governance - the so called cooperative models are defined. The aim of the categorisation is to define an effective internal structure suitable for various cooperative strategies within certain levels of market regulation or liberalization.

For the classification of the cooperatives three dimensions are used. Two sales strategy characteristics (*cost leadership:* on X-axis, and *product differentiation:* on Y-axis) are combined with a characteristics of the cooperative organizational structure (*degree of individualization of cooperative-member relationships:* on Z-axis). Low versus high values along three axis´ led to create a cube with eight corners, four of which are either non-suitable or non-logical, while the other four ones represent the extreme cooperative models with the coherent strategy-structure matches.[1] A schematic overview of models is given together with results in Figure 2.

The *village-cooperative* is a model of a small and local oriented cooperative with limited specific product requirements. It exists mostly because of low competition. It´s good perspectives come into consideration if the size or location of the market is not attractive for the competitors. This type of cooperative may be organised on a collective basis with democratic voting principles, equal pricing, unallocated capital etc. The *commodity cooperative* represents a model of cooperative that grew out of the village type through internal growth and/or mergers. Basically it´ s a typically price negotiating cooperative considering milk volume with no processing. It´s interest in permanent expanding volumes fits to open membership, free entry, democratic principles, limited investments, use of unallocated reserves and similarly. The *value-added cooperative* invests heavily in processing and marketing so as to serve the top market segments. This requires differentiated pricing for members, controlled delivery volumes by means of delivery rights

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[1] Quantification of cost leadership is made using member-milk intake volumes (as this characteristics basically referers to a horizontal growth). Product differentiation is quantified by total assets per kg of member milk (as this characteristics is mainly connected with the vertical growth and investment approach to value-added products) or market receipts approach is considered .The degree of individualization is assessed by milk pricing schemes, individual versus collective contribution of capital, risk bearing and the rights to residual claims.

systems or contracts, high amounts of individualized investments, tradable and appreciable form of capital etc. The strategic orientation of the *niche cooperative* is similar to the value-added one but it is smaller sized with a focus on small market niches, which means that it usually operates on regional markets addressing specific consumer groups etc. This model requires closed membership, obligatory investments in tradable production and delivery rights, differentiated voting schemes etc.

In the article, firstly raw milk sales distribution in the Czech Republic is outlined. In the second step, from all producers´ organisations in the country I chose a sample of seven ones in order to estimate their positions in the cube. The criteria for the choice of the MPOs were the annual milk volume negotiated and the regional coverage of milk suppliers (farmers). The choice followed the objectives to have both representatives of the most important organisations in the country and the small ones as well, and to have the most important production regions covered. The position on the X-axis comes form the milk volume negotaited. The position on the Y-axis was indicated according to their involvement in milk processing. For their position on the Z-axis, their internal structure characteristics were examined. Their choice has been inspired by the Onno-Frank V. Bekkum´s model (2001). Nevertheless, the complex character of the model was substituted by a simplified way with a limited number of characteristics. After the choice of the characteristics, indicating collective, individual or highly individual character of the internal structure, their occurrence at each of the MPOs was examined and summed in a survey. The examination has been realized by the guided interviews with representatives of the MPOs and completed by the documents search. To complete the position of the MPOs in the cube, I aimed to estimate their position in accordance with the survey. The main constrain rests at the identification of the maximum on the Z-axis as it seems difficult to define the full list of the individualization characteristics which would represent the maximum degree of individualization. Therefore the maximum on the Z-axis was considered like a sum of all individualization characteristics chosen in this examination. The position of each MPO on the Z-axis was estimated in such a way that each individualization or highly individualization characteristics put the MPO forward

to the maximum (by one or by two steps respectively) while a collective characteristics put it by one step back. The allocation on the Z-axis has an estimation character and should be considered like a mutual position of particular MPOs examined with a view of whether the MPO inclines rather to the collective or to the individualized structure in the frame of chosen characteristics.

Finally, the MPOs eventual impacts to the farm economics were estimated. For this purpose the space between the minimum and maximum milk price paid off by milk processors in the country[2] was considered to be a space for farmers within of which they can operate. Thus this space was considered to be a frame for the improvement of the milk price (and farm economics) by a rational behaviour of famers (MPOs) on the market. This step was done to get a basic and a very rough idea about the impacts of rational market beaviour to the farm economics while to get an exact evaluation, further factors should be taken into consideration. The estimation is based on return on cost calculation where the cost data come from research institute and cover a file of farms representing the country average, while milk price data come from the ministerial sheets, covering all processors in the country.

Within discussions, the positions of particular MPOs in the cube were confronted with the European dairy market policy. Based on the confrontation, the recommendations for the MPOs in the Czech Republic were made to stay competitive on the European market and to help let milk supply chain sustainable.

Results and discussion

Since the early nineties, when the MPOs started to be established in the Czech Republic, their share on raw milk sales in the country moved to about 70 % in recent years. In the quota year 2010/11 together 1 714 thousand tonnes of raw milk were sold through the mediation of the MPOs, which means 67 % of the national raw milk production. Out of total 2 224 milk producers, 1 147 ones (51,5 %) were organized in altogether 39 MPOs. The overview of milk sales realized by particular MPOs together with their members´ number is given in figure 1 and table 1.

By the Milk Package the maximum milk volume

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[2] which means the space between the processor with the poorest and with the highest milk price.

allowed to be negotiated by single MPO was defined up to 33 % of the national milk production Therefore in the mid-term view and in the context of current national production level, the scale on the X-axis in figure 1, coming up to 775 thousand tonnes, can be considered like a maximum annual sale of a single MPO. The figure 1 and the table 1 show that even the largest MPOs were far below the limit. Except of the 2ndL MPO, only 3 other ones exceeded 5% share on national milk production, while most of the other of 36 MPOs didn´t reach more than 2% share. The MPO marked 2ndL is a second level MPO, associating 8 single MPOs. While at the start of the millennium it disposed

of a great influence on the national milk market, due to a national government decree issued in 2005, it lost it´s official status of milk sales mediator and since 2005 it is functioning like a coordinating body with the remit of recommendations for the MPOs associated.

The MPOs chosen for the examination of their qualitative characteristics represent the spectrum of the MPOs in the country. As processing is concerned (table 2, first section), none of the MPOs chosen is involved in milk processing because they are not interested in. Thus they voluntary keep the positions of organisations bargaining
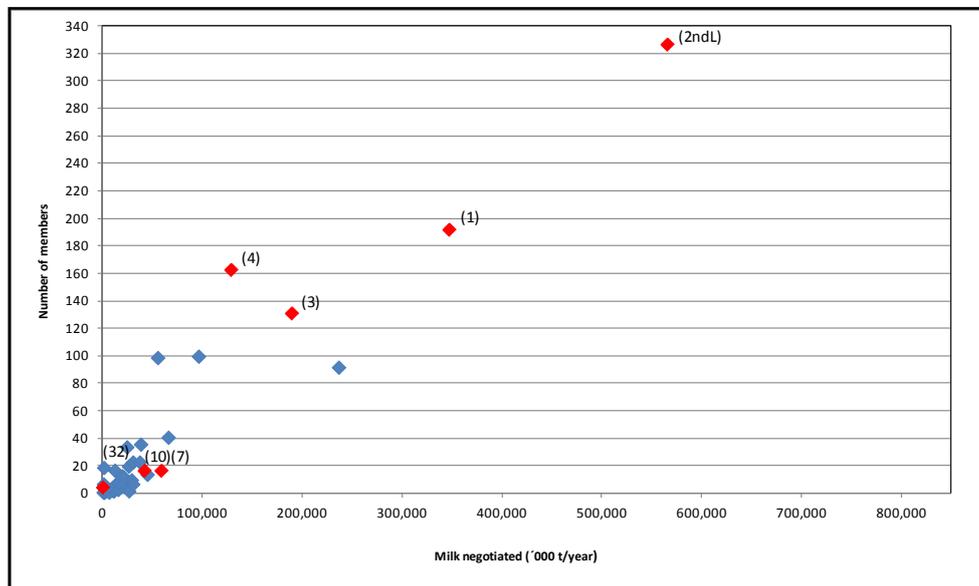
Note: data related to the quota year 2010/11
Source: own survey based on the data of SAIF (2013)

Figure 1: The size of milk producers organizations (MPOs).

MPO code	SP[1]	2ndL[2]	1	2	3	4	5	6	7	8	9	10	11	12
Share on total sales[3]	33.3	22.0	13.5	9.2	7.4	5.0	3.7	2.6	2.3	2.2	1.7	1.6	1.5	1.5
Share on MPOs sales[4]	0.0	33.0	20.2	13.8	11.1	7.5	5.6	3.8	3.4	3.2	2.6	2.5	2.2	2.2
MPO code	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
Share on total sales	1.2	1.2	1.1	1.0	1.0	1.0	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.5
Share on MPOs sales	1.8	1.8	1.7	1.5	1.5	1.4	1.3	1.2	1.1	1.0	0.9	0.9	0.9	0.8
MPO code	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	
Share on total sales	0.5	0.4	0.4	0.4	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	
Share on MPOs sales	0.7	0.7	0.7	0.6	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	

Note: [1] Single producers non organized; [2] Second level MPO - association of eight MPOs, the figures to be excluded from the sum of shares; [3] Share on all milk sold by producers registered in the country; [4] Share on all milk sales realized by the MPOs in the country.
Source: own survey based on data of the SAIF (2013).

Table 1: Sales shares of the MPOs in the Czech Republic on the national milk production.

the best milk price. The MPOs (4) and (7) got a short experience with the integration with processing few years ago, however, as shown in Ratinger, Bošková (2013), both of their attempts failed and they are not interested anymore. Other MPOs chosen showed no willingness in any capital investments in milk processing. They usually argue with no management skills to conduct milk processing. Only two of seven MPOs examined (and even of all MPOs in the country) have the full time managers, the rest of MPOs is led by farmers themselves like a side job.

As the internal structure is concerned, all the MPOs chosen proved certain features showing the individual approach in transaction relationship (table 2, second section), whereas the results of the individual approach in investments relationship (table 2, third section), were almost negative. This is a logical effect of zero involvement in milk processing, where only basic investments relationships connected with the entry and leaving the MPO are treated, while the other ones are of low importance.

Summing up the internal structures it is to say that the MPOs examined are individually developed in transaction relationship dominantly. All of the MPOs work with milk quality appreciation and the volume related characteristics are partly found. The patterns for milk appreciation within the coop usually follow the processors´ patterns. The volume control insists in annual contracting the volumes with members, based on the contracts with processors. This indicates that the coops examined operate with the characteristics which are able to transfer the processors (thus market) needs of milk volume and quality to the primary production. By this way they are able to carry the regulatory function of the volume and quality.

The position of the MPOs in the cooperative model is shown in figure 2. With regard to the Y-axis position, all seven MPOs lie at the zero level due to no involvement in milk processing. Based on the milk volume negotiated, they are distributed between cost leadership (commodity coop) and no competition (village coop) at the X-axis.

	MPO code	IN[1]	2ndL	1	3	4	7	10	32
	Processing		-	-	-	-	-	-	-
Transaction relationship	Open membership	C	+	+	+	+	-	-	+
	Volume control	I	-	+	-	+	+	+	+
	Volume included in price formula	I	+	-	+	-	-	+	-
	Market related pricing formula	C	-	-	-	-	+	-	-
	Performance based pricing[1]	I	+	+	+	+	-	+	+
	Tradable production and delivery rights	I	-	-	-	-	-	-	-
	Premium for high proportion of protein to fat content	HI	-	-	-	-	-	-	-
	Price corrections based on distance	HI	-	-	-	-	-	-	-
	Above/below hygiene standards appreciation/levies	I	+	+	+	+	+	+	+
	Surplus distribution according to delivery	I	+	+	+	+	-	+	-
	Creation of supportive fond	C	-	-	+	-	-	-	-
Investment relationship	Pro-forma entry fees	C	+	-	+	-	+	-	+
	Entry fees according to delivery	I	-	+	-	+	-	+	-
	Voting according to residual rights	I	-	-	-	+	-	-	-
	Obligatory production linked capital	I	-	-	-	-	-	-	-
	Production linked ex post investments	I	-	-	-	-	-	-	-
	Production linked ex ante investments	I	-	-	-	-	-	-	-
	Allocated risk-bearing capital in total assets	I	-	-	-	-	-	-	-
	Tradable allocated capital	I	-	-	-	-	-	-	-
	Allocated capital redeemable upon exit	I	-	+	+	+	+	+	+

[1] Note: IN = individualization code: C - collective structure characteristics, I - individualized structure characteristics, HI - highly indivudualized structure characteristics.
Source: Ratinger, Boskova (2013) completed with own data

Table 2: Characteristics of the internal structure of chosen MPOs.
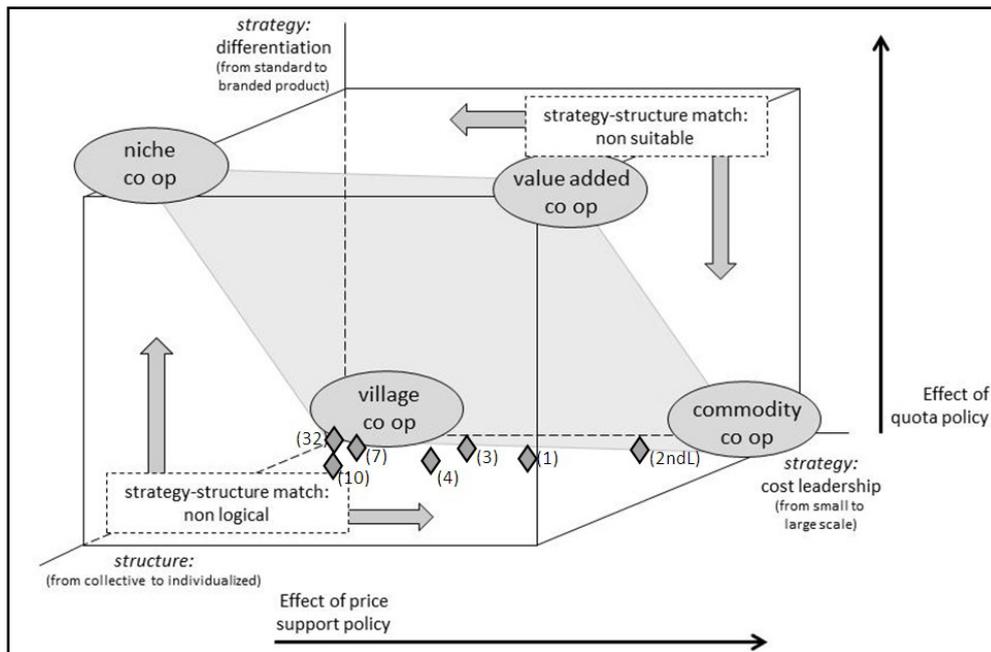
Source: Bekkum, O. F. (2001), completed with own records

Figure 2: Allocation of chosen MPOs in the cooperative model.

Close to the cost leadership strategy, there came the 2ndL MPO only. However, as described above, this MPO has no competencies to bind the MPOs associated with fixed rules and works rather like an advisory body. Other three MPOs lie somewhere on the half way between the „no competition corner" and the cost leadership strategy. Three MPOs are clearly located in the village coop corner, among them even the seventh largest MPO in the country (neither cost nor value added advantage.

The internal structures showed dominantly collective characteristics in the area of investment relationship and therefore none of the MPOs chosen exceeded the middle of the Z-axis. However, the MPOs (10), (4) and (1) showed a number of individualization characteristics in the area of the transaction relationship. Despite they aren´t involved in milk processing directly, their internal structures seem to be well developed to transfer price requires of processors to the MPOs members.

In figure 3 there are shown market receipts, reached by processors in the Czech Republic from 1 kg milk purchased. There operates a scale of processors in the country, some of them being able to utilize milk purchased in significantly higher market returns than others. Correspondingly there is significant milk price variation within the country. This gives a space to the MPOs and to farmers

to improve their economics by milk price if they find a proper way to reach the value added market. The most value added was observed at processors with low milk purchase, while the largest processors exhibited rather an average or under-average market receipts per milk unit. This might describe the situation that processors producing bulk products (having low value added and being milk volume demanding) swallow big volume of milk. One would expect to have cheese makers at the top of the value added scheme. Nevertheless the top positions are occupied by processors having important share of fresh products in their production programmes, such as yoghurts and sour creams.

The estimated theoretical MPOs impacts to the farm economics are given in figure 4. The scale of milk price paid off in the country showed a difference in the return on cost between 9 p. p. (in 2012) and 20 p. p. (in 2009).

Summed most of milk volume produced in the country is being marketed through MPOs with low market share which use bargaining strategies. The internal structures of the MPOs examined have well developed transaction related characteristics thanks to which they are able to carry partly the regulative function in the chain (as an mediator), the issue remains that they don´t use them in this way. In the country there are processors with the market for significantly higher
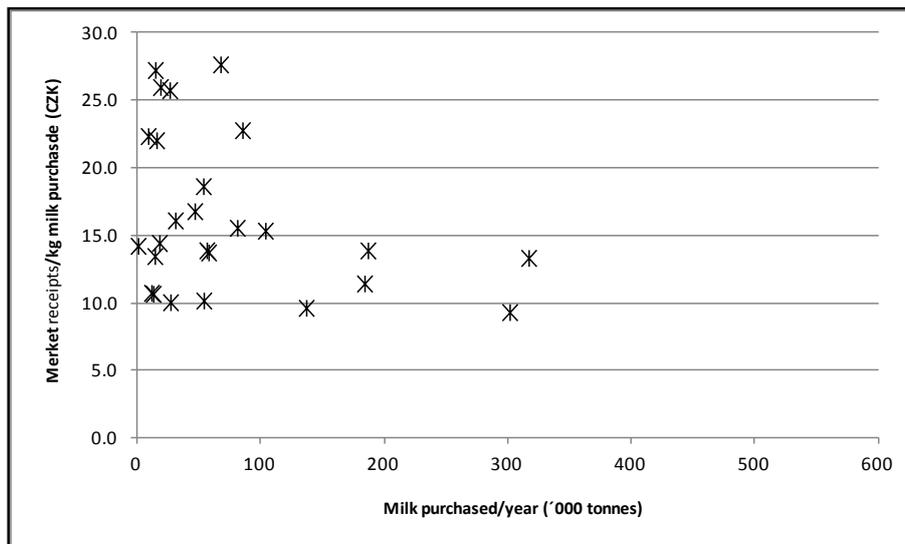
Note: The survey contains 24 milk processors where data available of 38 total ones. Top 5 and bottom 7 in milk purchase are complete.
Source: own survey from data of the SAIF (2013) and of the CR (2013)

Figure 3: Milk processors´ market receipts from kg milk purchased[1).
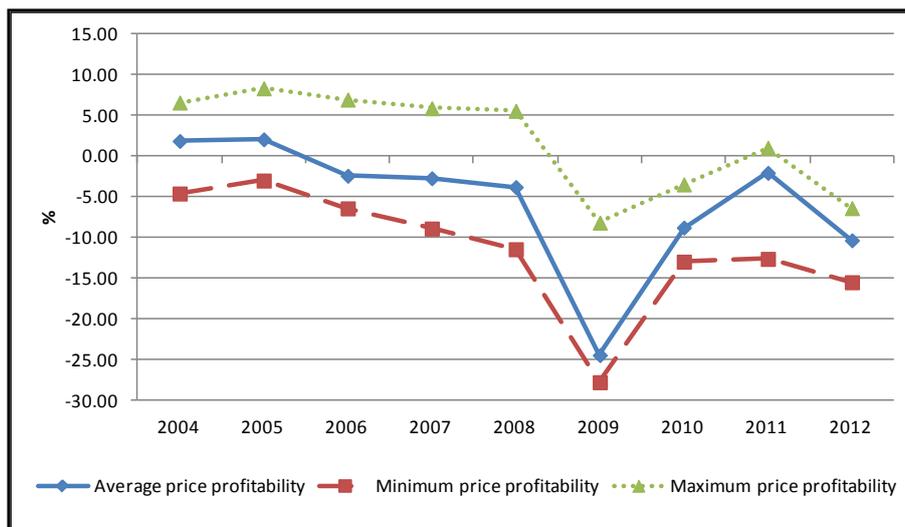
Note: Return on cost without government supports; milk price is the annual average of all processing plants in the country.
Source: own survey

Figure 4: Return on cost of primary milk production in the Czech Republic

value added output than other ones and thus there is a milk price range.

Most of the MPOs in the country are located close to the „no competition" corner of the cube. It evokes an idea that they operate in a low competition environment or it calls a question about other reason of their existence. It is hardly to declare the dairy sector in the country as a low competition area. Neither from the volume viewpoint, as there is about 20 % oversupply (MoA, 2011), neither from the regional viewpoint, as there are no significant distances between the farmers and MPOs, nor from the product viewpoint, as a homogenous product of raw milk is negotiated. Therefore it is hardly to consider the MPOs from this corner to be functional. One would assume

that the contribution of the MPOs from this cube´s corner to the dairy farmers is marginal or even that their existence is formal.

Some of the MPOs tend to the costleadership strategies. As the environment for this strategy is concerned, the EU mid-term outlook sounds for the milk production increase (EC, 2012), mainly as an effect of the global demand increase combined with the quota phasing out and abolishment. These effects may push the agents in the EU chain to aim for exports. Then the strategy of cost leadership and the commodity coop model would comply to the market character where bulk products are traded. However, the EU doesn´t belong to the cost leaders in the international scope and it´s export success relates to specific conditions when global supply drops under the global demand. Thus this is an unreliable strategy especially with respect to recent developments when the global market suffered of great imbalance (e. g. IFCN, 2012) and periods with supply shortage took turns to periods with global surplus and price volatility exceeded upper and lower historical records.

None of the MPOs applies the value added strategy. There is to refer Nilsson (1998) with his findings that if market is tight, the value added strategy generates the options to find market niches. In this context the strategies of the MPOs examined are not suitable for tight markets. Some of the MPOs in the country probably found a collaborative way of partnership with processors by means of contractual relations, as there are transaction costs spared and other advantages reached. Nevertheless, when the price is pushed downwards, reaching a mutual satisfaction becomes difficult and collaboration converts to bargaining. With respect to uncertain market future development, the value added strategy seems to be more reliable than the two a. m. ones, costleadership and no competition.

Conclusion

Milk producers organizations (MPOs) apply strategies which don´t match to the outlook for the business environment or which are risky. In this way they would rather disturb than support the dairy chain in future. Therefore first conclusion is made. Those ones, who are in the "no competition" corner, once they aim to be a supportive element both for the farmers and for the sector, should aim to move from this corner. Either by a vertical growth, i. e. by differentiation strategies (which is recommended) or by a horizontal growth (internal

growth or mergers), which is easier but more risky step. Those MPOs, which tend to costleadership strategies should be carefull as they apply a risky strategy. For both a value added strategy with the participation in milk processing seems to be more reliable. In this way the farmers might benefit of value added, differentiation and market acces. For doing it the farmers and the MPOs might choose different models of collaboration of the primary production with it´s processing. The direct integration of processing within a single coop might be implemented in various levels of farmers´ investments (e.g. Cook and Chaddad, 2004), or the joined ownership of processing by the coop and external investors are referred (e. g. Nilsson, 1998; Cook and Chaddad, 2004) or example of coordination within an inter-branch organization is described (Chavaz 2012).

In the context of the value added strategy recommendation, the second conclusion is made. Would the MPOs in the Czech Republic decide to join processing in an investments bound way, they will need to develop their internal structures. To stay competitive on the market with final milk products, the continuous investments in modern technologies and an innovative approach in the processing industry will be inevitable. In order to avoid the incentive problems associated with vaguely-defined property rights within the MPOs, the individualization of investments relationship will be required. Having reached that stage, however, it would seem difficult to continue to manage the MPOs as a side job. A voluntary additional job would have to be replaced by a designated management staff in those MPOs, where it is not matter of course so far. In this way the MPOs might become and element supporting farm economics and stability of the sector.

Finally the third conclusion is made. To make a step towards an integration of primary milk production to processing the government should create a supportive environment. Investments incentive measurements would be helpful, assistence for running the chain like backing for regional retailing, logistic, support of management posts focused on conducting the chain and others. In the sector there is a plenty of qualified and skilled managers to utilize such incentives and to help to keep the chain vital.

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Differences of Broadband Network Infrastructure, e-Readiness and Usage in EU Rural Regions

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Abstract

Different indicators and complex indexes can be used for ICT-level comparisons between countries. But usually just simple indicators are available for analyzing smaller territorial units within a country. By contrast, a multi-dimensional regional analysis allows to evaluate a given region in several ways, recognizing its strengths and weaknesses and development potential. The main aim of our research is to evaluate the availability and usage of broadband network infrastructure and the subscriber services in regional level, because the implementation of certain projects concerns principally the smaller areas directly. We used correlation analysis for find out whether there is any relation among the ICT and socio-economic indicators, regardless of the causal link between them. In the case of Hungary we present the development over time and regional differences of different indicators, which are related to the usage and availability of broadband networks. We tried to examine which factors have contributed to the change of these indicators, and to determine how the results obtained have contributed for the development of a region, what the direct or external effects are. The units of the analysis are the NUTS-2 regions of EU, but those member states, where any of the chosen indicators wasn't available; their regions have not been included in the present analysis.

Key words

Broadband networks, rural areas, regions, Hungary.

Introduction

The fusion of telecommunications, information technology and media industries are perceptible generally, and it embraces more and more socioeconomic areas. These three industries called IST (Information Society Technologies) on the whole and this signify its significant role in social advancement. The convergence of the different telecommunication networks leads to the development of an intelligent, uniform protocol-based and service-flexible network which we known generally as NGN (Next Generation Network). This means the standardization of present mobile and different line networks. The appearance of NGN is a natural process because this development generated by the market. Service providers offer more modern and cheaper technology to their clients with more modern and cheaper technology; meaning the clients get all they need owing to a 'one-stop' service. The line, cable and mobile service providers also have the opportunity to introduce integrated service packs and they appear on each other's market. Furthermore, the number of Internet subscribers is growing rapidly, new multimedia and interactive applications with high bandwidth demand are spreading, and costumers require ever faster and better quality services. This requires an increasing amount of data transmission at an ever increasing speed, but this becomes rather difficult on the existing networks.

Materials and methods

The IDI (ICT Development Index) was released by International Telecommunication Union (ITU). It compares developments in ICT. The index combines 11 indicators into a single measure that can be used as a benchmarking tool globally, regionally and in a country level. These are related to ICT access, usage and skills, such as households with a computer, the number of Internet users and literacy levels. It measures the digital divide and examines the development. The NRI (Networked Readiness Index) examines the extent of countries' rediness in three main fields the extent of countries' readiness and ability for network economy and

utilization of info-communication opportunities. The three fields are: 1. The general economic, regulatory and infrastructural environment of info-communication; 2. The readiness of individuals, firms and governments for application and utilization of ICT; 3. The extent of actual usage of latest available ICTs. The DOI (Digital and ICT Opportunity Index) is a composite index using a set of 11 indicators and equal weights in order to create a single value that can provide the base of cross-country comparison. DOI and ICT-OI illustrate different aspects of the digital divide. For instance, the DOI includes tariffs and developing services (such as mobile broadband), whereas the ICT-OI focuses on more traditional ICTs (such as television, fixed telephone network, education). Kolko (2010) worked out a methodology in connection with broadband access. He laid down, that these estimations give a clear picture of geographic differences in broadband availability and can be used to analyze factors affecting supply and, in future research, to assess the effect of broadband availability on social and economic outcomes. Because of this we determined the three main groups and the scope of factors for certain groups on the basis of NRI components or dimensions, that there are three important stakeholders to consider in the development and use of ICT: individuals, businesses, and governments (Dutta et al., 2004). We used regression analysis to find out whether there is any relation among the ICT and socio-economic indicators, regardless of the causal link between them. In the case of Hungary we present the development over time and regional differences of different indicators, which are related to the usage and availability of broadband networks. We tried to examine which factors have contributed to the change of these indicators, and to determine whether the results obtained have contributed for the development of a region, what the direct or external effects are. The major data sources are the EU strategies which have developed after 2004, the statistical database of EU, ITU and WEF. As regards the Hungarian analyzing, the data of national government agencies and the Central Statistical Office also have been used.

Rural areas and broadband services

1. Demands for developments

Rural development issues were addressed in the context of the eEurope Action Plan. Focus areas here included flexible and remote working methods, eBusiness within craft and other rural sectors, rural access to eGovernment services, and technologies for improving rural broadband coverage. Communication technologies and broadband Internet are increasingly perceived as a critical factor in social and economic development. They provide their connectivity for a range of innovative applications in areas like smart energy, electronic health services, e-government, and of course in the agriculture (Szilágyi, 2012). Building next generation infrastructure in rural areas, by this decreasing the extent of digital gap and reducing the disparities, is one of the main goals (Botos, 2012). Bottlenecks in broadband services are to be expected to materialize in poor social strata, rural, areas and small enterprises in countries facing the greatest efforts (Struzak, 2010). This theme is being continued under eEurope's successor initiative, where inclusion is one of three main pillars. Making ICT products and services more accessible, including in Europe's less-developed regions, is an economic, social, ethical and political imperative. NGN are seen as important instrument to bring competition and dynamism in the broadband sector in rural areas (Ruhle et al., 2011). And it has an effect on other economic sectors also (Péntek and Herdon, 2009). There are increasing returns to broadband telecommunications investments, which are consistent with the persistence of network effects (Koutroumpis, 2009). One important factor for growing is that the Internet plays a great role in spreading knowledge in an economy (Choi – Yi, 2009). Therefore, economic growth is positively related to the use of the Internet. The growing availability of high bandwidth is likely to enhance business growth opportunities for service providers (Picot and Wernick, 2007), furthermore it can enhance economic opportunities in rural areas by stimulating the development of home businesses and telecommuting and by facilitating access to education and training (LaRose et al., 2011). Demand for the convergence of line and mobile networks primarily arises from the service side provided for clients, and network developments are increasingly dependent on marketable services. The main factors which affect the developments are: 1. distance of customers; 2. general economic characteristic; characteristic of enterprises. The first key factor in costs is the distance of the customer. Thus, more densely populated areas are far less expensive in terms of investments per customer (Höffler, 2007). The second factor group is the general economic characteristic. Inside in this feature a very important fact

is the types of the economic sectors, which are typical in the certain region. Economic performance is lower in those regional economies which highly geared towards agriculture and manufacturing sectors and have relatively low incomes. It results lower ICT spending, fewer investment, infrastructure and service development (Preston at al., 2007). Furthermore ICT characteristics of public sector – which on regional level means local governments and public bodies - have to be considered. The characteristics of enterprises (penetration, usage, etc.) got in the third group. If these factors don't reach a sufficient level of development, telecommunication companies are not willing to invest in modern infrastructure development in rural areas because the expected profit is of high uncertainty (Moutafides and Economides, 2011). Due to this it is necessary that governments play role in network developments.

## 2. Differences between countries and regions

A dense networking infrastructure to support digital communication is the obvious backbone of any information society. New broadband and wireless technologies are being funded and developed so that eventually all citizens and businesses in urban and the most rural areas (the last mile and the last inch) will be connected. Deployment of broadband will not happen overnight. Upgrading, replacing, and adding to communication infrastructure is not cheap. For service providers the turnover of investment is crucial. Service providers develop the infrastructure of those cities where the demand for info-communication services is appropriate for them (Moseley – Owen, 2008). But in such rural

regions where the expected profit does not exceed a certain level from the investment, the development requires state support (Riding et al., 2009). State can influence the investment decision-process of local governments and enterprises in its interest by indirect devices, because they are independent entities and the final decision about an investment is theirs.

Taking into account infrastructure there is no big difference between the EU Member States (Figure 1). The household broadband penetration in terms of the lowest standard deviation was 10.6%. In 17 countries the penetration rate was between 61-80%, with the lowest penetration which was 50%, the highest 87% in 2012. As with the regular Internet usage shows a low standard deviation (13.3%). The lowest value in use was 43%, the highest 91%. Considering specific usage characteristics there is much greater variation in the range of around 20%. Promoting e-commerce for Individuals maximum value was 74%, and the Internet banking was 82%. Using electronic banking services in the Nordic countries were more widespread than in the Southern European countries. The usage of e-services regarding Greece, Romania and Bulgaria are very high lags.

We analysed 123 regions from 13 EU Member States. 5 Danish, 17 Dutch, 9 Austria, 11 Belgium, 8 Sweden, 18 Italian, 19 Spanish, 7 Portuguese, 8 Czech, 4 Slovaks, 7 Hungarians 8 Romanian and 6 Bulgarian (Figure 2).

According to the per capita GDP of countries ranked, three clusters can be distinguished. The first group
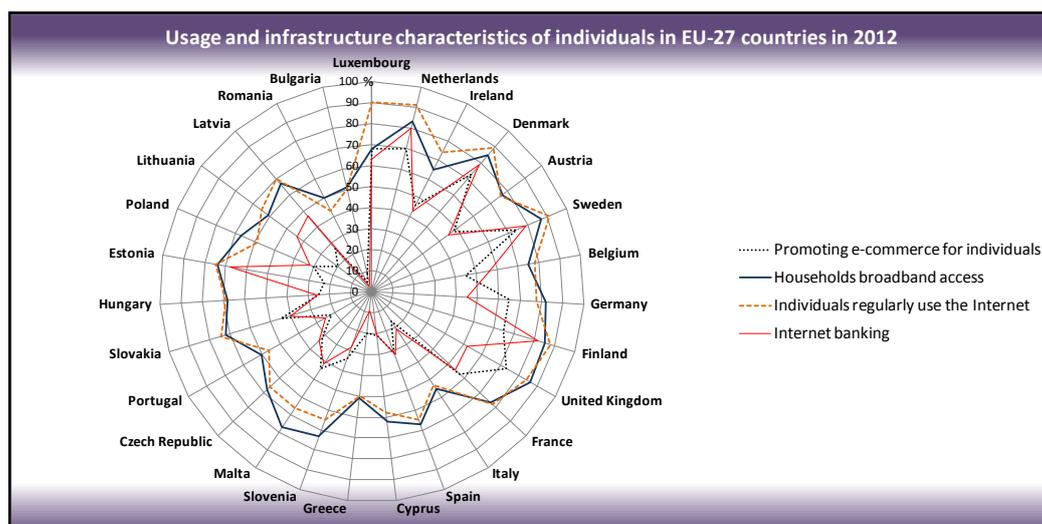

Source: own processing

Figure 1: Usage of infrastructure and services.
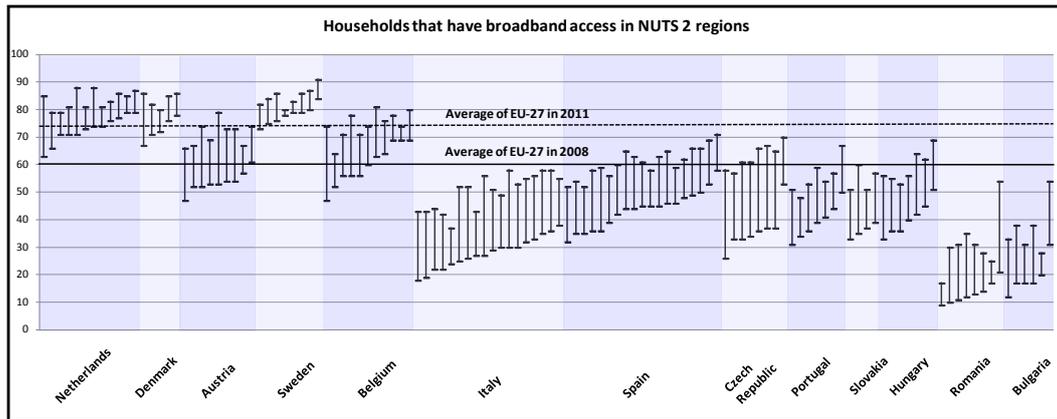
Source: own processing

Figure 2: Differences among regions in EU.
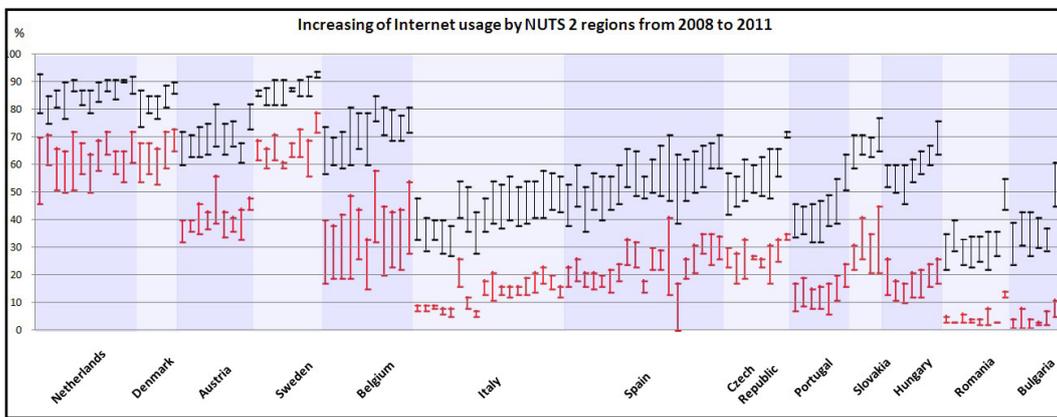
Source: own processing

Figure 3: Differences among regions in EU.

was made up of northern and western European countries and regions that were around average or above average in 2008 are well developed, and extent of the development has been an average of 12%. The second group were Southern and Central European countries. The 6 Member States show an average of 57% penetration value and the region standard deviation of only about 7%. The third group includes Bulgaria and Romania. The two countries capital effect is strong, the two metropolitan regions highly advanced compared to the rest of the regions and the scale of these developments is the highest. Within countries, with the greatest development aiming 10 countries of the region in 2008, the worst or nearly worst situation occurred. A study out of 13 was only for 8 countries in 2011 region containing the capital city with the most advanced, further tests are necessary to find out what the determinants are those that affect the regional ICT development level, since

in general we can say that in some countries the capital and the metropolitan agglomeration have the best socio-economic indicators. So if, for some countries access to the network is not the best in the region, the question arises why not, and perhaps can answer to the question is what the causal connections are among the socio-economic and ICT indicators.

Two related Internet usage were analyzed by regions in detail. Regular purchases on the Internet and Internet access indicators were closely related to each others. The purchases on the Internet are very low in the Central and Southern European countries. According to the basic indicators such as broadband access the same clusters can be identified. Significant differences were observed by the various indicators between countries and regions within the country (Figure 3).

3. Rural Broadband Development Programs in Hungary

In Hungary started large-scale infrastructure projects were started in 2003 by DSSC (Deputy Secretary of State for Communications) tender dossiers, which made settlements more attractive commercially. Later from 2004 to 2006 one of the most successful tender was ECOP 4.4.2, (Economic Competitiveness Operational Programme) the beneficiaries of it were the local governments, furthermore the less successful was ECOP 4.4.1, which supported SMEs. Both tenders were realized with EU co-financing and 50% of support level. This rate increased to 80-85% in case of ECOP 4.4.2 tender (Gál, 2008). Later, in 2007, EDOP-3.3.1 (Economic Development Operational Programme) tender targeted those micro-regions which are non-beneficial concerning investment. Overall these programs helped the network development with approximately 16 billion HUF. We chose NRI because we make an index for decision support of NGN investments, and NRI contains such social, economical and technological components which are related to broadband network. There is a general macroeconomic and regulatory environment for ICT in which the stakeholders play out their respective roles. Since the index is prepared for regional comparison, of course, the groups contain different components of the NRI (Table 1).

Such data are necessary, which are available on regional level, or may be calculated from existing data. First we analyzed the correlation between internet subscriptions and the basic economical factors. 11 components have been included in the test, and with expansion of database the number of factors will increase. Table 2 and Table 3 contain the results of correlation test.

All three IT characteristics – the number of internet subscriptions (Var. 1), the number of IT enterprises (Var. 2) and number of telecommunication enterprises (Var. 3) – showed the most closely relation with, the population density (Var. 6), the number of cities (Var. 7) the number of households (Var. 9) and the total value of the national economy investment (Var. 11). Certain data may be excluded from components because there is not significant correlation between two variables. So, the average income (Var. 5), the number of municipalities (Var. 8) has shown no correlation with variables in left-hand column. The value of R&D (Var. 10) just slight correlation with elements related to broadband and IT. However with the number of unemployed persons (Var.4) none of the factors show correlation. The explanation of that could be if broadband adoption stimulates economic activity, it might reduce cyclical unemployment, but by definition this is a temporary impact. We examined the relation between those data which related to usage. The results are given in Table 3.

The basis of the calculation the number of internet subscriptions (Var. 1) are a determining factor with respect to the intensity of usage of e-administration services in each county. In my opinion the number of registrations of client gateway (Var. 3) and electronic date reservations (Var. 4) illustrate well the intensity, therefore we analyzed these. In addition we also chose included the number of persons with diploma (Var. 2) as variable. The result of correlation test that the relation is close, so probably those people use e-services frequently, who hold university degree.

Factors linked to network infrastructure	Individual characteristics	Enterprise characteristics	Public sector characteristics
Number of internet subscribers	Employment	Number and size of enterprises	Territorial characteristics
Characteristics of access network	Unemployment	Number of IT and telecommunications enterprises	Number of settlements with local e-government
Number of settlements and households with optical access	Average income	Website of enterprises	Local e-government services
Communications characteristics	Assets	Population and population density
Use of e-business and degree of internet use	Number of persons with higher qualification	Investment and R&D	Settlement composition of region (number of cities and municipalities)

Source: own processing

Table 1: Factors which can be taken into account for the calculation of the index.

		Var. 4	Var. 5	Var. 6	Var. 7	Var. 8	Var. 9	Var. 10	Var. 11
Var.1	Pearson Correlation	0.236	0.328	0.794	0.832	0.051	0.931	0.452	0.914
	Sig. (2-tailed)	0.331	0.170	0.000	0.000	0.834	0.000	0.052	0.000
Var.2	Pearson Correlation	0.079	0.379	0.827	0.774	0.008	0.858	0.340	0.915
	Sig. (2-tailed)	0.747	0.109	0.000	0.000	0.973	0.000	0.154	0.000
Var.3	Pearson Correlation	0.336	0.285	0.732	0.844	0.170	0.937	0.332	0.879
	Sig. (2-tailed)	0.159	0.237	0.000	0.000	0.485	0.000	0.165	0.000

Source: own calculation by data of www.ksh.hu

Table 2: Result of correlation between broadband and economical factors.

		Var. 2	Var. 3	Var. 4	Var. 5	Var. 6
Var. 1	Pearson Correlation	0.979	0.964	0.910	0.151	-0.101
	Sig. (2-tailed)	0.000	0.000	0.000	0.538	0.681
Var. 2	Pearson Correlation	1	0.965	0.942	0.172	-0.164
	Sig. (2-tailed)	-	0.000	0.000	0.481	0.502

Source: own calculation by data of www.ksh.hu

Table 3: Result of correlation between data which related to usage.

In the field of IT usage the bottlenecks are households and small enterprises in rural areas and poor social strata (Struzak, 2010). This was confirmed by my calculation also, the two features of enterprises, namely the usage of internet based EDI (Var. 5) and the number of enterprises which have website (Var. 6) didn't show correlation with other factors. To change this attitude, additional stimulus programs and resources are required (Struzak, 2010). The characteristics of SMEs (penetration, usage, etc.) are very important in Hungary, because they mean one of the biggest business sectors considering their number. This sector employs 70% of the employees of national economy, and their contribution to GDP reaches 50%. Correlation test have to be done with each factor which related to the existence of network infrastructure. Since among the variables there are some which have an effect on each other also, multicollinearity analysis should be made. Finally scope of data and factors which may be included in the index actually, can be determined with factor analysis.

clusters can be distinguished. The first group is made up of northern and western European countries and regions that were average or above average in 2008, are well developed, and extent of the development has been an average of 12%. The second group were Southern and Central European countries, which were completed during the year, both regional average, but the gap in the EU-27 average in 2011, is no longer large. The 6 Member States show an average of 57% penetration value and the region standard deviation of only about 7%. The third group includes Bulgaria and Romania. In our opinion a rank can be defined among regions or settlements on the basis of the indicator, in respect of factors related to network infrastructure. The rank can help to realize targeted developing and improving of infrastructure, furthermore this enables to intervene on that place which is bottleneck.

Conclusions

NGN are seen as important instrument to bring competition and dynamism in the broadband sector in rural areas and it has an effect on other economic sectors also. The growing availability of high bandwidth is likely to enhance business growth opportunities for service providers. According to the per capita GDP of countries ranked, three

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Using of Business Continuity Standards in Agriculture, Industry and ICT

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Anotace

Vyhnutí se krizi na základě postupů řízení kontinuity činností lze v dnešním napjatém podnikatelském prostředí považovat za konkurenční výhodu. Eliminování hrozeb vyplývajících z vnitřního i vnějšího prostředí, které se snaží řízení kontinuity činností podporovat, je založeno na postupech, které vznikly z dobrých praxí a organizace je využívají v podobě normativních dokumentů. Hlavním cílem článku je identifikovat, zda je důležité ve vybraných odvětvích využívat standardy v oblasti zabezpečení kontinuity činností a identifikovat výhody a nevýhody plynoucí pro organizaci. Článek vznikl na základě zhodnocení dotazníkového šetření (N=779; n=106) a rozhovorů. Využíváním oficiálních standardů v jednotlivých organizacích zvyšuje efektivitu při nalézání potřebných postupů zabezpečení kontinuity činností při nepříznivých situacích a v neposlední řadě snižuje časovou náročnost při obnově klíčových procesů, které jsou však pro různá odvětví ekonomiky rozdílné. Příspěvek vznikl na základě podpory celouniverzitního grantu (CIGA), číslo 20121001 – Řízení kontinuity činností v organizacích vedoucí k vyšší výkonnosti organizace.

Klíčová slova

Management continuity činností, standard, zemědělství, průmysl, ICT, Česká republika, organizace

Abstract

In today's stressful entrepreneurial environment, avoiding crisis by applying business continuity management processes may be considered a competitive advantage. Business continuity management also facilitates the elimination of threats caused by internal and external environments. It is grounded on procedures arising from good practice and organizations use them in the form of normative documents. The main goal of the article is to identify whether it is important to apply business continuity standards in selected sectors and to identify possible advantages and disadvantages for organizations. The article has been drawn up on the basis of the evaluation of a questionnaire survey (N=779; n=106) and interviews. The application of official standards by individual organizations enhances efficiency when determining necessary business continuity management processes in unfavourable situations. Last but not least, it shortens the period of restoration of key processes which, however, differ in individual economic sectors. This contribution is a follow-up to the project of CULS – wide internal grant agency (CIGA), no. 20121001 – Business continuity management contributing to higher performance in organizations.

Key words

Business continuity management, standards, agriculture, industry, ICT, Czech Republic, organizations.

Introduction

Business continuity management (BCM) deals with unexpected situations that arise primarily from organisations' external rather than their internal environment and is targeted at preventing and suitably responding to such situations. However, it is necessary to realise that in particular organisations' weaknesses intensify the consequences of unfavourable situations. Sharp (2009) states that each organization, regardless of the sector, is obliged to take care of their employees, customers, clients, communities and environment. Therefore standards BS 25999-1, 2 have been established to recommend the right approach (best practice) to organizations to satisfy

the needs of all parties involved (BSIa, 2005; BSIb, 2005). Nevertheless surveys conducted by Järveläinen (2013) show that in the process of business continuity ensuring organizations primarily focus on information systems, which is also confirmed by the research Urbancová, Venclová (2013); Sawalha et al., 2012; Ahmad et al. (2012).

However, in the agrarian sector the preservation of processes is not dependent solely on information systems, but on the continuity of all processes that lead to the fulfilment of the global goal of agriculture, which according to the Ministry of Regional Development encompasses (in Fedyszak-Radziejowska, 2011), among other things, the ensuring of available capital for agricultural area and rural districts, the improvement of outdated technical and technological equipment in agricultural and processing companies and thus the elimination of impacts on the environment and the welfare of animals, dealing with social aspects of rural development by increasing the employment rate, the improvement of age and educational structure, and accessibility and safety of information. The goals laid down by the Ministry of Regional Development (in Fedyszak-Radziejowska, 2011) are in compliance with the agrarian policy of the CR and the EU that is anchored in the 1957 Treaty of Rome (Article 38 (1) to Article 47) which says that it is necessary (1) to increase agricultural productivity by promoting technical progress and by ensuring the rational development of agricultural production and the optimal utilisation of the factors of production, in particular labour; (2) to ensure a fair standard of living or the agricultural community, in particular by increasing the individual earnings of people engaged in agriculture; (3) to stabilise markets; (4) to ensure the availability of supplies and (5) to ensure that supplies reach consumers at reasonable prices. Fedyszak-Radziejowska (2011) states that farmland is a special production factor as it is unallocable and its area may not be increased (without annexation). For its cultural and social context related to property inheritance, land is the base and the condition of continuity, tradition and local identity and it is necessary to take care of it. Today, the specificity of agriculture is broadened by yet another aspect: the difficult choice between the extensification and intensification of agricultural production in relation to its impact on the environment

and the quality of harmless foodstuffs. The comprehension of the complexity of all conditions of agricultural business, i.e. its economic, social, cultural and psychological aspects, helps understand the process of development in agriculture (Fedyszak-Radziejowska, 2011).

If agriculture faces any potential threats that need to be eliminated and organisations are able to eliminate them, it is necessary to take counter-measures. The food-processing industry directly uses, for example, the HACCP certification which is an efficient tool that supports other preventive measures against the spread of bacterial, chemical or physical product contamination and is regulated by legislation in force, similarly to how the application of BCM standards is in the area of insurance and banking services (Hele, 2013; KPMG, 2010). Among common benefits arising from the certification and BCM standards, it is possible to mention the increase of an organization's prestige in the competitive environment that is connected with stronger trust of business partners, regulatory bodies and customers resulting from the demonstration of suitability, efficiency and effectiveness of the developed system of critical points by a third independent party beyond the frame of the minimum requirements laid down in the national legislation (Chin-Sen et al. 2012; Elliott et al., 2010).

Business continuity management requires planning of crucial aspects across the entire organization. For this purpose organizations may use standards issued by standardization institutions (BSIa, 2005; BSIb, 2005). These standards, however, are not identical for all countries around the world. Despite the fact that business continuity development is in progress in all parts of the world, the harmonization of methodology in this area has already taken place (Sharp, 2009).

The main causes of events that determine standards focusing on the area of Business Continuity include (Sharp, 2009; BSIa, 2005; BSIb, 2005) natural disasters and epidemics, unintentional human errors, intentional human errors and technological defects (hardware and software). It is also possible to mention the importance of loss of key employees and knowledge which, however, is not explicitly analysed within the frame of these standards (Venclová, Urbancová, 2012). Organisations that carry out risk analyses will be able to respond to this question (Münstermann et al., 2012; Pitt, Goyal, 2012). This contribution deals with the application of BCM standards or norms in the area

of agriculture by organizations and the advantages and disadvantages that it brings to them.

The main aim of the article is to identify, based on primary research, whether or not it is important to apply BCM standards in agriculture, industry and information and communication technologies and subsequently to determine the advantages and disadvantages arising therefrom. A partial goal of the article is to present the results of the quantitative survey conducted in the area of standard application in the Czech Republic with emphasis on the sectors examined and to provide organisations with recommendations regarding these issues. The article concentrates on agriculture since it is a very specific field and an important sector of the Czech economy; a total of 5-6% residents work in and contribute to the growth of GDP according to CSO (2010). The industry is an important source of the formation of GDP also. CSO (2010) states that there is a total of 2.654.571 organizations in the Czech Republic, small 98.79% (less than 50 employees), medium 1.12% (51 to 249 employees) and large 0.09% (250 and more employees). The Czech economy employs a total of 4.885.200 people, the primary sector employs 4% of people (76% of men and 24% of women), the secondary sector employs 37% of people (74% of men, 26% of women) and the tertiary sector employs 59% of people (46% of men, 54% of women). Based on these findings the use of the standards in the agricultural sector which represents the primary sector, in industry (secondary sector) and in information and communication technology (tertiary sector) is assessed.

The first part of the article presents theoretical background together with comparisons of secondary resources. The chapter Results and Discussion includes an analysis and synthesis of the survey targeted at the application of standards in all economic sectors in the Czech Republic, with special emphasis on agriculture, industry and ICT and identifies the advantages and disadvantages of standard application in agriculture. A comparison of results with results of similar surveys conducted abroad and draft recommendations are also included in this chapter.

Theoretical background of the work

At the beginning of the 21st century BCM was viewed as a blurred and vague field. The year 2006, when the British BS 25999-1 standard was published, was a turning point. The book contained best practices

of business continuity management on the basis of this standard, which helped actively manage risks not only in the banking sector (Siponen, Willison, 2009), but showed all organizations, regardless of the economic sector, how to use BCM as a way of managing organizational risk, disasters and crises, as well as business interruptions (Sawalha et. al., 2012). Sawalha et al. (2012) states that the level of BCM in organisations is determined by a number of factors at the organisational level, such as their vision, organisational culture, but also the organization's management (Järveläinen, 2013; Conlon, Smith, 2010), which in turn determines the type of standards or norms applied.

BS 25999 has been developed by a broad based group of world class experts representing a cross-section of industry sectors and the government to establish the process, principles and terminology of BCM. It provides a basis for understanding, developing and implementing business continuity within an organization and give a confidence in business-to-business and business-to-customer dealings (BSIa, 2005; BSIb, 2005). It also contains a comprehensive set of controls based on BCM best practice and covers the whole BCM lifecycle.

Hele (2013) says that the biggest difference between standards BS 25999-1, 2 and ISO (e.g. ISO/PAS 22399 (Societal Security), ISO 27001 Information Security Management System IS-ISMS and ISO 27002) is in structure of the document, which puts a much greater emphasis on planning and risk (Chin-Sen et al., 2012).

Risk Analysis Consultant (2012) officially published that the British Standards Institute (BSI) has published a new standard for ensuring the business continuity PD 25666:2010 - Business continuity management - Guidance on exercising and testing for continuity and contingency Programmes. This is the first standard that is exclusively focused on the BCM program verification and testing related continuity and recovery plans (Risk Analysis Consultant, 2012). The document PD 25666:2010 is intended as a supplement to the BCM(S) standards - BS 25999 and BS 25777 and other existing standards such as ISO / PAS 22399 or BS ISO / IEC 27001 and related documents issued by BSI but they are not the subject of this paper.

Sharp (2009) states that the British BS 25999 standard has been developed with the aim to lay down a common best practices standard and thus to satisfy the needs of customers, clients,

the government, regulatory bodies and all other parties involved from all economic sectors. It confirms Herbane (2010) who says that in the context of crisis management is already an important event in business history due to its influence on the consolidation of specific business practices within and between organisations across many sectors of the economy, and its basis as the rationale for legislation and regulation during the acceleration and focus phase (Herbane, 2010).

A Study of the Factors Influencing Business Continuity Programs (2008) states that 26% of organizations (n = 800) does not know nor approximate extent of their loss in case of disruption of business caused in the past. This study has come into existence thanks to the cooperation with KPMG (2010) focused on the area of business continuity management according to the standards. The extent of loss was measured in USD in order to the global comparison could be carry out. The most of the respondents (organizations) estimates that they are below 100 000 USD (43%) according to this research. 17% of organizations have subsequently stated that the extent was between 100 000 and 499 000 USD. Research on Factors Influencing Business Continuity Programs (KPMG, 2008) also shows that 87% of organizations does not exceed the investment in individual elements of the BCM amount of 250 000 USD. Overall, 58% of the organizations confirmed that they have a system for BCM, 20% of respondents still developed the plans and only 4.5% of respondents did not introduce any BCM program. Based on the research in the Czech Republic it can be said that only 18.7% of organizations have a system for BCM (Urbancová, Venclová, 2013).

On the results of the Factors Influencing Business Continuity Programs (2008) research in cooperation with KPMG (2010) it can be summarized that BCM based on the BS 25999 – 1 and 2 standards is applied by organizations with global operations, primarily applied by organizations from the financial, insurance, health care and public sectors and BCM is managed by two full-time specialists in organizations.

Comparing the results from the Czech Republic in period 2012-2013 and provided by KPMG (2010), it may be concluded that BCM based on the BS 25999 – 1 and 2 standards and comparable standards is applied by global organizations (30%), 25% of Czech organizations and 20% of foreign organizations apply the BS 25999 – 1 standard,

BCM based on the BS 25999 – 1 and 2 standards and comparable standards is applied in particular by ICT organizations (25%) and insurance companies (5%) and from 2 to 5 full-time specialists are engaged in 40% of foreign organizations and 30% of Czech organizations.

Based on research of Randeree et al. (2012), Low et al. (2010) and Herban (2010) and the Sharp's (2009) recommendations it can be stated that organizations in all sectors of the economy can offer to their customers and clients greater assurance that in the event of disruption they are able to manage and ensure its business continuity due to the application of BCM standards-based. The question is whether it is beneficial to apply this standard as well as in agriculture which is a specific sector. Research questions arisen from the theoretical background are: Q1: How to use organization the standard BS 25999-1 and 2 in the agriculture, industry and ICT in the Czech Republic? Q2: Are these standards effective for all the followed sectors? These research questions are answered on the basis of the evaluation of primary research.

Materials and methods

The article has been drawn up using scientific methods, in particular logical methods, such as analysis, synthesis, induction and deduction. The theoretical background was based on analysis of secondary sources, studying the structure of the standard BS 25999 1 and 2 on the official website of the BSI, Professional Evaluation and Certification Board and Business Continuity Management, Building resilience in public sector entities sheet Better Practice Guide (2009).

The results of primary survey were obtained by using the quantitative research by questionnaire data collection in organizations in the Czech Republic. The survey was answered by 106 organizations from the 779 addressed organizations (the return rate was 13.62%). The organizations which participated in the survey correspond to the percentage representation of organizations in the Czech Republic according to the Czech Statistical Office and all sectors of the economy by CZ-NACE are represented. The largest group of respondents who participated in the research were the organizations from the tertiary sector (73.7%) which is consistent with the statistics of the Czech Statistical Office (2011) about the structure of organizations in this country.

Specialists in the field of BCM and owners of small organizations organizations were addressed. To evaluate the results, methods of descriptive statistics were used (the IBM SPSS Statistics Data Editor, version 20 and Microsoft Excel), absolute and relative frequencies, testing of dependency between set qualitative features and dependency tests. Using extracted data the dependency was tested by applying Pearson´s Chi-Square test, a scale according to de Vaus (2002) was used. If the p–value calculated by means of the χ^2 test (Pearson Chi-Square) was lower than the selected level of significance $\alpha = 0.05$, null hypothesis was rejected. The achieved results of the research in the Czech Republic are also compared with the results of similar studies abroad.

In order to verify the outcomes obtained and to gain new practical knowledge the article presents results of an interview taken in the Prischink GmbH company, an Austrian agrarian organization, a holder of the AMA-Gütesiegel certificate. The company is a traditional onion and potato producer and is one of the main suppliers of the Inter/Eurospar Austria GmbH company. Representatives of one organization from the secondary and two organizations from the tertiary sectors were interviewed as well. In total, four interviews were conducted, each of them lasting approx. 40 minutes. Based on direct observation (in AMA-Gütesiegel) a case study was prepared. The following preconditions were set for the realization of the case study:

Case study type: instrumental case (only several subjects of observation).

Phenomenon monitored: the use of BC standards in the area of agriculture in the CR and the Austrian company.

- The subject of the survey: an unnamed Czech company operating in agriculture and the Prischink GmbH company. The overall number of employees: 13. The area of fields annually cultivated: approx. 220 ha. The organization was founded in 2003, but it had operated as a family business since the 1970s. Their goal is a high-quality plant production. This requirement is also laid down in the Spar GmbH internal regulations in which specific features of individual kinds of potato and onion are defined (e.g. size or nutrient content).

- Research questions: How often does your organization face problems, such as natural disasters and epidemics, unintentional human errors, intentional human errors and technological defects (of hardware and software)? Is it realistic for organizations in agriculture to ensure BC according to standards? Why is it/is it not important to deal with this? What advantages and disadvantages do agricultural organizations see in the application of BCM according to standards?

Based on the outcomes of the quantitative research (questionnaire survey) and the qualitative research (interviews, direct observation, case study), the practical advantages and disadvantages of BC standards were determined and recommendations for organizations primarily operating in the area of agriculture were formulated.

The following acronyms are used in the paper: BS = British Standards; BC = Business Continuity, BCM = Business Continuity Management, CSO = Czech Statistical Office, ICT = Information and Communication Technologies; R = respondent.

Results and discussion

This chapter contains evaluation of the data, their interpretation and recommendations. It is structured into the two sub-sections; the assessment of the current situation of BCM in the Czech organizations with emphasis on agriculture, industry and ICT and advantages and disadvantages in these sectors. The section "Results" is followed by the discussion and conclusions which summarize the most important recommendations from the evaluated results.

1. Results of the survey in the Czech Republic with emphasis on agriculture, industry and ICT

The results of a university-wide grant show that only 18.9% of the surveyed organizations have used the BCM according to standards (Venclová, Urbancová, 2012). The research focused on BCM ensuring was determined using the standards by standard BS 25999-1 (BS - Code of practice) and BS 25999-2 (BS - Specifications) then BS 25777:2008 (ICT Continuity Management) and ISO/PAS 22399 (Societal security). Among the surveyed standards which included in the research were ISO 27001 (Information Security Management System - ISMS), ISO 27002 (Information Security Implementation), COBIT and ITIL. The most commonly applied standard in the Czech Republic is BS 25999-1, followed

by BS 25999-1 and 2. Other BCM related norms and standards used in the territory of the Czech Republic are ISO 27001 (ISMS) applied by all organisations, CobIT used by 16% of organisations and ITIL by 53% of organisations who applied of BCM (Urbancová, Urbanec, 2013).

With respect to the fact that the sector classification according to CZ-NACE has been used, it is possible to present the outcomes in percentage points according to the sector of organizations involved and to evaluate the application of standards. The structure of organizations addressed is shown in Graph 1.

According to the Graph, it is possible to state that in total 10 organizations from the agrarian sector completed the questionnaire (9.4%). Only one of these organizations applies Business Continuity Management according to a standard. Within the frame of BCM standards, this organization focuses on IT and business processes. The organization examined does not have the BS 25999- 1 and 2 standards in place, but applies the ISO/PAS 22399 standard, ISO 27001 IS-ISMS Security Management Systems and ISO 27002 – Information Security Implementation. The reason of non-application of BCM according to BS 25999-1, 2 is the lack of support on the part of the organization's management. The remaining 8 organizations from the agrarian sector stated that they did not find the application of BCM according to standards in agriculture important. Pursuant to BSI (2010) BCM concentrates on four main risks

(natural disasters and epidemics, unintentional human errors, intentional human errors and technological defects (of hardware and software)). The results show that in organizations examined, regardless of the sector they operate in, primarily mentioned the threat of natural disasters, however, the representatives of agrarian organizations did not mention this fact. It is necessary to realize that this threat should not be underestimated by organizations in the agricultural sector since it is a danger that would significantly impact the agricultural sector in the given country. Therefore it is important to state that these risks need to be monitored and eliminated in this business sector. This is also confirmed by Chin-Sen et al. (2012). The results of the research also reveal another interesting finding that only one organization in the agrarian sector that applies BCM according to the ISO standard mentioned technological defects of hardware and software as the major impact. This fact may be explained by high complexity of technology (machinery, equipment) currently used in modern agriculture. When compared to other organizations involved in the research and applying BCM standards, it is possible to say that other 25% of companies gave the same answer. This was followed by the loss of key employees (20%) and unintentional human errors (10%) and intentional human errors (10%).

The majority of organizations in the CR that ensure BC according to standards are large organizations active in the tertiary sector (75%) and
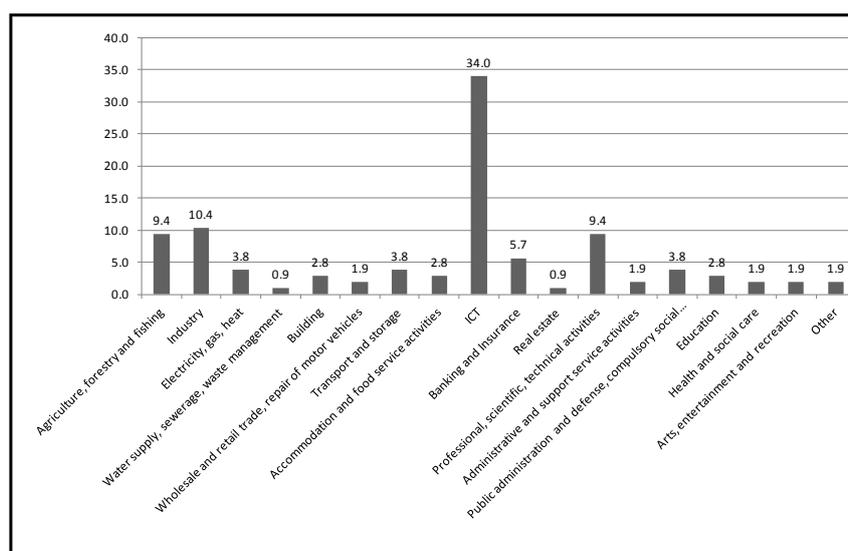

Source: own survey

Graph 1: The percentage of organizations by business sector in research.

within this sector in the area of ICT (55%) and banking and insurance services. This large proportion may be explained by the legislative obligation to ensure and maintain business continuity in these organizations. BCM is a common requirement in regulated industries, such as the financial sector or critical public infrastructure (see Graph 2).

These standards are used only occasionally in the area of industry and agriculture (see Graph 3).

The above said might be supported by the outcomes of the interviews in which the respondents from the tertiary sector unambiguously stated that they were satisfied with the application of BCM according to standards. It was also examined why they thought the majority of organizations did not ensure BCM. Respondents agreed that it was due to the lack of financial means to conduct all activities necessary for BCM certification, the lack of their own human resources, the shortage of knowledge (people), and know-how. R1 stated that smaller mid-size organizations did not need to have

a standard, as they might use consultation services to introduce BCM procedures. R2 mentioned that organizations primarily needed to realize all possible risks and consequences. Organizations were not sufficiently prudent in this respect, they thought it was costly and such costs needed to be justified and therefore it was easier to reject the whole idea at the very beginning (R2). Within the frame of statistical testing the dependencies of two features examined were statistically verified – i.e. the dependency between the application of a specific standard and an organization's size and sector. The research, however, only proved the dependency between the organization's size and BCM ensuring according to standards without any differentiation (p-value = 0.000; Cramer's $V = 0.485$, the moderate dependency). Subsequently a statistical dependency between the application of the ISO 27001 standard and an organization's size was proven (p-value = 0.003; Cramer's $V = 0.329$, the moderate dependency). For other standards the dependency between the application of standards and an organization's size was not confirmed.
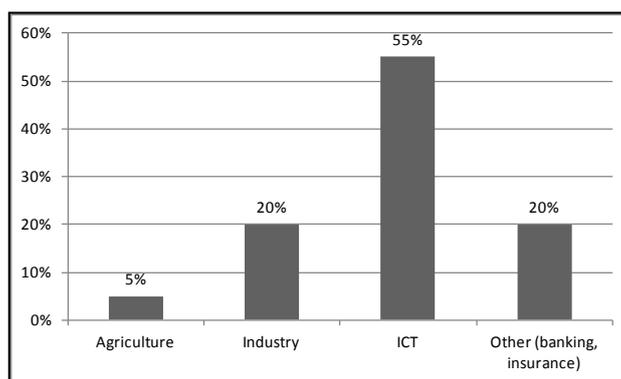
Source: authors

Graph 2: BCM ensuring in examined organizations.
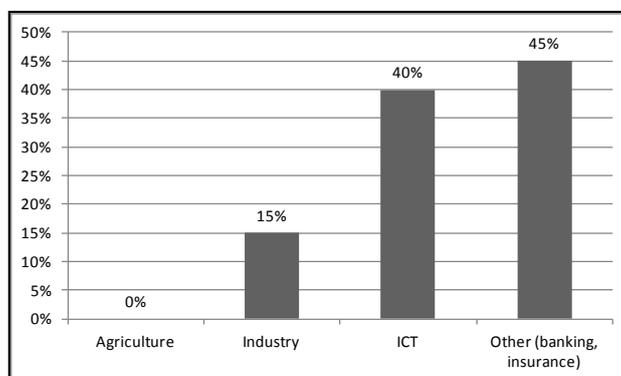
Source: authors

Graph 3: BCM ensuring according to BS 25999-1, 2.

The same applies for the testing of dependencies in relation to individual sectors of economy. Despite the fact that it was impossible to statistically prove the dependency between BCM and an economic sector in the sample group of organizations, it is possible to say – taking into account other surveys (Münstermann et al. 2012; Pitt, Goyal, 2012) – that BCM ensuring (of certain extent) is beneficial for all organizations regardless of their size or sector.

2. The advantage and disadvantage using the BCM standards in agriculture

Critical factors in agriculture include minor or major disasters in agricultural production. Fedyszak-Radziejowska (2011) states that due to this fact the system of commercial insurance policies defines such premiums for agricultural businesses that the majority of Union agrarian companies cannot afford. The production cycle in agriculture is determined by factors that are difficult to control by humans and therefore the pressures of market mechanisms sometimes force organizations to produce "for their own use", which means a kind of escape from the market. A family farm is able to survive despite losses and even despite the threat of bankruptcy because it maintains its business activities for its own use and searches for additional sources of income outside their business. Radical market liberalism in the approach to family agrarian companies (that represent a major part of businesses in the EU) therefore does not help understand processes that take place in these organizations. Based on the interviews taken, it is possible to determine the advantages and disadvantages that agrarian businesses see in the application of BCM according to standards.

The advantages of the application of BCM according to standards in the area of agriculture may include elimination of employee turnover, elimination of technological and technical problems, elimination of damage caused by force majeure and strengthening of financial independence based on risk reduction.

The disadvantages of the application of BCM according to standards in the area of agriculture may include high expenses for agricultural businesses, lack of employees specialising in these issues, lack of experience in the agrarian sector, lack of theoretical background with good knowledge in the area of practical application or no model businesses with a clearly defined system of functioning.

One of the main benefits of BCM application in organizations regardless of the sector is that standards contain instructions „what to do when", which is one of the purposes of BCM documentation. This documentation specifies what to do to mitigate the consequences (remedial activities following an event). However, it is more appropriate to view BCM as a preventive function, i.e. to prevent critical situations or to deal with them as quickly as possible. Other benefits include the ability to present themselves and qualify in the competitive market, to improve their state compared to the past (the environment is evolving), to strengthen awareness, and to find solution taking into account its costs. It is possible to say that BCM is no longer a new phenomenon; organizations, in particular those in the tertiary sector, are aware of it and they realise that the preset solutions work.

3. Discussion

With respect to the above said, it may be stated that at present organizations in the agrarian sector in the Czech Republic are not interested in applying BCM according to standards. This disinterest may be supported by the outcomes of the interview with the representatives of the farm in Austria specialising in potato and onion growing and selling its products to the Austrian Inter/Eurospar chain.

At present the company does not apply BCM either randomly or accordingly to standards and norms and according to the results of the interview (qualitative research conducted) it is possible to state that pursuant to its representatives BCM in the agrarian sector is not important since it depends on the type of activities that are primarily carried out by the company in question. In the tertiary sector it is important to apply BCM according to standards because of the highly qualified work that is required in this sector. In agriculture the share of highly qualified work is still rather low with low- and mid-qualified work prevailing. People can learn processes more easily and the continuity of processes is relatively easy to achieve. Natural disasters are viewed by respondents as a risk that is preventable only to a certain extent. At present they accept risks endangering critical processes that would jeopardise the business or processes whose restoration to the original state would require too much time (e.g. natural disasters, inability to grow crops) and plan, for example, to rotate fields they farm and they also accept the risk that they would not be able to run their business for a certain period of time while the disaster lasts (burned down crops, etc.).

In agriculture the most common problems are associated with natural disasters and epidemics that the organization in question cannot control. In industry and ICT it is connected primarily with technological defects, which is confirmed by surveys conducted by Doucek, Novák (2010) and Chow, Ha (2009). Using the results it is possible to answer the research questions (Q1) and state that the BS 25999-1 and 2 standards are most frequently used in the tertiary sector (ICT), followed by the secondary sector (industry) and then by the primary sector (agriculture). BC standards prevail in organizations in the ICT area, the situation in industry and agriculture is different, norms are more widespread there and it is possible to conclude that ensuring BC according to the BS 25999-1 and 2 standards is not efficient due to the above-mentioned reasons (Q2).

In relation to the above said it is also possible, for the purposes of organizations in agriculture, industry and ICT, to modify documents that present Business Continuity Management, Building Resilience in Public Sector Entities, and Better Practice Guide (2009) that will facilitate the decision of companies whether or not to deal with these issues (Table 1). Organizations are recommended to use the following documents

Undertaking a business impact analysis tasks	Completed YES/NO
Gather relevant existing information, such as: ▪ disruption scenarios, ▪ emergency response management plan, ▪ incident management plan, ▪ pandemic plan ▪ IT disaster recovery plan.	YES/NO
Consult key personal and business units. consider: ▪ internal audit, ▪ business areas, ▪ emergency response management, ▪ finance (and insurance), ▪ external entities and organizations (for example, service providers, interdependencies, and unions), ▪ information technology, ▪ risk management, ▪ building and facilities, ▪ occupational health and safety.	YES/NO
Evaluate the impacts of a loss of each critical process from the perspective of the entity´s objectives. consider: ▪ financial, ▪ reputation, ▪ regulation, ▪ health and safety, ▪ third party relationships and interdependencies, ▪ customer service, ▪ legal/contractual, ▪ work backlog, ▪ environmental, ▪ other categories (determined by the entity).	YES/NO
Identify interim processing procedures (alternative or manual processing) techniques to be adopted during the recovery phase.	YES/NO
Determine the maximum tolerable period of disruption for each critical process.	YES/NO
Determine internal and external critical interdependencies.	YES/NO
Identify vital records.	YES/NO
Determine the recovery time objective for each critical business process and it system/application.	YES/NO
Determine the recovery point objective electronic data.	YES/NO
Estimate the time to overcome the backlog of work accumulated during a business disruption event.	YES/NO
Obtain executive endorsement of the business impact analysis.	YES/NO

Source: Business Continuity Management, Building resilience in public sector entities, Better Practice Guide (2009), adjusted by authors

Table 1: Undertaking a business impact analysis checklist.

that may help them solve problems occurring in connection with business continuity ensuring.

Table 2 can be used to identification of the possible scenarios and determination the frequency of occurrence and potential impact on the business.

The flowchart of process steps (Figure 1) can be used for the needs of organizations by which it can be proceed in risk situation. An organization can adjust the individual steps according to their requirements.

Keeping in mind the above said it is possible

Scenario	Likelihood [%]	Consequence	Impact [low, middle, high]
Natural hazards. For example: ▪ Fire ▪ Food ▪ Pandemic			
Generics scenarios. For example: ▪ Loss of building ▪ Loss of people ▪ Loss of knowledge ▪ Loss of IT systems ▪ Loss of telecommunications ▪ Loss of water, electricity, gas, sewage ▪ Other hazards			

Source: Business Continuity Management, Building resilience in public sector entities, Better Practice Guide (2009), adjusted by authors

Table 2: Likelihood of Scenario.
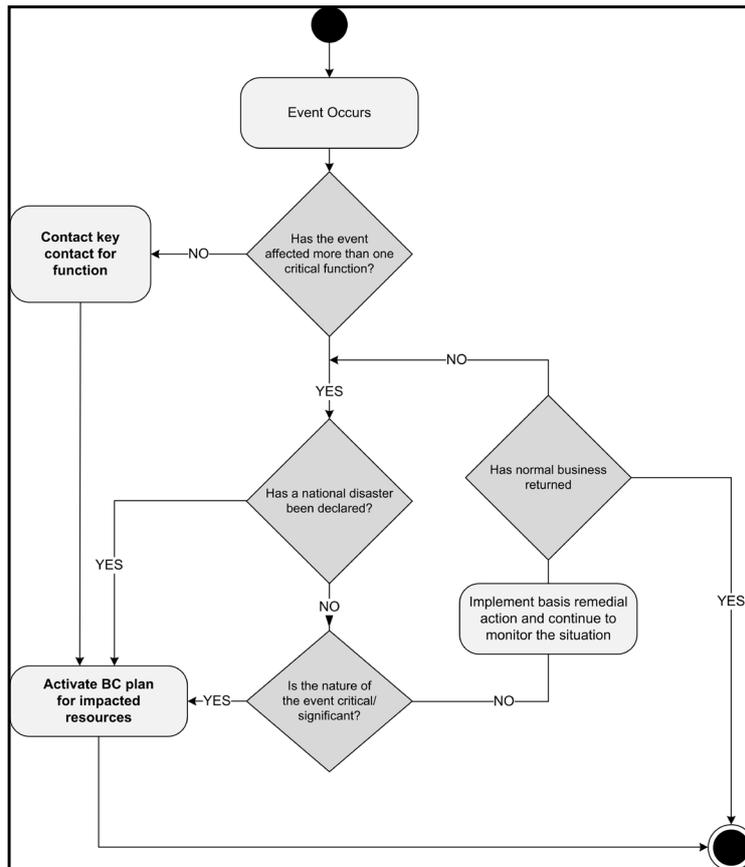
Source: Business Continuity Management, Building resilience in public sector entities, Better Practice Guide (2009), adjusted by authors

Figure 1: The flowchart of process of BC plan.

to state that at present organizations in the agrarian sector do not pay attention to BCM according to standards. Potato and onion growing and harvesting is labour-intensive, time-consuming and costly. This is caused primarily by the continuously growing demands of customers for quality and also by the use of very specific agricultural machinery. We can say that with the growing pressure on agrarian basic production and specialisation, the above areas are becoming more and more important.

Based on the results of comparison, the outcomes of the quantitative research as well as the additional qualitative research it may be summarized that organizations in the agrarian sector are not interested in the application of BCM according to standards and their use in agrarian businesses is an exception. The BS 25999 1 and 2 standards and norms examined are applied in particular in the tertiary sector, predominantly in the banking, financial, energy, ICT and similar sectors that focus, according to the research by Venclová, Urbancová (2012), primarily on IT and organizational processes.

Conclusion

The BS 25999 1 and 2 standards that represent the major groups of standards used by European countries do not display significant differences as they are based on the same conception and it depends on the organization which standard or norm it finds more appropriate (lower acquisition costs, faster implementation, etc.). In the Czech Republic BC standards are most frequently applied by organizations with foreign participation operating in the tertiary sector, predominantly in ICT. BCM standard application is not common in the agrarian sector yet. Agrarian organization are not interested in applying BCM according to standards; they would rather implement accompanying ISO norms, such as ISO/PAS

22399 and ISO 27031 whose introduction is less costly compared to BC standards. ISO norms are in the majority of cases introduced in order to ensure the continuity of operation, to resist disasters and to maintain supply chains. These standards are primarily applied by the tertiary sector (ICT), less in industry. If organizations identify their key elements and introduce norms or standards to ensure BCM according to their needs, it will help them eliminate risks.

The theoretical contribution of the article is the verification of theoretical suppositions from the literature examined regarding the suitability of standards for all economic sectors. The results show that not all sectors view BCM according to standards as justified. The practical benefit of the article is the presentation and evaluation of data obtained in the area of BCM, the evaluation of advantages and disadvantages that arise from the application of BCM according to standards in the areas examined and the proposal of possible documentation for better orientation in the given area. The results presented in the article are limited by the low number of organizations in the Czech Republic that manage process continuity according to the standards monitored. Future research may be extended to include neighbouring states (Slovakia, Poland, etc.) that co-operate with the Czech University of Life Sciences Prague on a long-term basis and to compare the obtained results in the areas of interest.

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Security of Agrarian Portals

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Anotace

Tento příspěvek se zabývá hodnocením bezpečnosti agrárních portálů provozovaných v České republice. Zaměřuje se převážně na bezpečnost autentizačního procesu při přístupu ke vzdáleným serverům. Na rozdíl například od aplikací internetového bankovnictví se ukazuje, že bezpečnosti agroportálů není věnována velká pozornost. Avšak i tyto systémy obsahují citlivé údaje, které je nutné adekvátně zabezpečit. Do hodnocení byly zahrnuty portály eAGRI, Portál farmáře, Internet pro chovatele a Agromanual. Pro porovnání výsledků zabezpečení agrárních portálů byly do srovnání také zahrnuty dva nejrozšířenější tuzemské portály – seznam. cz a Datové schránky. Cílem příspěvku je poukázat na nedostatečnou úroveň zabezpečení v souvislosti se správou identit uživatelů a navrhnout opatření pro zvýšení bezpečnosti.

Klíčová slova

Zabezpečení, autentizace, agrární portály, intranet, metriky, informační systémy.

Abstract

This paper deals with the safety evaluation of agrarian portals operated in the Czech Republic. It focuses mainly on security authentication process when accessing remote servers. The security of internet banking application has high level but the safety of agrarian portals seems to be very low. However, these systems contain sensitive data that must be adequately secured. The assessment covers "eAGRI" portal, "Portál farmáře" (Farmers portal), "Internet pro chovatele" (Internet for breeders) and "Agromanuál". Two most popular domestic portals – „seznam.cz" and "Datové schránky" (Data boxes) were also included to compare the results of agricultural portals security. The aim of this paper is to point out the lack of security in relation to the management of user identities and suggest measures to improve safety.

Key words

Security, authentication, agrarian portals, intranet, metrics, information systems.

Introduction

Since the beginning of mankind, the person in the society or community is in some way identified. In the various forms of human activities and communication with each other, it was necessary to identify the person and thus to distinguish him from one another. In ancient times merchant affirmed the identity with the finger printed in the clay plates to prove identity. Various seals and amulets were also used. In the modern history, the person is identified by hereditary characteristics in conjunction with paper documents that belonged to him. A person is referred to with a number, ID card, passport, etc. Identifying the value of original passports or legitimating securities was relatively low before the invention of photography.

From the perspective of information and communication technologies present trend points to the substantial centralization of data and applications. Original batch processing in the middle of the 20th century did not require verification of identity remote system - access to a computing machine was physically restricted by authorized persons. After the launch of the host-terminal model we can speak about relatively closed system. At the beginning of the 21st century the data were largely moved on server-side. In recent years there has been a shift to applications on the server side. This trend is related to the development of cloud-based applications. Given that these applications need to be accessed remotely, usually through a global network internet, great emphasis is placed on ensuring the authenticity of users accessing „remotely". (Vaněk, 2010), (Vaněk, 2011)

In conjunction with the development of the Internet also in agrarian sector (Šimek, 2008), the individual parts of network are in the hands of private companies and therefore it is not possible to prevent potential interception or alteration of communication, it is necessary to provide sophisticated authentication methods.

Authentication security

Proof of identity password is the most common method of authentication. While in the early computer networks they were operated locally, or local user authentication to local computers, the risk of misuse of passwords is relatively low. Using passwords were transferred to use also in Internet, where it is no longer possible to rely on the secure transfer of data. Yet already in the initial authentication systems the good habit was to save passwords on the server in a hidden form - preferably in the form of hash. When authenticating, only the password print is being compared and the attacker cannot determine the password itself during the transmission.

Another way of authentication is a challenge -response. It eliminates the risk referred to in the preceding paragraph. It provides two forms of authentication - just determine if the opposite side of the connection is „live" user (presence of natural persons) to avoid robots and machines. The second is the authentication by factor of knowledge.

Authentication certificate is based on the public key infrastructure. This consists of CAs exhibiting certificates of private keys of individual users. Currently, to improve safety, or for the provision of some IT services asymmetric, cryptography is often used. An example of this is the use of electronic signatures, encrypted connections using digital certificates, often used for example in electronic banking. When using asymmetric cryptography, a crucial role is the use of the certificates. Certified keys are used for authentication, encryption and secure communication. Each of the party's secured communication has two keys - one private, the other public. Often, however, not only one but more pairs of keys are used for each subscriber, when various key pairs are used for various purposes. But generally it is vital to keep the private key carefully on the smart card, floppy disk that is protected, on the hard drive with controlled access to the operating system, etc. On the contrary the public key is published. (Brechlerová, 2004) A certification authority (CA) performs publication usually in such a way

that the public key is stated as on of the entries in the certificate which is an electronic document with exactly given items. One of them is the public key, as well as identification of the signature algorithm, certificate serial number, identification certificate authority that issued the certificate, a place where you can find the certification policy, seniors certificates of the certification path, the period of validity, the next item is the identity of the owner key (common name). For sending signed e – mails, one should have an e-mail address in certificate. There are standards and recommendations, which items should be included in the certificate and the way how to be achieved. Still, there is some speculation as how to fulfill the certificate, respectively which information to place to which field in the certificate, so it is necessary to establish that data were structured in the same way at least in the given area. An example of this problem is the location of identifier of the citizen, replacing the native contact number for the public sector. After consideration I.CA (First Certification Authority) gives this to the name Alternative / Other name and others are likely to respect this fact, otherwise it would complicate development of application that needs this data.

Secure form of authentication provides one-time passwords, a password, which is not possible to carry out using an attack or repeating eavesdropping because the password is usable only once. (RFC2289) It can be easy to implement two-factor authentication, the second factor (for example, after entering the traditional static passwords) is token property to generate the OTP. Most hardware and software tokens does not protect current password, just press the button and look at the display, there is no need to enter your PIN or something like that. OTP is thus complement of the password, not a substitute. (Valasek, 2011) (Hoyer, 2009)

The advantage is that authenticating person requires no special equipment apart from token: one-time password is in the form of 6-8 characters or digits which are necessary just to be copied, direct connection of token to a computer is not necessary. It can therefore authenticate to a foreign computer in an internet cafe etc.

Materials and methods

Considerable attention is paid to secure logging into portal applications. Unfortunately it focuses mainly on safety of the password and its saving.

The general requirements for secure authentication can meet the following recommendations: (Greer, 1999) (McClure, and others, 2007)

1. Choose strong passwords
2. Passwords should be changed regularly
3. Never save your password
4. For each system you choose a different password
5. Maintain computer and antivirus program updated
6. Do not download and install illegal software

Closer examination reveals that the points 1-4 place significant demands on the user's memory and in real life it is almost impossible to faithfully comply with these rules. Regular change of the password in connection with the complexity leads the user to write down the password. But this is in contradiction with point 3. These requirements increase with the number of systems to which the user has accesses. This makes contradictory requirements 3 and 4.

Numbers of systems to which users gain access in the course of life continues to grow and requirements set out in paragraphs 1-4 are almost unreal. Responsibility for imperfect way of security is transferred to a large extent to the user in terms of system operators.

Point 5 is relatively easy to meet when setting your computer and OS correctly. The problem may be requirements for older/unpatched versions of software. This can occur when the software requires discontinued and unpatched software platform.

A simpler situation seems to be at a point 6, where it is up to the user whether he is willing to take the risk with the use of illegal software. But we cannot rule out a hidden installation caused by such a virus or spurious e-mail.

The analysis of agricultural sites was examined security authentication data. The evaluation was based on an analysis of literary sources selected following criteria:

1. The system used to connect and transfer data secure HTTPS
2. The system is secured by DNSSEC domain record
3. The system enables multi-factor authentication (one-time passwords, smart cards)

For comparison, the assessment has also added two dominant Czech portals – Datové schránky and seznam.cz.

For the evaluation of the author attributes metrics designed for secure authentication in information systems. Attributes of selected metrics are not standardized. The author proposes the evaluation in accordance with the available literature. (Vanicek, 2004) (Hayden, 2010) and (Učeň, 2001).

For the safety assessment of selected authentication systems have been designed following attributes of security metrics:

The rate of connection security assessed using an encrypted connection using HTTPS. For appropriate use of HTTPS is important trusted CA that can be trusted worldwide. Supreme HTTPS can be achieved by so-called extended validation when the CA guarantees not only domain ownership, but also belonging to the organization (table 1).

The level of security service assesses the use of DNSSEC security technology. This technology allows detecting a fake DNS entry (table 2). It is therefore an appropriate defense against phishing

Metric	Connection security
Name of metric	Connection security
Metric purpose	Encrypted connections make it harder for intercepting communications
Method of measurement	Analysis website
Metric interpretation	0 – no HTTPS
	50 - uses HTTPS with certificate from not trusted CA
	90- uses HTTPS with certificate issued by trusted CA (without extended validation)
	100 - uses HTTPS with certificate issued by trusted CA (with extended validation)
Source data	Web page, list of CAs and information about certificates from CA

Source: own processing

Table 1: Connection security metric.

and pharming attacks. The service on the server side has no other options – it is either implemented or not.

Metric	DNSSEC
Name of metric	DNSSEC
Metric purpose	The level of protection against spoofing DNS record
Method of measurement	DNS query
Metric interpretation	0 – no DNSSEC 100 - uses DNSSEC
Source data	Register nic.cz

Source: own processing

Table 2: DNSSEC metric.

Multifactor authentication typically uses other authentication data than a user name and password. Electronic signature (certificate) or one-time password can be used as an additional authentication data. The rate of multi-factor authentication is the ratio between the numbers of authentication factors against the highest number of factors obtained from the evaluation of the options (table 3).

Metric	Multi-factor authentication
Name of metric	Multi-factor authentication
Metric purpose	The use of multiple methods of authentication
Method of measurement	$X = 100 * \frac{n}{\max(n)}$, where X is rate of multifactor authentication, n = number of authentication methods, max (n) - the highest number of authentication methods in the sample
Methods of measurement	Website analysis
Metric interpretation	Ratio of multi-factor authentication
Source data	Website

Source: own processing

Table 3: Multi-factor authentication metric.

The weight of metrics is identical. Metrics are therefore normalized to values between 0 and 100. Results will be displayed as a radial diagram.

Portal eAGRI

Portal "eAGRI" forms the central point of access to information resources of MZ ČR (Ministry of Agriculture). It was originated by merging sites mze.cz, upu.cz (page land offices) and farmar. eu (Portál farmáře). "Portál sítě pro venkov" was

also integrated in this system. The portal supports for individual applications SSO, a single sign-on to all components.

Single sign-on is enabled with implementation of LDAP background. In LDAP the user certificate is also possible (table 4).

Parameter	Result	Notes
Address		**https://ilogin.mze.cz/distauth/UI/Login**
HTTPS	Yes	Trusted CA, only identity validation
DNSSEC	No	
Multi-factor authentication	No	

Source: own processing

Table 4: Results for portal eAGRI.

Portál farmáře

The user registers into "Portál farmáře" with request for access to the registry of the Ministry of Agriculture. To set up access it is required to submit documents necessary to verify the identity and eligibility of the applicant. User is authenticated to prove the identity (identity card or passport). Eligibility is presented by individual's identity card or passport. For other legal entities according to legal form:

Legal entity - a statement of the basic registers or extract from the commercial register (OR) or other certificate of business from which it is clear who is the legal representative of the company. If the applicant is not the legal representative of the entity, the applicant must submit a certified power of attorney, which is subject to the legal representative referred to in the submission of the statement of the OR or in a certificate of legal status. The power of attorney must be authorized by the applicant access to protected data subject to the Farmer's portal (also in the case of authorized natural person) and signature of principal/s must be officially verified (table 5).

Parameter	Result	Notes
Address		**https://www.szif.cz/irj/portal/pf/pf-uvod**
HTTPS	Yes	Trusted CA, extended validation
DNSSEC	No	
Multi-factor authentication	No	

Source: own processing

Table 5: Results for Portál farmáře.

Internet pro chovatele

Application "Přístup k datům" (data access) enables data to breeders of dairy cattle, sheep and goat farmers, dairies and milk cooperatives in electronic form. User name and password provides the user with the access to the data that belongs only to him.

Through the application of data access the user can obtain the results of analyses of samples of milk yield control of cattle, sheep and goats in two forms and the results of analyses of samples of milk for monetization. New users acquire access rights through the registration form.

The user name „aaa" and the password „aaa" has concluded in successful authentication during testing when determining where the user is redirected after a failed test - Therefore the user with these credentials already existed in the system. The same situation also occurred during logon of user „bbb" and the password „bbb" (table 6).

Parameter	Result	Notes
Address		http://data.cmsch.cz/login_data.php
HTTPS	No	
DNSSEC	No	
Multi-factor authentication	No	

Source: own processing

Table 6: Results for Internet pro chovatele.

Agromanual.cz

"Agromanuál" is a portal dedicated to plant protection products for both gardeners and farmers. When the user registers (through unsecured channel), the password is sent back to the user in plaintext.

The portal is closely bound to Agromanualshop.cz, but the two systems have separate login information. It is necessary to register separately (table 7).

Parameter	Result	Notes
Address		http://data.cmsch.cz/login_data.php
HTTPS	No	
DNSSEC	No	
Multi-factor authentication	No	

Source: own processing

Table 7: Results for Agromanual.cz.

Agroweb.cz

This site does not allow registration and login; therefore it was not included in the testing.

Seznam.cz

One of the most popular Czech portals provides very low security of authentication. Check-in is possible only with username and password. With regard to the number of users and the potential risk of abuse of the accounts the security is rather worrying (table 8).

Parameter	Result	Notes
Address		http://www.seznam.cz
HTTPS	Yes	Entry pages uses only HTTP, password is sent over HTTPS
DNSSEC	No	
Multi-factor authentication	No	

Source: own processing

Table 8: Results for seznam.cz.

Datoveschranky.info

Data boxes (right "informační systém datových schránek- ISDS) are operated pursuant to Act No. 300/2008 Coll. Electronic acts and authorized conversion of documents. The main advantage is to ensure the authenticity of users. It is secured by a personal identification during the registration process. If the request is sent electronically, a trusted digital signature is required to sign (table 9).

Parameter	Result	Notes
Address		http://www.mojedatovaschranka.cz
HTTPS	Yes	Trusted CA, extended validation
DNSSEC	No	
Multi-factor authentication	No	Chip card, SMS messages (paid by user, price 3 CZK per message), one-time passwords

Source: own processing

Table 9: Results for ISDS.

Results and discussion

Numeric expression of metrics based on the measurements is shown in Table 10. For clarity, the results are plotted in Graph 1.

Dominance of data boxes is a clear in Graph 1. In terms of security authentication "Datové schránky" reach the highest level of security in all criteria.

	HTTPS	*DNSSEC*	*Multi-factor authentication*
eAGRI	90	0	50
Portál farmáře	100	0	50
Internet pro chovatele	0	0	50
Agromanual	0	100	50
Seznam.cz	90	0	50
Datoveschranky.info	100	100	100

Source: own processing

Table 10: Rating authentication security of portals.
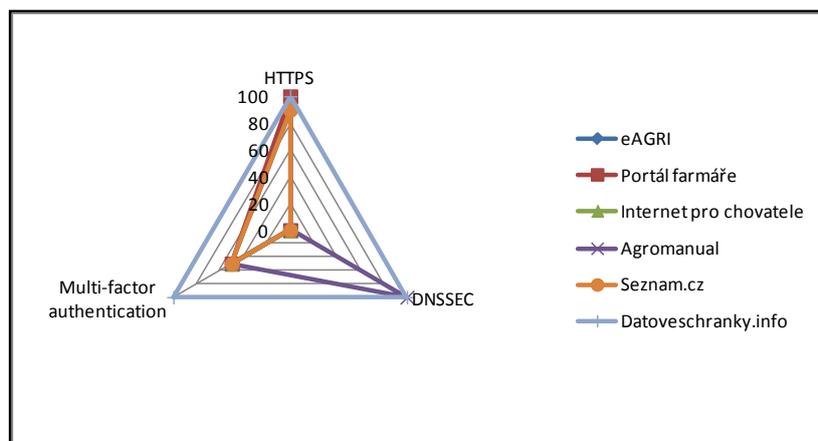
Source: own processing

Graph 1: Comparison of security.

"eAGRI" and "Portál farmáře" were evaluated to be the best portals as for the agrarian ones. The same authentication against LDAP as well as protocol HTTPS with a trusted certificate is used by both portals for secure data transfer. What is more "Portál farmáře" make also use of so-called extended validation. This confirms not only certified subject domain's ownership; it also confirms the identity of that company. Acceding user can thus be sure that the site really belongs to the actual company. During testing authentication data of some users were randomly found in portal "Internet pro chovatele". These users have the same password as the user name. It is a big security threat.

Apart from agrarian portals the best evaluated are "Datové schránky" They provide security at a high level. Conversely seznam.cz is evaluated very low in terms of security authentication.

Recommendation for portals (outside "Datové schránky") is primarily to enable solution that support multi-factor authentication.

The final order for agrarian portals (sorted from best rated) is following:

1. „Portál farmáře". It uses secure protocol for internet communication, but users can be only authenticated using passwords. In these times the password can be stolen from computer or captured from keyboard. I suggest implementation of DNSSEC and multi-factor authentication.

2. eAGRI. The only difference between „Portál farmáře" and eAGRI is, that eAGRI doesn't use extended validation for certificate. This vulnerability has disadvantage in communication with counterparty, when we cannot guarantee ownership of web address. In other cases it can be acceptable. I suggest implementation of DNSSEC and multi-factor authentication.

3. Agromanual uses from secure techniques only DNSSEC. It is important to ensure, that user opens actually the page, he had requested. But using combination authentication using password

with unsecure connection is highly vulnerable. I suggest implementation of HTTPs and multi-factor authentication.

4. The worst safety had „Internet pro chovatele", that uses no security techniques. It implicates very high vulnerability of this portal. I suggest implementation of DNSSEC, multi-factor authentication and HTTPs.

The future research will be focused on improving authentication security of agrarian portals. For this reason were in comparison included „Datové schránky". These are now at the top on security authentication.

Conclusion

This paper defines metrics for measuring authentication security of web portals. These metrics are then applied to agrarian portals. Detailed results are described in chapter Results and discussion.

Security of some agrarian portals is on very low level and should be increased using some advanced techniques. Also best rated portals offer only single-factor authentication, that is currently rated as low secured. Passwords can be captured via keyloggers or screenlogers. Possible solution is to use one-time passwords system or some OpenID solutions with high authentication security.

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Application Possibilities and Consequences of Biological Assets and Agricultural Produce Reporting in Accordance with IFRS Principles in the Czech Republic

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Anotace

Česká národní právní úprava účetnictví není harmonizována s Mezinárodními standardy finančního výkaznictví (IFRS). Kvůli tomuto faktu, všechny finanční výkazy sestavené podle české právní úpravy jsou neporovnatelné s výkazy sestavenými dle IFRS. Mezinárodní uživatelé účetních informací, např. potenciální investoři, mají tudíž problém získat potřebné informace. Článek analyzuje oceňování, účetní zachycení a vykazování biologickch aktiv a zemědělské produkce dle obou účetních systémů. Ilusturuje základní rozdíly a vysvětluje jejich vliv na informace vykázané ve finančních výkazech. Na základě případové studie článek doporučuje jak implementovat IFRS principy do účetního systému podniků v České republice. Autoři doporučují používat členění výkazu zisku a ztráty dle účelového členění, které není v České republice běžně užíváno. Výsledky výzkumu ukazují na možné změny v právní úpavě účetnictví a daní České republiky, které by mohly vest k "věrnějšímu a poctivějšímu obrazu" poskytovaných účetních informací. Předložené návrhy by měly posloužit tomu, aby informace poskytované finančními výkazy sestavenými dle české právní úpravy byly identické z informacemi ve výkazech sestavených dle principů IFRS. Oproti této snaze, výsledky dotazníkového šetření ukázaly skepticismus ekonomů zemědělských podniků k použití reálné hodnoty jako oceňovací báze biologickcých aktiv a zemědělské produkce.

Klíčová slova

Mezinárodní standardy finančního účetnictví IFRS, rozvaha, výkaz zisku a ztráty, výnosy, náklady obecně, náklady účetní, přínosy/zisky, újmy/ztráty, změna stavu zásob, rozvahový den.

Abstract

The Czech national law regulating accounting is not harmonized with International Financial Reporting Standards (IFRS). Because of this, all financial statements compiled according to Czech regulations are not comparable with IFRS statements. International users of accounting information, e.g. potential investors, therefore have problems to find valid information. This article analyzes the evaluation, accounting recording, and reporting of biological assets and agricultural produce in both accounting systems. It illustrates the principal differences, and explains their impact on financial statements information. Based on a case study, the paper recommends how to implement IFRS principles to the accounting system in Czech agriculture enterprises. The authors recommend using income statements with expenses by function, which is not commonly used by Czech entities. The research findings indicate possible changes in the Czech accounting and tax laws, which may lead to a "more true and fair view" of provided accounting information. The proposals should cause that accounting information provided by financial statements compiled according to Czech law would be identical with accounting information in compliance with IFRS principals. A questionnaire survey revealed scepticism of economists agricultural companies to use fair value as the measurement basis for biological assets and agricultural produce.

Key words

International Financial Reporting Standards IFRS, statement of financial position, income statement, income (revenues), costs, expenses, gains, losses, changes in inventories, reporting date.

Introduction

The process of the worldwide integration and globalization leads to the need for harmonization of accounting and financial reporting at international level. Accounting harmonization has been defined as "the coordination of pre-existing rules of a different and sometimes conflicting nature" (Van Hulle, 1989) also as "process of increasing the comparability of accounting practices by setting bounds to their degree of variation" (Nobes, 1991). "Harmonization is concerned with reducing the diversity that exists between accounting practices in order to improve the comparability of financial reports prepared by companies from different countries" (Murphy, 2000). Accounting harmonization should make easier the situation for the companies which expand their activities abroad (Šrámková, 2009). There are three major lines of international harmonization, International Financial Reporting Standards IFRS[1], European Union Accounting Directives (especially 4., 7. and 8) and, last but not least the United States Generally Accepted Accounting Pripcipals US GAAP. Currently, International Financial Reporting Standards IFRS are considered to be in the compliance with the need for international harmonization of accounting (Kovanicová, 2004). The implementation of IFRS would reduce the information asymmetry between informed and uninformed investors (Bushman, Smith, 2001). More than 100 countries in the world have adopted IFRS (ISAR, 2009; Deloitte, 2012). From January 1, 2005, all companies domiciled in the European Union with shares listed on securities exchanges must prepare their consolidated accounts in accordance with International Financial Reporting Standards (IFRS) issued by the International Accounting Standards Board (IASB). This event presents an opportunity for accounting researchers to analyze trends in research on international accounting harmonization (Baker, 2007). The process of international accounting harmonization has entered into a new phase. "International Financial Reporting Standard for small and medium-sized entities (IFRS for SMEs) was published in July, 2009". This standard is designed to meet the needs

and capabilities of entities which "do not have public accountability, and publish general purpose financial statements for external users" (IASB, 2009). Defined small and medium-sized entities are estimated to account for over 95 per cent of all companies around the word (Paseková, 2012). At present, "the European Commission analyzes data from surveys on this new standard and discussed its advantages and disadvantages". However, it has not taken a single decision on whether to adopt and incorporate the standard into the European accounting legislation (Bartůňková, 2012).

Czech accounting law is in conformity with the European Directives. (Bohušová 2008). The Amendment of the Act on Accounting of the Czech Republic, which entered into force on 1st January 2002, enabled the entities to prepare consolidated financial statements in accordance with IFRS. Another amendment entering into force on 1st January 2005, further progressed in the harmonization and requires the entities with shares listed on stock exchanges in the EU countries to prepare financial statements in accordance with IFRS. The European Commission Regulation No. 1606/2002 was applied in this way (Bohušová, 2008). However, any enterprise which has its registered office in the Czech Republic must calculate the income tax base without the influence of IFRS (Income Tax Act, 2013). Czech accounting law does not permit to keep accounting records according to IFRS for SMEs. The process of accounting harmonization seems to be an irreversible process. Despite of this fact, the most of the enterprises in the Czech Republic - about 1 million, which is about 99.84% of all enterprises (MPO, 2010), keep records according to Czech national rules. This causes the situation that information from Czech companies financial statements are not comparable with information provided by financial statements compiled according to IFRS. The basic financial statements are the statement of financial position[2] and the statement of income (Epstein, 2009; IASB, 2012), also called income statement[3].

In 2000, The International Accounting Standard No. 41 - Agriculture was approved by the Committee for International Accounting Standards. This standard came into force for financial statements covering the period beginning on 1st January

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[1] At the beginning (from the year 1974) standards were issued as "International Accounting Standards - IAS", from the year 2001, the new standards are called "International Financial Reporting Standards" – IFRS (Dvořáková, 2011). Currently is used acronym IAS/IFRS or just IFRS.

[2] Formerly called balance sheet.

[3] Can be also called statement of profit or loss.

2003 (Deloitte, 2000). Its aim was to establish a unified recording of farming activity, it reporting in the financial statements and the disclosure of the requested information. The reason for the issue of the standard for biological assets and agricultural produce was especially their specificity given by the fact that biological transformation is difficult to capture in accounting models based on historical costs (Dvořáková, 2011). Following the fair value orientation of IFRS, IFRS adoption is likely to introduce volatility in income statement and balance sheet figures and IFRS implementation leads to more value relevant accounting measures (Iatridis, 2010). The European Accounting Directives sets out a historical measurement model for biological assets and agriculture produce (EC, 2000). According to the EC (2000), fair value measurement is not in accordance with the European Accounting Directives. Due to the absence of the legislation of the Czech Republic, which would accept specificity of biological assets and agricultural produce reporting, it is necessary to analyze the possibilities and consequences of the application of the principles of IAS 41 reporting in the Czech Republic conditions.

The aim of this contribution is, in a theoretical line, to define the requirements of IAS 41 for reporting of biological assets and agricultural produce and convey the results of research focused on possibilities and consequences of the principles IAS 41 in the Czech Republic. Two problematic aspects of wide research are presented in this paper: the selection of appropriate forms for drawing up the statements and true & fair view of economic reality through statements.

Materials and methods

The article presents the results of the application case study focused primarily on biological assets and agricultural produce in the Czech Republic specific conditions of agricultural practice. The case study (to the possible extent without any software support) demonstrates the basic solution principles embodied in the international standards, which are largely different from the Czech Republic current legislation approach. The subjects under scrutiny being examined were formulated during the trial implementation of common accounting transactions performed according to IAS 41. Defining theoretical IAS 41 and IFRS for SMEs

requirements[4] for biological assets and agricultural produce reporting precedes the research findings. IAS 41 requirements are analysed and applied in the Czech context. Impacts on financial statements are pointed out, and recommendations are formulated.

A trial implementation of agriculture activities recording and reporting according to the International Accounting Standard 41 - Agriculture was conducted within the doctoral dissertation entitled „Valuation of biological assets and agricultural production in the Czech Republic within the European Union Accession"[5] (Hinke, 2006). The research is also related to the dissertation "Application of International Financial Reporting Standards into Small and Medium-sized Entities Reporting"[6] by Stárová Marta (Stárová, 2013). Both doctoral dissertations were elaborated at the Department of Trade and Finances of the Czech University of Life Sciences Prague, Faculty of Economics and Management.

The research of the scientific literature on biological assets and agricultural produce in articles, dissertations, theses, national and international articles between 2006 and 2011 is conducted by de Sousa (2013). The results revealed that 11 articles on biological assets and agricultural produce have been presented in national conferences, three articles were published in national journals, and two national papers were found on this subject. It was further observed that 6 international articles on this topic were published in this period and that among the international productions on this subject, there were a dissertation and a thesis. It is concluded that 24 studies on biological assets and agricultural products were found in the period 2006 to 2011. Accounting and Thinking Universe published book, each one, an article on the subject, the authors had only one published paper and the themes of the research was the application of IAS 41 and accounting treatment for biological assets, the national papers were found from the graduate programs in Sciences statements (de Souza, 2013). The comparative analysis

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[4] The same basic requirements for biological assets and agriculture produce reporting are in IAS 41 – Agriculture and in IFRS for SMEs section 34. Section 34 – Specialised activities is simplified version of IAS 41.

[5] Originally: "Oceňování biologických aktiv zemědělské produkce v rámci vstupu České republiky do Evropské unie".

[6] Originally: "Aplikace mezinárodních standardů finančního výkaznictví do účetnictví malých a středních podniků".

of the currently applied Czech Republic law rules for agricultural activity reporting and the analysis of the current accounting treatment of agricultural activity under the International Financial Reporting Standards were the starting point of the research of Bohušová (2012). Review of the possibilities of the provisions implementation relating to agriculture in the frame of IFRS for small and medium sized entities into practice of entities concerned, whose subject is agricultural production and recommendation of appropriate application in practice, is mentioned in the article by Bohušová (2011). In the Czech Republic, the issue of biological assets and agricultural produce reporting was also elaborated in the dissertation: Dvořáková, Dana. „Open problems of accounting harmonization in agriculture" in 2004. Dvořáková (2012) deals with the accounting and reporting of economic transactions arising as a result of agricultural production and forestry in accordance with the Czech legislation and with IAS 41.

Based on studies of expert sources the basic principles of valuation, recording and reporting of produced inventories, primarily biological assets and agricultural produce, are analyzed according to the Czech law, IFRS and IFRS for SMEs. The IFRS principles are applied into the Czech conditions. An appropriate form of financial statements is determined, reporting of unrealized gains/losses[7] is analyzed and fair and true projection of reality is discussed.

Czech law does not distinguish produced inventories according to their origin. Inventories coming from non-agricultural and agricultural activities are evaluated by the same principle. Any production is initially measured by own costs and later on, as of the reporting date, the carrying amount[8] is decreased to the selling price minus costs of sales (in case this value is lower than value recorded) (Accounting Act, 2013). In contrast, IFRS strictly distinguish inventories coming from agricultural activities from other activities. IAS 41 defines biological assets as living plants and animals controlled by the entity as a result of past events and agricultural produce as

the harvested product of the entity's biological asset awaiting sale, processing, or consumption (Epstain, 2009). IFRS philosophy is based on the fact that biological assets and agricultural produce are primarily intended for the market. Many of farm products are sold in the marketplace (at an auction or a grain elevator) (Wheeling, 2008). That is the reason for initial input evaluation at their fair value[9] less costs to sell[10]. Biological assets should be reported in fair value (less sell costs) as of each reporting date. After initial recognition, agricultural produce evaluation is guided by IAS 2 (IASB, 2009, 2012). As required by IAS 2, inventories are measured in accordance with LCM principle (Lower of Cost or Market). The acquisition cost is considered the basis for the inventory valuation of IAS 2, however, the recording must not exceed the net realizable value[11] (Krupová, 2009). The gain or loss which is reported upon initial recognition of biological assets and agricultural produce, and also arising from changes in the fair value less estimated point-of-sales costs of biological assets, should be included in the net profit or loss for the period in which gain or loss arises (Epstein, 2009). The valuation of produced assets in the fair value requires the finding of such a system of accounts that would meet the requirements of the standard and allowed the reporting of quality accounting information (Dvořáková, 2011). Czech law does not permit production initially registered at the fair value, and also does not permit to increase the inventories value as of the reporting date to the market price (Accounting Act, 2013).

Another difference between the Czech legislation and IFRS is the way of operating expenses structure. Entities that keep accounting records according to Czech law commonly divide operating expenses by nature. Production increases are recorded on the credit side of the account "Changes in inventories" and production decreases (consumption, sale) are recorded on the debit side of the same account. The (balance of) account "Changes in inventories" is reported in operating

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[7] The definition of income encompasses both revenue and gains Revenue is income that arises in the course of the ordinary activities, gains are other items of income The definition of expenses encompasses losses as well as those expenses that arisen the course of the ordinary activities of the entity. (IASB, 2009).

[8] Carrying amount is the amount at which an asset is recognized in the statement of financial position (Mackenzie, at al., 2013).

[9] The entity shall use the fair value model for those biological assets for which fair value is readily determinable without undue cost or effort, for all other the cost model should be used (Epstein, 2009, IASB, 2009).

[10] For agricultural produce is initial evaluation (acquisition cost) the fair value less costs of sale at the point of harvest (Epstein, 2009, IASB, 2009).

[11] Net realisable value is the estimated selling price in the ordinary course of business, less the estimated costs necessary to make the sale (Epstein, 2009, IASB, 2012).

revenues (Public Notice 500, 2013). Whereas IFRS and UAS GAAP prefer operating expenses to be structured by function. This classification usually provides more reliable and relevant information (Mládek, 2009). On the other side, IFRS permit operating expenses structure by nature. In this case the account "Changes in inventories" affects the operating expenses (Epstein, 2009). That is a result of a logical progression when unrealized production (produced but not sold) does not increase income, as in case of recording in accordance with the Czech law. It is expenses rearrangement according to IFRS, IFRS for SMEs, and also US GAAP.

The concept of changes in produced inventories as expenses correction is based on the basic elements of a conceptual IFRS framework, according to which:

a) expenses are decreases of economic benefits during the reporting period in the form of outflows or depletion of assets or incurring liabilities that result in decreases in equity, other than those relating to distributions to equity participants.

b) income is increases in economic benefits during the reporting period in the form of inflows or enhancement of assets that result in increases in equity, other than those relating to contributions from equity participants (IASB, 2009, 2012).

When including the account „Changes in inventories" in expenses, the same value of total revenues and total expenses is achieved as in case of expenses structure by nature. Therefore, the same values of financial indicators (e. g. return on revenues, return on expenses) are achieved. Whereas in case of account „Changes in inventories" included in revenues, the different values of financial indicators are achieved. The solutions of expenses structured by nature in accordance with the Czech law appear to be inconsistent.

The test implementation of accounting and reporting methods according to the provisions of the International Accounting Standard No. 41 — Agriculture was carried out in the Trade and Accounting Department of Czech University of Life Sciences, Prague within the framework of a doctoral dissertation: *The Evaluation of Biological Assets and Agricultural Production within the Framework of Accession of the Czech Republic into the European Union*. The application

case study focused primarily on biological assets and agricultural produce. Furthermore, it specifies the conditions of agricultural practices in the Czech Republic and demonstrates (to the maximum extent possible without having software support) the basic principles of solving problems within the international standards, which are considerably different from the present legal system according to the law of the Czech Republic.

The implementation, performed on a fictive accounting unit, resulted into the emergence of several problematic issues, all of which were selected for this second paper. Furthermore, in order to support the case study, a final questionnaire survey was conducted in a sample of 104 agricultural enterprises in the Pilsen and Central Bohemia Regions. The role of respondents was accorded to the economists of the aforementioned enterprises. This paper presents the conclusions of this survey, which are closely related to the selected problematic aspects.

Results and discussion

The case study of implementation of current operations and accounting and its implications in the context of biological assets and agricultural produce according to IAS 41 led to the evaluation of the following problematic issues:

(1) selection of appropriate forms of formulating statements,

(2) true and fair view of economic reality through these statements.

These problematic topics will be discussed in the following text.

1. Selection of appropriate form of the financial statements

Valid legislation of the Czech Republic stipulates a binding pattern of stating financial position, the form of which has been taken from The Fourth EU Directive – The First Pattern. This means it is based on the statement of financial position which equates assets with liabilities. The income statement is determined by the vertical form with a given content of each item.

Till 2002, this statement included only classification of expenses by nature (expenses were reported on the basis of their very nature: wages, depreciation, material usage, etc.). Since January 1st 2003 income statement in the Czech Republic can

be based on classifying expenses by function. This method (sometimes referred to as „cost of sales") divides the costs according to their function (cost of production, cost of sales, cost of administration). The functional layout of the profit and loss statement is established in the accounting system solution for US GAAP, IFRS, in The Fourth EU Directive. This way of dividing costs was incorporated into the legal system of the Czech Republic with the view of promoting economic cooperation between European countries.

In order to implement the income statement by function into the legislation of the Czech Republic the conducted research examined the extent of utilizing the option which classifies expenses by function. The results of the processed survey are shown in the following graph 1.

The survey shows that 97 companies (93.27%) do not reflect expenses classification by function at all, 6 companies (5.77%) compile income statement with expenses classification by nature and disclose expenses classification by function in a footnote, and 1 company (0,96%) uses expenses classification by function.

Apparently, the classification of expenses by function is not used in the Czech agricultural practice. This is related to the problem of different perception of „changes in inventories" in the operating costs by nature. While the IFRS accounting system considers this item as belonging to adjustment costs, in the accounting system

introduced in the Czech Republic „changes in inventories" are featured as financial accounting income. The application of both concepts on a specific example (milk production) shows the inadequacy of the concept introduced in the Czech Republic:

Assumptions:

- the farm produces 100 l of milk per day,
- costs: 800 (unit production costs 8 monetary units/litre)
- 80 l of milk sold for 680 monetary units (sales price per unit is 8.50/l),
- all production costs are the cost of the product (1 l of milk).

Description of economic transactions:

1. Various costs (expenses) in the production process for 800 m.u. (monetary units).
2. Production of goods (products) and their transfer to a store (800 m. u.).
3. Unloading the goods for sale in a store (640 m. u.).
4. Sale of a part of the products (selling price 680 m. u.).

The example of milk production, leading to the income statement compilation using the classification by nature is recorded as follows (scheme 1 and 2).

The concept of „changes in inventories"
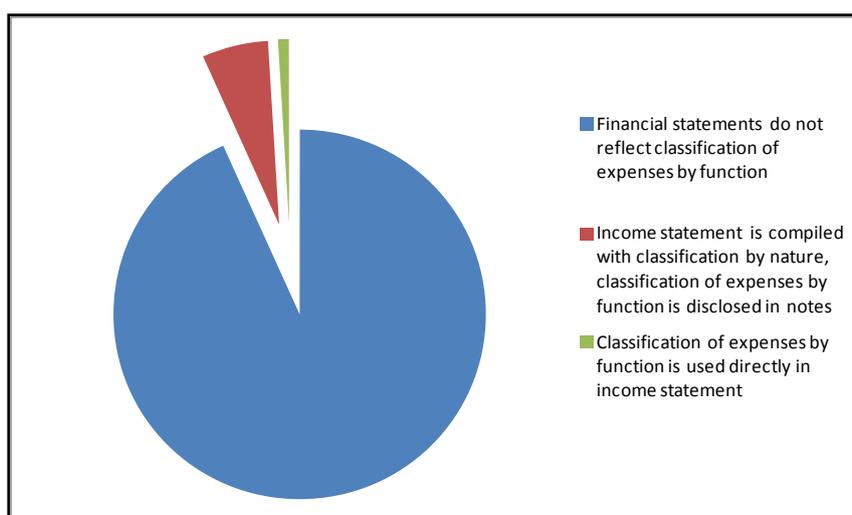
Source: own data

Graph 1: Usage of expenses classification by function in Czech agricultural companies.

Source: own data

Scheme 1: Specified example of recording using classification of expenses by nature.

Source: own processing

Scheme 2: The concept of changes in inventories as income adjustment.

as an income of financial accounting (the concept valid in the Czech Republic) leads to a distorted financial analysis and a quantification of indicators such as:

► Return on revenues = profit/revenues = 40/840 = 0,048 m.u. (840 = 160 + 680)

The indicator compares the profit from the sale of milk with the sum of sales, including the still unrealized profitability costs

► Return on expenses = profit/expenses = 40/800 = 0,05 m.u.

The indicator compares again the profit from products made with the cost of all manufactured products.

The following solution leads to the proper solution suggested by these indicators (scheme 3):

► Return on revenues = profit/revenues = 40/680 = 0,059 m. u.

► Return on expenses = profit/ expenses = 40/640 = 0,063 m. u.

The income statement with classification of expenses by function eliminates the misused concept of changes in production reporting. In this concept, accounts "changes in inventories" and "activation" are not used, and all costs are recognized and recorded on statement of financial position accounts. The inventory costs (milk) are not taken into account until the moment of realization with the classification of expenses by function. The previous example of milk production, leading to the income statement compilation using the classification by function is recorded as follows (scheme 4):

Note 1: different classification of expenses must not change the total amount of profit or loss.

Note 2: the description of the economic transactions is identical with the description in scheme 1.

Profit and loss account			
The cost of milk production	800	Revenues from the sale of milk	680
Change in inventories............	- 160		
Profit	40		
	680		680

Source: own processing

Scheme 3: The concept of changes in inventorie as expenses adjustment.

Profit and loss account			
The cost of milk production	800	Revenues from the sale of milk	680
Change in inventories............	- 160		
Profit	40		
	680		680

Source: own processing

Scheme 4: Specified example of recording using the classification of expenses by function.

It is clear from the information above that the expenses as defined in the Czech accounting system (in the fifth accounting group of Chart of accounts) and the revenues (designated by the sixth accounting group) do not correspond to the concept of cost-benefit of the accounting systems in the rest of the world.

The conclusion of the topic and formulation of recommendation

The need to complete the legal provisions which adjust accounting terminology (in particular the Czech Republic accounting law) by the missing definitions of the constituent elements of the financial statements can be inferred from the facts outlined above. This would be the basis for the harmonization of the concept of changes in inventories with the world's most respected views of both IFRS and US GAAP.

An interim solution is possible through a compilation of income statement with the classification by function. However, the concept of change in agricultural practices would mean editing the accounting software and increasing efforts of staff at the economics department, which according to the research carried

out appears to be redundant.

2. True and fair view of economic reality by means of financial statements

Universally recognized as the most superior accounting principle is the principle of a true and fair image of reality, since it plays a crucial role in determining current and potential users (owners, investors, and other entities). The objective of IAS 41 is capturing the agricultural activity as reported in the financial statements and publication in the context of the „true and fair view".

In some cases, however, the strict application of the already defined principles and fair presentation of these efforts can lead to a disparate reporting assets and debt in the statement of financial position and it extends to disparate reporting of expenses and revenues in the income statement.

Likewise, compliance with the principles as defined in IAS 41 generates these problems as well. If the actual value on the date of revaluation is lower than the book value, the reduction in value of biological assets is recognised in the income statement as a loss. If this fact is recorded in the income statement, it reduces

the reported profit or loss, and it is a yet unrealized loss. This procedure can be described as correct, since it complies with the principle of caution.

However, if the actual value on the date of revaluation of the biological assets exceeds a set value so far used in books, then the increase in value is recognised (in the income statement) as a gain. If this gain is recognized in the income statement, it increases the economic result, which represents an unrealized gain. The problem is the risk of the company not achieving this gain in the future, as the terms and conditions may be changed. Due to the biological nature of the assets we cannot entirely ignore the fact that in the future there could be no gain in connection with losing the assets. The businesses should be financially secured against the loss, but the recognition of unrealized profits resulting from uncertain asset breaks the principle of caution and threatens the very existence of the company, as the uncertain unrealized gain may be divided at the expense of preserving the property substance of the business.

On the other hand, this concept also includes a positive contribution – if the equity capital of the company (through the income statement) increases due to growth in the fair value of the assets, the financial position of the holding improves (however, the improvement may be temporary). This means the company may be for example allowed to obtain the necessary financial resources (positive for agricultural holdings). Nevertheless, if there is a rapid and noticeable decline in these values soon after

the revaluation at fair value, users of accounting information suffer losses arising from the fact that their views were built on a more favourable picture of the financial position of the company. For this reason in particular, it may not be always positive for external users of the fair value.

Respondents' views in agricultural enterprises of the valuation of biological assets and agricultural produce identify additional survey questions. The first examined issue inquires whether economists perceive fair value as beneficial for the true and fair view of economic reality. The processed responses are summarized in the graph 2.

For 8 respondents (7.67%) fair value is definitely beneficial, for 29 respondents (27.88%) fair value is probably beneficial, for 20 respondents (19.23%) fair value is definitely not beneficial, and for 36 respondents (34.61%) fair value is rather not beneficial to express an economic reality fair view. 11 respondents (10.58%) did not expressed their opinion.

The question above was followed by another question which aimed at identifying the pitfalls of fair value (graph 3).

The respondents have pointed out problems such as the inability to determine the fair value (64 respondents - 61,54%), lack of objectivity in the selection of fair value (55 respondents - 52.8%), emergence of unrealized gains/losses (18 respondents - 17.31%), and other (9 respondents - 8.65%).
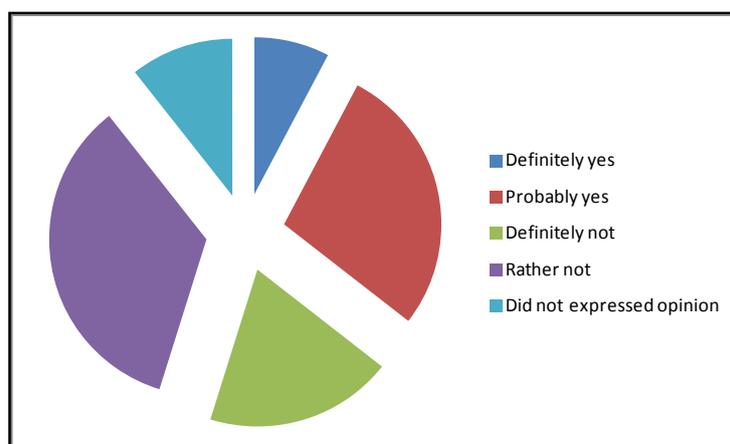
Source: own data

Graph 2: Evaluation of the benefits valuation of biological assets and agricultural produce at fair value.
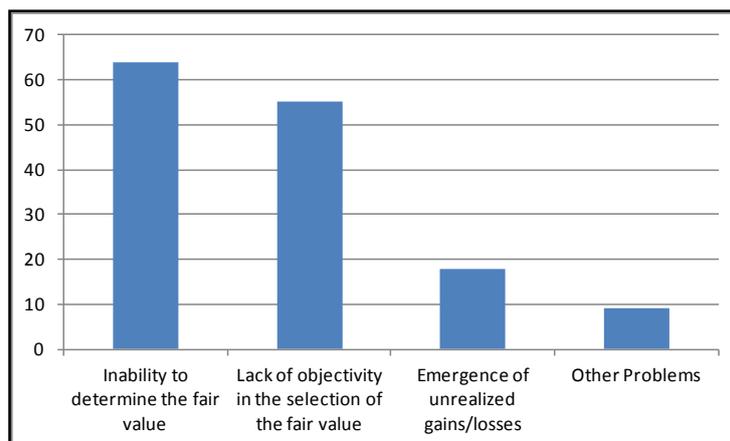
Source: own processing

Graph 3: Identified pitfalls in the valuation of biological assets and agricultural produce at fair value.

Note 3: Among the other problems identified in the last category belong very low correlation between the fair value and the price at which the asset is sold and the fact that some of the assets or the sale need not be determined.

The conclusion of the problem topic and formulation of recommendation

Professional public in recent years has also been facing the problem of inconsistency in the valuation bases of basic financial statement – statement of financial position (i.e. statement of financial position when using multiple valuation models summarizes mutually incomparable values).

In general, this problem can be approached in two ways:

a) to establish a unique valuation model which will be recognized as the most appropriate one

b) to allow using more valuation models, since the use of different valuation models derives from the different nature of the items (for example it is necessary to distinguish between items of financial assets and debts on the one hand, and nonfinancial assets on the other).

In the case of statement of financial position the world widely accepted opinion has been to ensure that assets and debts of a company are reported in the statement of financial position in a manner that would help to reflect the economic effects of the most quantifiable terms (e.g. the effect of inflation, changes in interest rates, foreign exchange rates) and other factors (the risk of State interference, the weather) on these items. This goal cannot be achieved without the application of multiple valuation models, including the concept of fair value of assets and liabilities, concerning not only biological and agricultural produce. The aforementioned concept of increasing explanatory power of the statement of financial position, however, introduces a different understanding of income statement. While this statement should bring information leading to an accurate assessment of the company´s financial performance during a relevant accounting period, the result of profit or loss should include not only realized gains (which are, however, in accordance with the principle of caution), but also unrealized gains (or losses); it means any additions/disposals values created by the holding during the accounting period.

The amount of profit or loss reported in this way would not be relevant to the calculation of the tax liability with regard to income tax, but it would help to express the earned value of the reference accounting period.

Profit or loss would not be suitable for division on all its levels either; as a part of the unrealized profits - in case of the profit distribution - it would break the concept of maintenance of business capital. This means the division could result in the erosion of the financial substance of the business.

Basic financial statements described according to IFRS are based on the idea of providing correct information about the economic value

of the company to all interested parties. It is, however, a figure reported by a specified date (usually on the statement of financial position date, on the date of initial recognition of an asset, etc.) reflecting the current market conditions and in case of unexpected changes in the conditions in agricultural practice, users of this information can suffer losses. Nonetheless, from the statement of financial position and income statement convergence of economic and accounting concepts of capital is visible and as is the economic value of the company as a whole.

These statements are not designed as a data source for tax purposes; however, they may serve as an alternative view on the economic value of agricultural enterprises (and not just in the case of sale or liquidation of enterprises, but also to ensure smooth business activities).

Conclusion

The paper compares financial reporting of agriculture activities according to the Czech law and IFRS. The results of research in the application of IFRS principles of biological assets and agriculture produce recording and reporting in the Czech Republic are presented. Biological assets and agriculture produce evaluation, recording and reporting are stated in IAS – 41: Agriculture and in IFRS for SMEs section 34 (IASB, 2012; IASB, 2009). The International Accounting Standard IAS 41 has been a full-fledged part of the whole of international financial reporting standards since 2003. In 2009, the International Financial Reporting Standard for Small and Medium Enterprises (IFRS

for SMEs) was created. Its activity is also a simplified version of IAS.

The paper pointed to the rare utilization of the presentation of the income statement in the functional classification of expenses which would remedy the problem with the incorrect conception of changes in inventories of own activities as income account. The incorrectness of this concept has been demonstrated in the financial analysis. In addition, a questionnaire survey revealed scepticism of economists within agricultural companies to use fair value as the measurement basis for biological assets and agricultural produce.

The reasons are apparent mainly in the impossibility of detecting or the lack of objective fair value. The potential application of IAS 41 in the Czech Republic would therefore face considerable difficulties in both these aspects.

The current development shows the growing influence of IFRS and its expansion into financial reporting of small and medium-sized entities.

In case that the elements of IFRS or IFRS for SMEs were introduced for the continuation of the process of harmonization with the EU and the Czech Republic, or for getting finances from the European Union, agricultural enterprises should be eligible for support, initially on the level of education and awareness (trainings or publications) and then on the legislative level through the gradual introduction of a solution of the IAS 41 into accounting (and correspondingly into the tax) legislation of the Czech Republic.

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Analysis of the Effect of Legal Form and Size Group on the Capital Structure of Agricultural Businesses of Legal Entities

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Anotace

Příspěvek se zabývá analýzou vlivu právní formy a velikostní skupiny na kapitálovou strukturu českých zemědělských podniků právnických osob. Je sledován vliv tří právních forem a šesti velikostních skupin na kapitálovou strukturu podniku, vyjádřenou prostřednictvím třech kategorií zadluženosti. Analýza vlivu právní formy a velikostní skupiny je provedena prostřednictvím analýzy rozptylu dvojného třídění.

Panelová data pro článek byla získána z databáze Albertina, poskytovaná společností Soliditet, s.r.o. Konkrétně byla využita data z účetních výkazů za roky 2004 – 2010 u zemědělských podniků právnických osob. Celkem bylo předmětem šetření 16075 podniků, které byly rozděleny dle právních forem (akciová společnost, družstvo a společnost s ručením omezeným) a následně příslušné velikostní skupiny (6 velikostních skupin). Celkem vzniklo 18 skupin podniků, kdy za každou skupinu byla sestavena průměrná rozvaha a výsledovka, na jejichž základě byly provedeny příslušné výpočty. Příspěvek je součástí grantového projektu IGA 20121069 „Identifikace hlavních determinant výsledku hospodaření zemědělských podniků právnických osob a určení jejich specifik" a výzkumného záměru MŠMT 6046070906 „Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systémů".

Klíčová slova

Kapitálová struktura, determinanty kapitálové struktury, zemědělské podniky, analýza rozptylu dvojného třídění, Scheffého test.

Abstract

The article deals with the analysis of the effect of legal form and size group on the capital structure of Czech agricultural businesses of legal entities. The effect of three legal forms and six size groups on the capital structure of the business is studied, expressed by way of three categories of indebtedness. The analysis of the effect of legal form and size group is performed by way of an analysis of the dispersion of dual classification.

The panel data for the article were obtained from the Albertina database, provided by the company Soliditet, s.r.o. Specifically, data from accounting statements for the years 2004 – 2010 among agricultural businesses of legal entities were utilized. A total of 16075 businesses were the object of examination, which were divided up according to legal forms (joint-stock company (AS), cooperative (D) and limited liability company (SRO)) and subsequently the relevant size group (6 size groups). A total of 18 groups of businesses resulted, whereby an average balance and profit and loss statement were drawn up for each group, on the basis of which the relevant calculations were conducted. The article is part of the grant project IGA 20121069 "Identification of the main determinants of the result of economic activity of agricultural businesses of legal entities and the determination of their specifics" and of the institutional research intentions MSM 6046070906 „Economics sources of Czech agriculture and their efficient use in the context of multifunctional agri-food systems".

Key words

Capital structure, determinants of capital structure, agricultural businesses, analysis of the dispersion of dual classification, Scheffé test.

Introduction

The capital structure of a business is a very broad topic, whose precise definition, however, is not entirely clearly determined. In the Czech professional literature, we encounter the definition of capital structure in various manners. Kalouda (2009) and Valach (2006) define the capital structure of a business as the element of business resources that is present within a business on a long-term basis and by way of which fixed assets as well as the permanent portion of floating capital are financed. On the basis of this definition, it is thus possible to consider capital structure to be the structure of long-term capital within a business. A further approach to the concept of capital structure states that the capital structure of a business constitutes the structure of the resources (source, origin) from which the assets of the business were created (Synek, 2011). On the basis of this definition, one can thus perceive capital structure as the structure corresponding to the classification of the aggregate liabilities of a business. Numerous other authors identify with this theory, such as, for example, Grünwald and Holečková (2007), Růčková (2010), who, in their publications, address the issue of financial analysis and productivity of businesses. Kalouda (2009) then correctly calls such concept of capital structure the financial structure of a business, corresponding to the right side of the balance (liabilities) and based on the accounting approach. From this perspective, it is clearly evident that the financial structure of a business constitutes a broader term than capital structure. Financial structure is constituted by the total capital within a business from which the total assets of the business are financed.

Neumaierová and Neumaier (1996) define capital structure on the basis of the general finance theory, where that is represented by a combination of capital in the form of stocks, bonds and bank loans. Their schematic expression then shows that capital structure consists of the liabilities of the business, comprised of equity, interest-bearing external resources (external resources for which interest is paid) and liabilities (external resources from which interest is paid or coupons and other liabilities).

We encounter completely different definitions in the foreign literature. Primarily in Anglo-Saxon literature, the definition of capital structure is identical to the definition of capital structure as the aggregate resources of a business.

In such literature, it is also evident that the financing of the assets of a business is conducted primarily by way of issued securities (Valouch, 2008). For example, Brealey and Myers (2000) define capital structure as a mixture of various securities. The authors then state that financial resources are equity created either through the issuance of stocks, or from retained earnings, debt, preferred stock, options. On the other hand, authors Levy and Sarnat (1999) define capital structure as the proportion of debt to equity capital.

The agricultural sector is a very significant part of the national economy. It is also among very sensitive areas of the economy, as it has its specifics that must be respected. Its specificity is brought about primarily by the seasonal nature of production, a high dependency on natural conditions, as well as by the production structure. These specifics are clearly reflected in the economic results of agricultural businesses and also affect the set-up of their capital structure.

The assessment of capital structure and its determinants is the object of research of numerous authors and one can thus identify a broad spectrum of professional literature and articles that deal with this area. Such studies originate primarily in the USA and focus primarily on industrial businesses, specifically on small and mid-sized businesses. In the area of Europe, such studies are usually based on those from the USA, and are variously expanded and supplemented (Rajan, Zingales, 1995; Weill, 2004; Michaelas, Chittenden, Poutziouris, 1999; Kayo, Kimura, 2011; Friend, Lang, 1988; Prášilová, 2012; Delcoure, 1997 and others). However, none of these studies focuses directly on the issue of agriculture.

The set-up of the capital structure within a business is a demanding process that is affected by numerous factors. Prášilová (2012) divides such determinants up into external and internal. The group of external determinants includes those that the business **cannot** affect, such as, for example, economic policy (primarily monetary policy, its effect on the development of the interest rate), the legislative environment (the taxation rate), the level of development of the economy, environment, government interventions, the situation on the capital market, informational asymmetry and others. The group of internal determinants, i.e. determinants that the business can affect to a certain extent, can then be considered to include a number of factors that are

primarily given by the type and economic activity of the company. For example, in this group, Prášilová (2012) includes some indicators of the productivity of the business, such as the asset structure, asset profitability, liquidity, profit stability and cash-flow, as well as the uniqueness of the product, growth opportunities of the business, sector relevance and the age of the business.

The objective of this article is to identify the effect of legal form and size group on the capital structure of agricultural businesses of legal entities in the Czech Republic for the period of the years 2004 - 2010. The main objective is fulfilled by way of the following working hypotheses:

- among the individual legal forms of agricultural businesses of legal entities, there is a statistically significant difference in the achieved results of values of average indebtedness;

- among the individual size groups of agricultural businesses of legal entities, there is a statistically significant difference in the achieved results of values of average indebtedness.

Materials and methods

The analytical section is based upon data of agricultural businesses of legal entities in the Czech Republic within the period of 2004 – 2010. The data base of agricultural businesses of legal entities was obtained from the Albertina database of business entities, created by the company Soliditet, s.r.o. The object of examination was businesses of legal entities, specifically joint-stock companies, cooperatives and limited liability companies, with predominant activity in agriculture; according to the OKEČ classification, it is OKEČ 01. The acquired accounting statements of individual businesses were further supplemented with the area of agricultural land for each business. That was obtained from a publicly accessible database administrated by the State Agricultural Intervention Fund (hereinafter the "SZIF"), containing information regarding the amount of direct payments provided to businesses of legal entities. On the basis of such information, the area of individual agricultural businesses was subsequently determined, by way of the share of the obtained SAPS subsidy with its unit rate in the given year.

The data were aggregated from several different

information sources and the resulting table contained more than sixteen thousand entries. For the subsequent analysis, only data of companies with an accounting statement having a scope of at least 6 months within the given accounting period were utilized. In all, 16075 businesses were an object of examination, being divided up according to legal forms (joint-stock company, cooperative and limited liability company) and subsequently the relevant size group (6 size groups). A total of 18 groups of businesses were created, where an average balance and a profit and loss account were drawn up for each group, on the basis of which the relevant calculations were performed.

The number of observation in created groups is demonstrated in the table 1.

The manner of division of the businesses into individual size groups is demonstrated in the table 2.

For the conducting of the analysis of the effect of legal form and size group on indebtedness, analysis of dispersion of dual classification was utilized.

Analysis of Variance

The analysis of dispersion of dual classification is intended for the monitoring of the effect of **two factors** on the resulting quantitative attribute. Specifically, this analysis is utilized for the examination of the effect of legal form and size group on indebtedness (aggregate, short-term and long-term).

Testing was performed for each parameter separately by using a one-way analysis of variance (ANOVA). This is a multi-sampled test when differences in more than two groups of units are tested, in our case, size groups and legal forms. Method of analysis of variance is based on the distribution of total variance on the dispersion between classes, which is related to the indicator (indebtedness) and the residual variance, which represents the rest of the influences on fluctuations of the values (Kába, Svatošová, 2012).

The null hypothesis that among the selected groups there is no difference in the average value of the given indicator is tested. To verify the rejection or acceptation of the null hypothesis, the F-test is used. Decisions are made by comparing the maximum first type error (the p-value), based on our data, and errors of the first type of alpha, which we have set before testing. Alfa is usually

Size group	Legal form	Number of observation
1	Joint-stock-company (AS)	1 707
	Cooperative (D)	1 362
	Limited liability company (SRO)	6 069
2	Joint-stock-company (AS)	105
	Cooperative (D)	155
	Limited liability company (SRO)	886
3	Joint-stock-company (AS)	409
	Cooperative (D)	599
	Limited liability company (SRO)	811
4	Joint-stock-company (AS)	485
	Cooperative (D)	496
	Limited liability company (SRO)	478
5	Joint-stock-company (AS)	439
	Cooperative (D)	357
	Limited liability company (SRO)	201
6	Joint-stock-company (AS)	710
	Cooperative (D)	647
	Limited liability company (SRO)	159

Source: own processing

Table 1: The number of observation in created groups.

Size group	Hectare area (ha)
1	0-99
2	100-499
3	500-999
4	1000-1499
5	1500-1999
6	2000 and more

Source: own processing

Table 2: Size classification of businesses, according to hectare area of agricultural land.

set at 5%. If the p-value is less than 5% alpha, the null hypothesis is rejected and it shows that there is a significant difference in the average value of the indicators in between monitored groups. Otherwise, the null hypothesis cannot be rejected and thus it is consider as valid.

In case of rejection of the null hypothesis further detailed evaluation is carried out. Alternative hypothesis applies. It can be formulated as follows: there is no significant difference in at least one pair of compared averages. We are not able to identify in which pair the difference exists and in which one it does not. For a more detailed evaluation many different methods are used, of which some of them are universal, other are not. Versatility of the methods allows even application for comparison of groups, which contain different number of statistical units, which are presented in our case as regions. The Scheffe's method used in the paper also belongs to the group of methods with detail evaluation.

The quantification of the effect of legal form and size group on the capital structure of businesses is conducted with the utilization of the STATISTICA statistical software. Two-factor analysis of variance without interactions was conducted in two steps. In the first step, the effect of legal form and size group on the value of individual categories of indebtedness was tested, and then, in the second step, a more detailed assessment was possibly conducted.

In the model, two factors (size and legal form) were defined as independent variables, and categories of indebtedness (aggregate indebtedness, long-term indebtedness, short-term indebtedness) were defined as dependent variables (Table 3).

Results and discussion

By way of the analysis of variance of dual classification, the statistically significant differences in the average value of individual categories of indebtedness in at least one pair of the compared legal forms and size groups were first defined. Subsequently, by way of the Scheffé test, it was identified which of the pairs of compared averages are, in terms of legal form as well as in terms of size group, statistically significantly distinct. It was thereby possible to identify which of the analyzed pairs statistically significantly differ from one another. The analysis itself is conducted for agricultural businesses of legal entities in the Czech Republic within the period of the years 2004 - 2010, where the object of assessment was a total of 18 groups of agricultural businesses of legal entities.

1. Analysis of the effect of legal form and size group on the capital structure of businesses

The following text sets out and discusses the results of two-factor analysis of variance without interactions, which identifies statistically significant differences in the legal forms and size groups in regard to the indebtedness of a business.

A total of 3 models are set up, so that the effect of these determinants on the individual categories of indebtedness (overall, long-term, short-term) can be analyzed separately. Each of the tables set out below summarizes the results of the conducted analysis of variance of dual classification for the period of the years 2004 – 2010, as well as the results of the Scheffé test.

Total indebtedness

Table 4 show results of two-way analysis of variance for overall indebtedness.

For both of the analyzed factors, the zero hypotheses of the congruence of average values of individual variants were tested. On the basis of the above results, it can be stated that the p-value for both factors achieves a lesser value than the chosen level of significance 0.05. It is thus possible to rule out both zero hypotheses (meaning that there is a significant difference in the average value of overall indebtedness in at least one of the pair of compared legal forms and there is a significant difference in the average value of overall indebtedness at least in one pair of size groups). Thus, a significant difference was established in the average indebtedness among size groups, as well as among legal forms.

This result confirmed that size is statistically significant determinant of capital structure in terms of the overall indebtedness of a business. Such result is also in accordance with the results of empirical studies that confirmed the statistical

Indicator		Determination*
Dependent variables	*Total Debt*	*Total debt (R85) / Total Assets (R1)*
	Long-term Debt	*Long-term Deb (R86+R91+R115) / Total Assets (R1)*
	Short-term Debt	*Short-term Debt (R102+R115+R116) / Total Assets (R1)*

Note: *⁾ This is an expression of individual indicators in relation to the balance sheet lines (R).
Source: own processing

Table 3: Identification of dependent variables entering the regression models.

Variability	Sum of squares	Degrees of discretion	Average square	F-test	p-value
Agregate	32.28401	1	32.28401	4595.439	0.000001
Legal form	2.22804	2	1.11402	158.574	0.000001
Size group	0.46173	5	0.09235	13.145	0.000001
Residual	0.82898	118	0.00703		

Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 4: Results of two-way analysis of variance for overall indebtedness.

significance of the determinant (Rajan, Zingales, 1995; Weill, 2004; Song, 2005; Michaelas, Chittenden, Poutziouris, 1999; Delcoure, 2007; Chittenden, Hall, Hutchinson, 1996; Hutchinson, Hall, Michaelas, 1998; Kayo, Kimura, 2011; Chen, 2004; Aulová, 2013). These studies, however, use expression of size by way of revenues. Better expression of the determinant of size for the category of agricultural businesses is size of its hectare area, as the main factor of production. On the basis of businesses distribution into different size groups it can be found differences in specific size groups.

The influence of legal form as a determinant of capital structure has not been studied yet. In agricultural sector the legal form is an important factor affecting the capital structure of the business. Further examination of this determinant of capital structure could thus bring new conclusions.

In order to identify which of the pairs of compared averages are statistically significantly distinct in terms of legal form as well as in terms of size group, the Scheffé method was utilized. This is the technique of multiple comparison, on the basis of which it may be stated which of the analyzed pairs significantly differ from one another. The results of the conducted method are set out in Table 5 and Table 6.

According to these results, it can be stated that all of the legal forms (joint-stock company, cooperative and limited liability company) are mutually statistically significantly distinct. In all combinations, the p-value is lesser than the chosen level of significance α 0.05, and thus we rule out the zero hypothesis of the congruence of averages.

As far as size groups are concerned, a significant difference between groups 1-2, 1-3, 1-4, 1-5 and 1-6 was also established here, where the p-value was lesser than the chosen level of significance of α 0.05. The difference between the first group and all of the other size groups is a result of the conditions for the size classification of agricultural businesses of legal entities. The first group was made to include such businesses that, within the analyzed period, had an area of agricultural land of 0 - 100 hectares available. This category comprised the greatest percentage share out of the entire number of businesses; specifically, 56% of all analyzed businesses fell under this category. The greatest representation in this size category in terms of legal form is seen for limited liability companies, whose share is 66% (see Table 1). Businesses in this group are characterized by a higher value of indebtedness. Subsequently, it is thus possible to state **that**, in the analyzed sample of businesses, **the working hypothesis**: There is a statistically significant difference among the individual size groups of agricultural businesses of legal entities in the achieved results of values of average indebtedness, **could only be established among groups** 1-2, 1-3, 1-4, 1-5 and 1-6, where the p-value

Legal form	AS	D	SRO
Joint-stock-company (AS)		0,0001*	0,0001*
Cooperative (D)	0,0001*		0,0001*
Limited liability company (SRO)	0,0001*	0,0001*	

Note: *) p-values are less than 0.0001
Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 5: Results of the Scheffé test for the legal form factor - p-values (overall indebtedness).

Size group	1	2	3	4	5	6
1		0.000641	0.000034	0.000001	0.000002	0.000001
2	0.000641		0.98819	0.767118	0.825922	0.489649
3	0.000034	0.98819		0.983107	0.992266	0.874609
4	0.000001	0.767118	0.983107		0.999998	0.998258
5	0.000002	0.825922	0.992266	0.999998		0.994866
6	0.000001	0.489649	0.874609	0.998258	0.994866	

Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 6: P-values of the Scheffé test for the size group factor - overall indebtedness.

was lesser than the selected level of significance of α 0.05. A statistically significant difference in values of average indebtedness was not found in the combinations of the other size groups.

Further descriptive characteristics for the legal form and size group factor are set out in Table 7 and Table 8.

On the basis of the descriptive characteristics, it can also be stated that, within the analyzed sample of businesses, the lowest average value of indebtedness was achieved among joint-stock companies. This fact is clearly evident from the achieved results, where the other companies show more than a 50% share of external resources among aggregate assets. This result is thus clearly determined by the legislative requirements in regard to the registered capital of these companies, which is several times higher than among the other assessed legal forms, and is a part of the equity capital.

On the basis of this result, it is thus evident that the legal form of businesses can be considered another deciding factor of capital structure. This fact is also in accordance with some empirical studies that consider this determinant to be a deciding factor of capital structure (Wiwattanakantang, 1999).

According to the descriptive characteristics of the individual size groups, we cannot conclude that the average value of indebtedness among businesses with a small hectare area is lower than

among large businesses. According to this result, it is evident that more difficult access to external capital among agricultural businesses of legal entities with a small hectare area was not confirmed. According to this result, it can thus be presumed that currently the hectare area of agricultural land of a business is not a factor determining access to external capital.

Long-term indebtedness

Also in the case of long-term indebtedness, two-factor analysis of variance without interactions was conducted in two steps. In the first step, the effect of legal form and size group on the value of long-term indebtedness was tested, and, in the second step, more detailed assessment was possibly conducted. The results of the conducted analysis of dual classification are summarized in the Table 9.

For both analyzed factors, the zero hypothesis of the congruence of the average values of the individual variants was tested. On the basis of the results set out above, it can be stated that the p-value for both factors achieves a lesser value than the chosen level of significance of 0.05. Therefore, both zero hypotheses can be ruled out (meaning that there is a significant difference in the average value of long-term indebtedness in at least one pair of compared legal forms and there is a significant difference in the average value of long-term indebtedness in at least one pair of size groups). A significant difference in average

Legal form	Average	Standard deviation	Lower limit RI*	Upper limit RI*
Joint-stock-company (AS)	0.332774	0.004666	0.323351	0.342197
Cooperative (D)	0.529874	0.023634	0.482144	0.577603
Limited liability company (SRO)	0.655905	0.013008	0.629634	0.682175

Note: *) Limits of 95% of the reliability interval for the average value of indebtedness.
Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 7: Descriptive characteristics of overall indebtedness for the legal form factor.

Size group	Average	Standard deviation	Lower limit RI*	Upper limit RI*
1	0.635894	0.049765	0.532086	0.739702
2	0.511005	0.033714	0.440679	0.581331
3	0.491138	0.027469	0.433839	0.548436
4	0.46964	0.033841	0.399048	0.540231
5	0.473015	0.030376	0.409652	0.536377
6	0.456413	0.029034	0.39585	0.516977

Note: *) Limits of 95% of the reliability interval for the average value of indebtedness.
Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 8: Descriptive characteristics of overall indebtedness for the size group factor.

Variability	Sum of squares	Degrees of discretion	Average square	F-test	p-value
Agregate	10.74559	1	10.74559	1600.003	0.000001
Legal form	1.06985	2	0.53492	79.649	0.000001
Size group	0.08782	5	0.01756	2.615	0.027903
Residual	0.79249	118	0.00672		

Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 9: Results of two-way analysis of variance for long-term indebtedness.

Legal form	AS	D	SRO
Joint-stock-company (AS)		0.000001	0.000001
Cooperative (D)	0.000001		0.052741
Limited liability company (SRO)	0.000001	0.052741	

Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 10: Results of the Scheffé test for the legal form factor - p-values (long-term indebtedness).

Size group	1	2	3	4	5	6
1		0.071458	0.9913	0.999477	0.990045	0.901566
2	0.071458		0.284253	0.163894	0.293786	0.567579
3	0.9913	0.284253		0.999824	1	0.997707
4	0.999477	0.163894	0.999824		0.999758	0.980193
5	0.990045	0.293786	1	0.999758		0.998109
6	0.901566	0.567579	0.997707	0.980193	0.998109	

Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 11: Results of the Scheffé test for the size group factor - p-values (long-term indebtedness).

indebtedness was thus established for size groups as well as for legal forms.

This result confirmed that size is statistically significant determinant of capital structure in terms of the long-term indebtedness of a business. Such result is also in accordance with the results of empirical studies that confirmed the statistical significance of the determinant (Song, 2005; Michaelas, Chittenden, Poutziouris, 1999; Delcoure, 2007; Chittenden, Hall, Hutchinson, 1996; Hutchinson, Hall, Michaelas, 1998; Chen, 2004; Mateev, Poutziouris, Ivanov, 2012; Bevan, Danbolt, 2002; Aulová, 2013). These studies, however, use expression of size by way of revenues. Better expression of the determinant of size for the category of agricultural businesses is size of its hectare area, as the main factor of production. On the basis of businesses distribution into different size groups it can be found differences in specific size groups. The influence of legal form as a determinant influence the capital structure in terms of long-term indebtedness has

not been studied yet.

For the identification of which of the pairs of compared averages are statistically significantly distinct both in terms of legal form, as well as in terms of size group, the Scheffé method was utilized. The results of the conducted method are set out in Table 10 and Table 11.

On the basis of the results stated above, the zero hypothesis of congruence can only be ruled out for combinations AS - D, AS - SRO. These legal forms are mutually statistically significantly distinct. In these combinations, the p-value is lesser than the chosen level of significance α 0.05, and this we rule out the zero hypothesis of congruence. In the combination D - SRO, the zero hypothesis cannot be ruled out, as the achieved p-value is greater than the chosen level of significance. These combinations of legal forms do not show a statistically significant difference in the value of long-term indebtedness. Subsequently, it can therefore be stated that **the working hypothesis**:

There is a statistically significant difference among the individual legal forms of agricultural businesses of legal entities in the achieved results of values of average indebtedness, **could only be established partially** on the analyzed sample of businesses.

As far as size groups are concerned, a statistically significant difference among the individual size groups was not established in the case of long-term indebtedness, as the achieved p-value was, in all cases, greater than the selected level of significance α 0.05. According to these results, it can be stated that **the working hypothesis**: There is a statistically significant difference among the individual size groups of agricultural businesses of legal entities in the achieved results of values of average indebtedness, **could not be established** on the analyzed sample of businesses.

Further descriptive characteristics for the factor of legal form and size group are set out in Table 12 and Table 13.

The results of the conducted analysis of dual classification for short-term indebtedness are summarized in the Table 14.

For both of the analyzed factors, a zero hypothesis of the congruence of average values of individual variants was tested. On the basis of the results stated above, it can be stated that for both factors, the p-value achieves a lesser value than the chosen level of significance of 0.05. Both zero hypotheses can thus be ruled out (meaning that there is a significant difference in the average value of short-term indebtedness in at least one pair of compared legal forms and there is a significant difference in the average value of short-term indebtedness in at least one pair of size groups). A significant difference in average short-term indebtedness

Legal form	Average	Standard deviation	Lower limit RI*	Upper limit RI*
Joint-stock-company (AS)	0.164210	0.004512	0.155097	0.173322
Cooperative (D)	0.333978	0.005876	0.322111	0.345845
Limited liability company (SRO)	0.377907	0.021362	0.334766	0.421048

Note: *) Limits of 95% of the reliability interval for the average value of indebtedness.
Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 12: Descriptive characteristics of long-term indebtedness for the legal form factor.

Size group	Average	Standard deviation	Lower limit RI*	Upper limit RI*
1	0.318798	0.045011	0.224907	0.412689
2	0.237051	0.022290	0.190555	0.283547
3	0.300622	0.023139	0.252355	0.348890
4	0.308707	0.023935	0.258779	0.358635
5	0.300083	0.021495	0.255245	0.344922
6	0.286927	0.018465	0.248411	0.325444

Note: *) Limits of 95% of the reliability interval for the average value of indebtedness.
Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 13: Descriptive characteristics of long-term indebtedness for the size group factor.

Variability	Sum of squares	Degrees of discretion	Average square	F-test	p-value
Agregate	5.759567	1	5.759567	897.373	0
Legal form	0.405451	2	0.202725	31.5857	0
Size group	0.561872	5	0.112374	17.5086	0
Residual	0.757354	118	0.006418		

Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 14: Results of two-way analysis of variance for short-term indebtedness.

for size groups as well as for legal forms was thus established.

Also this result confirmed that size is statistically significant determinant of capital structure in terms of the short-term indebtedness of a business. Such result is also in accordance with the results of empirical studies that confirmed the statistical significance of the determinant (Song, 2005; Michaelas, Chittenden, Poutziouris, 1999; Delcoure, 2007; Chittenden, Hall, Hutchinson, 1996; Hutchinson, Hall, Michaelas, 1998; Mateev, Poutziouris, Ivanov, 2012). These studies, however, use expression of size by way of revenues. Better expression of the determinant of size for the category of agricultural businesses is size of its hectare area, as the main factor of production. On the basis of businesses distribution into different size groups it can be found differences in specific size groups. The influence of legal form as a determinant influence the capital structure in terms of short-term debt has not been studied yet.

In order to identify which of the pairs of compared averages are, in terms of legal form as well as in terms of size group, statistically significantly distinct, the Scheffé method was utilized. The results of the conducted method are set out in Table 15 and Table 16.

On the basis of the results set out above, the zero hypothesis of congruence can only be ruled out for combinations AS - SRO, D - SRO. These legal forms are mutually statistically significantly distinct. In these combinations, the p-value is lesser than the selected level of significance of $\alpha = 0.05$, and therefore we rule out the zero hypothesis of congruence. In the combination AS - D, the zero hypothesis cannot be ruled out, as the achieved p-value is greater than the selected level of significance. These combinations of legal forms do not show a statistically significant difference in the value of long-term indebtedness. Subsequently, it can thus be stated that **the working hypothesis**: There is a statistically significant difference among individual legal forms of agricultural businesses of legal entities in achieved results of values of average indebtedness, **could only be partially established** in the analyzed sample of businesses.

As far as size groups are concerned, a significant difference among groups 1-3, 1-4, 1-5 and 1-6 was established, where the p-value was lesser than the selected level of significance of α 0.05. Further, a significant statistical difference was established among groups 2-4, 2-5, 2-6. According to these results, it is possible to conclude that **the working hypothesis**: There is a statistically significant difference among the individual size groups of agricultural businesses of legal entities in the achieved results of the values of average indebtedness, **could only be established among groups** 1-3, 1-4, 1-5,1-6, 2-4, 2-5, 2-6 within the analyzed sample of businesses. This result indicates that the values of short-term indebtedness do not show statistically significant differences between the third, fourth and fifth size group.

Legal form	AS	D	SRO
Joint-stock-company (AS)		0.450881	0.000001
Cooperative (D)	0.450881		0.000001
Limited liability company (SRO)	0.000001	0.000001	

Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 15: Results of the Scheffé test for the legal form factor - p-values (short-term indebtedness).

Size group	1	2	3	4	5	6
1		0.137853	0.000018	0.000001	0.000001	0.000001
2	0.137853		0.165255	0.001137	0.012121	0.008825
3	0.000018	0.165255		0.644000	0.945130	0.919222
4	0.000001	0.001137	0.644000		0.989696	0.995041
5	0.000001	0.012121	0.945130	0.989696		0.999999
6	0.000001	0.008825	0.919222	0.995041	0.999999	

Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 16: Results of the Scheffé test for the size group factor - p-values (short-term indebtedness).

Legal form	Average	Standard deviation	Lower limit RI*	Upper limit RI*
Joint-stock-company (AS)	0.163132	0.006024	0.150966	0.175298
Cooperative (D)	0.185272	0.019453	0.145987	0.224558
Limited liability company (SRO)	0.292999	0.018746	0.255141	0.330857

Note: *) Limits of 95% of the reliability interval for the average value of indebtedness.
Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 17: Descriptive characteristics of short-term indebtedness for the legal form factor

Size group	Average	Standard deviation	Lower limit RI*	Upper limit RI*
1	0.337646	0.036478	0.261554	0.413737
2	0.265379	0.028627	0.205664	0.325093
3	0.195438	0.013283	0.167730	0.223146
4	0.150053	0.010605	0.127932	0.172175
5	0.168486	0.012983	0.141404	0.195567
6	0.165805	0.012688	0.139339	0.192271

Note: *) Limits of 95% of the reliability interval for the average value of indebtedness.
Source: own processing, calculated by using statistical software STATISTICA, 2012

Table 18: Descriptive characteristics of short-term indebtedness for the size group factor.

Further descriptive characteristics for the legal form and size group factor are set out in Table 17 and Table 18.

Conclusion

The legal form and size of agricultural businesses is among the significant factors affecting the capital structure of businesses. The goal of this article was to identify differences in capital structure, expressed by way of three categories of indebtedness, in terms of the legal form as well as in terms of the size group of agricultural businesses in the Czech Republic within the period of the years 2004 – 2010. The analysis itself was based on extensive sectional data obtained from the Albertina database, supplemented with data from the publicly accessible SZIF database. Calculations were performed with the utilization of the Statistica statistical software. For the monitoring of the effect of two factors on the dependent variable (indebtedness), analysis of variance of dual classification was selected, and for the defining of statistically significant differences among the compared pairs, Scheffé method of multiple comparison was utilized.

A total of 3 models were drawn up, within which capital structure was expressed by way of three dependent variables, specifically aggregate indebtedness, short-term indebtedness and long-term indebtedness.

The first working hypothesis presumed that among the individual legal forms of assessed businesses, there is a significant difference in their average value of indebtedness, primarily because of differing legislative requirements in regard to the registered capital of such legal forms. The hypothesis was verified by way of an analysis of variance of dual classification. The results of this analysis, including a more detailed evaluation by way of the Scheffé method, established statistically significant differences among all of the legal forms (joint-stock company, cooperative, limited liability company) mutually. **On the basis of this result, it is thus evident that the legal form of businesses can be considered another deciding factor of capital structure.**

This hypothesis was subsequently elaborated for long-term and short-term indebtedness. It was also established in both of these categories of indebtedness that there is, at least in one pair of compared legal forms, a significant difference in the average value of indebtedness. In the case of long-term indebtedness, a statistically significant difference in the combinations of legal forms AS - D, AS – SRO was identified by way of the Scheffé method. Further, in the case of short-term indebtedness, only the combinations

of legal forms AS - SRO, D – SRO were mutually statistically significant.

On the basis of the results stated above, this hypothesis can thus only be accepted partially, specifically for the category of aggregate indebtedness.

The second hypothesis presumed that there is a significant difference among individual size groups of evaluated businesses in their average value of indebtedness. In setting it, the fact that the size groups of businesses were created on the basis of the hectare area of agricultural land of the businesses was taken into consideration, and it was thus presumed that the capital structure of each group would be different in connection with its hectare area. Further, the effect of subsidies was also presumed, specifically of individual payments per area, the amount of which is dependent primarily on the hectare area of agricultural businesses. Subsidies as one of the sources of financing, and primarily SAPS, which comprise the greatest share of paid subsidies, thus determine the capital structure of a business to a great extent. The hypothesis was, just as in the case of dissimilarities among legal entities, verified by way of the analysis of variance. On the basis of that, including a more detailed evaluation by way of the Scheffé method, the following can be stated: A significant difference at a level of significance of 5% was established among groups 1-2, 1-3, 1-4, 1-5 and 1-6. It can thus be stated that businesses with a hectare area of over 100 hectares do not show statistically significant differences in indebtedness. The dissimilarity specifically between the first group and all of the other size groups is caused by the conditions for size classification of agricultural businesses of legal entities. The first group was made to include such businesses that, within the analyzed period, had an available area of agricultural land of 0 - 99 hectares, and the other groups were then set within a size range of 500 hectares. From this perspective, it is possible to assume that the greatest differences in the value of indebtedness will be identified specifically between the first group and all of the other size groups. The businesses in this group are also characterized by the greatest value of indebtedness. Consequently, it can be stated **that the working hypothesis could only be established among groups** 1-2, 1-3, 1-4, 1-5 and 1-6, at a level of significance of 5% in the analyzed sample of businesses. In the combinations of the other size groups, a statistically significant difference in the values of the average indebtedness was not found. This hypothesis was subsequently elaborated for the category of long-term and short-term indebtedness.

In the case of long-term indebtedness, **a statistically significant difference** at a level of significance of 5% among the individual size groups **was not established**. This result is very surprising, as it can be stated on the basis of this that in the case of long-term indebtedness, there are no statistically significant differences in long-term indebtedness among businesses that have a varying hectare area of agricultural land. Therefore, the need for long-term external resources is not bound to the area of agricultural businesses, but primarily to their investment activity and financing primarily by way of long-term bank loans.

However, in the case of short-term indebtedness, the achieved results are substantially different. In this case, a statistically significant difference among groups 1-3, 1-4, 1-5 and 1-6 was established. This result indicates that in terms of short-term indebtedness, businesses in the first and second size group do not show statistically significant differences. Thereby, it is thus evident that businesses with an area of 0 - 99 and 100 - 499 hectares have **similar demands for short-term sources of financing**. Differences among groups 2-4, 2-5, 2-6 can also be considered statistically significant differences in short-term indebtedness. That means that a statistically significant difference in average short-term indebtedness was not established among businesses with a hectare area of 500 - 999 hectares, and further, among businesses with an area of 500 hectares or more. According to these results, it is possible to conclude that there is a statistically significant difference among the individual size groups of legal entities in the achieved results of values of average indebtedness, **could only be established at a level of significance of 5% among groups** 1-3, 1-4, 1-5, 1-6, 2-4, 2-5, 2-6 in the analyzed sample of businesses. This result indicates that the values of short-term indebtedness do not show statistically significant differences among the third, fourth and fifth size group.

Aknowledgements

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On the Design of Environmental Protection Networks

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Abstract

During the last decades, it has come to the attention of many scientists, working on the fields of environmental protection, that there is a tendency for the appearance of extreme environmental phenomena (floods, extreme temperatures, prolonged dry seasons etc). Additionally the frequency of these phenomena tends to shorten, which means that although they started as rare, nowadays they are more common. Many scientists believe that their appearance is directly connected to the global climate change; nonetheless however since they become more frequent there is a need for developing monitoring methods in order to protect sensitive regions from their destructive force. Additionally the protective actions must be implemented in a new framework, which mainly consists on budget cuts, personnel reductions etc. The purpose of this paper is the presentation of a methodology which can be used in order to deploy monitoring networks, which can be modular and installed in problematic regions. Additionally we present a case study of the proposed methodology for a Greek area of special interest.

Key words

Environment, Network, Monitoring, GIS.

Introduction

It is difficult to define precisely the environment, but in general, it embraces the social, geographical, physical and biochemical conditions under which we live. Conceptually it can be divided into the social and natural environment. The former is created by human activities, including industrial complexes, cities, villages etc., while the latter is a system comprising from the atmosphere, hydrosphere, lithosphere, cryosphere and biosphere. The components of the natural environment undergo changes on a range of temporal and spatial scales, which impact upon the social and economic activities of human society (Peng et al, 2002).

A profound feature of the environment is that its processes take place over a wide range of time scales, from micro-seconds to millions of years, and even billion of years if geological processes are also considered. The spatial domain of the environment depends upon the time scales we are interested in. In general it extends from the upper levels of the stratosphere to the upper levels of the lithosphere.

In the new millennium, human society faces unprecedented challenges arising from environmental changes brought about by both natural and human-induced processes. Some of these challenges are the following: Global warming caused by the extensive usage of fossil fuels, industrial activities and deforestation (Nordell Bo, 2003; Akerlof et al, 2013). Desertification, the drought affected areas on Earth total almost 48.8 million square kilometers (about 1/3 of the total land surface) and ¾ of this area is experiencing desertification, affecting about 1 billion people (Stringer, 2008; Barrow, 2009). Water resources, water covers about 71% of the Earth's surface, but water resources in many regions of the world are limited (Tan and Wang, 2010; Kaldellis and Kondili, 2007). Regarding air water and soil pollution, studies made on air pollution show the rapid increase of air pollution in the recent history (Downing and Watson, 1974). Studies, on rivers in the region of Paris, France showed elevated concentrations of Atrazine which is one of the most important contaminants. Measured concentrations exceeded the value of 100 mg/l most of the time, thus proving that the aquifers drained by the three rivers of the area are contaminated (Tisseau et al, 1996). Similar results were found in Greece (Vryzas et al, 2009), Croatia (Jurisic

et al, 2012), Bulgaria (Georgieva et al, 2010) etc. Soil pollution has also increased due to the uncontrolled usage of pesticides (Taiwo and Oso, 1997), and the lack of management of household and industrial waste (Ren, 2003; Travis and Arnold, 2008; Ienciu et al, 2012). Soil erosion, caused by the usage of inappropriate cultivation systems in agricultural production (Domuta et al, 2012) and due to the change in land uses after human interventions (Brejea et al, 2011).

Finally, concerning natural disasters. According to the frequencies of their occurrence worldwide in the last three decades, the most serious disasters are the following: floods, tropical cyclones, tornados, and whirlwinds, earthquakes, thunderstorms, landslides and avalanches (Loayza et al, 2012;Irasema, 2002; Zhao et al, 2012).

It is evident that there is a constant threat for the environment, and scientists must make enormous efforts to accurately monitor every threat, in order to provide solutions. Additionally under the scope of the economic crisis, which includes more countries every day, modular, cheap and above all accurate systems must be produced, which will allow researchers to monitor endangered areas more efficiently. The purpose of this paper is to present a methodology, using a combination of Geographic Information Systems (G.I.S) and Wireless Networks for deploying measurement networks, which based on simple and cheap commercial products, will allow scientists to deploy cost effective monitoring systems. Although GIS have been used extensively in the past, by many researchers (Vanek, et al, 2010) for mapping resources, finding the best agricultural practices in a region (Rathonyi et al, 2010), or acting as a spatial decision support system (Halbich and Vostrovsky, 2011), in this effort we take a step forward by combining the spatial analysis provided with a wireless network communication technology in an effort to provide a new methodology for designing measuring networks.

Materials and methods

In order to design the network, initially we must create the Digital Elevation Model (DEMs) of the study area, and then we apply the viewshed analysis. This is done because we design to deploy a wireless communication network. In order for the various parts of the network to communicate we must make sure that there is direct optical contact.

To develop the Digital Elevation Model (DEMs) and perform the viewshade analysis the following steps were implemented:

1. Acquisition of maps in various scales, aerial photographs and satellite images of the study area.
2. Geo-reference of the maps using the proper projection system.
3. Development of the following digital layers: Forest Boundaries, Contour lines, Stream Network, Land-uses (based on CORINE 2000), TIN (Triangular Irregular Networks), Map with the Station Network.

Once the above mentioned geographic information is digitized, the problematic locations regarding our case study are determined. These locations are found by utilizing the Intersect Tool of the Arc Toolbox. For example if we want to find locations with extensive erosion then we use the intersection tool among the slope, geology and land-use layers. This will allow us finding the locations where the stations that would take the measurements should be placed.

Measuring sensor

The proposed sensor is of general use, the measurement values can vary significantly based on the research needs (measuring water quality, soil conductivity, rain height etc).

Traditionally measurements are recorded with various types of individual instruments e.g. oscilloscopes, multi-meters etc. In addition, the need to record the measurements, analyze and visualize the collected data is becoming more important in the field of measurement and control of electrical signals information.

A measuring system displays or records a quantitative output that corresponds to the variable measured that is the input amount. Measurement systems do not react to the value of the input quantity, but they only display it in a way that is understandable by the user.

There are many ways that collected data can be transmitted between the sensors and a computer. The protocols that can be used for the transmission are different in nature. These protocols can vary from very simple such as the RS-232 (serial) to very sophisticated protocols, such as the CAN or IEEE - 488. CAN is used primarily in the in automotive industry. The IEEE - 488 is the GPIB (General Purpose Interface Bus) protocol.

The measurable values in nature are analog, so the design and development for the transmission of the data, in general needs to follow the provisions in Figure 1. Specifically the measurement process can be divided into different stages. An example of a thermometer will be used that is a very simple measurement process. In this case, the sensing functions, the signal conditioning and its display are all incorporated in the thermometer and are an integral part of the instrument. The signal conditioning is essentially the conversion of air heat in the movement of mercury in the thermometer. Many measurement systems are more complex and it is useful to separate them into individual sections that are the sensor, the signal adjustment unit and the recording or display unit. (Tsardaklis, 2007).

Based on Figure 1, the data acquisition system can be determined. Thus, the data acquisition system is an electronic interface system between the analog world (physical quantities such as pressure, temperature, weight, etc.), that are recorded by the sensors and the digital world (A / D converters, computers, microprocessors).

Initially, the measured physical quantity is the analogue value that is derived from the natural world and measured by the sensor. Then this information passes to the A / D and the value is converted from analog to digital. Therefore, in the final phase it will be transmitted to the computer.

The data transmission in the proposed sensor network will be done wirelessly using the wireless data transfer standard 802.11x.

Wireless data networks

In 1997, the foundations for the first wireless computer network with a maximum data transmission speed of 2Mbps in the 2.4 GHz band were laid based on the protocol 802.11. The protocol was established by the IEEE Institute in order to serve initially the needs of small computer networks (WLAN-Wireless Local Networks). The Spread Spectrum technology has been the backbone for the development

of the 802.11, and its successors. Originally, it was used for military purposes, which necessitated the use of secure communication lines at multiple levels to prevent eavesdropping and interference. It took almost two years for the Institute to present the new standard IEEE 802.11b (also known as Wi-Fi), that would replace its predecessor, ensuring that it could reachspeeds of 11 Mbps at the frequency of 2.4 GHz. The main advantage of the new model was the higher data transmission speeds. There were also other minor differences between the two protocols.Since then a variety of flavors has been presented with differences mainly in range and data transfer speeds (Table 1).

The choice of the technology used for the wireless transfer of the data collected from the network of sensors is very important because it will determine the majority of the overall costs of the network.

Based on Table 1 the range of the networks can vary from 100m to 5000 m. It must be noted that these ranges are under optimal conditions and with the use of directional antennas. Each protocol technology has a different installation cost and also requires a different number of antennas. (Andreopoulou et al, 2004).

In our case, the objective is to maintain full communication (complete coverage) with the smallest possible number of stations in order to have the least imposition on the area aesthetically, while also reducing the installation costs by using the least number of relay stations.

Viewshade analysis

To find and choose the best and most efficient technology a viewshade analysis is performed using ArcMap software. The map with the transmission stations is used as the input map, based on this map and with the use of the viewshade analysis we create new polygon layers containing the limits of each wireless protocol from Table 1 as buffers around the transmision stations.

To perform the viewshade analysis, initially a new point-layer is created that contains information
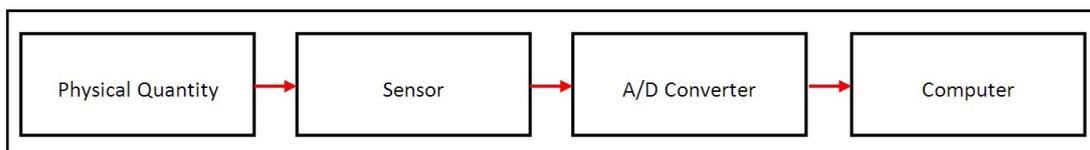
Source: own processing

Figure 1:The functioning system of the sensor.

Technical Specifications of 802.11x Technologies						
Protocol	Release Date	Frequency (GHz)	Bandwidth (MHz)	Data Rate (Mbits/s)	Range (indoors) (m)	Range (outdoor) (m)
Initial	6/1997	2.4	20	1.2	20	100
A	9/1999	5	20	6-54	35	5.000
B	9/1999	2.4	20	1-11	35	140
G	6/2003	2.4	20	6-54	38	140
N	10/2009	2.4/5	20/40	7.2-150	70	250
ac (Draft)	11/2011	5	80/160	433-6.93 (Gbit/s)	70	-

Source: IEEE

Table 1: Technology Networks 802.11
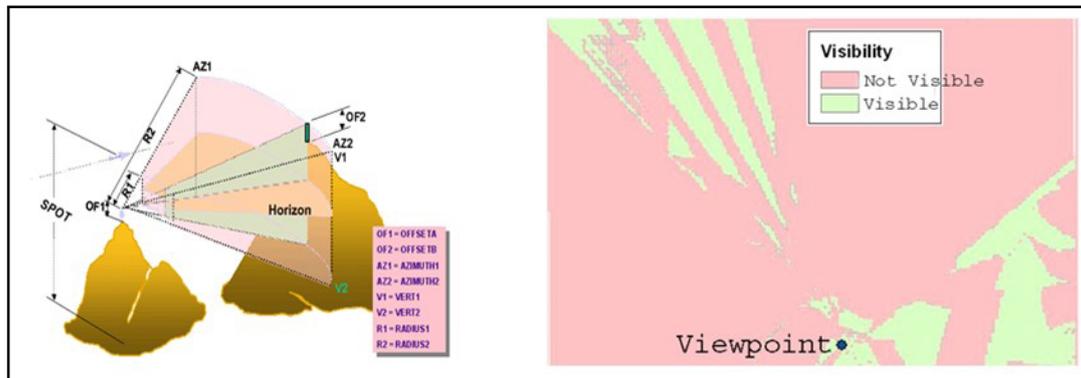
Source: own processing

Figure 2: Schematic representation of the variables of the viewshade analysis and the result.

about the locations of the erosion stations. Theviewshade analysis identifies areas that are visible from one or more observation points or linear objects. Each area in the exported information layer takes a value that indicates how many observation points are visible from this area. If there is only one point of view, each area that is visible from the observation point takes a value of 1. All the other areas take a value of 0.

A validation of the basic parameters of visibility analysis is conducted by introducing the appropriate fields in the database-layer information. The schematic graphical representation of the way the analysis is done can be seen in Figure 2. The observation point is at the top of the mountain on the left (OF1 position in image). The direction of the field of view is illustrated by the cone which is turned to the right. Additionally, we can determine the height of the point of observation (e.g. in the case of observation towers), the direction of the observation etc. (ESRI, 2011).

Overall we can control nine characteristics of the viewshade analysis.

1. The elevation of the ground at the observation position (Spot).

2. The vertical distance in the ground units that is added to the Z axis of the observation position (OffsetA).

3. The vertical distance in the ground units that is added to the Z axis of the each checkpoint (OffsetB).

4. The starting point of the horizontal angle of vision in order to limit the control range (Azimuth 1).

5. The end point of the horizontal angle of vision in order to limit the control range (Azimuth 2).

6. The upper end point of the vertical angle for limiting the control range (Vert 1).

7. The lower end point of the vertical angle for limiting the control range (Vert 2).

8. The inner radius that limits the control distance when we recognize areas that are visible from each observation point (Radius 1).

9. The external radius that limits the control distance when we recognize areas that are visible from each observation point (Radius 2).

Results and discussion

A case study of the proposed methodology

An application of the suggested methodology, on the design basis, has been done regarding the suburban forest of Seich Sou. This forest acts as an area of protection for the city of Thessaloniki, and for many years has been the receptor of great pressure caused by the expansion of urban fabric to the area of the forest (Figure 3). Additionally the increase in the mean temperature of our planet (the climate change phenomenon) has also caused major changes (Zaimes and Emmanouloudis, 2007). Based on these facts it is evident that there is a need to study the effects of these phenomena to the area of the suburban forest. In this case study we find the most suitable areas for the installation of an erosion measuring network.

Erosion does not occur steadily and constantly throughout the year. In contrast certain soil conditions need to be established for erosion to occur. Erosion rates can also differ from year to year depending on climatic conditions (Zaimes et al, 2006). The above facts clearly indicate that to properly understand the phenomenon of erosion continuous measurements are required. Most erosion measurement methods that are frequently used today are point methods that measure erosion at a specific moment of time (Sapountsis et al, 2006; Sapountsis et al, 2009).

For the creation of digital terrain models (DTM) the digital contour map was used. This layer contains a database that maintains information on the elevation of each contour line. Afterwards with the use of 3D Analyst software ArcMap the TIN is created. Figure 4illustrates how the digital elevation model process is started. In this figure the digitized boundary of the suburban forest is depicted with red while the contour lines are with green. The output information layer after its completion is characterized by a pseudo three-dimensional look that allows the decision maker to have a more complete picture of the study area. Based on this layer, the points to perform the analysis will be selected that will be used for the viewshade analysis based on their location and other characteristics.

To implement the viewshade analysis method two files are required. The first file consists of a Digital Terrain Model (DTM), while the second file contains the data points that illustrate the locations of antennas that will transmit the data to the central data collection station.

The next step after finding their location is the introduction of the antenna characteristics (height from the ground, emission angle, etc.). In figure 4 the light green color indicates the areas that are covered by the pillars while in red are the areas outside the coverage. It is quite clear that the majority of the pilot area is covered by the suggested network.

The map in Figure 4 also shows with concentric circles starting from inside towards the outside, representing the networks ranges of 100 m, 140 m and 250 m. Obviously none of them is sufficient for the implementation of the proposed measurement network. So for the implementation of this network the 802.11a protocol should be used that has a maximum potential range of 5000 m,
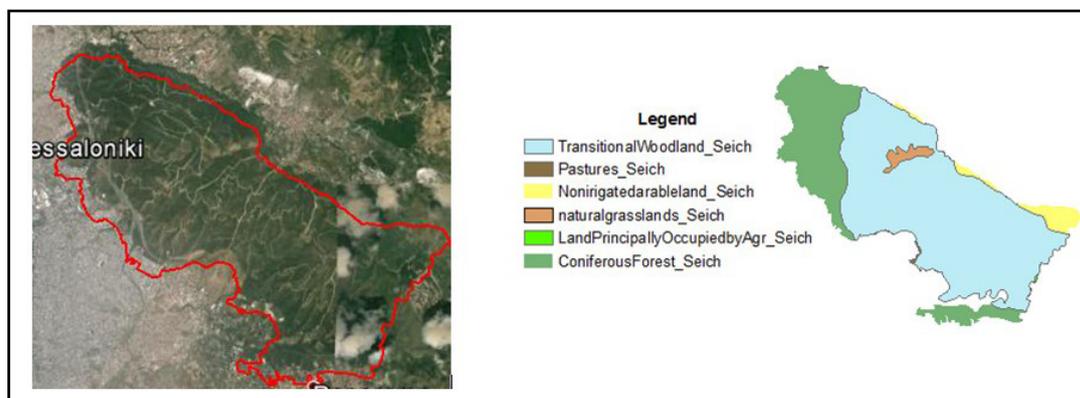
Source: own processing

Figure 3: Satellite image of the SeichSou boundaries (in red) and main Land Uses in the area.
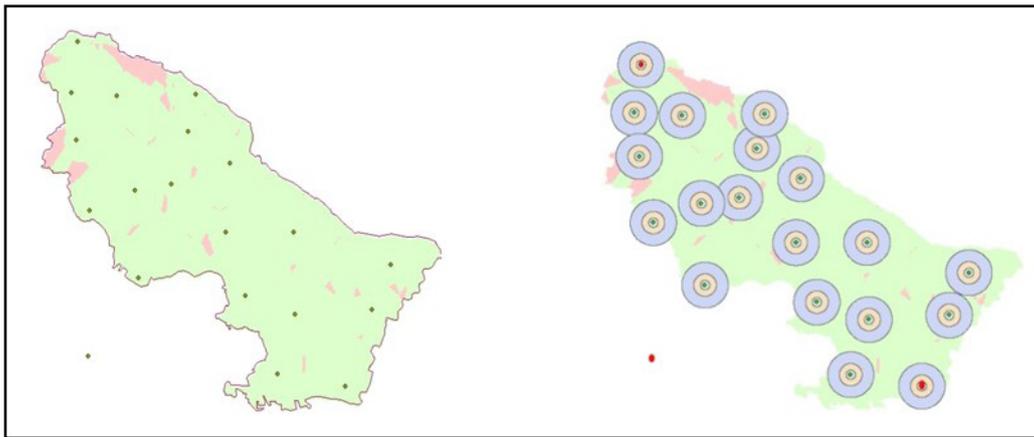
Source: own processing

Figure 4: The results of the visibility analysis, and the location (in red) of the transmission station based on technology protocol 802.11a

in combination with the other protocols.

For the complete coverage of the entire area of the forest a total of 3 stations will be required that will include sources of transmission and collection according to the 802.11a protocol. The locations of these stations are shown in Figure 4 with red dots.

The results for the suggested locations can be seen in Figure 5. The reason a combination of technologies used for the implementation of the wireless network instead of one single technology, was the significant reduction in the installation costs and the reduced levels of radiation. Additionally, it is evident that the use of 802.11a technology stations provides the network with the ability to operate even if one or more technology stations malfunctions or is removed for maintenance.
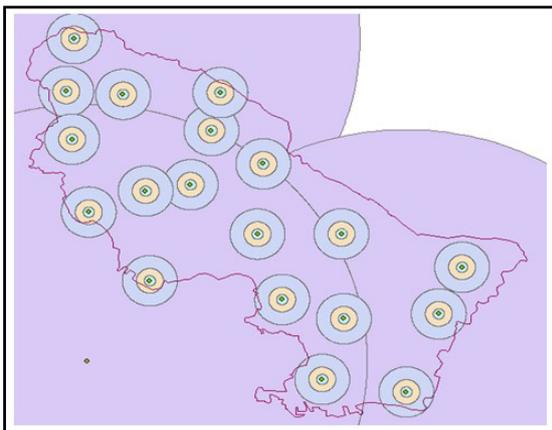
Source: own processing

Figure 5: The resulting network.

Conclusion

Nowadays it is more crucial than ever to protect the environment. Extreme weather conditions in conjunction with the increase in human activities and population have led the planet to a crucial point where is urgent for researchers to suggest actions that will help mankind to overcome the problem. One of main problems environmentalists have to deal with is the lack of sufficient data to support decision making, due to the fact that the monitoring of environmental phenomena is both time intensive and money consuming. The purpose of this paper is to present a cost benefit methodology, for designing and deploying environmental measuring networks.

The methodology is based on the combination in the well established knowledge of Geographical Information Systems and Wireless communication networks. Based on these tools, we try to demonstrate a methodology of finding the optimum coverage of an area using GIS analysis techniques. Additionally we present a case study, based on real data from the suburban forest surrounding the east side of the city of Thessaloniki, Greece.

Recommendations

In the future the proposed methodology can be improved by using the 3G technology to transfer the erosion measurements. This technology is based on using the existing infrastructure of mobile phones in order to achieve data transmission. The complete coverage of the large territories is crucial in order to make the adoption of this data transmission technology. However we must underline the fact, that up until now there are vast areas with no GSM

coverage or incomplete coverage, and that data rates still are a significant disadvantage which affects the adoption of GSM technologies.

In the case study of the suburban forest, although there is the possibility of using this technology it was not chosen because it would increase operating costs although there is the possibility of installing the server in a position very close to the erosion measurement network.

The time series produced by the network of sensors can be used to supply data to an artificial neural network (ANN) that in combination with the expected values of rainfall can create a map that will display areas that pose the greatest risk of future erosion phenomena. This will help towards the reduction of the administrative costs of the forest by pointing out this before they are eroded.

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Non-indigenous and Endangered Animal Record Keeping in the Czech Republic

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Anotace

V příspěvku je popsán způsob sběru, zpracování a vizualizace dat o výskytu některých nepůvodních a ohrožených druhů živočichů v České republice. Vytvořený software umožňuje široké odborné veřejnosti snadné vložení informací o pozorování sledovaných druhů. Získaná data jsou následně využívána odbornými a vědeckými pracovišti pro hledání optimálních řešení ochrany přírody a managementu populací a jsou přístupná veřejnosti.

Analytické a softwarové řešení bylo vyvinuto Katedrou informačních technologií České zemědělské univerzity v Praze, data jsou následně využívána Fakultou lesnickou a dřevařskou a Fakultou životního prostředí.

Klíčová slova

Zvířata, monitoring, životní prostředí, mapy, GPS, vizualizace, nepůvodní druhy, Česká republika.

Abstract

In the paper, the method of data collection, processing and visualization of the occurrence of non-indigenous and endangered animal species in the Czech Republic is described. Our new software enables easy data entry about the observation of monitored species to the expert public. The data obtained is then used by expert and scientific institutions in order to search for optimal solutions of nature protection and population management and results are open to the public.

This analytic and software solution was developed by the Department of Information Technologies, Czech University of Life Sciences; the data has been also used by the Forestry and Wood Faculty and the Faculty of Life Sciences.

Key words

Animals, monitoring, environment, maps, GPS, visualization, non-indigenous species, Czech Republic.

Introduction

Human activities in nature can result in many different effects of the workings of ecosystems and population. The composition of species of animals in the wild has been changing; original species have been disappearing and other non-indigenous species have been migrating, and this generates further disruption of the natural balance and has also impact on human activities (agriculture, fishery, forestry, etc.). The starting point of searching for solutions is the existence of data of occurrence of individual, endangered and migrated non-indigenous species (Vaněk, 2011).

Significant invasive species in the Czech Republic are primarily Raccoon dog (Nyctereutes procyonoides), Raccoon (Procyon lotor), American mink (Neovison vison) a Golden jackal (Canis aureus). On the contrary, the endangered species are e.g. Eurasian lynx (Lynx lynx), Brown bear (Ursus arctos), Gray wolf (Canis lupus), Western Capercaillie (Tetrao urogallus), Black Grouse (Tetrao tetrix) and Hazel Grouse (Bonasa bonasia) (Law 114/1992).

Observation of occurrence is relatively demanding: most information is gained from people who are regularly present in nature – foresters,

farmers, gamekeepers, nature fun etc. Collection of structured information from such a wide range of people who are not organized in a unified way is a relatively big problem (Svobodová, 2011). For this reason, there was a need to find a solution which collects as much data as easy as possible, so that this data could then be used by expert and scientific institutions in order to search for optimal solutions of nature protection and population management (Aarts, 2008).

Materials and methods

Based on the analysis, a prototype for verification of system functionality was created. Open source technologies were used for this development. All data obtained is saved on MySQL (My Structured Query Language) database server, version 5.6.10. The software solution of the web application was released in the standard environment PHP 5 (Hypertext preprocessor) programming language with use of Nette framework version 2 libraries (nette, 2013). The application architecture was modularly designed (Cui, 2009). This design enables easy and rapid development of other application functionalities as well as effective modification of current functions and current needs. The utilization of the Nette framework enables the creation of safe and effective modular

applications (Figure 1). Dibi database layer is used for communication with the database server (dibi, 2013). The application supports mainly work within the MS SQL (Microsoft Structured Query Language) database server environment, but owing to Dibi database layer utilization, the application enables utilization in other commonly open database systems. Web server Apache version 2 guarantees running of the application.

Google Maps developed by Google Inc is used to view the animals monitored. Communication with Google Maps is realised via Google Maps JavaScript API V3 (Application Programming Interface). (Jarolímek, 2012) (Bearman, 2012) Display of information about detected animals is created by the client-side of JavaScript with use of jQuery framework (Thanopoulos, 2012)(Liao, 2012) (McCormick, 2004). The application is optimized for the most widely used web viewers, i.e. viewers running on different operating desktops, notebooks as well as mobile devices like tablets or smart phones (Leyshon, 2013).

Results and discussion

Requirements for the system

- The basic requirements are simplicity of operation; open to the general public and
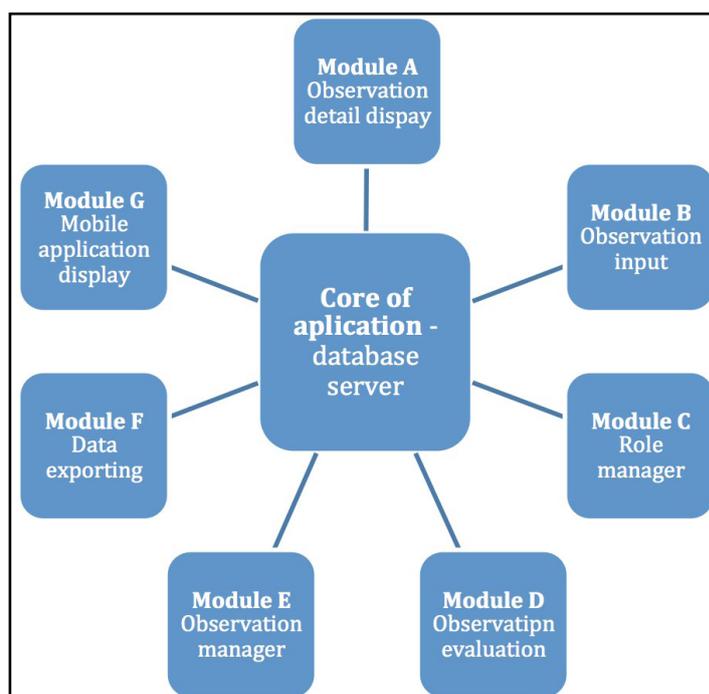
Source: own processing

Figure 1: Single application modules.

the possibility of collecting and browsing of data saved (Vaněk, 2011).

- System function requirements:
- A public part for the data entering and browsing; and an internal (administrative) part for data validation, index adjustment and utilization of advanced functions of data analysis
- Friendly data entry for users
- Process of approval, validation and administration of entered data(observation)
- Possibility to use historical data (some species data has been accessible since 1960)
- Data selection and filtering
- Visualization of data – display on a map

- Possibility to use application on different types of devices (PCs, notebooks, smart phones, tablets) and operating systems
- Possibility to create new language versions of application
- Online availability of application

Web interface is composed of three basic sections (Figure 2).

- Heading – placement of control menu and switch between „Show" mode for data display and „Add" mode for data entry
- Map – display and data entry
- Menu in right column – form for selecting and filtering / obtaining data
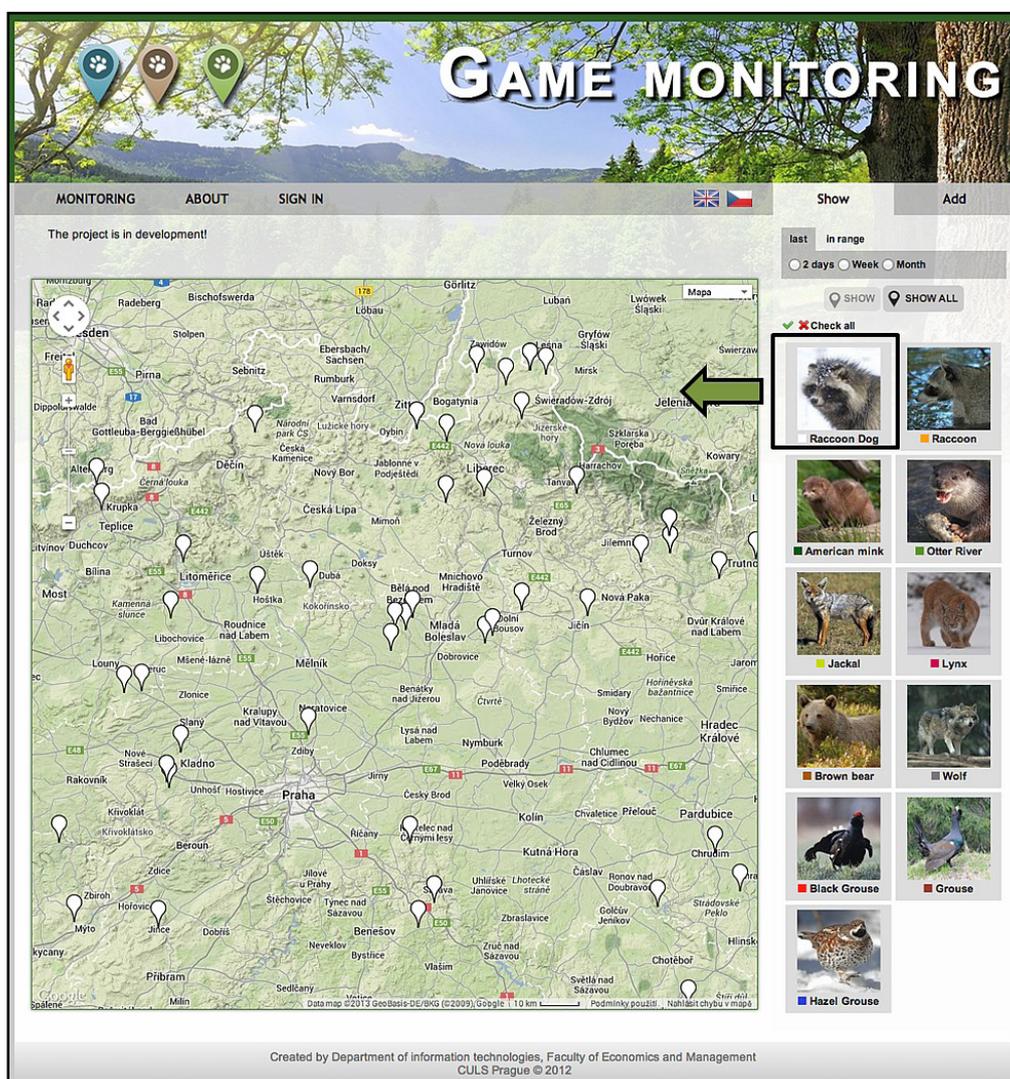
Source: own processing

Figure 2: Web interface for monitoring of game, in this example, the occurrence of Raccoon dog.

Data entry

- Every visitor of web pages is enabled to contribute with the data in "Add" mode. Entered data of the observation:

- Species selection (Raccoon dog Raccoon, American mink, European otter, jackal, lynx, bear, wolf, Black Grouse , grouse, Hazel Grouse) and possibility to enter other species)

- Author´s e-mail – validation of identity*

- Date and time of the observation

- GPS (Global Positioning System) coordinates – by clicking on the map or directly from a mobile device

- Selection of observation type (observation, shoot, collision with vehicle, death, footprint

- Number of specimens

- Sex (male, female, cub, not recognizable).

- Possibility to enter a photo

- Description of the observation

In the end, it is necessary to press, "send" to save the data (Figure 3).

Source: own processing

Figure 3: New observation forms.

As wide a public as possible is needed for this activity. A relatively large awareness has been attempted through specialized magazines, hobby web pages and in cooperation with institutions managing large areas of land, e.g. the Forests of the Czech Republic, a state-owned enterprise and the Military Forests and Estates of the Czech Republic, a state-owned enterprise. Notification via social networks will be another medium, which is now being prepared.

Data browsing

Data is available for all visitors of web pages in „Show" mode. The visitor selects the species of interest and time period of the data to be watched. After clicking "send", the individual places of the occurrence will be viewed in the map with a description of the observation.

There is a small discrepancy in historical data; in the past, names of the nearest municipalities were entered instead of GPS coordinates of single places. When entering the data in a map, the coordinates of particular municipality were used so the place of the observation is entered as a place of the municipality

For scientific use, the saved data is exported to specialized Geographical Information Systems (GIS), where it is possible to perform other analyses with respect to vegetation, altitude, population density, climatic conditions etc.

Application allows exporting data to XML (Extensible Markup Language) file by using Dublin Core metadata terms and AGROVOC thesaurus for data description (Šimek, 2013).

Data verification and approval

The entered observation data is not immediately displayed in the application. First, the user must be authorized via confirmation e-mail – the system sends an e-mail to the address entered and the user has to confirm. Authorized data is subsequently checked by the administrator of the application. Only after verification of authenticity of the observation data is the object logged into the system and displayed via online web application and utilized further (Figure 4).

Mobile devices

Most mobile devices (smart phones, tablets) are equipped with a GPS module, camera and Internet connection. Therefore, a user application interface has been optimized for mobile devices. This application enables the entry of observation data
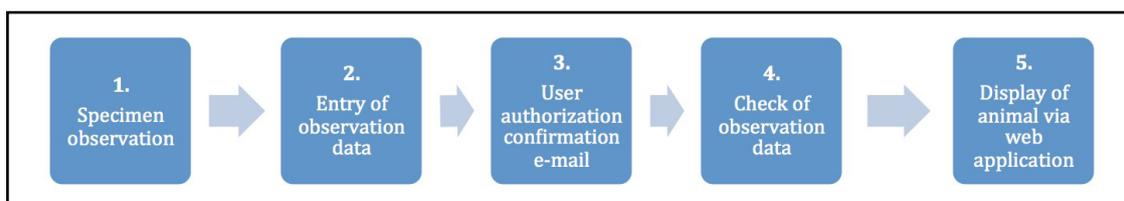
Source: own processing

Figure 4: Authorization of observation data entered.
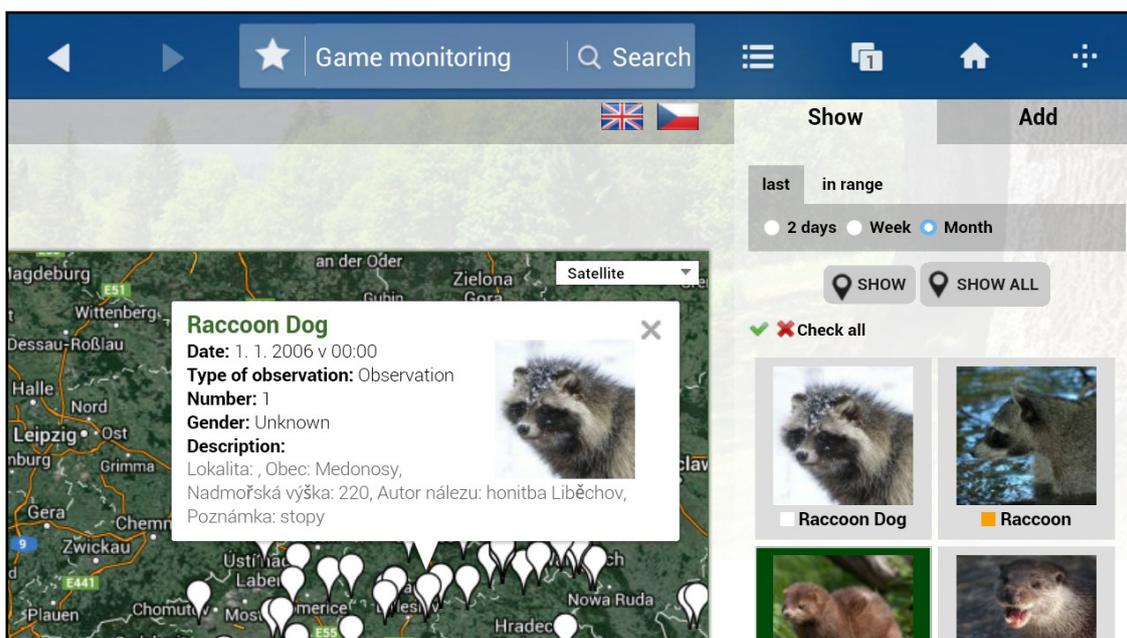
Source: own processing

Figure 5: Application running on mobile device (Description: – only in Czech)..

directly into the system from the field via a single device, which enhances user comfort (Figure 5).

Conclusion

This solution is used for plotting the occurrence of protected game species within the Czech Republic. The application enables easy data entry by the general public. The data obtained is saved in the database and used for additional scientific research in other areas, for educational purposes and for the popularization of scientific research. It is possible to use this solution to record the occurrence of different species in any chosen environment. Also it can be used to monitor and display the occurrence of any object. Currently, this prototype is available in a pilot version at www.monitoring-zvere.cz.

The paper presents solution state of the issue in mid-2013. The system going to upgraded to the new version based on user feedback and comments, and further analyzes in 2014.

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Soviet Collectivisation and Its Specific Focus on Central Asia

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Anotace

Hlavním cílem tohoto příspěvku je osvětlit poměrně málo známý proces kolektivizace v sovětské Střední Asii. Cílem je ukázat specifika této kolektivizace se zaměřením na Kazachstán. Kolektivizace měla ve všech svazových republikách podobný scénář – rolníci nejprve získali půdu, aby o ni v procesu kolektivizace za několik let přišli. Chudí zemědělci, zejména ti, kterým chyběly morální zábrany, často vnímali proces kolektivizace jako svou příležitost k získání moci. Zdá se, že většina z nich neviděla, nebo nebyla schopna vidět účel změny v sociální struktuře obce, nebo především reálné záměry komunistického režimu. Jakákoli manipulativní ideologie je ve své podstatě velmi škodlivá, a její důsledky jsou obtížně odstranitelné i po dlouhé době.

Tento článek se zabývá i současnou zemědělskou transformací ve Střední Asii a ukazuje na riziko při použití necitlivých postupů používaných při další zemědělské transformaci.

Klíčová slova

Kolektivizace, SSSR, Střední Asie, zemědělská transformace, tranzice.

Abstract

The main objective of this paper is to illuminate the relatively little-known process of collectivisation in Soviet Central Asia. The aim is to show the specifics of the collectivisation of Soviet agriculture, using the example of Kazakhstan. The peasants were first given some land, only to have it taken it away over the course of several years, during the process of collectivisation. The poor farmers, especially those who lacked good civil morals, perceived the process chance to control the future development of the countryside. It seems most of them did not see or were not able to see the purpose of the changes in the social structure of the village, or especially the real intentions of the communists. Any manipulative ideological influence on the countryside is very harmful in its effect, and the consequences are difficult to remove even after a long period of time.

This article deals with the current economic and agricultural transformations in Central Asia and demonstrates a risk for the insensitive procedures used in agricultural transformation to be repeated.

Key words

Collectivisation, USSR, Central Asia, agriculture transformation, economic transition.

Introduction

The aim of this paper is to illuminate the little-known process of collectivisation in Soviet Central Asia and, especially in the example of Kazakhstan, to show specifics of this part of Soviet agricultural collectivisation.

The topic of the Soviet collectivisation has been processed by a huge number of Russian authors, but compared to evaluation of the collectivisation in other post-communist countries, in some cases there is still evident a significant ideological slant when assessing this period of Soviet history. In some cases, we can register an endeavour not to see the process of the collectivisation as black-and-white.

In the Soviet Union, literature relating to the collectivisation could be classified

chronologically into several time periods – since the 1920s and then in the Stalinist era, there appeared non-critical and ideological-free publication mentioning only positives of the carried out process. Since the 1950s, in connection with the shift of the political situation after the accession of N. S. Khrushchev to the function of the First Secretary of the Communist Party of Soviet Union, there appeared publications that were very critical toward the Stalinist regime, including criticism of methods used during forced collectivisation. Over time, publications with the theme of the collectivisation became more moderate in criticism of the methods used. In this time period, we can include for example the publications of V. M. Selunskaya (1961) *Bor'ba KPSS za socialisticheskoe preobrazovanie sel'skogo khozyaystva (oktyabr' 1917-1934)* [Struggle of Communist Party for the socialist transformation of agriculture (October 1917-1934)] or S. P. Trapeznikov (1959) *Istoricheskiy opyt KPSS v socialisticheskom preobrazovanii sel'skogo chozyaystva* [The historical experience of Communist Party in the socialist transformation of agriculture]. Since the 1990s, works have appeared with the theme of the collectivisation noticing the complexity of assessing this process.

For example, Osorov (2000) assessed impacts of the collectivisation on the Kyrgyz culture and claimed that the transition from nomadic life to sedentary life style is a turning point in a history of each culture, because it brings socio-economic and cultural development. Now, it appears that the culture that went through this turning point first, naturally wins. While in South Kyrgyzstan there was intensive agriculture already developed in the 2nd millennium BC and in North Kyrgyzstan since the 8th millennium BC, nomadic pasturage always remained essential. Russian colonisation during the 19th century accelerated the process of transition to a sedentary life style, but according to statistics from the year 1914, still only 21,772 of the total of 98,840 Kyrgyz families (22%) lived a sedentary life style. Collectivisation and (often forced) settlement of nomadic population was done only thanks to the formation of the USSR and the Stalinist regime. In the 1930s, there were more than 400 new villages and tens of thousands of new houses built; the process of building new roads, schools and hospitals was very fast; electrification was done; and a fight was declared against illiteracy (which reached approximately 90%). The darker sides of recent Kyrgyz history – repression of people, trials

with former owners of herds – were especially painful for herdsmen, because the freedom and at least relative independence of nomadic life were utterly incompatible with the ideology and spirit of the Soviet regime. It is ironic that the worst methods bore fruit, because Kyrgyzstan became a modern country via this process.

The topic of collectivisation in Central Asia and especially in Kazakhstan is mentioned in some works of non-Russian authors – for example A. Blum (1991), *Uncovering the hidden demographic history of the USSR*, N. Pianciola (2001), *The collectivization famine in Kazakhstan, 1931–1933* or B. H. Loring (2008), *Rural dynamics and peasant resistance in Southern Kyrgyzstan, 1929–1930*.

Collectivisation in the Soviet Union had different signs, and many works focusing on concrete regions were written. For example, O. A. Nikitina (1997) described the collectivisation in Karelia (*Kollektivizaciya i raskulachivanie v Karelii, 1929–1932 gg.*); N. A. Mal'ceva (2000) wrote about the collectivisation in the Stavropol region. In terms of more fundamental works on the Soviet collectivisation, it is necessary to mention the book by N. A. Ivnicky (2004), *Tragediya sovetskoy derevni: Kollektivizaciya i raskulachivaniye, 1927–1939*, and the book by D. A. Alimova (2006), *Tragediya sredneaziatskogo kishlaka: kolektivizaciya, raskulachivaniye, ssylka*.

In connection with the collectivization appear articles (from the 90s) that mention problems with de-collectivization and the transition to a market economy – here is possible to mention the paper by Kazbek Toleubayev (2010), *Knowledge and agrarian de-collectivisation in Kazakhstan* or the paper *Land reallocation in an agrarian transition* by M. Ravallion and D. van de Walle (2006), both from the World Bank Group.

Materials and methods

Quantitative and qualitative methods are used for getting results. Quantitative data relating to statistical data on the collectivisation in Soviet Union were garnered from publications that have already evaluated the collectivisation critically and were not significantly touched by falsification or idealisation of the collectivisation processes (which is typical for many period publications). Part of the statistical data relating to Central Asia used is from the year 1930 – these data inventory

managers in *kolkhozes* in terms of their profession and education.

Qualitative data are used in the form of secondary (inferred) data from publications documenting autobiographical narration of directly interested people, as well as in the form of primary data, also with an emphasis on personal stories related to the issue. Primary data come from terrain research in Central Asia within the period of 2003–2011.

Results and discussion

Initial conditions of the Soviet collectivisation

After the revolution of 1905, the *commons*[1] (common ownership of production means with full or partial self-government) and commons equal land use were removed in Russia. Russian commons were actually feudal establishments, because it was not possible to secede from them unilaterally.

This situation changed on 9th Nov 1906, when the Russian government issued a decree establishing the allowed secession from commons. Stolypin's Agrarian Law allowed gathering all shares of commons land, whose permanent users were peasants, into a private property. The aim of the reform was to create an independent state of private farmers, while maintaining manor farm estates from old commons in the countryside. Therefore, the land intended for buyout by stronger subjects was taken from the common property – commons. The only hitch was that the best common lands had been changed to *kulak*[2] *otruby* (lands transferred into private property) and khutors (the same land but separately positioned, with outbuildings and residential buildings).

The tsarist government failed to establish individual property everywhere; until the beginning of 1917, *khutors* and *otruby* represented approximately one tenth of all peasant homesteads, especially in the northwest (in the neighbourhood of Baltic) and the south and southeast (south of Ukraine, Caucasian, central Volga). In other governorates, there remained mostly commons.

Small and poor farmers numbering around 1,200,000, who seceded from commons, sold approximately 4 million '*desyatins*'[3] of allotment land to kulaks for significantly reduced prices. The government took steps to move these 'excess' peasants: when looking for land, Russia peasants often headed to very remote areas of Russia (for example, to Central Asia), but such efforts were not very successful – peasants usually returned back from new places.

The commons system was kept in different parts of Russia (and later the Soviet Union) at varying levels. While in the European part, the commons were removed (including the change of the patriarchal family) even in the mostly undeveloped areas by the 1940s, in some parts of Central Asia the commons elements remained until the disintegration of the USSR. As an example, we can mention the territory of today's Tajikistan.

The village community (*commons*) based on kinship always played a great role in Tajik Pamir and its foothills (Karategin, Darvaza, Kulyab). In Kulyab (Pamir foothills), a very special system was created, which linked together elements of commons and the *kolkhoz* system (Olimov, 1994). The region of Kulyab had very good conditions for agriculture (similar to the Leninabad region), but because of the great distance from bigger cities, business did not develop there based on the monetary relations. Another impact of the great distance from any major cities was that the lower consumption of above standard goods and the traditional way of life, including commons elements, were preserved here to a greater extent than in most other areas. In the era of the Soviet government, the commons were formally changed into *kolkhozes*, with unlimited power for the commons leader (*rais*), who was the chairman of a kolkhoz (and was called *bobo*, 'granddad'). Maintaining commons elements during socialism was acceptable due to the strong elements of solidarity, and, moreover, it did not threaten the stability of society. In addition, the transformation (and simultaneous partial maintenance of original elements) in the sphere of religion could be seen as curious. Under the Soviet government, a 'national' Islam with a special *adat*[4] formed. The Kulyabs (also Muslims by religion) just became members of the Communist Party and defenders of the Soviet ways.

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[1] Common is characterized as a form of association of people, characterized mainly by a primitive communal system.

[2] *Kulak* (the fist) – term for wealthier independent farmer in Russian village (with acreage up to 200 ha). This social class was formed from the original uniform Russian village due to the Stolypin agrarian reform after the revolution in 1905.

[3] 1 desyatina = 1,093 ha.

[4] Adat – secular common law completing the religious right (sharia).

Reign of J. V. Stalin

Although the tragedy and the impact of the Stalinist policy touched lives throughout society, we can notice probably the greatest impacts in the case of agriculture and rapid collectivisation, according to more or less uniform patterns applied under very different conditions within the entire Soviet Union.

Stalin's ideology came from the belief that each community is divided into opposing classes fighting each other. Stalin published these opinions in his writings in proletarian magazines in the year 1906 (in which he refers to Karl Marx, '*alliance of the bourgeoisie can only be shaken by an alliance of the proletariat*').

…There is no doubt that the class struggle will be harder and harder. The task of the proletariat is to bring a system and organization into its fight. (Stalin, XI. 1906)

Stalin (together with Lenin) followed the thesis of class struggle with a clear requirement for the confiscation of all lands and their transfer to those who were working on them. Land confiscation was supported by the Congress of the Communist Party in 1903 and at the Congress in 1905; unity dominated in this respect also among the *Bolsheviks* and *Mensheviks*. (Stalin, III. 1906)

After the Soviet leadership gained the power, it first assumed two ways of converting villages into socialist villages; both should mean abolition of exploitation by eliminating private farming. Both of these ways assumed formation of new economic units based on collective farming: *kolkhozes* and state farms.

Kolkhozes had already been formed as of 1917, but the 'new economic policy' program (NEP) applied beginning in 1921 and replaced the policy of 'military communism' from the civil war era, making a space for private enterprise and suspending the growth of *kolkhozes*. After 1917, cooperative enterprises existed in the following form:

- cooperative farms for collective tillage, while working tools remained in private hands of cooperative farm members;

- collectivised arable land, drawing power, agricultural inventory; right to own property related only to dwelling, crofts, big and small domestic cattle, domestic poultry;

- communes with a great degree of collectivisation including entire farmstead,

including for example poultry; revenues were divided by 'units' (Aliyeva 1973:35).

During the first post-revolutionary years, cooperative farms of the 2nd and 3rd type prevailed. Their number reached up to 18 thousand, but they were disorganised under the NEP policy.

Collectivisation in the 1920s began to take place in villages at first in the form of commune formation, to which supports from the state were promised and provided, and a campaign was led for their creation and expansion. At the same time, benefits of communal life in villages were underlined. According to the period promotional materials, communes were supposed to bring benefits to all workers, and only people using other people for day-labour were supposed to be frightened by them (Kislyanskiy, 1921).

Communes had a different character compared to *kolkhozes*. Generally, we could say that in communes there was deeper division of labour, which interfered in labour matters as well as family matters. Communes organised education of their members, arranged courses for tractor drivers, etc. However, the organisation of courses was often very chaotic. Cases of arranging course for tractor drivers without having any tractors available were documented.

In the middle of the 1920s, communes and *kolkhozes* legislatively existed side-by-side; later on farm steading took place only in *kolkhozes* and state farms, which were formed on state fund lands, former Tsarist lands, etc.

The development of cooperative enterprises in the USSR proceeded in 1920s, but very slowly: in 1927, in the whole Soviet Union, there were 17,267 *kolkhozes* of all types, which associated just 400 thousand farms, representing only 1.5% of the total (Tragediya sovetskoy derevni… 2004).

A new offensive in founding *kolkhozes* came after the 15th Congress of the Communist Party in December 1927. The Congress declared collectivisation to be a main goal in the socialist transformation of the countryside and required the creation of production cooperatives. Despite this, all delegates who reviewed work in villages during the Congress, underlined that caution and progressiveness were important for the collectivisation. Molotov[5] said in his contribution: '*We need many years to proceed from individual farming to joint farming… It is necessary*

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[5] Molotov, V. M. (1890–1986), Soviet politician and diplomat.

to realize that experience from the seven-year NEP existence taught us enough about what Lenin said already in the year 1919: no acceleration, no indiscretion by party organ or Soviet government in relation to peasants'.

Still in 1928, Stalin said that the farming in private hands would be the basis of the whole agricultural system. In mid-1928, there were less than 2% of all peasant farms, 2.5% of all sown areas and 2.1% of grain-sown areas in *kolkhozes*.

Nevertheless, within a year, Stalin markedly changed his opinion and decided on an accelerated rate of collectivisation. Consequences of the accelerated collectivisation came very quickly: on the all-union scale, agricultural production decreased during the first 'Stalinist' Five Year Plan for the National Economy of the Soviet Union[6].

Mass collectivisation began in the years 1928-1929, and at first, it included small peasants and landless people. For persuasive agitating action, there were 25,000 activists, communists, called up from cities, who were supposed to persuade peasants of the benefits of joint farming. It was quite a paradox that people from cities, without any experience in rural life and agriculture, persuaded experienced peasants who had been living in the countryside often for several generations. As the factual arguments were missing, agitation degenerated into the promotion of a simple motto: 'The one who would not enter the *kolkhoz* is an enemy of the Soviet government'. From there, it was just a small step to the mass persecution of collectivisation opponents as well as people who just doubted some of its aspects and asked for some time to think it over. Soon, methodical intimidation and violence were utilised against opponents, and the idea of forcible seizure of property and deportations of opponents arose.

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[6] Planned for the period 1 October 1928 to 1 October 1933, officially fulfilled one year earlier.

Creating a class enemy as a pillar of the Soviet collectivisation

In December 1929, Stalin came up with a slogan about liquidating kulaks as a class and announced that the liquidation of kulaks must become a part of establishing cooperative farms and total collectivisation.

Thus, two inseparable processes represented part of the collectivisation throughout the whole Soviet Union: establishing *kolkhozes* and liquidation of wealthier farming classes. These were divided into three categories; the criterion, even if not clearly defined, was the size of property. In Russian terminology, these were '*bednyaki*' (poorest people), '*serednyaki*' and the wealthiest were '*kulaki*'.

In Russia, in 1917, landowners had the largest land areas (41.7% of agricultural land), but they produced only 12% of all grain; *kulak* farms worked on 21.8% of lands, producing 38% of all grain, and *serednyaki-bednyaki* farms accounted for 36.5% of lands, yielding 50% of all grain (data from 1913; Kamenshchik, 2003) (table 1).

The table 1 unambiguously shows the inefficiency of big landowning farming, while the efficiency of *kulak* farming was the highest. It is a matter for discussion whether it was prudent to get rid of just *kulak* farming.

When liquidating *kulaks*, a special term was introduced, '*rozkulachivaniye*' (un-*kulak*ing). Un-*kulak*ing should break the protest against collectivisation, and property of *kulaks* should form a material basis for the building of cooperative farms, kolkhozes (Kokaisl, Pargač, 2007). The total number of 'un-*kulak*ed' farms in the Soviet Union represented 10–15% of all farms (Ivnitskiy, 2003).

When planning the liquidation of *kulaks*, *kulak* farms were divided into three groups:

1. Participants of the contra revolutionary rebellions and terror organisers: These people

	lands totally	share of yields	average efficiency
big landowners	42%	12%	29%
kulak farms	22%	38%	174%
serednyaki-bednyaki farms	37%	50%	137%
Total	**100%**	**100%**	**100%**

Source: data from 1913; Kamenshchik, 2003

Table 1: Share of different types of farming in Russia of yields and land under cultivation (1913).

were supposed to be isolated or even shot dead. Relatives were supposed to be evacuated to remote areas of the country.

2. The wealthiest kulaks: These were supposed to be evacuated into remote areas of the country together with their families.

3. Owners of smaller farms: They were able to remain in regions where they lived, but they had to move beyond collectivised villages.

Among *kulaks*, there were included peasants having two cows or two horses, or even just a better house. The category in which the peasant was included, however, also depended on skills or the good will of the apparatus. This registry was done by a so-called 'trio', formed by representatives of the village committee ('*selsoviet*'), party organisation and militia. The trio categorised residents, including the kulak. The general framework was established, but its interpretation depended on the trio.

The 'un-*kulak*ing' included not only the seizure of property, but also the evacuation of *kulaks* and their families into predetermined regions. The policy of forced resettlement or forced migration (or deportation) had already been practiced in the Soviet Union since the 1920s; it followed the practices of the Tsarist regime, and in the 1930s it reached huge proportions. It was justified as serving 'state interests' and the 'interests of working people' (Zemskov, 2003).

While in Central Russia, *kulaks* were resettled to the north, to Siberia, a considerable number were also sent to Central Asia and Kazakhstan, and opponents of collectivisation from this region were evacuated to Northern Caucasus, Ukraine and other regions. During the two-year period of 1930–1931, 6,944 families (33,278 country people) were evacuated just from Central Asia, except for Kazakhstan (Alimova, 2006).

According to the archives of the Main Administration of Corrective-Labour Camps (GULAG) and a unit of the Ministry of Interior of Russian Soviet Socialist Republic (OGPU), during the same period of 1930–1931, 6,765 *kulak* emigrants were evacuated from Kazakhstan. Other sources mention higher numbers: between January and March 1930, 5,563 people were evacuated; in 1930, another 5,500 people, and more (Abylkhozhin, 1997). Evacuated people were relocated to the Kola Peninsula, Kolyma and Siberian regions. At the same time, groups of evacuated people from other regions of Russia moved to Kazakhstan.

The number of evacuated kulaks from particular Central Asian republics (Alimova, 2006) is recorded as follows:

*   Uzbek SSR 3,500
*   Turkmen SSR 1,000
*   Tajik ASSR 700
*   Kirgiz SSR 700
*   Kara-kalpak AO 100
*   Kazakh SSR 6,765

From the list of evacuated *kulaks*, it is evident that entire families, also large families, were deported, if they farmed together – so a farm owner with his wife, his married children and their children, and eventually married brothers of the farmer.

In 1930, the accelerated collectivisation was applied throughout the Soviet Union. This happened after the issuance of a document of the Communist Party, *About the pace of the collectivisation and state support to the collectivisation.*

The collectivisation pace was planned in relation to nature of the regions: in the territory of today's Kazakhstan, in Ukraine and black soil regions of Russia, it was supposed to take place over two years, and in other regions over three years.

When evaluating previous achievements of continuous performance from the first Five Year Plan at the Congress of Workers of Socialist Industry in February 1931, Stalin talked about the previous weakness of Soviet industry, which came only from scattered and small farms: *But that is behind us now, no it is different. Tomorrow, maybe in a year, we will become a state with the biggest agriculture in the world. State farms and kolkhozes, which undoubtedly belong to large economic enterprises already gave us a half of all grains this year. This means that our system, Soviet system, gives us such possibilities to move forward rapidly, which no bourgeois country can dream of* (Stalin 1931).

The first Five Year Plan ended with mass collectivisation but also with famine (even bigger than in 1921), which took millions of lives. Livestock production had fallen down to 65% of the level from 1913; the number of horses, sheep, goats and poultry decreased by more than a half.

The Soviet collectivisation was also not accepted without reservation. In 1930 alone, there were 14 thousand rebellions, demonstrations and violent actions registered against the Soviet regime, attended by approximately 2.5 million inhabitants.

The most significant protests took place in the peripheral areas of the USSR: the *Basmachi* rebellion in the Central Asia, Altai rebellion, and rebellions in Chechnya, Taymyr and Kazakhstan.

It is very difficult to use a single instance as an example of a 'typical' collectivisation in the Soviet Union, because its implementation could vary greatly within particular regions of one federal republic.

The most well-known instance related collectivisation is probably the Ukrainian famine of 1932–1933, which peaked in early 1933 and directly or indirectly caused the deaths of 4-7 million people. Today it is almost impossible to determine the real cause of the famine based on Soviet statistics; according to these statistics, the total crop yield was higher in 1932 than in 1930 and 1931, which does not correspond to testimonies of witnesses. It is certain that an explosion of Ukrainian nationalism certainly played a role, and which Stalin wanted to break decisively; and another element may well have been the reluctance of peasants to work in the fields, when they had no opportunity to use the crop grown and were forced to sell grain to the state for absurdly low prices. At any rate, the system of compulsory (often un-realisable) contributions was a very effective tool to eliminate opposition to the collectivisation.

Much less is known about the collectivisation in Kazakhstan, except that very similar methods were used in collectivisation there.

Kazakh tragedy

Although collectivisation throughout Central Asia was carried out under similar scenarios, it had the most terrible consequences in Kazakhstan.

As in other places, in Kazakhstan, collectivisation proceeded as an enactment of class struggle, in which society had to deal with a class enemy, represented by village farmers and every peasant who was not immediately willing to give up his property on behalf of the collective. That is why the collectivisation proceeded in an atmosphere of fear and violence and deportations of those who did not want to accept its principles.

Under the Kazakh conditions, it was a liquidation of the *kulak* class (big land owners) and family and tribal leaders: agriculture was ruined; there was a famine; people escaped beyond the Union Republic or even the USSR, especially to China. Opponents were largely imprisoned, and participants and

organisers of the resistance received judgements of death. The mass emigration of the population also resulted in a population collapse. Another feature was the forcible settlement of nomadic herders into *kolkhozes*, and the destruction of their traditional way of life.

The aim was to stimulate the Kazakh nomadic commune and destroy social differences. Part of the transformation was supposed to be the conversion of nomadic shepherds to settled agricultural way of life. Particular pastoral families (and so single families) had no stable areas intended for grazing. In the territory of today's Kazakhstan, there had been three tribal states (*orda*, jüz) since the late 17th century headed by hereditary khans with subordinated sultans. After building up the Russian administration since the early 19th century, the Russian governor of Western Siberia confirmed *volost mayors* and aga-sultans to manage particular regions. Aga-sultans generally came from the strongest, but in many cases rather from the wealthiest family. Aside from juridical and executive power, he also determined which way particular families would migrate to summer grazing and in what order. Kazakh nomadic commons had in some respects a similar structure to commons formed among settled peasants in other parts of Russia – this similarity consisted in a relatively high degree of autonomy within a common. Differences related to the extent of disposition of owned property; that was not related to real estate in the case of nomadic herdsmen, while settled peasants had their houses and outbuildings under their full control.

Dramatic changes in the Kazakh countryside began in the middle of the 1920s and are imputed to the ultra revolutionary methods of the former secretary of the Communist Party, F. I. Goloshchyokin[7]. After ascending to the function in 1925, he declared the intent to transform an 'aul' in the revolutionary way to socialistic 'aul'. One element of the 'Little October' was to remove all politicians who disagreed with the Goloshchyokin´s intentions from their positions. The Little October attack was led against party opponents as well as against members of national intelligence, which demanded stopping arrivals of new immigrants. Goloshchyokin routinely had political opponents removed from their functions, beginning in 1928;

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[7] F. I. Goloshchyokin (*1876–†1941). Like the vast majority of top representatives of the Central Asian Soviet republics, he was kept in prison and executed during the Stalinist cleansings.

he had been sending them to jail as followers of so-called 'national deviation'.

Arable lands and pasture lands were re-designated. According to the decree of 21st August 1928, property of wealthy farmers and Beys[8] was liquidated. Farmers were deprived of approximately 1.36 million *desyatins* of meadows used for hay crops; these were given to small- and middle-size peasant farm. None of this produced the expected results. As these farmers did not have any cattle, they could not use the land they received, so often such lands were given back to the original owners.

The other step was a confiscation of properties of Beys, owners of numerous cattle herds. Around 145,000 head of cattle owned by 700 big farmers were distributed among small owners. Simultaneously, big farms were burdened with high taxes (Taukenov, 2002).

The collectivisation proceeded so rapidly that even its organisers were not able to manage it, let alone have it be understood by its subject, the peasants. As of 1928, 2% of farms were collectivised; as of 1st April 1930, this number was 50.5%; in November 1931, it was approximately 65%. Some regions even exceeded this average: for example, in Ural and the Peter-Paul circle of the Ural region, 70% of property was collectivised, and as of the autumn of 1931, the republic had 78 districts (of 122) in which 70–100% of farms were collectivised. Although the former public officials sowed optimism regarding the quantitative side of the action, there is a more and more evident slump in the economy (Abylkhozhin, Kozybaev, Tatimov, 1989).

According to Goloshchyokin, the changeover from nomadic to a settled way of life could not be managed without sacrifice. That is why he considered necessary the concomitant circumstances that liquidated Kazakh agriculture, resulting in a radical decline in livestock, not compensating losses of efficient agricultural production, food shortage and starvation among the population. Goloshchyokin did not respect Kazakh cultural and economical traits and assumed that economic development must take place here the same way as in other union republics. He exaggerated the level of the 'class struggle' in Kazakh *aul* in the belief that it could not be otherwise in the environment

of semi-feudal social relations (Abdakimov, 1994).

Collectivisation preceded the crisis in grain production. In 1927, there were 430 million puds of grain (1 pud = 16.38 kg) harvested; in 1928, the harvest was only 300 million, and sown areas were reduced, because the state purchase prices were three times lower than market prices. Managing administration made every endeavour to strengthen grain resources; in this respect, kolkhozes were supposed to help. A broad campaign proceeded for meat and wool production, which led to the massive slaughter of cattle. In winter of 1930, another campaign was implemented for wool supplies, so there was high sheep mortality due to freezing. At the same time, the number of cattle continued to decrease rapidly.

Hunger, population dying

Data on the number of victims of hunger vary. Masanov (2001) reported a 1.798 million drop in population, which represented 46.8% of the total Kazakh population in 1930. However, we must interpret such numbers as including people who left the country, were evacuated, deported or nomadised out of the republic. Nonetheless, according to other data, hunger took a big toll on the population: according to the population census in the year 1926, 3.628 million local Kazakh people lived in the territory of today's Kazakhstan and in 12 years, that number decreased by 1.321 million people (36.7%) (Tatimov, 1968).

According to data from the Central Office of Economic Records USSR, in 1932, the number of Kazakhstan inhabitants decreased from 5.873 million down to 2.493 million, among which 1.3 million people emigrated.

Realisation of the Central Committee of the Communist Party policy and policy of the Regional Committee of the Communist Party in Kazakhstan in the sphere of collectivisation brought enormous human and economic losses. It led to a reduction of the cattle population from 40 million to 4 million, which caused a famine and migration of a large number of people from this Federal Republic. This exodus was triggered by fear of the future, hunger, poverty and disruption of the economic and social bases of all spheres of life.

Bands of hungry people filled the cities of Alma-Ata, Tashkent and Bishkek. Mortality and emigration in this era were high in all groups of the population in Kazakhstan: Russians,

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8 Beys possessed juridical power. The position was not heritable, although good material conditions and connections were preconditions for transferring the position.
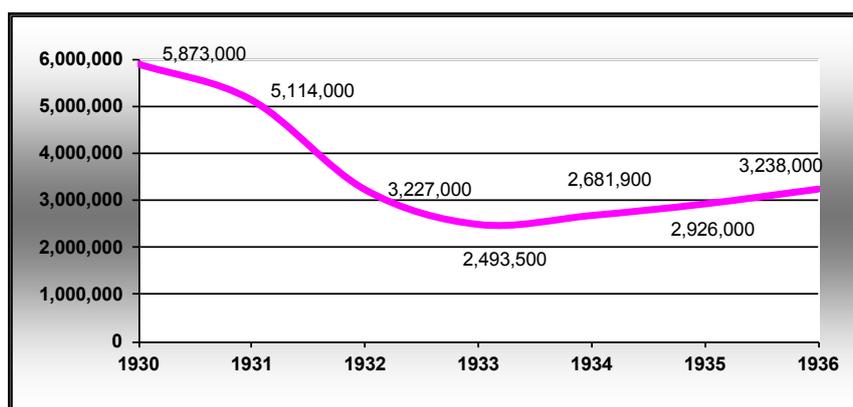
Note: Alexeyenko, A. N., Masanov, N. E. Migracionnyye i etnodemograficheskiye procesy v sovet-
skiy period…, p. 376
Source: chart made by the author of this study

Chart 1: Population development in Kazakhstan in the years 1930−1936.

Ukrainians, Uyghurs, etc. However, in the case of Kazakhs, both these indicators were the highest, due to forced sedentarisation. The chart 1 shows demographic trends.

The eastern part of Kazakhstan (today's East Kazakh region) was the most famine-affected region. The population here declined by 370.8 thousand people (63.5%). A large number of migrants headed to neighbouring China and to border regions of RSFSR (Russian Soviet Federative Socialist Republic). The total population in Kazakhstan decreased from 5.8 million in 1930 to 3.2 million in 1936. During the period of 1930–1933, the population decreased by 2.4 times due to deaths and emigrations. One quarter of Kazakhstan's population (1.03 million people) nomadised from Kazakh steppes to neighbours or abroad (China, Mongolia, Afghanistan, Iran, Turkey). From this number, 616,000 people moved permanently, and 414,000 people returned later. Among the permanent migrants, 200,000 people moved abroad: from southern and eastern areas to China, Mongolia, Afghanistan; from western areas to Turkey and Iran; from northern areas to Russia.

In the neighbouring republics of the Union, the number of Kazakhs increased significantly during this era: 10 times in Kyrgyzstan, 7 times in Tajikistan, 6 times in Turkmenistan, 1.7 times in Uzbekistan and 2.3 times in the RSFSR (Tatimov, 1968).

Respondents in Kyrgyz Bishkek (in 2007) mentioned that in the 1930s whole families starved to death who had come from Kazakhstan and were looking for some Kyrgyz help. Some of them were dying from hunger and the consequences of the distressing journey, others managed to settle there. Even in 2007, many Kazakhs lived in Bishkek.

Assessment of the Soviet collectivisation

The Soviet collectivisation resulted in many millions of uprooted people during collectivisation mismanagement. During the first years of the collectivisation, there was a huge decline in agricultural production and an inability to feed the population. The thesis of class struggle during the collectivisation provided the tools for dealing with opponents of the Soviet regime and potential political opponents in the highest places of the republic bodies of the Communist Party.

The Soviet collectivisation also brought certain positives. Among these positives, the elimination of the feudal order, reducing hand labour share by the introduction of mechanisation: according to the *Great Soviet Encyclopaedia*, in 1928, cattle ensured 96% of energy sources for use in farming; in 1932 this number decreased to 77.8%. The efficiency of farming also eventually increased.

Table 2, which presents data taken from the *Great Soviet Encyclopaedia*, quite convincingly demonstrates the success of collectivisation based on quantitative data. These figures are, however, regularly missing the period of 1923–1928, because in this period, production was so high that it would completely overshadow the image of successful collectivisation (Kamenshchik, 2003).

The established *kolkhozes* gradually gained a considerable social function in many places,

years	1900–1904	1905–1909	1910–1914	1928–1932	1933–1937
yields q/ha	7.0	6.6	7.3	7.5	9.1
Total grain production (mil. q)	563.8	566.8	675.6	735.9	944.7

Source: Great Soviet Encyclopaedia

Table 2: Production and grain yields in Russia and USSR in 1900–1937.

because they provided livelihood and fulfilled social and cultural functions: building schools, libraries, securing the sale of goods and transportation even in very remote areas.

Post-Soviet era

Nevertheless, at the beginning of the 1990s, the agriculture went through another post-communistic transformation, this time to privatisation. Again, a quite insensitive process was chosen, and during the privatisation, rather than transformation, the functioning system was damaged, again followed by a rapid decrease in production and the number of animals bred.

Especially in some Union republics, *kolkhozes* were bound very closely to people from specific villages, and they had a significant social function that was completely lost with their abolition. In Soviet Central Asia, the agricultural sector played and still plays a big role, and in areas with specific weather conditions, in extensive pastoral livestock husbandry in particular. Pastoral livestock husbandry always significantly affected the whole culture, both in its material and spiritual parts. When the agricultural transformation was performed, however, significant changes were carried out. Former large farming units (*kolkhozes*, state farms), which had a significant social function in addition to agricultural production, fell apart. Families (together with other relatives), which had partially undertaken the social function previously belonging to *kolkhozes* and state farms, became a basic production unit. The family institution also went through changes, but in many respects, the patriarchal nature remains.

In pastoral farming methods, animals began to be grouped into herds again, grazed by *chabans* for themselves and their relatives. The hiring grazing method resumed, where *chabans* graze animals for people other than their relatives as well (Kokaisl, Pargač, 2006).

On the one hand, in post-soviet republics, there was evident inevitability of the privatisation in the agricultural sector, because of the transformation of the entire national economy and its transformation to the market economy. These all-society changes concerned the entire system including agriculture. On the other hand, under the slogans of the transition from the centrally planned economy to free market economy, agricultural enterprises were privatised quite at a flat rate, regardless of their economic results and interests of their employees or management of such enterprises.

Situation in Tajikistan is a good example of an extremely bad transformation. Privatisation took place entirely according to recommendations by the world's most influential financial institutions, the World Bank and the International Monetary Fund. However, these recommendations very often came from one universal pattern and took very little notice of the socio-economic particulars of each region, or even of entire countries. The uniform character of privatisation recommendations were common to African as well as Latin American and Asian states, and also for states facing problems of post-socialist transformation. In effect, the given recommendations were commands, because states that did not follow them could not obtain loans and financial resources they needed for their development. For this reason, they were trying to get a positive assessment and present statistical data documenting the rapidly declining number of state and semistate enterprises. This indicator tends to have a greater value as a criterion of transformation success. The methods and impact of the privatisation are considered rather as marginal issues.

These matters were nonetheless fully relevant for the Tajik agriculture. The number of *kolkhozes* and state farms rapidly declined, from 348 down to 152 (44% of the original number) state farms, from 387 down to 185 (48% of the original number) *kolkhozes*, and from 13 down to 6 (46% of the original number) large agricultural companies during the period of 1996–2002 (Seľskoye khozyaystvo… 2003).

The mentioned figures, however, do not highlight the full loss of the state farms that (as a state property) were subjected to obligatory privatisation,

	Minimum (2004-2006=100%)	Year	Maximum (2004-2006=100%)	Year	Current production (1992=100%)
Kazakhstan	61.65	1998	144.86	1992	98%
Kyrgyzstan	65.81	1995	108.33	2011	128%
Tajikistan	56.81	1999	129.88	2011	151%
Turkmenistan	42.75	1996	117.97	2007	184%
Uzbekistan	74.78	1996	134.14	2011	165%

Source: FAOSTAT database, FAO Statistics Division 2013

Table 3: Minimum, maximum, and current percentage of agricultural production from 1992 to 2012.

because many of them showed a very high degree of economic efficiency.

In the case of *kolkhozes*, the situation was different. Even though principles of common decision-making and *kolkhoz* property ownership in Soviet era were often only formalities, the state (sovereign post-Soviet Tajikistan) did not have a legal right to decide about their flat-rate liquidation. The decision of the state to restructure *kolkhozes*, which in fact meant their absolute liquidation, was just such a state intervention, which made it completely impossible to apply the property rights of members of *kolkhozes*. The state progression was justified by the state effort to increase production efficiency and reduce government expenses, which would be sent to the social sphere, but after some time it is more evident that even these partial goals remained largely unfulfilled. On the contrary, now it is evident that many *kolkhozes* were pioneers in the effort to introduce market principles into their economy even in the Soviet era and worked completely without any state grants; these *kolkhozes* significantly contributed by their own production into the state budget.

The table 3 (FAOSTAT database, FAO Statistics Division 2013) shows the percentage of agricultural production from 1992 to 2012 (Index 2004–2006=100). From to this table, it is not apparent at first glance that the fastest and deepest agricultural transformation after the collapse of the USSR was conducted Kyrgyzstan and that by contrast transformations in Turkmenistan and Uzbekistan took place the slowest among all the Central Asian states. Turkmenistan, of all Central Asian states had the largest decrease in production, while on the other hand the smallest is seen in Uzbekistan. Kyrgyzstan, a country with the fastest reforms, has a fall in production that was not as big as that in Turkmenistan, but current production compared to 1992 is only 20% higher. Kazakhstan has a current agricultural production even lower than in 1992,

but it is the only Central Asian state that is food-self-sufficient.

Conclusion

During the socialistic transformation in the USSR, first peasants obtained land allocations, just to lose it several years later during the collectivisation. All the poorer farmers, especially the ones with not really good morality, felt it was their chance to influence the future of the countryside.

Intensified class struggle was programmatically controlled from higher positions in the state, within which forced agricultural collectivisation had also been carried out, resulting in the destruction of political opposition (in some cases also potential opposition). In the countryside, the poor lacked land and small farmers, owners of minor lands, hardly big enough to feed their own families, were punished for having what they did. In many places, hateful attitudes of poorer rural classes were reinforced by the superior behaviour of rich landlords toward poor rural people. Human envy together with poverty also contributed.

Another feature of the Soviet collectivisation was haste and absurdity in establishment and management of cooperative farms as well as, under the guise of the class struggle, a liquidation of the highest party and state representatives, who threatened or could threaten the governing group.

The main problem was a total lack of trained personnel who would be able to lead the newly created large farms. It was evident that collectivisation makers took too big a bite, which was clearly beyond their capabilities. In this phase of the collectivisation, the poorest social groups were less painfully affected but at the same time, this group was least qualified.

Groups that suffered a painful loss of property largely lost any motivation to further engage

in transformation steps, and for ideological reasons their involvement in management of emerging *kolkhozes* was refused. *Kolkhozes* could not be led by the former exploiters, but only by people with a good relation to the new order.

Remedies to injustices caused by the Soviet collectivisation began almost immediately after Stalin's death. Over the course of three years, approximately ten thousand political prisoners were released in the Soviet Union; after the 20th Congress of the Communist Party of the Soviet Union, the door was opened to relative freedom and rehabilitation for several million others, although some unjustly convicted people had to wait for full rehabilitation until the 1980s or 1990s.

It took several decades before the transformation of cooperative farms developed into prosperous firms led by qualified people. With the benefit of hindsight, we can say that large-scale farming has considerably higher competitiveness compared to small, fragmented farms. This fact was also accepted by those who were personally affected by the forced collectivisation.

Establishing cooperative farms would be clearly beneficial if it was done on a voluntary basis and based on the real needs of farming peasants. However, using disorganised and violent methods when establishing socialistic cooperative farms necessarily took a big toll on the populace and the economy: transformation shock together with a huge drop in production, breaking up many families and eradicating entire cultures. These negative phenomena could have been avoided by using more sensitive initial practices.

Statistical data from *Food and Agriculture Organization* shows that in the case of the Central Asian republics, none of the transformation methods can be retroactively designated as the best. Countries that implement a quick-shock agricultural transformation in a relatively short period of time involving large ownership changes, including significant changes in the structure of crops, gained no advantage. After twenty years, their agricultural production is comparable to the production states that performed agricultural transformation significantly more slowly.

It turns out that any violent or rapid implementation of reform is very damaging, and these after-effects cannot be removed even after a long time; often it is a matter of multiple generations. It is a pity that the initiators of reform often do not learn from past mistakes, resulting in hastiness and insensitivity in implementation.

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Selected Aspect of the Microbreweries Boom

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Anotace

Článek si klade za cíl na základě tří kvantitativně deklarovaných hypotéz podchytit důvody vzniku minipivovarů v ČR, jejichž počet narůstá setrvale od roku 1991. V hypotézách definovanými vysvětlujícími aspekty jsou nárůst koncentrace a tedy i pokles počtu výrobních jednotek v segmentu průmyslových pivovarů, kvantitativní vliv spotřeby piva a konečně opět kvantitativně definovaný demografický aspekt. Na závěr jsou výsledky zobecněny.

Klíčová slova

Minipivovar, pivo, průmyslový pivovar, demografie, CAMRA.

Abstract

This article aims to use three quantitatively stated hypotheses to determine the reasons for the rise of microbreweries in the Czech Republic, whose numbers have been growing constantly since 1991. The explanations defined by the hypotheses are concentration growth, and thus the fall in the number of units of production in the industrial brewery segment, the quantitative impact of beer consumption, and finally again a quantitatively-defined demographic aspect. The results are summarised and elaborated on in the conclusion.

Key words

Microbrewery, Beer, Industrial Brewery, Demography, CAMRA.

Introduction

The aim of this article is to identify and analyse the reasons for the appearance of a large number of microbreweries in the Czech Republic.

The above-stated aim will be achieved by verifying or rejecting these three hypotheses:

1. there is a statistical significance between the number of microbreweries and industrial breweries,
2. there is a statistical significance between the number of microbreweries and beer consumption,
3. there is a statistical significance between the number of microbreweries and the number of males between the ages of 25 and 39 years.

Beer consumption has a powerful cultural role in many societies (Carroll, Swaminathan, 2000; Kirkby, 2003; McAllister, 2003, 2006). Today, microbreweries are doing well, not just in the Czech Republic, but also in many countries worldwide. The United States is without doubt the pioneer in microbrewing, as evidenced in particular in the fact that the concentration of the brewing industry there achieved extremely high values, while at the same time there was also a massive product harmonisation. In the eyes of many consumers, these huge and now multinational brewing companies had lost their identity. The producer's identity may very well be the primary attraction for consumers. (Boisard, 2003; Guy, 2003). The American brewing industry witnessed a spurt of new foundings beginning in the late 1970s (Swaminathan, 1998).

The first American microbrewery was opened in 1976 and was called New Albion Brewing. It was founded by Jack McAuliffe. It was in fact the first completely new brewery to open since the end of prohibition in the USA in 1933.

Only top-fermented beer was produced. Although the brewery had to close in 1982 for economic reasons, it triggered a revolutionary change in the brewing industry in the USA. The United States also came up with the term 'craft brewery'. Because of the huge size of the American market in particular, many of its microbreweries were so successful that they grew to sizes more typical for industrial breweries, although their spectrum of customers did not undergo much change. It is these breweries for which the term 'craft brewery' is used. A typical example is Samuel Adams, which currently has an annual production of around 3m hl.

Also important would be Anchor Brewing Company, the pioneer of American microbreweries (Carrol, Wheaton, 2009). Its story begins in 1896, and in the 1960s it was one of the last breweries which hadn't been swallowed up by one of the large brewing companies. It was protected by Fritz Maytag when he purchased a 51 % controlling interest in the company in 1965. The price for this transaction can no longer be found, but Yenne (2007) states that it was for the 'price of a second-hand car'. A completely new era of the brewery began; in 1971 the first batches of bottled Anchor Steam Beer were produced and over time another half-forgotten beer style was remade. In 1995 there were over 100 microbreweries operating at very small scales. (Pinkse and Slade, 2002). By 2006 there were an estimated 1390 microbreweries, brew-pubs and craft brewers in the United States, making up 3.6% of the market volume (Tremblay, Iwasaki,Tremblay, 2005).

Nearly every one of the breweries founded in the intervening period associated itself in some way with the self-labelled „microbrewery" movement, a group of brewers and consumers concerned with craftsmanship and taste in brewing beer. (Carroll, Dobrev and Swaminathan, 2002). The mass production brewers had already seen much of the market for their high-end products, the so-called superpremium beer category, erode because of competition from the microbreweries (Van Munching, 1997). Consider again the American beer brewing industry - its market was virtually stagnant before the microbrewery movement. Specialty brewers tapped new beer business, bringing in new customers for as much as half of their markets (Backus, 1999).

In addition to the USA, a number of other countries are experiencing a boom in microbreweries, countries such as the United Kingdom. Here,

however, the situation was somewhat different to that in the USA. Traditional British ales were slowly losing out to lagers, especially those produced by multinational companies. In the UK, an indication is the emergence of the Campaign for Real Ale (CAMRA) in reaction to the loss of traditional (handpumped) beers (Wells, 2013). CAMRA was founded in 1971. It is a consumer organisation and as such we can conclude that while in the USA the trigger for the microbrewery revolution came from the supply side, in the United Kingdom it was clearly demand. In 2011 the UK Society of Independent Brewers reported membership had doubled since 2002 to reach 463 enterprises offering 2500 cask beers, with 3500 seasonal beers and 1750 bottled brands (SIBA, 2011). As with the US microbreweries, there is a very different market proposition involved with high priced, often seasonal beers, of high quality, often alongside local food, made by and for enthusiasts (Schnell and Reese, 2003). These small-scale breweries mostly serve local and regional markets. Equally, Baldacchino (2010) observes that many island economies have their own breweries. Local patriotism is a phenomenon specific for certain commodities, such as – in our case – beer or football clubs (Chmelíková, 2013)

It would be appropriate to first of all define the expression 'microbrewery' under Czech conditions. Czech law does not recognise the term ¬ 'microbrewery'. 'Microbreweries with an annual production capacity of up to 10 000 hl of beer and which are small independent breweries in accordance with Section 82 of Act 353/2003 Coll. on excise duties' are able to become members of the Bohemian-Moravian Association of Microbreweries, which was founded in 2011 as a professional organisation defending the interests of microbreweries in the Czech Republic. Nevertheless, **the typical microbrewery can be defined in somewhat more detail as follows**:

1. Production of no more than 1 000 hl/year,
2. Does not have its own distribution network
3. Does not export its products
4. Its products are not available in standard stores.
5. Most of its production is usually consumed in its own restaurant and bar premises.
6. It is not owned by a larger company, with the owner usually one person, or a legal entity made up of a small number of people.

7. The owners are not just involved economically in the sector, but are also enthusiasts

8. The business strategy is not just dependent on economic interests

9. Beer is only very rarely bottled in glass bottles; PET plastic bottles are much more commonly used.

Industrial breweries, which can be considered the opposite of microbreweries, began to appear during the industrial revolution, gradually displacing small breweries. The last small brewery in the Czech Republic was closed at the time economy was centrally-planned. The only small brewery, a microbrewery, to survive this period was U Fleků microbrewery. Sometimes the U svatého Tomáše brewery is incorrectly said to have done so, but this stopped producing beer in 1951 and this misinformation probably comes about because a celebrated dark beer was later served here. This beer, however, was imported first from Nusle brewery, and later from Braník brewery.

The first microbrewery subsequent to 1989 was opened in 1991 in Svinišťany and was called Meloun; it closed down in 1998 for economic reasons. In the same year as Meloun, a microbrewery was opened in Babice, but this closed down in 2002; in this case, however, it was more of a home-brewing set-up. The oldest microbrewery still working today founded after 1989 is Pivovarský dvůr Chýně, which was founded in 1992, the same year the microbreweries Pegas in Brno and Kvasar in Sentice were founded.

Graph 1 shows the growth in the number of microbreweries in the Czech Republic, not taking account of numbers of breweries closed. The data for the number of microbreweries for 2013 is valid to the end of July, so it can be expected that by the end of 2013 the number will be around 190. As such, the Czech Republic is the country with the highest growth in microbrewery numbers in the world.

The most common cases where owners set up microbreweries are the following:

1. a current home-brewer who has had some success and begins to brew beer commercially; an example is Staňkův rukodělný pivovárek in Prague,

2. a restaurant owner or operator who decides to provide his own beer in addition to traditional industrial brewery brands, either from an extra tap, or completely replacing the products previously offered; an example is Biovar microbrewery in Ostrava,

3. a former brewery employee who for one reason or another opens a brewpub; an example is Krkoška microbrewery in Liberec,

4. a business plan is made; an example is U krále Ječmínka microbrewery in Prostějov,

5. a part of a larger business plan; an example is Pivovarský dvůr in Plzeň,

6. a commercial brewery experiment; an example is Jeník or Litovel,

7. renewal of production; an example is Dalešice microbrewery.

Sometimes a combination of the above applies.
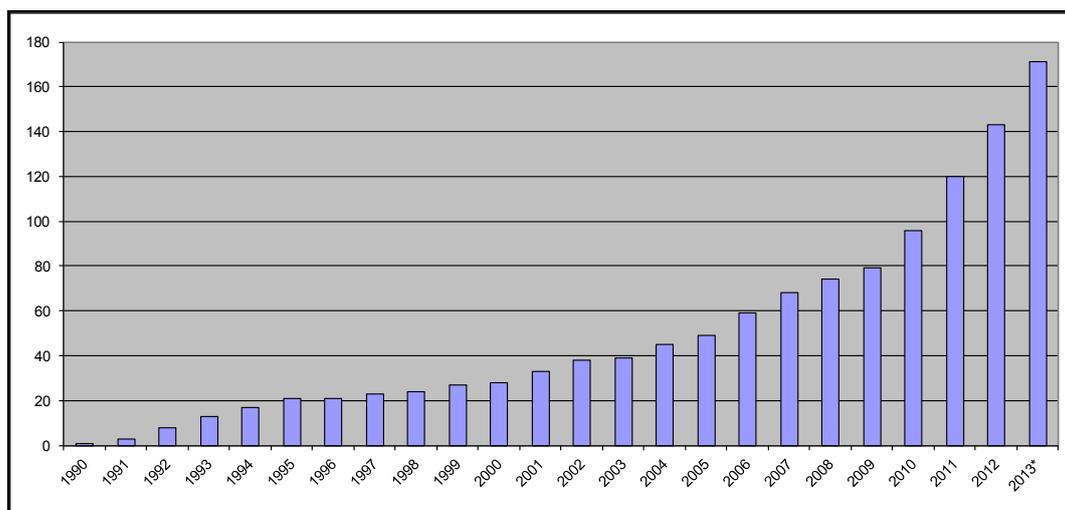
Source: Own calculations (* means end of July 2013)

Graph 1: Number of microbreweries development in the Czech Republic after 1990.

The majority of the variation in the performance of microbreweries stems from differences in the management, organization, or market of individual breweries (Wesson and De Figueiredo, 2001). The rise of microbreweries and brewpubs resulted from the authenticity appeal of their organizational forms (Carroll and Swaminathan, 2000).

The market structure of microbreweris comparing to industrial breweries is very similar to polypostic. In case of industrial breweries is oligopolistic with strong price leader (company Plzeňský Prazdroj, member of SABMiller). The oligopoly means a market form in which a market or industry is dominated by a small number of sellers (Špička, 2013).

Materials and methods

Regression analysis is used to quantify the relationship between variables both in linear form:

$$y = \gamma_1 + \gamma_2 x_2 \qquad (1)$$

and power form:

$$y = \gamma_1 x_2^{\gamma_2} \qquad (2)$$

where nevertheless using the standard least squares method to estimate the equation requires the use of a logarithmic transformation

$$\ln y = \ln \gamma_1 + \gamma_2 \ln x_2 \qquad (3)$$

The parameter γ_2 here expresses elasticity.

Data with an annual periodicity was used for quantification; for the first two hypotheses, time series with a length of 23 periods were used, and a length of 17 periods for the third hypothesis.

Data was obtained for the number of microbreweries and industrial breweries through my own research, and data on beer consumption and the number of males in the population was obtained from the Czech Statistical Office.

Quantitative estimates were made using the Gretl software package.

Results and discussion

1. Relationship between number of microbreweries and number of industrial microbreweries

In 1990, there were a total of 70 industrial breweries, and as mentioned above, just one microbrewery. By 2012 a total of 26 industrial breweries were closed, while the number of microbreweries rose to 142.

As Table 1 makes clear, there is a strong statistical significance between the number of microbreweries and industrial breweries at a significance level of better than 0.00001. This is a power dependency, so the structural parameter 5.77 (after rounding to two decimal places) can be interpreted as the percentage of opened microbreweries for each one percent of closed industrial breweries. The co-efficient of determination also has a good value, achieving a value of 0.75, or 0.74 after correcting for the number of degrees of freedom.

2. Relationship between number of microbreweries and consumption

Until roughly 2009, beer consumption per head was more or less stable, significantly falling in 2008, more so in 2009. This is the exact time when there was a massive growth in the number of microbreweries.

	Coefficient	Std. Error	t-ratio	p-value	
const	26.4106	2.90693	9.0854	<0.00001	***
industrial	-5.76797	0.727325	-7.9304	<0.00001	***

Mean dependent var	3.377214	S.D. dependent var	1.126267
Sum squared resid	6.985689	S.E. of regression	0.576760
R-squared	0.749675	Adjusted R-squared	0.737755
F(1, 21)	62.89107	P-value(F)	9.47e-08
Log-likelihood	-18.93183	Akaike criterion	41.86367
Schwarz criterion	44.13466	Hannan-Quinn	42.43482
rho	0.508074	Durbin-Watson	0.464481

Source: own processing

Table 1: OLS, using observations 1990-2012 (T = 23) Dependent variable: microbreweries.
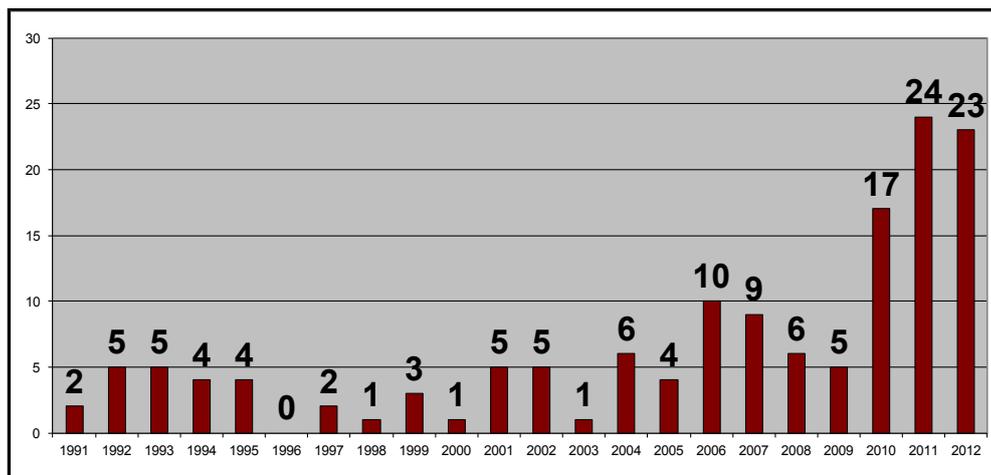
Source: Own calculations

Graph 2: Numbers of breweries – year-on-year differences.

	Coefficient	Std. Error	t-ratio	p-value	
const	602.214	162.996	3.6946	0.00135	***
consumption	-3.56976	1.04303	-3.4225	0.00256	***

Mean dependent var	44.78261	S.D. dependent var	37.09932
Sum squared resid	19437.81	S.E. of regression	30.42384
R-squared	0.358062	Adjusted R-squared	0.327494
F(1, 21)	11.71346	P-value(F)	0.002559
Log-likelihood	-110.1396	Akaike criterion	224.2792
Schwarz criterion	226.5502	Hannan-Quinn	224.8504
rho	0.777719	Durbin-Watson	0.421612

Source: own processing

Table 2: OLS, using observations 1990-2012 (T = 23) Dependent variable: microbreweries.

It is clear to see (Graph 2) that the quantitative period of extreme growth in net number of microbreweries unequivocally corresponds with the fall in beer consumption. The net number of breweries means the number of microbreweries from the previous period (year) plus the number of microbreweries opened during the year in question, minus the number of microbreweries closed during the year.

In this case (Table 2), the dependency is given by a linear relationship, so you can say that a fall in consumption of one litre per head results in the opening of 3.57 microbreweries.

3. Relationship between number of microbreweries and number of males in the age category 25 – 39 years

The basis for this quantitative relationship is the assumption that the greatest consumer group

for microbreweries is comprised of men between the ages of 25 and 39. They are sufficiently old to be economically independent, and also sufficiently young to want to experiment and not just stick to the well-established brands of large industrial breweries. According to the Czech Public Opinion Research Centre, 90% of males and just 57 % of females consumed beer between 2004 and 2014. Furthermore, the President of the Bohemian-Moravian Association of Microbreweries (Českomoravský svaz minipivovarů) estimated in 2012 that the strongest consumer group is comprised of people between the ages of 25 and 45 years.

Again (Table 3), a power function appears most appropriate due to the very close correlation of 0.92. The regression is significant even at a very high significance level, and it can be interpreted that a one-percent growth in males between 25 and 39

	Coefficient	Std. Error	t-ratio	p-value	
const	-63.4019	4.98451	-12.7198	<0.00001	***
men_25_39	4.95731	0.367306	13.4964	<0.00001	***

Mean dependent var	3.868676	S.D. dependent var	0.595844
Sum squared resid	0.432190	S.E. of regression	0.169743
R-squared	0.923917	Adjusted R-squared	0.918845
F(1, 21)	182.1525	P-value(F)	8.54e-10
Log-likelihood	7.090929	Akaike criterion	-10.18186
Schwarz criterion	-8.515432	Hannan-Quinn	-10.01621
rho	0.637548	Durbin-Watson	0.737696

Source: own processing

Table 3: OLS, using observations 1996-2012 (T = 17) Dependent variable: microbreweries

years of age would result in a 4.96% percent growth in the number of microbreweries. The number of males in this category rose over the whole of the period monitored except for 2012.

Conclusion

The process of founding breweries in the Czech Republic has been going on for more than two decades now, although there was a significant acceleration in 2010, and in 2012 and 2013 the Czech Republic has had the greatest rate of growth in the world. Somewhat paradoxically, this boom has fully expressed itself during a period of global economic crisis, but the reason may well be that consumers are trying ever more to consider their outgoings, and it can also relate to a greater identification of consumers with regional production. So the greatest acceleration in the number of microbreweries has coincided with a fairly significant decrease in beer consumption.

Demographically, the growth in the number of microbreweries is to a large extent influenced by the very strong generation of consumers aged between 25 and 39 years, who are not afraid to experiment and who basically from adulthood have had the opportunity to travel freely and as such take note of the microbrewery boom in the West which took place during the 1980s and 1990s. It is this age group in particular which demands a greater extent of beer styles than that offered by industrial breweries. *The microbrewery movement resembles a true social movement in many respects (Carroll, 1997; Swaminathan, Wade, 2001)*. An example would be wheat beer, which about 150 years ago was the most common on the territory of today's Czech Republic, but which was very quickly supplanted by Czech lager, making Bavaria the home of wheat beer. Today, thanks in no small part to travel, this beer style is undergoing a major renaissance here.

Microbreweries will never be fully-fledged competitors to industrial breweries; their average production costs per unit are too high, which is why microbreweries generally don't try to compete price-wise with industrial breweries. As such, these are two more-or-less autonomous sectors, which do, however, influence each other, and it can be said that it is industrial breweries which are more influenced by microbreweries than vice-versa, at least in terms of product innovation. This is because microbreweries are much freer to experiment, and microbrewery's consumers are much more likely to overlook sensory imperfections in their products than is the case for industrial breweries.

Another major trigger for the founding of new microbreweries is the stagnation of the conventional market for beer and its oligopolistic structure, which a section of consumers have always perceived somewhat negatively, just as was the case in the United States, where in the 1970s in particular there was even greater product harmonisation than in the Czech Republic.

Although some speculation is required, it may not be too much of an exaggeration to claim that the Czech market for beer is now slowly approaching what it would look like if the natural development of the market had not been interrupted by nationalisation and subsequent central planning.

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Technical Efficiency of Organic and Biodynamic Farms in the Czech Republic

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Anotace

Cílem článku je vypočítat na panelových datech za roky 2005–2012 technickou neefektivnost resp. efektivnost biodynamických farem a porovnat ji s ekologickými. S využitím stochastické hraniční analýzy a t-testu jsme ověřovaly, jestli biodynamické farmy jsou při užívání svých vstupů méně efektivní než ekologické farmy. Byl také zjišťován vliv dotací na produkční schopnost a technickou neefektivnost farem.

Průměrná neefektivnost biodynamických farem byla vymezena ve výši 58.09 % a ekologických ve výši 28.60 %, přičemž byly zjištěny statisticky významné rozdíly mezi oběma skupinami. Zatímco přímé platby a podpory z fondu EAFRD produkci obou skupin zvyšovaly a ostatní dotace ji snižovaly, všechny typy dotací snižovaly technickou neefektivnost.

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Klíčová slova

Biodynamické a ekologické zemědělství, technická efektivnost, stochastická hraniční analýza.

Abstract

The aim of this paper is to estimate based on panel data from 2005–2012 the inefficiency and efficiency of biodynamic farms and compare it to the organic. Using stochastic frontier analysis and t-test we tested whether the biodynamic farms are less efficient in using their inputs than organic farms. Another concern was the impact of subsidies on the production and technical inefficiency of the farms.

The estimated average inefficiency of biodynamic was 58.09 % and of organic farms 28.60 % and we found statistically significant differences between both groups. While the direct payments' and support from EAFRD fund increased the production of both types of farms, and other subsidies' decreased it, all type of subsidies decrease the technical inefficiency.

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Key words

Biodynamic agriculture, organic agriculture, technical efficiency, stochastic frontier analysis.

Introduction

Biodynamic agriculture was developed based on a series of eight lectures by Rudolf Steiner in 1924 as one of the first responses to the proliferation of chemical usage in agriculture (Paull, 2011). Current biodynamic agriculture is a form of organic farming that, in addition to the common tools of organic agriculture, as soil building,

composting, and crop rotations (Matteo et al., 2013), uses specific biodynamic preparations (Steiner, 2004) as compost additives and field sprays. These preparations are included in the list of materials and techniques permitted in organic farming by an EC Regulation (834/2007). Biodynamic agriculture became the subject of surveys during the past decades. The existing researches in this area are more focused on the effects

of biodynamic preparations and their impact on soil and crop quality and profitability, as well as impacts on the physical, chemical and biological properties of soil (e.g. Turinek, 2011; Matteo et al., 2013), whereas an economic efficiency of biodynamic farms was never (as far as we are concerned) examined.

In this paper, the frontier production function models are proposed and estimated with a panel data on Czech organic and biodynamic farms. The structure of the article is as follows. After the introduction to the problematic of the technical efficiency measurement, the methodology is presented. In the results section the alternative models are estimated and the inefficiency is calculated. Last section summarizes the results and brings conclusions.

1. Technical efficiency of organic farms

Organic agriculture is a form of land management where the use of chemical inputs is limited; hence it is more environmental friendly. It contributes to animals' welfare, human health, environment protection and biodiversity. Biodynamic agriculture goes beyond and relates the land management with philosophy. Like organic agriculture, biodynamic agriculture has a certification process. The need to comply with set rules has the impact on farms' performance. "Competitiveness is influenced by the duties and restrictions resulted from the observance of the rules of law and as well by the prices that do not often relate to the quality of production." (Jánský et al., 2006)

Despite having higher market prices of organic products, the profitability of organic farms might be lower if the productive differential between conventional and organic is not compensated. The lower productivity is an argument for justification of financial support. Organic farms can benefit not only from direct payment – Single Area Payment Scheme (SAPS) per hectare of agricultural land, but moreover they obtain support from agri-environmental measures (AEO). Until 2013 also national subsidies (Top-up) were available. However, their effect on the farm economic results is not only positive. Subsidies might support the survival of inefficient farms and further lowers their competitiveness. Such an ambivalent effect of public support has already been observed in many studies. For example Bakucs et al. (2008) analysed the impact of the entrance to the EU on the Hungarian farmers and concluded that the subsidies together with technological progress had negative impact

on the otherwise positive development of the technical efficiency of the farmers. Kumbhakar et al. (2009) proclaimed that only technically efficient organic farmers should be compensated. In other words, the finances might be provided only to the farms, where the productivity differential is due to technological difference and not due to technical inefficiency. "Subsidies should be designed in a way that they do not promote inefficiency." (Kumbhakar et al. 2009)

Technically efficient production is defined as "the maximum quantity of output attainable by given input" (Pitt and Lee, 1981). Regarding the technical efficiency of organic farms in the Czech context a study of Kroupová (2010) can be mentioned. She concluded that organic farmers are by 13.5 % less efficient in comparison with conventional farms. „In average, the organic farms are moving on 55.1 % of the potential production, although 50 % of surveyed organic subjects achieve less than 50.1 % of the technical efficiency" (Kroupová, 2010). Čechura (2012) used the Fixed Management model for the estimation of technical efficiency and the construction of TFP for the total agriculture and its individual branches. He came to the conclusion that "technical inefficiency is an important phenomenon in Czech agriculture and its individual branches" Čechura (2012).

The influence of EU's subsidies on the technical efficiency of the Czech agriculture was examined by Čechura and Matulová (2011). They used model with random parameters to estimate stochastic frontier (SF) of different sectors and examined the technical efficiency and the impact of the subsidies on it. They found out that the differences in technical change between livestock and plant production were not statistically significant. Hence, the direct payments meant to support this change did not motivate the farmers to invest into new technologies. Antoušková et al. (2011) assessed the impact of subsidies on the production ability, cost efficiency, and profit of the conventional and organic farms. They found that cancellation of the payment on permanent grasslands and lowering of the payment on arable land would contribute to the profit and production increase. Malá et al. (2011) examined the subsidies effect on the farms in plant sector. They concluded that direct payments lower the amount of production. In livestock production, the effect of payments tied to hectares is only indirect via own feed production and consumption while hog and poultry producers do not receive subsidies at all. Trnková et al. (2012)

examined the effect of subsidy policy on technical efficiency of livestock production. They estimated frontier function using Battese and Coelli (1992) model with heterogeneity and found that subsidized farms produce only 44.6 % of the potential product, while those without subsidies achieve 60.4 %.

Materials and methods

The aim of this paper is to estimate based on panel data from 2005–2012 the inefficiency and efficiency of biodynamic farms and compare it to the organic. The analytical part utilizes the data from the organic farmers register administrated by the Ministry of Agriculture of the Czech Republic. It contains the information about the total farms' acreage. This database was combined with Albertina (managed by Bisnode Česká republika, a.s.) which includes bookkeeping information from balanced sheets and profit and loss statements of the legal persons. Prices indexes were obtained from Czech Statistical Office. The amount of subsidies received by each farm was acquired from database of State Agricultural Interventional Fund. Official prices of farmland came from a study of Pírková (2013).

In order to assess the technical efficiency of the organic and biodynamic farms, SFA was used. We considered alternative specifications of "true" fixed effect (TFE) model as suggested by Green (2002) and estimated Cobb-Douglas production function. Subscript i ($i = 1, 2, ..., N$), where N is total number of farms, represents particular farm and t ($t = 1, 2, ..., T$) stays for a time period for which are available farm's observations. Company's production (y_{it} – output) is represented by the sales of own products and services and change of the stock of own activity in particular year (in thousands of CZK). In order to remove the impact of price changes, the production was deflated by the price index of agricultural producers for particular year (2005 = 100).

Material ($x_{1, it}$) is represented by the amount of consumed material and energy by $i^{(th)}$ farm in time t. To remove the influence of price changes from data it was deflated by the industrial producers' price index (2005 = 100). Similarly capital ($x_{2, it}$), consisting of long-term assets of $i^{(th)}$ farm in time t was deflated.

Labor ($x_{3, it}$) is calculated as the division of personal costs of $i^{(th)}$ agricultural holding in time t by average wages in agriculture in particular region. The data for wages were available for years

2005 to 2010, for others were estimated from linear trend function. For companies with no employees was assumed that there is at least one owner and the labor input was set to 1.

The acreage of farmland (input land – $x_{4, it}$) was corrected to take into account land quality. The actual land price for $i^{(th)}$ farm was multiplied by normalized (official farmland price in a region divided by the maximum price from all regions in particular year). Official prices of farmland in the Czech Republic are on the basis of quality soil-ecological unit (BPEJ) and reflect the climatic region, type of soil, slope, exposure, and depth of the soil profile and stoniness. The data were available for years 2009–2012, but as the prices were not much volatile, they were predicted for other years by linear trend function.

Sum of SAPS and Top-up subsidies was included in variable x_5. Subsidies related to the AEO were summarized with support for Less Favored Areas (LFA) and Rural Development Program (RDP) in variable x_6. Variable x_7 contained all other direct payments.

We used dummy variable (*Dummy*) taking value of 1 when the farm was biodynamic. Dummy variables were utilized also to distinguish the region where the farm was situated. The composite error term consisted of the noise and inefficiency ($\varepsilon_{it} = v_{it} - u_{it}$)·

First approach towards the assessment of the subsidies' effect is to estimate the SF function, quantify the inefficiency and then in second step construct separate inefficiency function, where the u_{it} is explained by various factors. Despite being widely used, this procedure violent the basic assumption about the inefficiency term (i.e. that it is independently distributed). Therefore, better approach, which we also used, is to include the subsidies directly in the SF function. As suggested by Kroupová (2010) we considered subsidies and localization of the farm as explanatory variable in linear function of the variance of the inefficiency term. We only changed the localization in LFA for the region.

Model A

We considered the inefficiency term to be homoscedastic, i.e. with constant variance. The SF function (1a) linearized as (1b) consisted of production factors (inputs) and a dummy variable for biodynamic agriculture (added in non-logarithmic form).

$$y_{it} = x_{1,it}^{\beta_1} . x_{2,it}^{\beta_2} . x_{3,it}^{\beta_3} . x_{4,it}^{\beta_4 \,^{it}} . e^{u_{it}} . e^{v_{it}} \qquad (1a)$$

$$\ln y_{it} = \beta_1 \ln x_{1,it} + \beta_2 \ln x_{2,it} + \beta_3 \ln x_{3,it} \qquad (1b)$$

The inefficiency term was half normally (2a) and stochastic noise normally distributed (3). These assumptions were similar for all models.

$$u_{it} \sim N^+(0, \sigma^2) \qquad (2a)$$

$$v_{it} \sim N(0; \sigma_v^2) \qquad (3)$$

Model B

Second model was extended to take into account heterogeneity among farms and the heteroscedasticity in inefficiency term (2b). Inefficiency variance function included as explanatory variables constant and subsidies (x_5 – direct payments, x_6 – support from EAFRD including those for organic farming and x_7 – others). The specification of frontier function is the same as stated above (1a, 1b).

$$u_{it} \sim N^+(0, \sigma_{it}^2) = N^+(0, \omega_1 + \omega_2 x_{5,it} + \omega_3 x_{6,it} + \omega_4 x_{7,it})$$
$$(2b)$$

Model C

The specification of the third model enlarged the frontier function of subsidies (1c) and explained the variance in the inefficiency term by dummies for NUTS II regions, where the farm was situated (2c).

$$\ln y_{it} = \beta_1 \ln x_{1,it} + \beta_2 \ln x_{2,it} + \beta_3 \ln x_{3,it} + \beta_4 \ln x_{4,it} +$$
$$+ \beta_0 Dummy + \beta_5 \ln x_{5,it} + \beta_6 \ln x_{6,it} + \beta_7 \ln x_{7,it} +$$
$$+ v_{it} - u_{it} \qquad (1c)$$

$$u_{it} \sim N^+(0, \sigma_{it}^2) = N^+(0, \omega_1 + \omega_5 MS + \omega_6 NE +$$
$$\omega_7 NW + \omega_8 SC + \omega_9 SM + \omega_{10} CM) \qquad (2c)$$

where *MS* represents Moravian-Silesian region, *NE* North East, *NW* North West, *SC* South Bohemia, *SM* South Moravia and *CM* Central Moravia. All regions are compared to Central Bohemia. There was no farm from Prague, therefore the region was omitted.

Farms with incomplete data and those with only one observation (1 farm) were excluded from a sample. Final unbalanced panel of 48 farms (including 4 biodynamic) and time period from 2005 to 2012 contained 293 observations (24 for biodynamic farms).

We compared the estimated models according to Akaike (AIC) and Bayes (BIC) information

criteria. To test the specification of the model we used likelihood-ratio (LR). To calculate the inefficiency of particular farm the Jondrow et al. (1982) estimator was used. The efficiency was estimated via $e^{-E(u|e)}$.

The statistical significance of the differences in mean and standard deviation in technical inefficiency (or efficiency) between biodynamic and organic farms was tested by t-test and F-test. We assumed that biodynamic farms would be less efficient in resources usage than classical organic farms because of technology's specifics.

The calculations were done in econometric software Stata version 11.2. Descriptive statistics and tests were elaborated in software Statistica version 10.

Results and discussion

There were 2 689 organic farms in the Czech Republic in 2009. (Darmovzalová et al., 2010) Since 1990, where there were only 3 farms farming on 480 ha, but since 1992 the number increased every year by average 18.49 %. However, the developments varied from 0.84 % to 64.93 % inter year change. There was mild decrease between 1994 and 1995 due to the problems with certification and in 2004 after the entrance of the CR in EU. Over 10 % of the agricultural land in the Czech Republic is farmed organically, which is above average of the EU. On the other hand, there are only three certified biodynamic farms with average size of 445 hectares (Demeter certificate holders) and few others farming the land in biodynamic way. In spite of limited sample of biodynamic farms; the analysis provides useful view to the problematic. Despite that biodynamic farms use less material, capital and labor, they produce higher average output. On the other hand, they utilize more land, which points out on more extensive way of production.

As expected, the standard deviation of production, labor and land is much higher in biodynamic holdings than in organic farms. In total, standard deviation of production is over two times higher than mean production, standard deviation of consumed material is almost twice higher than an average of it, standard deviation of used capital is also higher than mean (1.5 times) as same as it is the case of labor (1.3 times). Only standard deviation of land is lower than its mean. This points out on huge differences and high heterogeneity among farms. The summary statistics of the panel for years 2005 to 2010 are presented in Table 1.

Type	Var	Mean	Min.	Max.	Std. Dev.
Biodynamic farms	y_{it}	223 406	239	1 187 023	388 059
	$x_{1,it}$	4 402	4	16 691	5 660
	$x_{2,it}$	23 005	368	98 185	33 348
	$x_{3,it}$	20	1	117	36
	$x_{4,it}$	352	7	919	318
Organic farms	y_{it}	56 942	27	720 867	102 074
	$x_{1,it}$	32 045	65	543 283	58 842
	$x_{2,it}$	68 131	655	696 963	102 384
	$x_{3,it}$	101	1	933	130
	$x_{4,it}$	277	.4	847	256
All farms	y_{it}	70 624	27	1 187 023	153 492
	$x_{1,it}$	29 773	4	543 283	56 897
	$x_{2,it}$	64 422	368.1	696 963	99 298
	$x_{3,it}$	94	1	933	126
	$x_{4,it}$	283	.4	919	262

Source: own processing

Table 1: Summary statistics for biodynamic, organic and all farms in a panel.

T-test was used to assess whether there are statistically significant differences in the amount of production between organic and biodynamic farms. It proved that means of both groups are statistically significantly different from each other with the exception of land input. Therefore we included explanatory variables for farms heterogeneity in models B and C. The results of various specification of TFE are discussed below and displayed in Table 2.

1. Model A

Firstly, only explanatory variables of the production frontier were inputs and dummy variable taking value of 1 for biodynamic farm. We supposed that these alternative farms will have lower production than conventional organic farms. All coefficients, with exception of land were statistically significant at least at 0.05 level. As expected, an increase of each production factor (i. e. material, capital, labor and land) causes an increase of the production.

If the farm is biodynamic, the value of production is by 1 959 CZK higher. This might be due to the majority of organic farms in the Czech Republic maintain permanent grasslands and are not realizing this production on a market. According to Darmovzalová et al. (2010), there were 330 thousand ha of permanent grasslands in 2009 which accounts to 82 % of total land in organic agriculture. Hence, the most of the production of farms (grass) is not reflected in sales or stocks (i.e. in production). On the other

hand, biodynamic farms work on self-sustain principle and probably produce more market products.

The coefficient λ implies that the SF function differs significantly from the regular production function. Hence, the technical inefficiency is significant and must be taken into account.

2. Model B

Second model took heteroscedasticity in account. The variance in inefficiency among farms can be caused by various factors which are farm-specific. Firstly, the subsidies were considered because they condition the rational behavior of the farms which consequently reflects in their technical efficiency. Coefficients in frontier function were statistically significant for material, capital and labor. The interpretation of all inputs is similar to this in Model A. Again the highest influence on production had labor.

The results showed that subsidies had positive influence on the inefficiency of the farms. As it can be seen from variance of the inefficiency term function, if the SAPS and Top-up subsidies increase, the inefficiency decreases. The increase of EAFRD finances caused the decrease in the inefficiency as same as the other subsidies. The influence is statistically insignificant for other subsidies and for the constant. However, the influence is very mild. The information criteria (AIC, BIC) and likelihood-ratio test favor this model to Model A.

3. Model C

Another possibility how to assess the differences among agricultural holdings is to include the regions where they farm in a form of dummy variables in the equation explaining variation of the inefficiency term. The model included 6 NUTS II regions (without Prague) which were compared to Central Bohemia. The subsidies were included in SF as one of the inputs in order to assess their impact on production.

As the results show, if material, capital, labor or land input increase by 1 %, the production increase by less than 1 %. Coefficient of dummy variable implies that if the farm is biodynamic, the production is about 9692 CZK higher. SAPS and Top-up subsidies surprisingly contribute to the production increase. Despite that the effect is only mild, it is contrary to the expectations. SAPS were designed by McSharry reform in 1992 to decouple the provided financial support from the production. This was to mitigate former overproduction. Our results are also not in line with those of Malá et al. (2011). They came to the conclusion that "direct payments have a negative effect on the production of [conventional]

	Model A	Model B	Model C
Frontier			
β_1 (ln $x_{1,it}$)	.231366 (.082008)***	.278999 (.969192)***	.5888342 (.036666)***
β_2 (ln $x_{2,it}$)	.23053 (.102507)**	.218020 (.070309) ***	.135924 (.102999)
β_3 (ln $x_{3,it}$)	.431208 (.117102)***	.351256 (.068899)***	.458056 (.122556)***
β_4 (ln $x_{4,it}$)	.316692 (.255802)	.320977 (5.28185)	.118381 (9.141763)
β_0 (*Dummy*)	1.958705 (.442143)***	2.40183 (22.47924)	9.691662 (62.072170)
β_5 (ln $x_{5,it}$)			.0186726 (.006884)***
β_6 (ln $x_{6,it}$)			.000789 (.002250)
β_7 (ln $x_{7,it}$)			-.000461 (.002391)
Inefficiency variance function			
ω_1 Constant		.285698 (244600)	-1.95460 (.817384)
ω_2 ($x_{5,it}$)		-4.03e-07 (1.38e-07) ***	
ω_3 ($x_{6,it}$)		-2.42e-07 (5.52e-08) ***	
ω_4 ($x_{7,it}$)		-6.29e-08 (4.35e-08)	
ω_5 (Moravian-Silesian)			1.180455 (.861589)
ω_6 (North East)			-.034465 (.837477)
ω_7 (North West)			1.613818 (.888546)*
ω_8 (South Czechia)			.959242 (.950446)
ω_9 (South Moravia)			.370090 (.811116)
ω_{10} (Central Moravia)			.651117 (.861244)
Information criteria			
Prob > χ^2	.0000	.0000	.0000
Log likelihood	-52.7185	-9.7445	-11.1084
AIC	205.4369	135.4890	122.2167
BIC	389.1031	348.5418	305.8829
λ	.986848 (.049129)***	.580024	.420721
σ_u	.580024 (.049129)***	.420721 (N/A)	.523008 (N/A)
σ_v	5.88e-08 (5.18e-06)	.127466 (.011326)***	6.49e-07 (6.81e-06)
Returns to scale			
RTS	1.209796	1.169252	1.301195

Note: Estimated standard errors in parentheses; Statistical significance: -) coefficient is not significant, *) α = 0.1; **) α = 0.05; ***) α = 0.01; N/A = not available
Source: own processing

Table 2: Estimated SF – TFE model.

agricultural businesses." Increase in direct payments by 1 % caused decrease in production by 0.19 % in their case. Kroupová and Malý (2010) focused only on organic farms and identified the same impact of the direct payment, but the effect was milder). Increase in direct payments by 1 % caused decrease in production by 0.10 % in the second case. In our case, the increase of SAPS and Top-up causes increase in production by 0.02 % and subsidies from EAFRD (AEO, LFA and investments RDP) increase of 0.0008 %. On the other hand, other subsidies cause mild and not statistically significant decrease of production by 0.0005 %. The impact of the region on inefficiency is statistically significantly only in case of North West. Assessment by the information criteria preferred this model to the previous one.

4. Returns to scale

The sum of variables' coefficients was higher than 1 in all models, hence there are increasing returns to scale. Model A, B and C estimated that 1% increase of inputs causes 1.21%, 1.17% or 1.30% increase of outputs, respectively. This might be explained by the fact that organic farms are large. Despite that the average size of organic farm is steadily decreasing since 2001, when it

was the highest, it is still true, that the acreage of average organic farm is higher than conventional. (Darmovzalová et al. 2010).

5. Efficiency and inefficiency

Estimated models suggested that the inefficiency of organic and biodynamic farms is between 28.93 % (Model B) to 32.40 % (Model A). Model B, where subsidies were included in inefficiency variance function, predicted the lowest inefficiency. However, when the subsidies are added to the production function (Model C), the inefficiency is higher. The farms are using their resources only from 77.73 % (Model A) to 79.30 % (Model B). The comparison of inefficiency and efficiency estimated by each model is presented in Table 3.

6. The differences between biodynamic and organic farms

The hypothesis about lower efficiency of biodynamic farms was tested. Table 4 displays the inefficiency and efficiency estimates for biodynamic and organic farms. It can be observed that biodynamic farms are more inefficient and less efficient than the conventional ones. According to Model C the biodynamic farms produce only 65.94 % of the potential output, while

	Model A	Model B	Model C
Estimated technical inefficiency			
Mean	.324022 (.481949)	.289280 (.431714)	.310360 (.436934)
Min.	2.82e-07	.000010	2.13e-06
Max.	3.900815	3.667509	3.689260
Estimated technical efficiency			
Mean	.777346 (.212949)	.793042 (.190702)	.779671 (.203975)
Min.	.020225	.025540	.024991
Max.	1.000000	.999990	.999998

Source: own processing

Table 3: Estimated technical inefficiency and efficiency.

	Model A	Model B	Model C
Technical inefficiency			
Biodynamic farm	.517502	.517726	.580942
Organic farm	.305587	.268746	.286038
Technical efficiency			
Biodynamic farm	.683780	.680192	.659445
Organic farm	.782825	.803184	.790477

Source: own processing

Table 4: Technical inefficiency and efficiency according to the type of a farm.

	Mean		t-value	p-value	Std. Dev.		F-ratio	p-value
	Organic farms	Biodyn. farms			Organic farms	Biodyn. farms		
Inefficiency	.286038	.580942	-3.217920	.001438	.393756	.728535	3.423316	.000001
Efficiency	.790477	.659445	3.057600	.002440	.271045	.271045	1.954585	.013321

Source: own processing

Table 5: Difference in mean and standard deviation in technical inefficiency and efficiency.

the organic holdings produce 79.05 %. Model B and C give analogical results. Model B predict the highest efficiency of organic farms (80.31 %) and Model B of biodynamic (68.38 %).

Based on the AIC and BIC, we use model C for consequent analysis. The results of the t-test and F-test are displayed in Table 5. We came to the conclusion that there are statistically significant differences between biodynamic and organic agriculture in technical inefficiency and efficiency. These differences are statistically significant both in mean and also in standard deviation (on 0.05 significance level).

As there are no other researches on the biodynamic technical efficiency, it is not possible to compare our results with other findings. However, we can consider the situation to be analogical to the comparison of organic and conventional farmers. It has been proved that conventional technology is more productive and that the organic farms are, on average, less technically efficient than conventional farms. (Kumbhakar et al., 2009; Kroupová, 2010). Therefore our results correspond to the reality. Despite that the biodynamic farms are producing more, their technical inefficiency is higher.

Conclusion

The aim of the paper was to estimate the technical inefficiency and efficiency of the organic and biodynamic farms. Based on SFA and estimation of the TFE model the inefficiency of all farms in the sample was 31.04 % which was according to expectation, but lower than in Kroupová's (2010) study.

Because the organic farming is subsidized, another concern was the impact of subsidies on the production and technical inefficiency of the farms. SAPS and Top-up were decoupled from production in 1992 in order to limit overproduction. Therefore we supposed negative

impact on the production. However, our model predicted slight increase. This shows that direct payments still are not clearly fulfilling their purpose and are not fully decoupled from production. The situation might change after introduction of Single Payment Scheme after 2014, where a single payment per farm will be applied. Subsidies under RDP had positive impact on production possibilities of the farms as expected. Our assumption that subsidies will lower the inefficiency of organic farms was proved. The effect, despite being mild, was even statistically significant with exception of other subsidies. Hence, the financial support for agricultural holdings seems to be justified.

We found statistically significant differences in the inefficiency and efficiency of resources usage between biodynamic and organic farms. The first mentioned produce only 65.94 % of the potential output, while the organic 79.05 %. Therefore, some farmers farming biodynamically should reconsider their stay in a business. If they are not able to use their production factors efficiently, they should rather leave this type of land management and maintain only organic type. This does not mean that they would necessary produce more output in organic regime, but they can increase their efficiency by up to 13.09 %. Another possibility is that they remain in business, but will modify their production technology to be more efficient.

The challenge for future research is to use data also from foreign countries and compare the technical inefficiency among them.

Acknowledgements

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An Assessment of the Differentiated Effects of the Investment Support to Agricultural Modernisation: the Case of the Czech Republic

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Anotace

I když je podpora investic považovaná za klíčový instrument politiky rozvoje zemědělství, bylo jí dosud věnováno jen málo pozornosti v české ekonomické literatuře. Cílem tohoto článku je posoudit ekonomické dopady opatření 121, Modernizace zemědělských podniků PRV pro období 2007-2013. Výzkum je zaměřen na distribuční aspekty podpor a na diferencované dopady podle výrobních podmínek a velikosti podniků. V článku je použit kontrafaktuální přístup využívající přímé přiřazování s možností ošetření heteroskedasticity. Ilustrujeme signifikantní přínosy investičních podpor na rozsahu podnikání (reprezentované hrubou přidanou hodnotou) a zvyšování produktivity práce. Analyzováním souboru žadatelů u opatření 121 poukazujeme na fakt, že velké farmy dostávají co do rozsahu větší podpory než malé farmy. Rozdělením souboru hodnocených podniků podle přírodních podmínek a velikosti demonstrujeme, že přínosy jsou větší na farmách v horších přírodních podmínkách a na středních farmách jak v absolutním tak relativním vyjádření. Když prozkoumáme změny v bankovní zadluženosti, ukazuje se, že v průměru podpory mobilizují další zdroje pro financování investic. Ovšem, na velkých farmách změna bankovní zadluženosti není statisticky signifikantní v důsledku investičních podpor. To se dá interpretovat jako spíš vysoká mrtvá váha u velkých podniků, zatímco v průměru je mrtvá váha nízká. Následně tvrdíme, že opatření by se společensky zefektivnilo, pokud by se zaměřilo na střední a malé zemědělské podniky.

Klíčová slova

Kontrafaktuální analýza, přímé přiřazování nejbližšího souseda, heteroskedasticita, mrtvá váha, modernizace.

Abstract

Despite being considered as a key instrument of the agricultural development policy, the investment support has received only limited attention in the Czech economic literature. The objective of this paper is to assess economic effects of the measure 121 "Modernisation of Agricultural Holdings" of the RDP 2007-2013 on the Czech farms. A particular focus is on the distribution of the supports and differentiated impacts of the supports according to the production conditions and farm size. The counterfactual approach is adopted, deploying direct matching algorithm with the treatment of hereoscedasticity. We show significant benefits of the investment support in terms of business expansion (represented by Gross value added) and labour productivity improvements. Analysing the sample of applicants for Measure 121 we show that large farms get much larger support than smaller farms. By splitting the sample by natural conditions and by size we demonstrate that benefits are higher on farms in less favoured areas and on medium-size farms in both the absolute and relative terms. Investigating the changes in bank indebtedness we yield an indication that on average the support mobilised additional resources to finance the sector investment. However, there is no statistically significant increase of bank indebtedness on large farms due to investment support. In turn, it can be interpreted that deadweight is rather high on large farms, while on average the deadweight of the investment support programme is rather low. Thus, the programme can improve its social efficiency if it is targeted to small and medium size farms.

Key words

Counterfactual analysis, direct nearest neighbour matching, heteroscedasticity, deadweight, modernisation.

Introduction

As we pointed out in our earlier paper (Medonos et al., 2012) encouraging investment activities has always been considered as a principal vehicle for enhancing competitiveness of the Czech agriculture. In spite of their adherence to the investment support instrument, politicians as well as other stakeholders paid only little attention to the investment support programmes evaluation before the EU accession. Also the national scientific literature is rather scarce on agricultural investment in the Czech Republic in general. Medonos (2007) analysed investment behaviour of farms in the effort to assess barriers in farms' access to the financial sources. Řezbová and Škubna (2010) looked at factors affecting investment in farm machinery in the period before and shortly after the EU accession (1999-2008) paying an attention to the national and EU investment support programmes. Žídková et al. (2011) and Rosochatecká et al. (2008) concentrated on the dynamics of the sector gross fixed capital formation suggesting that increasing investment activity is likely associated with farmers' expectations of benefits from the accession and full adoption of the Common Agricultural Policy (CAP).

The need for a more rigorous assessment arrived with the EU rural development programmes. This is particularly justifiable, if we consider that the investment support to the modernization of Czech agriculture accounts about 9.4% of the total budget of the current Rural Development Programme (2007-2013), i.e. approximately € 329.4 million i. e. CZK 8,235.0 million (MoA, 2012). The respective evaluation follows the Commission's Common Evaluation a Monitoring Framework (EC, 2006), however, this is methodologically weak pursuing simple comparison of result indicators (as production or GVA[1]) between supported and non-supported groups. Thus the evaluation omits the fact that farm's GVA is affected by a number of other internal and external factors and that the investment measures are targeted to or exploited by only some groups of producers/regions (Henning and Michalek, 2008). In the Czech context, evaluation studies (e. g. DHV CR and Tima, 2010) applied the comparative analysis of supported and non-supported farms but without the counterfactual approach. Medonos et al., (2012) adopted a rigorous counterfactual approach (see also Khandker et al., 2010; Abadie and Imbens (2006)). Medonos et al. (2012) showed using the propensity score matching approach on a sample of about 800 farming companies that there were benefits of the investment support measures in terms of improved GVA and labour productivity. However, when extending the sample to about 1,300 observations the heterogeneity of farms increased and we faced a serious problem of heteroscedasticity[2]. To deal with it we adopted an alternative matching approach suggested by Abadie and Imbens (2002).

The general objective of the paper is to confirm significant economic benefits of the measure 121 "Modernisation of Agricultural Holdings" of the Rural Development Programme (RDP) 2007-2013 on the extended sample of Czech farms. The specific objective is to choose appropriate methods which will separate as much as possible the effect of Measure 121 from other factors influencing investment and production behaviour of farmers. A particular attention is paid to the issues of equity (i.e. distribution of the supports in respect to farm size), differentiated impacts of the supports according to the production conditions and deadweight.

The paper is structured as follows: in the next section, we briefly review some recent literature concerning differentiated effects among farm groups and deadweight. It is followed by the methodological part including a brief description of data. The core part of the paper consists of empirical results presented in the fourth part. The investigation is summarised in the concluding paragraph.

Some inspiring literature

In spite of increasing emphasis on the counterfactual evaluation of policies, there are not many publications in outstanding agricultural economics journals on this topic. Actually, most of the relevant works are published at conferences and seminar. Some literature we already listed in Medonos et al. (2012). Here, we mention two most recent conference papers which are closely related to our research efforts.

Kirchweger and Kantelhardt (2012) separated from the Austrian sample of farms two subsets: dairy farms and granivore farms. They showed that

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[1] Gross Value Added

[2] This issue is discussed in Pufahl and Weiss (2009).

the farm investment supports perform differently in these two sub-samples: insignificant effects among dairy farms and significant effects in the sector of granivore farms. We also acknowledge differences of production systems splitting the samples by natural conditions and by size. As it will be apparent from the analysis of recipients, we expect that the effects of the support will be less pronounced in the subsample of very large farms.

Michalek et al. (2013) attempted to estimate the deadweight effect of the support by investigating the changes in total assets due to the participation in the support programme. They found that there is no significant average effect of participation on total assets suggesting that there is strong deadweight loss of the investment support policy among the dairy farms in Schleswig-Holstein. Because total assets is used as a structural variable determining similarity of farms we have decided for changes of bank credits (indebtedness) as an alternative indicator of the dead weight. Significant increase of indebtedness is regarded as a mobilisation of additional resources for financing modernisation of agricultural holdings, while insignificant changes or negative changes will indicate high deadweight.

Materials and methods

Since it is principally impossible to observe on the same farm the effects of participation and non-participation in the measure, one has to choose or to construct a control farm with "identical" characteristics from the pool of non-participating producers. The standard framework in evaluation analysis to formalise the above problem provides Roy-Rubin-model (Caliendo and Kopeinig, 2008). In this model, the parameter which has received the most attention of scholars is the Average Treatment Effect on Treated (ATT); it is defined

$$\tau_{ATT} = E[\tau \mid D = 1] = E[Y(1) \mid D = 1] - E[Y(0)|D = 1] \tag{1}$$

where $\tau = Y(1)-Y(0)$, $Y(D)$ is a result variable, D equals 1 if the unit got an investment support (treatment) and 0 otherwise. The sample ATT (SATT) takes the form of

$$\tau_{SATT} = \frac{1}{N_1} \sum_{i \in particip} [Y_i^T(1) - Y_i^C(O)], \tag{2}$$

where the upper indices T and C indicate

participating and control farms respectively. Matching estimators are based on imputing a value on the counterfactual outcome for each unit. Abbadie and Imbens (2002), propose direct matching which is based on metric $\|x\| = (x'Vx)^{1/2}$, where x is a vector of structural variables and V is a positive semidefinite matrix. This metric is used to determine the nearest similar unit(s). Let M denotes the number of nearest control units to the treated unit i. We define the distance $d_M(i)$, which follows

$$\sum_{D_j=1-D_i} I(\|X_j - X_i\| < d_M(i)) < M \text{ and}$$

$$\sum_{D_j=1-D_i} I(\|X_j - X_i\| \le d_M(i)) \ge M \tag{3}$$

Where $I()$ is an indicator function which is equal to one if the expression in brackets is true and zero otherwise. Let $J_M(i)$ denotes a set of indices of the control units which are as close as the Mth control unit and $card(J_M(i))$ is a number of the elements of $J_M(i)$. We define

$$K_M(i) = \sum_{j=1}^{N} I(i \in J_M(j)) \frac{1}{card(J_M(j))} \tag{4}$$

Obviously, the sum of $K_M(i)$ over all observations is equal N (i.e. to the number of all observations), over participating units to N_0 (i.e. to the number of controls) and over non-participating units to N_1. Now, we can construct a simple estimator

$$Y_i^C(0) = \begin{cases} Y_i(0), & when \ D_i = 0 \\ \frac{1}{card(J_M(i))} \sum_{j \in J_M(i)} Y_j, & when \ D_i = 1 \end{cases} \tag{5}$$

Equation (5) means that a counterfactual is an average of the nearest control units. Putting (5) in (4) we yield a sample average treatment effect on treated (SATT)

$$\tau_{SATT} = \frac{1}{N_1} \sum_{i=1}^{N} [D_i - (1 - D_i)K_M(i)]Y_i \tag{6}$$

In the same manner, we can derive estimators of the average treatment effect on controls (ATC, SATC) and the overall average treatment effect (ATE, SATE). The latter constructs the counterfactual matches to both – the participants and non-participants in the programme.

The simple estimator (3) will be biased in the finite set if the matching is not exact. Abbadie and Imbens (2002) propose a bias-corrected matching estimator (i.e. adjusting the difference within the matches

for the differences in their covariate values) by using regression estimates of Y as a linear function of the considered structural variables (covariates); for SATT in the control group ($\hat{\mu}_0(x)$), for SATC in the sub-sample of participants ($\hat{\mu}_1(x)$) and for SATE using the both regressions. The adjusted estimator of the effect over controls is now

$$\tilde{Y}_i^C(0) = \begin{cases} Y_i(0), \text{ when } D_i = 0 \\ \frac{1}{card(J_M(i))}\sum_{j \in J_M(i)}\left(Y_j + \hat{\mu}_0(X_i) - \hat{\mu}_0(X_j)\right), \text{ when } D_i = 1 \end{cases} \tag{7}$$

The adjusted SATT

$$\tilde{\tau}_{SATT} = \frac{1}{N_1}\sum_{i \in particip}\left(Y_i - \tilde{Y}_i^C(0)\right) \tag{8}$$

Similarly, SATC and SATE are constructed.

With the new sample of Albertina (CreditInfo) in which the number of observations (farms) doubled, the problem of heteroscedasticity occurred. The heteroscedasticity affected the variance of the estimates and the significance of the results of the counterfactual analysis. It called for dealing with heteroscedasticity. First, we removed outliers, but the principal treatment rest in an improved estimation method. For SATT (as defined in (4)) the variance is given by

$$V_{SATT} = \frac{1}{N_1^2}\sum_{i=1}^{N}([D_i - (1 - D_i)K_M(i)])^2 \sigma_{D_i}^2(X_i) \tag{9}$$

where $\sigma_D^2(X)$ represents the conditional of the performance indicator Y in respect to the vector of its covariates. If there is no heteroscedasticity, then

$$\sigma_1^2 = \frac{1}{2N_1}\sum_{i \in particip}\left[\frac{1}{card(J_M(i))}\sum_{j \in J_M(i)}\left(Y_i - Y_j - \tau_{SATT}\right)^2\right] \tag{10}$$

In the same way one can express it also for SATC a SATE.

If the variance $\sigma_D^2(X)$ is unstable, we need to estimate it for each unit in the sample. It can be done by further matching. Define $d'_M(i)$ as a distance to the Mth unit with the same indication of the treatment (participation).

$$\sum_{D_j=1-D_i, i \neq j} I\left(\|X_j - X_i\| < d'_M(i)\right) < M \text{ and}$$
$$\sum_{D_j=1-D_i, i \neq j} I\left(\|X_j - X_i\| \leq d'_M(i)\right) \geq M$$

Similarly, we construct $J'_M(i)$ as a set of the indices of the first M nearest neighbours to unit i. The conditional variance is estimated as a sample variance of this set extended of the unit i:

$$\sigma_1^2(X_i) = \frac{1}{card(J'_M(i))}\sum_{j \in J'_M(i) \cup \{i\}}\left(Y_j - \bar{Y}_{J'_M(i) \cup \{i\}}\right)^2 \tag{11}$$

where

$$\bar{Y}_{J'_M(i) \cup \{i\}} = \frac{1}{card(J'_M(i))+1}\sum_{j \in J'_M(i) \cup \{i\}} Y_j \tag{12}$$

is an average of the performance indicator in the set $J'_M(i) \cup \{i\}$.

This approach is implemented in STATA as the nnmatch procedure (Abadie et al., 2004).

If selected neighbours exhibit more or less identical values of the performance indicators as the participant at the time of launching the investment support programme we can compare directly the values of the performance indicators at the time horizon t. The *ATT* will refer to the distance between the solid and dashed lines at the point t in Figure 1. However, often there is a considerable difference between the values of the performance indicators of the participants and counterfactuals. In this case, we compare changes over the time period t instead of the final figures. This approach is called "difference in difference" and the respective effect is marked as *ATT(d-i-d)* in Figure 1.

The advantage of using d-i-d estimators is demonstrated and discussed in Smith and Todd (2005). In addition we are introducing two relative indicators of the effects

$$relATT_{fin} = \frac{ATT\_(d-i-d)}{Y^T(t)},$$

$$relATT_{change} = \frac{ATT\_(d-i-d)}{Y^T(t) - Y^T(0)}$$

The former referring to the share of the *ATT* on the final value (Y^T) and the latter referring to the share of *ATT* on the change of the performance indicator over the time t (see Figure 1).

We used several sources of data on farm characteristics and performance: Albertina (Creditinfo) database, Land Parcel Identification System (LPIS), data on agricultural supports published by the State Agricultural Intervention Fund[3] (SZIF) and

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[3] which is the Paying Agency for CAP in the Czech Republic.
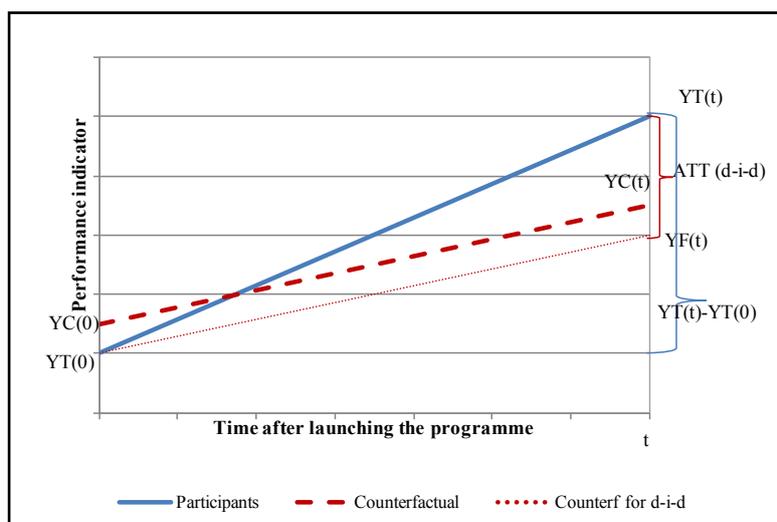
Note: YT – performance of the treated (i.e. participants), *YC* – performance of the counterfactual, *ATT(d-i-d)* - average treatment effect on treated in the difference-in-difference mode
Source: own chart based on Khandker et al. (2010)

Figure 1: Support chart for relative effects.

provided by Ministry of Agriculture. The Albertina data set is the main source, it is a database built on annual reports of companies which are obliged to publish their economic and book keeping figures. Since the Albertina database includes only financial indicators, we linked information on the utilised agricultural area (UAA) and on type of land use from LPIS. Similarly, the information on the investment supports was linked from the database of SZIF provided by Ministry of Agriculture.

There were 1,274 agricultural businesses in the Albertina database which provided all economic figures for all four years of the period 2007-2010. A slightly more than a third of them (447) were awarded an investment support from the Czech RDP (measure 121).

In order to investigate differences in investment support impacts we have divided the sample in several sub samples by size (measured by total assets) and by production conditions and orientation (given by the share of grasslands, e.g. grasslands >20%, <20%, <10% etc.).

The characteristics of the applicants of Measure 121

From the sectoral point of view, most of the support was directed in the livestock production; in terms of project numbers it was 57% and in terms of funds

72% in the period 2007-2012. This bias against the livestock sector results directly from the policy preferences (Medonos et al., 2012).

There are also differences among applicants/ project holders of the measure 121 in terms of size measured in hectares of UAA or by the value of the total assets. As showed in Table 1, the farms applied for 2 projects on average in the period 2007-2012, small farms (up to 100 ha of UAA) applied for one or two projects (on average 1.5) while large farms over 1,500 hectares applied often for 3 and more projects, the absolute extreme are 13 farms over 5,000 hectares which applied for 11 projects on average in the period 2007-2012.

In contrast to their activity, very large farms (over 3,000 hectares) are notably less successful in getting their project approved than the rest of the farms applying for the support in Measure 121; the success rates of the categories "3,000-5,000 ha" and ">5,000 ha" are 80% and 71% respectively, while the national average is 85%. But these relative figures are a bit misleading, because in absolute terms the large farms get more projects and more support (the very large farms 3 and 8 projects respectively).

The overlap between the sample of applicants for the Measure 121 from SZIF and the Albertina

Category by UAA	Number of farms	Number of Applications	Applications per farm	of the total applications			The share of approved projects
				Approved	of it Completed	Rejected	
<20 ha	287	445	1.6	378	182	67	85%
20 - 50 ha	262	357	1.4	318	131	39	89%
50 - 100 ha	270	419	1.6	358	155	61	85%
100 - 250 ha	321	590	1.8	504	186	86	85%
250 - 500 ha	244	484	2.0	421	158	63	87%
500 - 1000 ha	332	667	2.0	572	204	95	86%
1000 - 1500 ha	270	647	2.4	546	175	101	84%
1500 - 2000 ha	155	472	3.0	401	132	71	85%
2000 - 3000 ha	175	530	3.0	440	137	90	83%
3000 - 5000 ha	72	287	4.0	229	91	58	80%
> 5000 ha	13	147	11.3	105	33	42	71%
Total	2,401	5,045	2.I	4,272	1,584	773	85%

Source: own calculation, processed on the basis of data provided by Managing body of RDP (MoA)

Table 1: The distribution of applications by the farm size categories.

sample accounts for 837[4]. We split the resulting sample in ten size categories by the average value of total assets over the period 2008-2010. Using total assets instead of the area helps us to avoid bringing among small farms capital intensive enterprises which do not cultivate land such as pig fattening or poultry production. It is important to keep in mind that farms from Albertina sample are only legal entities and thus large farms representing just about 5% of farms, nevertheless cultivating almost 34.7% of the total UAA according to LPIS for 2010. Thus "small" in the following analyses has to be understood in this context.

It is evident from Figure 2 that the size of the project increases with the size of the farm[5]. The investment projects of farms of the largest category (10) are on average 10 times bigger than the investment projects of farms in the smallest category (1). The lower rate of the co-financing (Figure 2) affects the final disproportion between the investment supports from the RDP funds only marginally. Thus farms from category (1), i. e. the smallest

farms, got on average an investment support of CZK 3.6 million (EUR 142 thousand) while the very large farms (category 10) got 9.4 times more (i. e. CZK 33 million, EUR 1.3 million).

The importance of supports of Measure 121 declines with the scale of farming. The average share of Measure 121 supported projects on the total investment is 85% in Category (1) while it is only 63% in the three largest categories (with the total assets over CZK 500 millions, EUR 20 millions)

Bringing the above observations together we can conclude that there is serious indication that the current system supports those who are needed less than those who are well.

One of the policy relevant questions is if more supports generate more benefits. In Figure 3 we depicted efficiency (measured by the ratio GVA/Revenue) and labour productivity (the ratio GVA/Labour costs). Note that the chart includes only farms which received investment support in the period 2007-2010. The efficiency and labour productivity evidently increases with the level of supported investment. However, as we pointed out earlier, the size and the number of projects increases with farm size, thus the share of supported investment on total investment increases with farm size. Therefore, it is not clear if the higher efficiency and productivity is a result of the higher investment support or due to the economy of scale.

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[4] 2,685 projects were authorised for Measure 121till 30th July of the 2012 for total number of 1,536 applicants with total value of investment expenditures CZK 15,103 million and total volume of subsidies CZK 6,198 million. Our sample thus represents 55% of all supported farms, 56% of all projects, 87% of total volume of investment expenditures and 77% volume of investment support.

[5] The relationship is rather linear, the exponential shape is given by the non-linear axis x/no-linear categories.
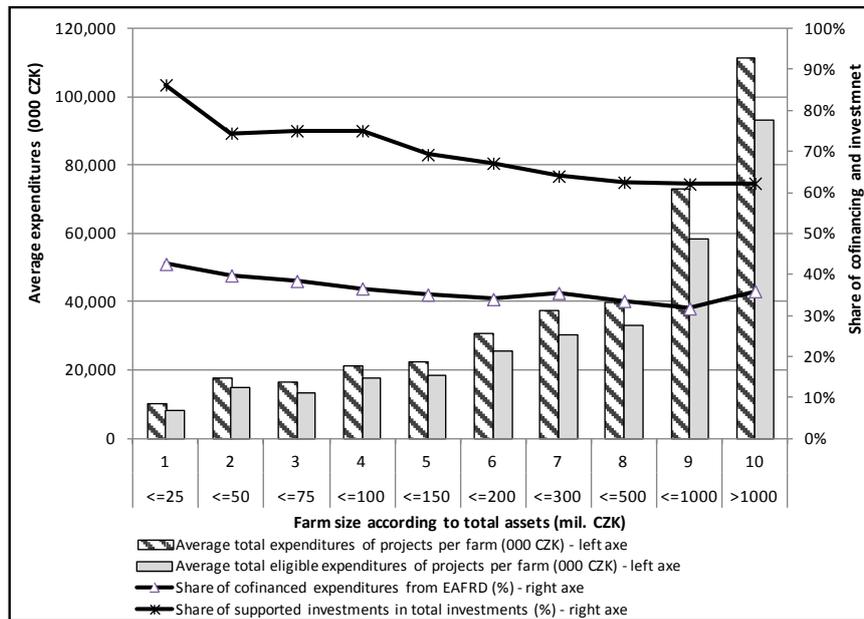
Source: own calculation based on Albertina and SZIF samples

Figure 2: Characteristics of recipients of the investment support (Measure 121) by size categories.
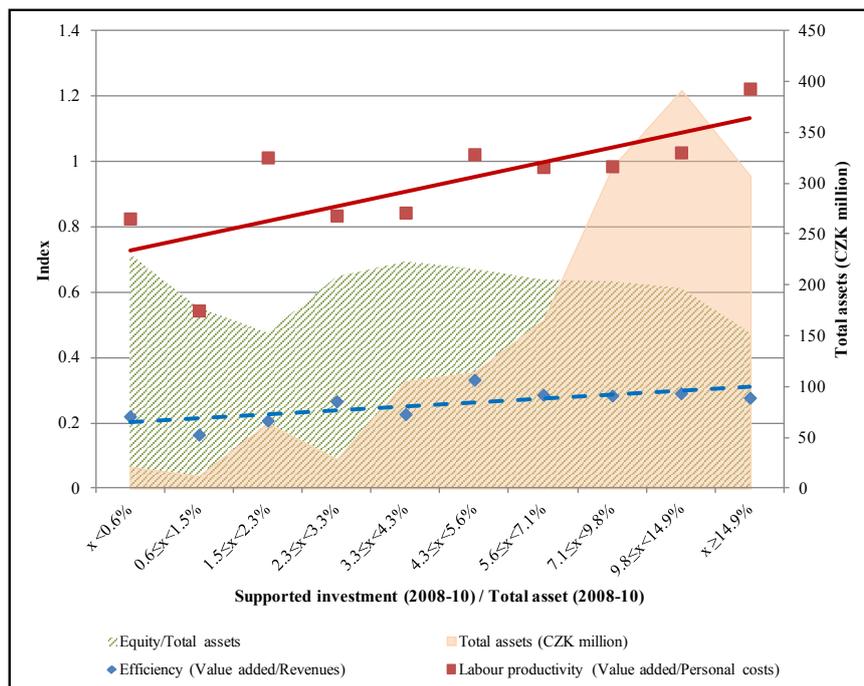
Source: own calculation based on Albertina and SZIF samples

Figure 3: Efficiency and productivity in relationship to the level of the support.

Results and discussion

There are significant differences between participating and non-participating farms in the Albertina sample. The average utilised agricultural area of participating farms is substantially greater (1,800 ha) than the one of non-participants (1,135 ha) and

a similar difference is in terms of total assets (the participating farms: CZK 134 million, the controls: CZK 68 million). The participating farms are on average not only substantially larger but also more capital intensive than non-participating ones[6]. In contrast, the groups do not differ statistically in terms of the share of grasslands (24.4% for the participating farms and 23.6% for the control group) and investment activity (the averages of the investment/total assets ratio are 0.134 and 0.151 respectively).

For selecting the nearest neighbours we used

7 structural variables (Table 2) regarded as likely determinants of farm participation in the modernisation programme (most of them were used in the propensity score matching in Medonos et al., 2012). The total assets and sales represent size of the business; the share of grasslands indicates if a farm is in the less favoured area, and the rest are variables referring to financial sources for investment.

We chose 6 performance variables (GVA, GVA/labour cost, profit, bank indebtedness, cost/revenue ratio and investment intensity) on which we measured results of the investment support programme. The first four were used also in the difference-in-differences form.

With exception of profit in the difference in differences form, all variables exhibit a significant effect of the investment support to modernisation (Table 3). Note that the sector crisis was deepest

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[6] The indicator total assets per hectare is however affected by the presence of intensive pig and poultry farms having no or little land. Thus if we take the whole sample we yield a large difference between group averages (CZK 634 thousands), but insignificant due to the even larger variance. If we eliminate the intensive pig and poultry farms we yield a smaller but significant difference between the groups of participating and non-participating farms (the group averages of CZK 70 thousands and CZK 53 thousands respectively).

Year 2007 Indicators	Unit	Number particip.	controls	Mean particip.	controls	T stat.	P	Signif.
Total assets	CZK million	447	827	134,909	68,195	11.079	0.000	***
UAA in LPIS	ha	447	827	1,800	1,135	10.257	0.000	***
The share of grasslands	%	447	827	24%	24%	0.486	0.627	
Cash flow	CZK million	447	827	16,272	8,390	10.592	0.000	***
Revenue	CZK million	447	827	75,337	41,477	8.887	0.000	***
Cash flow/Labour costs		447	827	0.940	1.996	-3.261	0.001	***
Indebtedness		447	827	0.428	0.523	-6.778	0.000	***

Source: own calculation, Albertina sample

Table 2: Description statistics of structural variable.

	Particip.	Controls	ATT	st. error	T	P	Signif
GVA	20,251	16,436	3,815	686	5.558	0.000	***
Productivity (GVA/Labour cost)	0.874	0.651	0.223	0.057	3.949	0.000	***
Profit	4,229	2,731	1,498	478	3.131	0.002	***
Bank credits	0.162	0.122	0.039	0.008	4.871	0.000	***
Investment in fixed assets	45,888	29,647	16,240	2,120	7.660	0.000	***
Cost Revenue ratio	0.948	0.962	-0.014	0.005	-2.603	0.009	***
Investment / Fixed assets	0.200	0.164	0.036	0.007	5.296	0.000	***
Difference-in-Difference							
GVA	-4,846	-6,801	1,955	668	2.925	0.004	***
Productivity (GVA/Labour cost)	-0.212	-0.368	0.156	0.047	3.333	0.001	***
Profit	-2,985	-3,667	682	497	1.372	0.170	
Bank indebtedness	0.035	0.002	0.033	0.007	4.782	0.000	***

Source: own calculation (nnmatch, Stata 11)

Table 3: Average treatment effect on treated, the whole Albertina sample, 2007-10.

in 2010 and thus the over-time differences (difference in differences) of GVA and productivity are negative. Thus the investment support effect is reflected in a smaller decline of these indicators in the group of beneficiaries that in the control group.

Similarly strong positive effects of the investment support can be found also in the sub-sample of farms with the high share of grasslands (over 20%). The production systems with a significant share of grasslands are likely farms in less favoured areas (LFA) with important cattle, particularly dairy, production. These productions were in the policy focus as pointed out earlier (see also Medonos et al., 2012). Positive effects can also be showed in the sub-sample of arable farms (grasslands below 20%), however, some indicators like profit (in both modes) and GVA in the difference-in-difference mode are not statistically significant.

The significant productivity effects in (d-i-d terms) can be observed in the both size sub-samples; on medium size farms these effects are bigger than on large farms. Also, on medium-size farms one can see the gains in terms of GVA and profit in d-i-d terms while it cannot be found (statistically significant) on the large ones.

Except for large farms, all samples and subsamples exhibit increased bank indebtedness on participating farms in both terms – the final value as well as in the difference in difference mode (Table 4).

It can be interpreted as a mobilisation of additional resources (bank credits) to finance modernisation of agriculture. From this point of view, we can judge on the rather low deadweight effect of Measure 121 in medium farms, and in contrast on considerable deadweight in large farms (i. e. with the total assets over CZK 150 million, EUR 6 million).

Looking at relative gains from the participation in the modernisation measure (M121, RDP) in Figure 4 we can observe that relative gains from the support are substantially more pronounced in the subsample of farms with the higher share of grasslands and in the subsample of medium-size farms. Actually, the case needs a careful interpretation since the change of the GVA between 2007 and 2010 is negative. Thus, the programme beneficiaries of these two sub-samples reduced almost to half the impacts of the sector crisis (comparing to their counterfactual farms). From the perspective of the final value of GVA, 15 and 19 per cent respectively can be accounted to the support of the measure 121.

In terms of labour productivity, the situation is a bit more complicated. First, only arable farms and large farms exhibit the ratio GVA/Labour costs higher than 1; in turn it means that GVA on farms in LFA and medium farms does not cover (on average) even the cost of labour – these farms would not survive without subsidies. Second, labour productivity

Indicator	Total sample		Arable Farming (Grassland < 20% UAA)		Production Systems in LFA(Grassland >20% UAA)		Large Farms (Total assets>150)		Medium-size Farms (Total assets< 150)	
GVA	3,815	***	3,950	***	4,077	***	6,277	***	2,618	***
Productivity (GVA/Labour cost)	0.22	***	0.16	***	0.32	***	0.11	**	0.24	***
Profit	1,498	***	1,000		1,779	***	2,047	*	1,310	***
Bank indebtedness	0.04	***	0.04	***	0.03	**	0.03	*	0.05	***
Investment in fixed assets	16,240	***	16,253	***	15,721	***	22,601	***	12,593	***
Difference-in-Difference										
GVA	1,955	***	1,191		2,280	***	2,312		2,175	***
Productivity (GVA/Labour cost)	0.16	***	0.14	**	0.16	**	0.11	**	0.16	***
Profit	682		22		945	*	-129		1,083	***
Bank indebtedness	0.03	***	0.03	***	0.03	***	0.01		0.04	***

Source: own calculation (nnmatch, Stata 11)

Table 4: Average treatment effect on treated (ATT) in sub-samples.
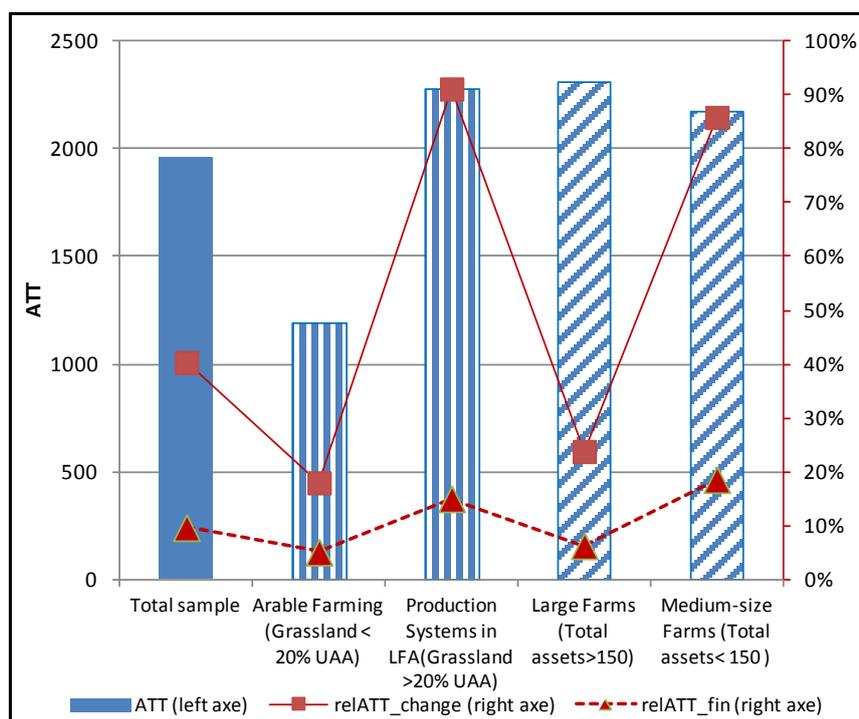
Source: own calculation (nnmatch, Stata 11)

Figure 4: The effect of the investment support on GVA; the difference in difference model, 2007-10.

declined on all farms - the most dramatic drop was on medium-size farms of almost 23% in the group of participants and of 43% in the control group. On large farms the decline in labour productivity is much more moderate (15% for participants and 24% for the control group). Third, there are significant gains in productivity in all four sub-samples, the most pronounced are again for farms in LFA and medium size farms in both the absolute (Table 4) and the relative terms (relATTfin(arable) = 13%, relATTfin(LFA) = 27%, relATTfin(large) = 10%, relATTfin(medium-size) = 21%).

Conclusion

On the enlarged sample of farms included in the Albertina database which now covers almost 50% of the national UAA we confirmed significant positive effects of the investment support measure (Modernisation of agricultural holdings (M121) of the Czech RDP. Our pervious analysis (Medonos et al., 2012) was enriched in several respects:

First, we captured some distributional effect. Analysing the sample of applicants for Measure

121 we could show that large farms get more and larger projects, thus, in spite of the lower level of co-financing from public budgets they get much larger support than smaller farms. In contrast the importance of the support for financing investment is much higher on small than on large farms.

Second, by splitting the sample by natural conditions (represented by the share of grasslands) and by size (total assets) we could show differentiated response of farms the support. Gains in terms of GVA and labour productivity are higher on farms in LFA and on medium-size farms (i.e. with the total assets less than CZK 150 million, EUR 6 million) in both the absolute and relative terms. Nevertheless, labour productivity remains tremendously low on farms in LFA (high share of grasslands) and medium-size farms.

Third, investigating the changes in bank indebtedness we yield an indication that on average the support mobilised additional resources to finance the sector investment. It was also showed that there is no statistically significant increase of bank indebtedness on large farms due

to investment support. In turn, it can be interpreted that on average and in the subsample of medium sized farms the deadweight of the investment support programme is rather low and on large farms it is rather high. It definitely complements our results from interviews which were included in Medonos et al. (2012).

The most general conclusion of the presented research is that the investment support measure (Modernisation of agricultural holdings (M121) has positive effects, however that there are serious indications that the measure is biased toward large (even very large) farms where the deadweight is rather high. Thus, the measure can be more socially effective and efficient if it is targeted to medium-size and small farms.

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Sugar beet production in the European Union and their future trends

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Anotace

Hlavním cílem příspěvku je analýza naturálních výnosů bílého (polarizačního) cukru a výrobních nákladů na tento cukr a cukrovou řepu v rámci hlavních evropských producentů za účelem identifikace hlavních vývojových trendů. Dílčím cílem je analýza výrobních (variabilních) nákladů na jednu tunu cukrové řepy ve Francii, Německu, Polsku, Velké Británii a České republice, komparace výnosů cukrové řepy ve společnostech Tereos France a Tereos TTD a.s.. Základními metodami, užitými v příspěvku, jsou řetězové a bazické indexy a regresní analýza časových řad. Na základě regresní analýzy je stanovena predikce vývoje výnosů cukru (t/ha) u hlavních evropských producentů. Na základě analýzy primárních dokumentů a na základě regresní analýzy je možno stanovit závěr, že hlavní producenti v Evropě nedosáhnou v roce 2015/2016 výnosu cukru 15 tun z hektaru při variabilních nákladech na jednu tunu cukrovny v maximální výši 15 EUR. Článek byl zpracován v rámci VZ MSM 6046070906 „Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systémů“.

Klíčová slova

Cukrová řepa, produkce cukru, výnosový potenciál, variabilní náklady.

Abstract

The main aim of this paper is to analyze the yield (t/ha) and the production costs of white (polarized) sugar and sugar beet in the main European producer countries in order to identify main development trends. The partial objectives of this study are: to analyse the production costs (variable costs) of sugar and sugar beet of the main European producers (France, Germany, Poland, United Kingdom, Czech Republic), to compare sugar beet yield of Tereos France and Tereos TTD a.s., to analyse sugar beet yield potential and their trends. The used methods are chain and basic indexes and regression analysis of time series/trend data - for predicting on next tree years. The main producers of sugar beet in the European Union (i.e. France, Germany, Poland, United Kingdom, and Czech Republic) can not achieve goal of sugar yield 15t/ha while maintaining the amount of variable (direct) costs at 15 EUR/tone of sugar beet in the business year 2015/2016. Pieces of knowledge introduced in this paper resulted from solution of an institutional research intention MSM 6046070906 „Economics of resources of Czech agriculture and their efficient use in frame of multifunctional agri-food systems“.

Key words

Sugar beet, sugar production, yield potential, variable costs.

Introduction

Sugar is produced in over 100 countries worldwide. In most years, over 70% of world sugar production is consumed domestically which allowed the development of a large export market. However, a significant share of this trade takes place under bilateral long-term agreements or on preferential terms.

Total world sugar trade is projected to increase by 19.9% from 34.5 million metric tons to 37.9 million metric tons between 2010 and 2020. Brazil's exports are projected to increase from 21.6 million metric tons in 2010 to 25.6 million metric tons in 2020 even though Brazil uses a substantial amount of sugar cane for ethanol production. World sugar prices are projected to decrease from 27.3 cents/lb in 2010 to 18.4 cents/lb in 2020 (Pylor, Koo, 2011).

Twenty percent of the world's supply of sugar is derived from sugar beet, mainly cultivated in industrialized countries, while the remaining 80% of the world's sugar supply is derived from sugar cane, mainly cultivated in tropical climates in developing countries (FAO, 2009).

Production and trade in sugar are very closely linked with the policies of sustainable development (Smutka, Rumánková, Pulkrábek, Benešová, 2013).

Global sugar production for 2013/14 is forecast at 175 million (metric) tons, narrowly setting a record with growth in Brazil and Thailand more than offsetting sharply lower production in India. International raw sugar prices are at levels not seen in nearly three years with prices less than half the peak set in February 2011. Low prices are expected to stimulate global consumption and trade, with exports forecast 4 percent higher at 59 million tons (USDA, 2012).

Brazil's sugar production for 2013/14 is forecast at a record 40.4 million tons, up 1.8 million on higher yields as a result of good weather and adequate sugarcane renewal. Record exports are forecast at 29.3 million tons despite mills likely expanding ethanol production to fill a domestic increase in the ethanol content blended with gasoline. The share of the sugarcane crop for sugar is down slightly to 48 percent, as opposed to an even 50/50 sugar to ethanol split the prior year. China is Brazil's top market, though risik exports to the United Arab Emirates, Algeria, Indonesia, Russia and India are expected to continue (FAO, 2009).

The growth of the world sugar production relies on the increase in the sugar crops cultivation. In the years 2008/2009 - 2011/2012 alone the worldwide sugar beet production reached nearly 272 million tons, with an average growth rate of production standing at about 2.5% per year. In the case of sugar cane, during the same period its production reached the level of about 1 794 million tons, and the rate of the production growth achieved an average of 2.7% per year. (Svatoš, Belova, Maitah, 2013).

While sugar cane still remains the world's no.1 crop for sugar production, its use for this purpose has been stagnating. Sugar beet, on the other hand, continues to show both qualitative and quantitative growth potential. Last year's (i.e. 2011/2012) world sugar production was in excess of 172 million metric tons; its consumption amounted to 169 million metric tons. Sugar consumption is up by about 2%, i.e., by 3 million metric tons. Since the Sugar

Common Market Organization reform, the EU has been showing an annual deficit of 3-4 million mt. The Commission deals with this by importing sugar from third countries. Importation is done on the basis of reduced-duty tenders, duty-free imports, and industrial sugar imports (Reinbergr, 2012).

EU sugar production for 2013/14 is forecast to rebound slightly to 15.9 million tons on higher yields, most of which will be added to ending stocks. Consumption is steady at 18.1 million tons, nearly unchanged over the last several years. Imports are forecast to remain at 3.8 million tons while exports, limited by the EU's WTO sugar export ceiling, remain unchanged at 1.5 million tons (USDA, 2012).

The sugar content in sugar beet can vary from 12% to 20%. It is the sugar that gives value to the sugar beet crop. The by-products of the sugar beet, such as pulp and molasses, give an added value of up to 10% of the value of the sugar. The sugar extraction rate depends on the sugar content of the sugar beet at the moment of its arrival in the processing plant. European norms define the sugar beet as marketable if it contains 14% sugar or more (in Ukraine, for instance, the average sugar content is only 11.2%). The standard sugar beet should have a sugar content of 16%, which would yield 130 kg of sugar per 1 ton of standard sugar beet processed at a sugar plant - ideal efficiency is 82.5%.

In Europe, the total production cost of beet sugar (16% sugar content) is arend EUR 20–30 per ton in competitive countries and EUR 30–40 per ton in noncompetitive countries (FAO, 2009).

Question number one is sustainability of sugar beet growing and beet sugar industry. This sustainability has a fundamental economic aspect regarding competitiveness with cane sugar, and an environmental aspect including mainly the current issue of emissions and foreign chemical substances. The principle of sustainability also sets other relevant research directions: yield potential, resistant breeding (with the aim to decrease the consumption of biocides), alternative uses of sugar beet (sugar, ethanol, methane), growing technologies decreasing the input of chemicals, fertilizers, energy, limiting soil erosion, the position of sugar beet within an agricultural enterprise. Nowadays, a full extent research is done only in big sugar beet growing countries in the Europe (i.e. France and Germany); in the Czech Republic

the research concentrates on individual issues such as sustainability and growing technologies and is financed exclusively by beet growers and sugar producers (Chochola, Pulkrábek, 2012).

Sugar beet has been selectively bred since the early nineteenth century with the principle objective to develop varieties with the maximum root and sucrose yield potential at the lowest economic and environmental costs possible (Richardson, 2010).

Historically, the most productive developments in sugar beet breeding have been monogerm seed, male-sterility and subsequent hybrid development, and pest and disease resistance (Biancardi, McGrath, Panella, Lewellen, Stevanato, 2011).

In order to maximize yields, it is important to look at the plant water requirement which highly depend on the atmospheric water demand and the settlement conditions. Sugar beet is generally neither irrigated in northern Europe, in central Europe it is commonly necessary to irrigate 100-200 mm water per year (Rodrigo, Morillo-Velarde, 2010).

Production quota reduction was achieved through buy-outs and some efficiency gains were realized as efficient producers were allowed to buy renounced quota within member states. Under this system, support payments to growers became decoupled from production, with the purpose of allowing farmers more freedom to produce to market demand (Haley, Polet, 2011).

According to Robert Ohlson, researcher at NBR association – Nordic Beet Research, the main points of sustainable development of sugar beet production in Europe are:

i.   Profit, reducing the cost of 1 tonne of sugar beet and 1 tonne of sugar (low-cost production)

ii. Environment, growing conditions, use of yield potential of sugar beet cultivars

iii. Personnel, the quality of management

iv. Integrity and mutual cooperation between sugar beet industry and sugar beet growers.

The basic prerequisite for a competitive and sustainable cultivation of sugar beet in Europe, according to the scientists above are three magical "15's" as objectives to fulfill – by the year 2015 the European growers should reach sugar yield of 15 t/ha while maintaining variable (direct) costs at 15 EUR/tone of sugar beet.

The main aim of this paper is to analyze the yield and the production costs of white (polarized) sugar and sugar beet in the main European producer countries in order to identify main development trends.

Materials and methods

The basic research question is whether the main producers of sugar beet in the European Union (i.e. France, Germany, Poland, United Kingdom, and Czech Republic) can achieve goal of sugar yield 15 t/ha while maintaining the amount of variable (direct) costs at 15 EUR/tone of sugar beet in the marketing year 2015/2016.

The main aim of this paper is to analyze the yield and the production costs of white (polarized) sugar and sugar beet in the main European producer countries in order to identify main development trends.

In farming, economic goals such as profit or output maximisation may be the growers primary goal, however the non-economic goals are also important. Production efficiency is the ability of the farmers to produce an output at minimum cost and to combine outputs for maximum profit.

The partial objectives of this study are:

i.   To compare prices of sugar from sugar beet and sugar cane (time series 1996-2006) and to determine the ratio between these prices

ii. To compare sugar beet production costs (EU and U.S.) and their relation to the sugar cane production costs (Base 100 = sugar cane production costs)

iii. To analyse the production costs (variable costs) of sugar and sugar beet of the main European producents (France, Germany, Poland, United Kingdom, Czech Republic).

iv. To compare sugar beet yield of Tereos France and Tereos TTD a.s.

v.   To analyse sugar beet yield potential and their trends

Data used in this paper comes from the following sources: CEFS SUGAR STATISTICS 2012, Gain Report Number E80045: EU-27 Sugar Semi-annual Report 9/2013, The John Nix Farm Mangement Pocketbook, 42th edition: 2012, Agribenchmark (agribenchmark.org), Section Cash Crop, 2011-2012, Tereos – Annual Report 2012, FAOSTAT database Online, Crops (2011,2012).

The first used statistical methods are the Fixed Base Index Numbers and Chain Base Index Numbers. For Fixed Base Index Numbers (usually just called Index Numbers), the Base is given the value 100 and everything after that is given relative

to the Base, going above 100 for higher values or below 100 for values which drop below the original. For Chain Base Index Numbers, each value is given an Index based on the previous value being used as the Base.

The second used statistical method is simple regression analysis of time series/ trend data, for predicting on next two years (2014-2015). Linear prediction is a mathematical operation where future values of a discrete-time signal are estimated as a linear function of previous samples. Linear regression can be used to fit a predictive model to an observed data set of y and x values. Simple linear regression predicted values of one variable.

The data are pairs of independent and dependent variables {(xi,yi): i=1,...,n}. The fitted equation is written y = ax + b, where y is the predicted value of the response obtained by using the equation. Regression coefficient represents the rate of change of one variable (y = million hectares) as a function of changes in the other (x = year); it is the slope of the regression line. The simple linear regression is counted by STATISTICA 10 Software.

Production costs (sugar, sugar beet) may be classified by their behavior as fixed, variable or semivariable costs. Fixed costs do not change with the level of production (e.g. rents, insurances, salaries of certain executives); variable costs are in direct proportion to the volume of production (e.g. materials, wages, packaging); semi-variable costs increase or decrease as volume of production changes but not in direct proportion.

In relation to products or services provided by a manufacturing company, costs may be direct or indirect. Direct costs can be identified with and allocated to products/units (e.g. materials, labour charges including related social costs, expenses such as lease of special equipment

required for manufacturing certain products); indirect costs – often referred to as overheads or burdens – cover materials, labour and expenses which it is either impossible or inconvenient to charge direct to the product/unit (e.g. supervision, administration, maintenance, utilities).

Results and discusion

1. Basic overview

Beet and sugar production in the EU is based on a market organization, known as the common market organization of the sugar sector or Sugar

CMO. In 2006, this CMO was thoroughly reformed leading to a large reduction in quota sugar production of around 6 Mio tons (-30%). This left a remaining quota sugar production of around 13.3 Mio tons. In the years leading up to and following the adoption of the CMO reform, the number of EU sugar factories has fallen sharply as the industry has undergone major restructuring driven by the need to improve efficiency. Virtually every country and region of the EU has been affected. Today beet sugar production is distributed among 18 EU countries, as opposed to 23 before the restructuring, with 70% of the production concentrated in 7 countries (CEFS, 2012).

Reform of the EU Sugar Protocol began in 2006, with full liberalisation of the EU sugar market scheduled for 2015, including abolition of production quotas. Reform was driven by the need to reduce EU budgets and align the sugar market with the EU's overall move towards a market-oriented CAP (Common Agricultural Policy), which would also enhance the competitiveness of EU sugar production by eliminating unprofitable production capacity. Between 2006 and 2010, the EU had to reduce domestic production and also gradually reduce guaranteed beet prices and reference prices for imports of in-quota white and raw sugar by 36 per cent (Commodity Briefing, 2013).

The sugar reform in 2006 affected the sugar industry in many European countries. The volume of sugar beet and white sugar production was significantly reduced. The size of sugar industry in EU decreased and many production capacities were closed down. The number of sugar factories decreased more than 50 % and also the number of people working in sugar industry decreased significantly (cca 50%). The reform affected more production capacities in new EU member countries, while in the case of old EU members the reduction of both sugar beet and refined sugar production capacities was much lower (Smutka, Benešová, Pulkrábek, Belova, Urban, 2013).

2. Costs of sugar : sugar beet and sugar cane

One way to measure the effect of reform on current European Union sugar productivity and efficiency is examine costs of sugar production before and after reform. LMC International provides estimates of world sugar and high fructose syrup (HFS) costs of production. The data go back to 1979/80 and extend through 2009/10, with a preliminary forecast for 2010/11. Field, factory, and administrative costs are detailed for 35 beet producing countries

and for 61 cane producing countries. The lowest cost areas are in The Netherlands and the United Kingdom – under $525 per tonne. The three largest producing countries of France, Germany, and Poland are in the intermediate cost set with costs between $525 and $625. The high cost areas are in the Czech Republic, Hungary, Slovakia (between $625 - $850 per metric ton) and very high areas are in the Bulgaria, Finland, Greece, Italy, Portugal, Romania (Sugar and Sweetener Outlook, 2011).

The sugar beet belongs to the products with high production (so called highly intensive) but it is necessary to admit that the earnings are appropriate (Strnadová, 2009).

The total composition of sugar beet costs is in contrast with other products very different. For example the sugar beet and the rape are the products with high production costs related to the application of chemicals. By contrast, the rape is a product where we can buy relatively cheap seeds, while regarding the sugar beet, it is other way round. Purchase of quality seed pelleting and dosing means very high purchasing costs (for example in 2009: 12.5–14.5%). Also the harvest costs are high. Into the costs items, it is necessary to include also the contribution for the sugar beet transport in the sugar-refinery or settlement of production allotments.

The subsidy SAPS (Single Area Payment Scheme) and CNDPs (Complementary National Direct Payments) per 1 hectare of sugar beet have a positive impact on its economics though not sufficient enough. In practice, it means that it is highly probable that the break-even point will not be achieved and thereby it is highly probable that the fixed costs are not covered and the update of machines is significantly limited. If the agricultural companies count on the separate sugar payment, the sugar beet growing is (in all regions of the Czech Republic) with acceptable risk (Pulkrábek, Kavka, Rataj, Humpál, Nozdrovický, Trávníček, Pačula, 2012).

The price of sugar beet is a contractual price agreed between a sugar beet processor and a sugar beet farmer. Sugar beet prices depend on sugar prices. The price of sugar is fixed by the sugar producer according to market conditions and governmental agreements (FAO, 2009).

The price is also seriously affected by many technical factors that include beet yield, the sugar content of the beets and the sugar yield. Table 1 contains detailed information on production costs

of both beet sugar and cane sugar in a range of selected countries in the time period 1996-2006.

In Europe, the production cost of beet sugar (16% sugar content) is around EUR 20–30 per ton in competitive countries and EUR 30–40 per ton in noncompetitive countries. As can be seen from Table 1, the production cost of beet sugar is more than twice as high as the production cost of cane sugar. The production cost of beet sugar is significantly offset by the revenue from the sale of the by-products, i.e. molasses, pulp, beet particulate matter and carbonation lime.

Brazilian sugar production costs rose in recent years due to factors such as adverse weather, which cut cane throughput in mills, but this trend is now set to reverse as mills ramp up production of a huge harvest in 2013/14. Sugar mills in Brazil have substantial fixed costs and need to produce at near full capacity to keep their marginal costs to a minimum.

Graph 1 shows beet sugar production costs in the European Union and the United States relative to the world weighted-average cane sugar production costs. European Union costs are higher than those in the United States but costs in both regions have been declining since 2003/04 relative to cane sugar production costs. Although the most significant European Union cost declines started after the reform began, United States costs were declining as well.

3. European Union: production costs of sugar beet

Sugarbeet growers in Europe face the challenge of keeping up their financial yields. Due to the reform of the European Union sugar regime, the EU minimum price for quota beet fell from 43.63 EUR/tone sugarbeets (EC 1260/2001; Zeddies, 2006) to 26.29 EUR/tone from 2009 onwards (EC 318/2006), implying a 39.7% decrease. Growers have to raise their yield by the same percentage to compensate for this price drop, if the costs remain on the level of 2006. Another strategy is to reduce costs. Possibilities to save up to 20% of the costs without yield loss in sugarbeet production were identified (Pauwels, 2006). However, to compensate for the beet price drop by cost savings, costs should decrease much more to keep the absolute difference between costs and payment the same. Therefore, cost saving still leaves a need for raising sugar yield. A combination of both raising yield and saving costs would be profitable for the growers, too. The potential

		SUGAR BEET				SUGAR CANE				
		Poland	Ukraine	United States	Germany[1]	Brazil[2]	Australia	Thailand	S.Africa	India	United States
Yield of beet/cane	ton/ha	39.5	19.5	46.1	60.3	68.5	97.7	42.5	53.6	73.8	74.4
Sugar content	%	13.9	11.2	14.6	16.6	11.5	14.0	10.0	11.5	9.9	11.7
Sugar yield	ton/ha	5.5	2.2.	6.7	10.0	7.9	13.7	4.3	6.2	7.3	8.7
COSTS	EUR/ha	945	262.5	1,877.5	2,542	762.5	1,564.5	665.5	951.5	860	2,501.5
COSTS	EUR/100 kg beet (cane)	3.29	1.35	4.1	4.22	1.12	1.60	1.55	1.77	1.16	3.36
COSTS	**EUR/100 kg sugar**	**17.18**	**11.93**	**28.17**	**25.4**	**9.65**	**11.42**	**15.3**	**15.35**	**11.78**	**28.75**
Cost of labour	EUR/100 kg sugar	4.40	2.80	5.42	4.49	2.35	2.55	5.10	4.20	5.98	8.68
Labour required	hour/ha	180	150	30	24	200	35	400-500	400-500	x	50
Labour costs	EUR/ha	1.35	0.31	12.50	18.70	1.05	10.70	0.50	0.60	0.23	15.00
Cost of machinery	EUR/100 kg sugar	6.23	3.35	5.99	7.50	17.50	3.67	1.07	2.85	0.83	6.85
Cost of land	EUR/100 kg sugar	0.635	0	4.96	5.32	1.65	1.83	2.33	2.01	0	4.85
Cost of lease	EUR /ha	35	0	332.5	425	100	250	100	125	0	355.5
PROFIT	EUR/ha	1,011	355	2,082	3,253	548	1,686	6,36	1,072	1,454	2,176
PROFIT	EUR/100 kg beet (cane)	2.56	1.82	4.51	5.39	0.80	1.175	1.50	2.00	1.97	2.92
PROFIT	EUR/100 kg sugar	18.38	16.13	31.06	32.55	6.99	12.30	14.83	17.30	19.91	25.00

Note : 1) Database operated by the Association of South German land (Beet Growers, 1996-2006),
    2) Centre/south region: strong devaluation of the Brazilian currency
Source: Association of South German Beet Growers, USDA, 1996-2006

Table 1: Production profits and costs of beet sugar compared with cane sugar (1996-2006).
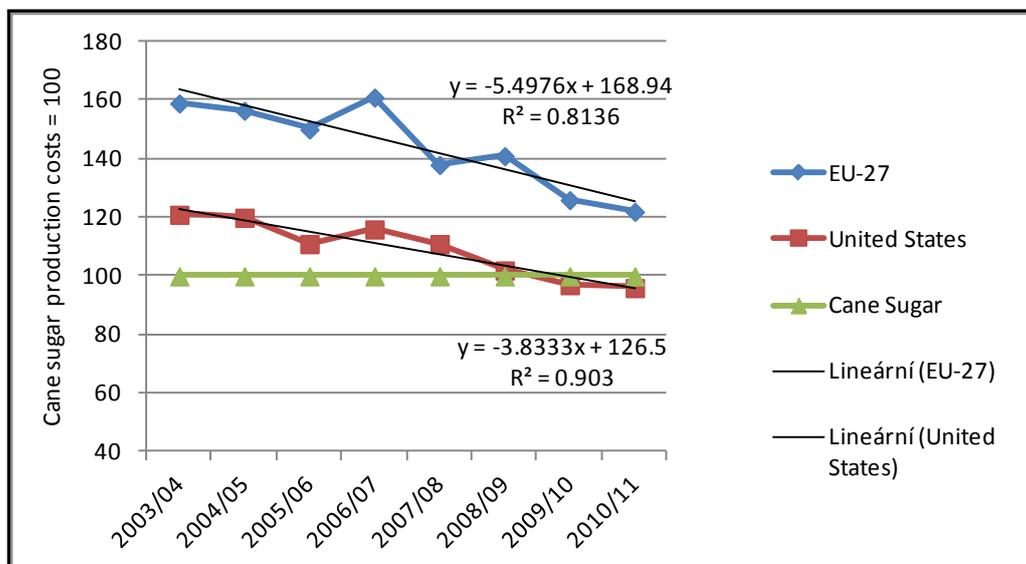
Note: Axis Y: Proportion (Cane sugar productin costs =100, Base)
Source: LMC International, Sugar and Sweetener Outlook, April 2011, own calculation

Graph 1: Sugar beet production costs (EU and U.S.) and their relation to the sugar cane production costs.

sugar yield in The Netherlands was calculated at a maximum of 23 t/ha (De Wit, 1953), more recent research found 24 t/ha sugar for Germany However, the average sugar yield achieved by Dutch growers was 10.6 t/ha in the period 2002-2006 (Van Swaaij, 2007), only 46% of theoretical potential.

Considering the above mentioned, the IRS (Institute of Sugar Beet Research, The Neterlands) formulated the 3 x 15 target. In 2015 the present EU sugar regime may be canceled and the target for sugar beet cultivation is national sugar yield of 15 t/ha (equivalent to 60% of the sugar beet potential) and 15 EUR/tone sugar beet of total variable costs. The costs per tone of sugar depend on the sugar beet yield and the sugar content. This reality has been reflected in the rate of sugar beet profitability.

Graph 2 shows sugar beet production costs (EUR/tone, year 2011) of the main European producers – France, Germany, Poland, United Kingdom and Czech Republic. Graph 2 presents comparison of the cost structure of sugar beet growing based on Agri-benchmark Cash Crop network. Based on that, cost and revenues for the individual crops on "typical farms" are calculated for the various locations (member countries).

France and Germany are the main European producers of sugar beet with 393,000 and 358,000 hectares (FAS Statistics, 2013/2014).

Germany and Czech Republic total costs and variable costs (EUR/tone) are higher than those in France, United Kingdom and Poland. Substantial differences are between cost of plant protection (in the Czech Republic and Germany 4.51-4.83 EUR/tone, in the France, United Kingdom and Poland 2.41-3.36 EUR/tone).

The average spent on sugarbeet herbicides in the United Kingdom in 2001 was around ₤105/ha (ca.158 EUR/ha). The cost of each application was about ₤6/ha (9 EUR/ha).

The total cost of growing sugar beet in the United Kingdom is arend ₤1100/ha. Crop protection is an essentials element and cost around ₤25 million (approximately ₤150/ha) in 2000 (British Sugar Annual Crop Surveys, 2000). Average spend per hectare on herbicides is usually between ₤105 and ₤120 /ha, on insecticides approximately ₤40 /ha, whilst arend ₤15/ ha is spent on fungicides (but usually only half the crop area requires treatment against fungal leaf diseases). Average yields in the United Kingdom in 2001 are usually around 55 t/ha of roots at 16% sugar.

In France, the national average cost for herbicides used in sugarbeets is approximately 130 EUR/ha. In France, for a number of different plant species, non-transgenic herbicide-tolerant varieties (HTVs) are beginning to be cultivated or are currently the object of petitions for inclusion in the Official Catalogue of Agricultural Species and Varieties (INRA, 2011). In this context, the public authorities and evaluative bodies in France are considering the various perspectives
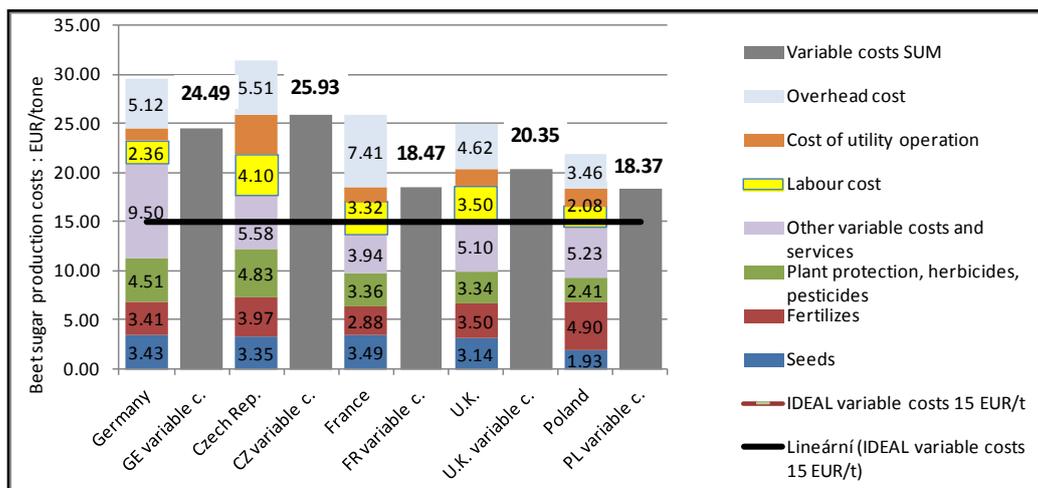
Source: AGRIBENCHMARK, (agribenchmark.org), Section Cash Crop, 2011-2012, own calculation

Graph 2: Structure of sugar beet production costs (EUR/tone, year 2011).

for future development of herbicide-tolerant varieties. The Ministries of Agriculture and Ecology wish to avail themselves of analytical elements with regard to the real effects, both medium- and long-term, of the cultivation of herbicide-tolerant varieties and their compatibility with existing environmental policies, notably the French plan for the reduction of the use of pesticides (Ecophyto 2018).

Total amout of variable costs per tone of sugar beet in main European producer countries (see Graph 2) are higher than 15 EUR (ie 18.37-25.93 EUR/tone) – member countries can not reach goal 15 EUR/tone of sugar beet in the marketing year 2015/2016.

4. Czech Republic and Tereos TTD a.s.: sugar beet yield potential and beet sugar campain 2012/2013

Assortment of present genetically single-germ sugar beet cultivars is quite wide and their yield potential and technological and growing characteristics are being improved by breeding; however, the use of these characteristics in operation conditions is very often low. The use of the yield potential in operation conditions is suitably defined by comparison of average data with the results reached in small plot trials (Pulkrábek et. al., 2008). In the period 1983-2008 the root yield in the Czech Republic increased at operation area by 0.8 tons per year and in small plot trials by 1 ton per year. During 2001-2007 the yield potential use was 71.1%. The highest use is in obtained sugar content. The use of yield potential of white sugar production reached 66.5%. The yield of white sugar increased very intensively in the time period 2001-2007 at the operation areas, yearly it increased by 0.2%. The yield of roots converted to 16% sugar content increased in the last decade very significantly, yearly in experiments by 2.35 t per ha and in operation conditions by 2.01 t per ha. The results, published in Pulkrábek et. al. (2008) prove very high production intensity and standard of new sugar beet cultivars. Production potential of sugar beet root yield reaches in the Czech Republic 110-130 tonnes from hectare, polarization sugar yield potential reaches 18-22 tonnes.

The results based on database from the Institute of Agricultural Economics and Information (IAEI) and published in Špička and Janotová (2013) show decreasing average costs per tonne of root, especially staff costs, and increasing profitability

of Czech sugar beet producers between 2007 and 2011. Most producers are highly economically effective. However, there is potential in efficiency of material costs and sugar yields. Sugar beet seems to maintain its irreplaceable position in the Czech agriculture.

The sugar campaign 2012/2013 in the Czech Republic was characterized by excedent technological quality of the processed beet and favorable climatic conditions throughout the growing and treatment seasons. A total of 4.293 mil. tons of beet were processed in the campaign with average root yield 66.99 t/ha and polarized sugar yield 11.41 t/ha. The weighted average sugar content has surpassed 17.61% (range 18.07–16.61 %) in the Czech Republic. The campaign took 110.9 days; the amount of sugar from beet was 535.5 kt in white sugar. Intensive and extensive quantities reached predominantly positive values which prove that within the European Union Czech Republic is a producer of high quality sugar beet and high quality sugar. In 2012/2013 investments in Czech sugar factories concentrated mostly on improving ecology, technology and increasing efficiency of beet products.

In the marketing year 2012/2013 operates in the Czech Republic 5 sugar companies, among which is divided quota 372 459.207 tons. Tereos TTD a.s. sugar company has a quota of 208 715.651 tons, witch is 56.04 percent of national quota.

Cukrovary TTD (owned jointly by Tereos and German sugar group Nordzucker), which was bought over in the early 1990s, controls a significant part of the Czech sugar market, and its management has also been raving enthusiastically about expansions and acquisitions and producing lots of ethanol from sugar beet and selling some of it to Germany. In France and the Czech Republic Tereos is the leading sugar producer. All activities combined, Tereos sold 2.3 million tons of sugar across Europe in 2011/12.

Tereos has been supporting its cooperative growers for a long time with a view to further strengthening the quality and competitiveness of their beet production. Tereos France advises growers throughout the sugar beet growing journey, from fertilising to weed and dinase control.

Tereos's results include the operations of Tereos Internacional and its original activities of sugar beet processing in Europe, which remain within the unlisted cooperative which groups 12,000

farmers. Tereos is the largest beneficiary of European Union farm subsidies in the 27-member bloc.

The company aims to raise French average yields to 110 tonnes per hectare by 2020, which combined with energy costs savings, would allow it to raise its competitiveness against sugar cane.

According to Tereos Annual Report (2012), Tereos TTD a.s. in the Czech Republic, in 2012/13, followed on from the previous year with another outstanding performance. Favourable weather conditions, increase in growing areas, efficient facilities: all indicators have progressed or been maintained. The 2012/13 Tereos TTD a.s. campaign made it possible to achieve abundant production again, with a sugar beet yield of 79.5 tons per hectare at 16%, benefiting from the favorable weather conditions.

Table 2 and Graph 3 shows sugar beet yield

in the marketing year 2006/07 - 2012/13. Used statistical methods are the Fixed Base Index Numbers and Chain Base Index Numbers.

Table 2 shows the Fixed Base Index Numbers and Chain Base Index Numbers of described companies: Sugar beer yield per hectare of Tereos France and Tereos TTD a.s. (Czech Republic). Important is the dynamic in last analyzed years (2009/10 - 2012/13), because it shows the trend for next years. The Chain Base Index Numbers is higher for Tereos TTD a.s. (31.92 % in the marketing year 2011/2012) than for Tereos France (nearly 13.42% in the same period).

Graph 3 shows the difference (%) between sugar beet yield of Tereos France (Base, 100 %) and Tereos TTD a.s. (Czech Republic). In the marketing year 2006/07, the difference of yields (per hectare) was 26.86 percent, in 2012/13 difference droped to 5.69 percent.

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Tereos France	79.3	81	85.5	94	84.2	95.5	84.3
Tereos TTD a.s.(Czech.R.)	58	59	63.2	66.7	61.4	81	79.5
Difference (%)	26.86%	27.16%	26.08%	29.04%	27.07%	15.18%	**5.69%**
Base index Tereos France	1	1.021	1.078	1.185	1.061	1.204	**1.063**
Base index Tereos TTD a.s.(Czech R.)	1	1.017	1.089	1.150	1.058	1.397	**1.371**
Chain index Tereos France	x	2.14%	5.56%	9.94%	-10.43%	13.42%	-11.73%
Chain index Tereos TTD a.s.(Czech R.)	x	1.72%	7.12%	5.54%	-7.95%	**31.92%**	-1.85%

Source : TEREOS Annual Report 2012, Tereos' Communications Department, 2013, own calculation

Table 2: Sugar beet yield in the marketing year 2006/07 - 2012/13, tons per hectare, 16% sugar content.
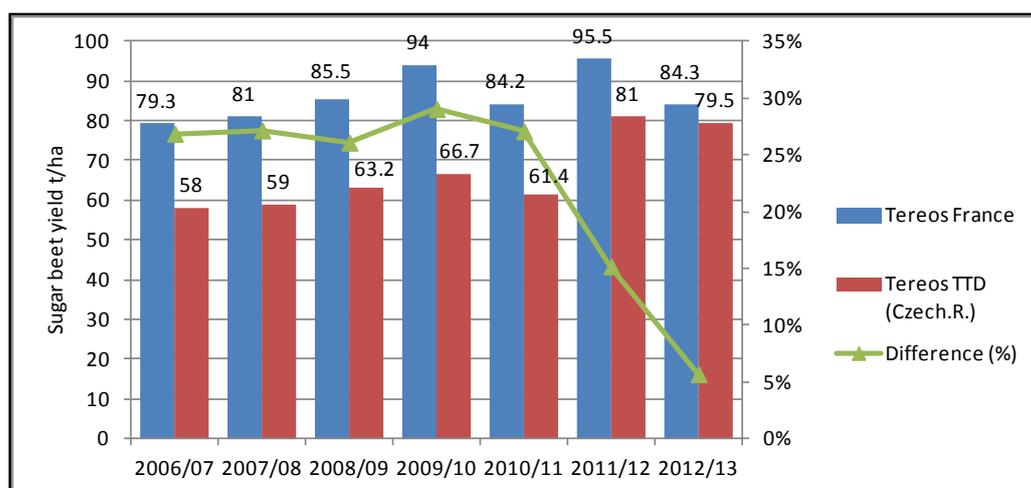
Source: TEREOS Annual Report 2012, Tereos' Communications Department, 2013, own calculation

Graph 3: Difference (%) between sugar beet yield of Tereos France (Base, 100 %) and Tereos TTD a.s. (Czech Republic), t/ha.
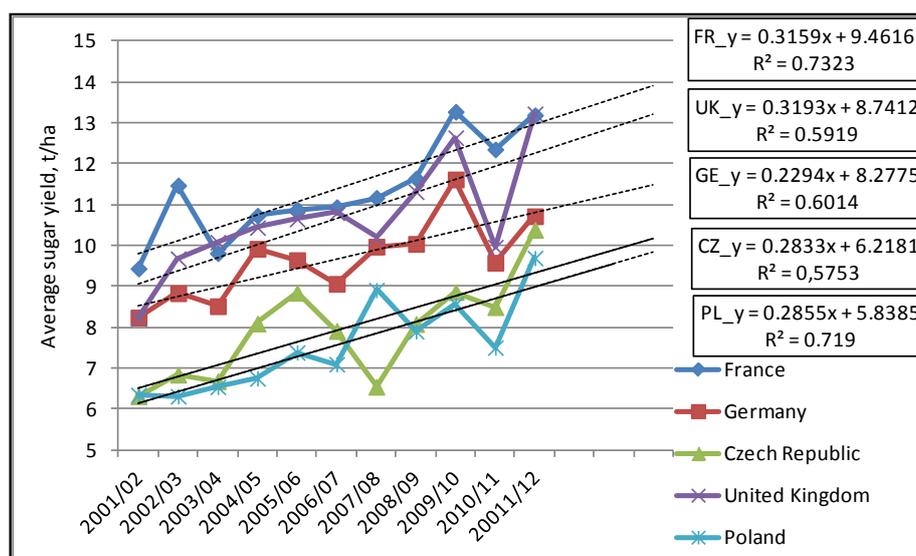
Note: In statistical significance testing, the p-value is under 0.015 by all countries. The results are statistical significant.
Source : CEFS SUGAR STATISTICS 2012, Comité Européen des Fabricants de Sucre, , STATISTICA 10 Software, own calculations

Graph 4: Average sugar yield, t/ha, regression analysis of time series.

5. Future trends in beet sugar sector – regression analysis of average sugar yield (t/ha)

Regression line, calculate in the Graph 4 is linear (y = ax + b) and the regression coefficient is the constant (a or Beta). Regression coefficient represents the rate of change of one variable (y = sugar beet yield t/ha) as a function of changes in the other (x = year); it is the slope of the regression line.

The highest value of regression coefficient includes United Kingdom sugar yield line, Beta = 0.3193, i.e. year-to-year prediction growth is 0.3193 tons of sugar per hectare. In 2014/2015 can be achieved 13.14 t/ha of sugar yield.

The second highest value of regression coefficient includes France sugar yield line, Beta = 0.3159, i.e. year-to-year prediction growth is 0.3159 tons of sugar per hectare. In 2014/2015 can be achieved 13.97 tons of sugar per hectare.

The third highest value of regression coefficient includes Czech Republic and Poland sugar yield line, Beta = 0.2833 (0.2855), i.e. year-to-year prediction growth is 0.2833 (0.2855) tons of sugar per hectare. In 2014/2015 can be achieved in the Czech Republic 10.14 t/ha of sugar yield (Poland 9.85 t/ha).

The lowest value of regression coefficient includes Germany sugar yield line, Beta = 0.2294, i.e. year-to-year prediction growth is 0.2294 tons

of sugar per hectare. In 2014/2015 can be achieved in the Germany 11.55 t/ha of sugar yield.

The conclusions made from simple linear regression are statistically significant and correct, but there is necessary to compare the linear trends to real European situation.

> *The main producers of sugar beet in the European Union (i.e. France, Germany, Poland, United Kingdom and Czech Republic)* **can not achieve** *goal of sugar yield 15t/ha while maintaining the amount of variable (direct) costs at 15 EUR/1t of sugar beet in the marketing year 2015/2016.*

Conclusion

The sugar beet is the strategic and energetic crop, which can multiply (by the best way) the invested energy. Sugar crops are improving the soil fertility and the growing of sugar beet increasing the yield of crops produced after the sugar beet within the crops rotation cycle. Sugar beet is not only raw material for food industry. It is used for food production (white sugar, alcohol), it is also used as a renewable source of energy (dehydrated alcohol, raw material for biogas units), feed materials (fresh beet pulp and granulated beet pulp, distiller's grains), fertilizers (green parts, carbonation lime) and CO_2 (liquid carbon dioxide for both alcoholic and nonalcoholic beverages production).

The energy balance of beet is very positive, with beet producing 15-16 times more energy than is required to produce it. Beet is playing a more significant role in the bioeconomy than before 2006 and is contributing to the aims of the Europe 2020 strategy. The sugar quota, allocated to beet growers through delivery rights, gives farmers an opportunity for stable diversification of rotation crops.

Because of its character sugar is one of the strategic commodities. Its position within the frame of global market is becoming to be more and more important especially because of the permanent growth of global consumption. The average inter annual growth rate of consumption is about 2 %, i.e. about 3.9 mil. t/year. The importance of sugar in nowadays is even multiplied because of the growth of its consumption for the production of the renewable sources of energies. The expected World production of sugar in the period 2012/2013 is 177 mil. t.

The reform restricted the sugar production in the EU by about 30% (for 5.1 mil. t), it caused the reduction of number of farmers growing sugar beet by about 19 % (i.e. 150 000 sugar beet producers/farmers) and the number of sugar producing capacities by about 41 % sugar producers (i.e. 83 sugar refineries were closed). After the reforming the total area of sugar beet production in the European Union was reduced to about 1.5 – 1.6 mil. ha. The above mentioned reform is the reason why the European Union lost self-sufficiency in sugar production. The restriction of own production reduced the European Union's position on the world sugar market. The current world sugar price is dependant primarily on the demand for the sugar cane. The cane sugar production represents about 84% of the total world sugar production.

The year 2013 is crucial for the future of beet sugar production In the European Union. Regardless of its minor share, sugar beet as a raw material – compared to sugar cane – has a potential of further qualitative production growth. In the European Union, sugar beet yields reach 800-110 t/ha and white sugar yields reach 10-11 t/ha. This growth potential is also one of the main arguments for prolonging the current form of sugar regime in the European Union until 2020.

The accession of the Czech Republic into the European Union affected the Czech sugar production. The sugar reform made by the European Union in 2006 significantly influenced the Czech sugar and sugar beet production capacities. This reform did not influenced only Czech sugar industry but it has a direct impact on the whole EU sugar production capacities.

During the last two years 2011 – 2012, yields of Czech sugar beet production reached the high level. The year 2011 represented a record, the average yield of Czech sugar beet producers reached more than 70 t/ha (16% sugar content is taken in consideration for calculation of average yield volume). The same trend was recorded in the year 2012. In the year 2012, the significant differences between particular regions were recorded – producers in Czech region harvested on average cc 80 t/ha, in Morava region the yields were oscillated between 50-70 t/ha (weather was a key factor influencing the volume of yield and harvest).

During the last ten years (2002 – 2012) the average volume of Czech sugar beet yields per hectare recorded about 61 t/ha. In the same period the average yields of sugar beet per hectare increased by 57% in the Czech Republic (for example in France it was only by 39.7%). During the analyzed time period, the average growth of Czech yields per hectare (in the case of 16% sugar content) reached 2.85 t/ha the Czech Republic (for example in France it was around 2.45 t/ha).

According to the Ministry of Agriculture of the Czech Republic, it is important for the Czech Republic to keep the competitive sugar production. The reason for the keeping of competitiveness is the ability of the Czech Republic to ensure an influence on sugar price development in neighbouring countries in the moment when the EU market will be liberalized. It is necessary to use historically good experiences of Czech sugar beet and sugar producers. To be able to keep a good position on the market, it would be suitable to set the system of subsidies according to the document issued by Ministry of Agriculture "Strategy for growth for the period 2014 till 2020". Sugar beet belongs among the stabilizing crops in crops rotation process in the Czech Republic.

Weeds can grow very well in sugar beet stands and if they are not controlled, the yield can decrease dramatically. In the Czech Republic, a system of several (normally three) post-emergent herbicide applications is currently used. For particular terms of application, herbicides and their rates are chosen according to weed spektrum and growth stages

of both the weeds and the crop. Weed management in sugar beet is relatively expensive, which is one of the main reasons why management based on herbicide tolerant (HT) sugar beet varieties has been massively used outside the European Union. The most frequently used is Roundup Ready system based on crop tolerance to glyphosate. Roundap Ready sugarbeet is an important relatively new biotech crop first commercialized in the USA and Canada in 2007, and an increased adoption rate of 59% in 2008, and 95% in 2009 when acreage reached more than 1 million hectares (in 2011) - this makes it the fastest adopted biotech crop since the genesis of commercialization in 1996.

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The Factors Influencing the Application of Organic Farming Operations by Farmers in Iran

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Abstract

The overall aim of this study is to study the factors influencing the application of organic farming operations by farmers. The research's statistical population would consist of all the farmers in Divandarreh city (N=7931). Using the Cochran's sampling formula, 98 individuals were selected as the sample. In order to enhance the validity of findings, a total of 120 questionnaires were distributed using stratified random sampling, with proportionate and finally, 115 ones were completed and analyzed. The research's main instrument was a questionnaire whose viability by a panel of experts and its reliability was confirmed by Cronbach's alpha coefficient ($\alpha > 0.7$). Data analysis was carried out by the software SPSSwin18. The results showed that the study farmers apply organic farming operations at a low and moderate level. Additionally, the results indicated that there is a positive and significant relationship between the application of organic farming operations with the variables of farming-work experience, literacy, use of communicative media, attitude to organic farming, knowledge and awareness of organic farming, participation in educational courses of extension, and use of educational publications. Moreover, the results of regression analysis showed that the three variables of use of information and communicative resources and channels, attitude to organic farming, and use of educational and extensional publications explained 61.2 percent of the changes related to the variance of the study's dependent variable (application of organic farming operations).

Key words

Sustainable Agriculture, Organic Farming, Soil Preservation, Divandarreh City.

Introduction

After World War II, farming sector, especially because of modern technologies utilization, machinery, increasing use of chemicals, and specialization of public policies, has dramatically changed and enhanced the yield and productivity of farming products. Although, the above items have led to considerable variations and have lowered the original risk of farming activities, they've imposed remarkable costs such as surface soil erosion, ¬underground¬ waters contamination, decline of family farming, the ever increasing neglect of laborers'

Working and livelihood circumstances, high costs of production, and lack of consistency with socio-economic conditions in rural communities (Shabanali Fami et al, 2010). Modern agriculture has resulted in great achievements in respect of increasing food products, enhancing the productivity of production resources, and improving commonwealth. According to many

scholars (Godfray et al., 2010; Lang & Barling, 2012; Borlaug, 1997) it plays an extremely significant role in providing welfare and food security for communities. Therefore, excessive reliance on the external inputs, especially chemical fertilizers, farming machinery, and immoderate use of them has really damaged the environment (Burn, 2000; Storkey et al., 2011). So that in recent decades, due to the concerns about environmental problems, modern agricultural systems were severely criticized (Alonge et al, 1995; Rodrigues, 2005). In most of the farms as well as in our country, the agricultural products, especially fruits and vegetables, are precipitously sprayed. In an operational period, sometimes a melon-bedis sprayed up to 15 times and it's not acceptable to observe any time distance between spraying and harvesting, thus you didn't need to apply complex and sensitive devices to measure pesticide residues. Consumer taste by itself truly testifies the pesticide taste in product. The current paradigm shift in the production and transition

to sustainable agriculture is undeniable (Maxey, 2007). Over the past two decades, human has sought to find effective solutions to solve these problems one of which has been a movement towards sustainable agriculture that, in recent decades, has caught much attention and popularity in various countries. Sustainable agriculture is not only concerned with many social and environmental problems, but also it creates innovative and economically advantageous opportunities for farmers, growers, workers, consumers, policy makers and other actors involved in the agricultural sector and all the society. Sustainable agriculture which, as cited in Al-Subaiee et al., (2005) aims to produce healthy and sufficient food for the present and future generations through proper use of natural resources is defined by various experts in different ways (Minarovic et al., 2000). Effects of industrial agriculture on the environment in the late 1960s and early 1970´s caused the sustainable agriculture to be considered (Harwood,¬1990). Moreover, Organic farming or biological agriculture means to use traditional and scientific information to reduce the use of pesticides and chemicals in agricultural production, with regard to the compatible interaction of human activities with the cycles of nature and using it reasonably. This fact will lead to the sustainable balance in the basic water and soil sources (Lampkin, 1990; Fuller, 1997; Guthman, 2004). Organic farming is discussed in terms of biological or biodynamic farming as well, and has four basic principles of health, ecology, fairness and care and is based on ecosystem management (Lockie & Halpin, 2005; Mohammadi, 2008). The philosophy of this agricultural method is based on human goals and long-term effects of human activity on the environment, so that agricultural systems must be equitable, protect natural resources, reduce pollution and enhance productivity. In generally, Organic farming considers food production as a living process in which the health of soil is very important (Anon, 1979). In this way, the farm is managed in such a manner that the maximum advantage is taken out of foods and minimum wastage is left (Malakouti, 2000). Producing the food with acceptable quantity and quality, maintaining and improving soil fertility, reducing the pollution of water and soil, increasing the producers' revenue and decreasing production costs in regions with low yield rate, and protecting the health of farmers and producers by creating a healthy ecosystem in the long run can be referred to as some of the important goals of organic agriculture (Guthman, 2004). This type of

farming improves soil conditions, using minimum tillage, biological fertilizers, the use of crop rotation and cover crops, compost and organic fertilizers. Organic farming is actually in harmony with the ecology and leads to the conservation of the water, carbon and nutrients cycles (Trewaves, 2004). In addition to thinking of food quantity, this type of farming pays specifically attention to the food quality and safety (Jacobsen et al., 2005; Antoine, 2008). With this regard, considering the importance of the subject, several studies have examined the application of organic agricultural operations by farmers and the factors influencing it. Among them, we can mention the following:

In a study on farmers in West Kenya, Makah et al. (1999) showed that farmers' participation in agricultural workshops and seminars, contacting with the Extension Organization and deciding to reduce the use of chemical fertilizers, and specific technological characteristics and the effects of these technologies on crop production has a significant influence on the adoption of conservation farming operations.

According to Beedell & Rehman (1999), such methodologies can be standardized and repeatable, thereby making them useful in monitoring change over time for EU policy-makers. These requirements have contributed to a recent increase in the application of 'behavioral approaches' to investigate issues such as food security and agricultural sustainability. Fakoya et al (2007) shown that there is a significant positive relationship between people's attitudes and use of sustainable agricultural operations. Along & Martin (1995) represented that the perception of farmers towards the compatibility of sustainable agriculture operations with their farming systems are the best predictor of the adoption of these operations. Bagheri et al (2008) illustrate that education level, contact with agriculture experts, and participation in the extensional programs is the best predictors of the attitudes of rice farmers in Haraz region, Mazandaran province, towards the technology application in sustainable agriculture. Comparing the attitudes of male and female rice farmers in a village of Kazeroon city. Mansoorabadi & karimi (2007) concluded that female farmers have a more positive attitude to sustainable agriculture than males and the factors, such as education and access to information, are effective on the farmers' attitudes to the use of sustainable agriculture. In generally, some writers are concerned that organic farming systems are becoming 'conventionalized' in their

production, marketing and distribution methods (Lockie & Halpin, 2005; Rosin & Campbell, 2009), some of them think that they have the potential to 'develop in distinct ways in different national contexts' (Hall & Mogyorody, 2001, p. 401; see also Coombes & Campbell, 1998 and Guthman, 2004).

Therefore, the overall aim of this study was to examine the factors affecting the application of organic agricultural operations by farmers in city of Divandarreh.In order to achieve that, the following specific objectives will be pursued:

1. To identify the individual, social and economic characteristics of the sampled farmers;

2. To evaluate the application of organic agricultural operations and prioritize its constituent items;

3. To analyze the relationships between the studied variables with the application of organic farming operations by the study farmers;

4. To determine the effect of studied variables on the application of organic farming operations by the study farmers.

Materials and Methods

The design of the study was a descriptive survey that done by single cross-sectional study. The survey would contain all farmers in the city of Divandarreh (Kurdistan province), including the central part (4736 subjects) and Saral part (3195 subjects) (N =7931). Using Cochran's sampling formula, 98 individuals were selected as the sample (in Cochran's sampling formula, the application organic farming operations is as dependent variable). To increase the validity of findings, 120 questionnaires were distributed using stratified random sampling method (different parts were considered as classes) with proportionate probability and finally, 115 completed questionnaires were completed and analyzed. The main research instrument was a researcher-made and pre-tested was questionnaire. The questionnaire consisted of three parts, first: 14 items related to individual, social and economic characteristics, second: 14 items to measure the attitudes of farmers to organic farming, third: 12 items to assess their knowledge of organic farming, fourth: 18 items to evaluate the use of information sources and communication channels, and fifth: 17 items to measure the application of organic farming operations. To determine the validity of the questionnaire, a panel of experts, including the experts in the fields of agricultural education

and extension and agricultural development and management of Tehran University, was used and based on their comments and suggestions, necessary amendments were made to the questionnaire. To estimate the reliability of the questionnaire, the Cronbach's alpha coefficient test was used (Table 1). Given that Cronbach's alpha coefficients calculated for each of the questionnaire's sections was above 0.7, it was concluded that the questionnaire had good reliability for conducting research. In order to classify the study farmers according to the application of organic farming operations, Standard Deviation from the Mean (ISDM) was used as follows (Gangadharappa et al., 2007):

Low: A < mean- SD

Middle: mean- SD < B < mean + SD

High: C > mean + SD

SD is standard deviation, Adoption of organic farming operations are classified in three parts (high, medium, low). The data analysis implemented in two parts, consisting descriptive and inferential statistics by using SPSSwin18 software. In the descriptive part of the statistical analysis frequency, percentage, mean and standard deviation were used. In the t inferential statistical analysis comparison, correlation analysis and regression analysis were used. The step-by-step iterative construction of a regression model that involves automatic selection of independent variables. Stepwise regression can be achieved either by trying out one independent variable at a time and including it in the regression model if it is statistically significant, or by including all potential independent variables in the model and eliminating those that are not statistically significant, or by a combination of both methods.

Results and discussion

Individual, social and economic charact-eristics of the study farmers the results showed that the average age of farmers was 42.12 years with a standard deviation of 14.57, the youngest 19 years old and the oldest was 71 years old. Average annual income in terms of results was 7.3 million Tomeans. Average use of communicative media among farmers was 6.85 hours per day with a standard deviation of 3.7. Average farming experience was 17.12 years, with SD 44/13. Farmers owned an average of 21/11 acres with SD 4.71. Moreover; the farmers owned an average of 7.8 pieces of land. The results of other characteristics

The variables	Number items	The value of Cronbach's alpha
- Attitude	14	0.78
- Knowledge	12	0.81
- Communication channels	18	0.84
Application	17	0.79

Source: authors own processing

Table 1: Calculated Cronbach's alpha coefficients.

Variable	Variable levels	Frequency	Valid percentage	Facade
- Literacy rate	- Primary school	56	48.69	*
	- Guidance school	42	36.52	
	- Diploma	15	13.04	
	- Higher than diploma	2	1.75	
- Participation in extensional courses	- Less than two times	79	68.69	*
	- Two to four times	25	21.72	
	- More than four times	11	5.59	
- Concerns with environmental issues	- Very low	15	13.04	
	- Low	45	39.13	*
	- Middle	23	20	
	- High	15	13.04	
	- Very high	17	14.79	
The use of educational publications	- Very low	31	26.95	*
	- Low	28	24.34	
	- Middle	25	21.72	
	- High	20	21.04	
	- Very high	11	5.95	
Introduction to organic farming	- Very low	51	44.34	*
	- Low	23	20	
	- Middle	25	21.73	
	- High	12	10.43	
	- Very high	4	3.5	

Source: authors own processing

Table 2: The frequency distribution of the individual characteristics of the villagers.

of the study population are given in Table 2.

Evaluation of the application of organic farming operations and prioritizing its constituent items among the study farmers

In order to investigate the application of organic farming operations, ISDM scale was used. The results of this section are shown in Table 3.

The results of Table 3 indicate that only 11 individuals (9.57 %) greatly apply organic farming operations, whilst, 39 individuals (33.91 percent) at a moderate level and 65 subjects (56.52 %) at a low level would apply organic farming operations. Therefore, according to the above, it can be stated that the majority of farmers don't apply

organic farming operations in this city, because 104 subjects (90.43 %) applied organic farming operations on their farm at a low and moderate level. In order to prioritize the items related to the application of organic farming operations by farmers in the study, Mean was used. The results of this section are presented in Table 4. Based on the results of Table 4, it can be stated that the farmers in city of Divandareh use more the operations of "crop rotation on the farm"and"use of shallow culture". However, the operations of „intercropping" and „culture of Leguminosae plants" are used less by them.

Analysis of the relationships between the study variables with the application of organic farming

Application levels	Frequency	Percentage	Cumulative percentage
- Low	65	65.52	65.52
- Middle	39	33.91	43.90
- High	11	9.57	100

Average: 25.9, Min: 11, Max: 49, Standard Deviation 7.21.
Source: authors own processing

Table 3: Classification of farmers based on the application of organic farming operations.

Items	Mean	SD	Rating
- Application of crop rotation	4.06	0.477	1
- Application of plow shallow in farm	3.64	1.25	2
- Application of breeding seeds	3.65	1.31	3
- Application of animal fertilizers on the farm	3.61	1.11	4
- Application of green fertilizers in farming	3.59	0.759	5
- Biological control of pests	3.27	0.857	6
- Application of the principles of sustainable water resources management	3.14	1.12	7
- Application of the trap plants	3.12	1.16	8
- Covering soil surface by vegetation residue	3.02	0.987	9
- Proper management of soil erosion	2.84	1.00	10
- Application of no use in farming	2.76	0.852	11
- Application of varieties resistant to pests and diseases	2.45	0.487	12
- Plowing perpendicular to the slope	2.38	0.931	13
- Application of beneficial insects in farming	2.14	1.15	14
- Application of Leguminosae plants	2.02	1.12	15
- Application of mixed cultivation	1.95	0.974	16

* Scale: 1-very low, 2-low 3-middle, 4-high, 5-very high
Source: authors own processing

Table 4: Prioritizing the items related to application of farming organic operations.

operations by farmers in the study:

In order to investigate the relationship between the research variables (including relative and spatial data) with the application organic farming operations by farmers the study, Pearson and Spearman correlation coefficients were used, respectively. The results of this section are shown in Table 5.

The results presented in Table 5 indicate that there is no statistically significant relationship between the variables of age, income, amount of farming lands, and number of land parcels with the application of organic farming. However, the above results indicate that there is a positive significant relationship between the variables of field work experience, level of education, application of media, attitudes towards organic farming, knowledge of organic farming, participation in extensional courses, and application of educational publications with the application of organic farming. This means that the farmers who take more advantage of communicative media or enjoy good knowledge of and attitude toward organic farming as well as participate in extensional-educational courses, further apply organic farming operations.

To determine the effect of the studied variables on the application organic farming operations by farmers. In order to determine the effect of the studied variables on the application organic farming operations by farmers, stepwise multiple regression analysis method was used. Stepwise method is a technique in which the most powerful variables, one by one, enter into the regression equation and this continues until the significance test error reaches 5%. In this study, after entering the variables that correlated significantly with the dependent variable of the study

Independent variables	Application of organic farming operations	
	r	Sig
1 - Age	-0.412	0.452
2 - Income rate	0.125	0.475
3 - Work experience	0.524**	0.000
4 - The amount of farming lands	0.414	0.126
5 - Literacy rate	0.458**	0.000
6 - Number of land parcels	0.352	0.254
7 - Application of communicative media	0.625**	0.000
8 - Attitude towards organic farming	0.758**	0.000
9 - Knowledge and awareness of organic farming	0.451**	0.000
10 - Participation in extensional courses	0.213**	0.000
11 - Application of educational publications	0.125**	0.000

** Significance at 1% level
Source: authors own processing

Table 5: Correlation between the study variables with the application of organic farming operations.

Step	Independent variable	R	R2	R2 Ad	Sig
1.	Communicative channels and resources	0.528	0.214	0.157	0.000
2.	Attitude towards organic farming	0.698	0.421	0.396	0.000
3.	The application of educational-extensional publications	0.785	0.612	0.498	0.000

Source: authors own processing

Table 6: Multiple regression to examine the effect of the independent variables on the dependent variable.

Independent variables	B	Beta	t	Sig
- Fixed coefficient	18.625	-	7.658	0.000
- Communicative channels and resources (X1)	3.011	0.625	3.524	0.000
- Attitude towards organic farming (X2)	1.125	0.752	3.985	0.000
- Application of educational publications (X3)	1.236	0.396	3.502	0.000

Source: authors own processing

Table 7: The influence rate of the independent variables on the dependent variable.

(the application organic farming operations), the equation moved 3 steps forward. The results of this section are shown in Table 6.

The results presented in Table 6 show that in the first step, the variable of application of communicative media entered into the equation. The multiple correlation coefficient (R) equals to 0.528 and the coefficient of determination (R2) equals to 0.214. In other words, 21.4 % of the changes of dependent variable (the application organic farming operations) are explained by this variable. In the second step, the attitude towards organic farming entered the equation. This variable increased multiple-correlation coefficient (R) to 0.698 and the coefficient of determination (R2)

to 0.421. In other words, 20.7 % of the changes of dependent variable (the application organic farming operations) are explained by this variable. In the third step, the application of educational-extensional publications in the field of agriculture entered into the equation. This variable increased multiple-correlation coefficient (R) to 0.813 and the coefficient of determination (R2) to 0.612. Therefore, 19.1 % of the changes of dependent variable (the application organic farming operations) are explained by this variable. Based on the results, 61.2 % (R2 = 0.612) of the changes of dependent variable (the application organic farming operations by the farmers) can be explained by these three variables and the remaining 38

percent is due to other factors that have not been identified in this study.

According to the above description and the results of Table 7, the linear regression equation is as follows:

$$Y = 18.625 + 3.011 X_1 + 1.125X_2 + 1.236 X_3$$

The significance of F and t tests showed that regression equation is significant. Regression equation dose not express anything about the relative importance of the independent variables to predict the changes of dependent variable. To determine the relative importance of independent variables in predicting the dependent variable, the value of Beta should be noted. These statistics show the impact of each independent variable, out of the impact of other independent variables, on the dependent variable. Accordingly, the most influential independent variable on the dependent variable (application organic farming operation), is the variable of attitude toward organic farming in which the Beta value is about 0.752. That is, one unit of change is created in the standard deviation of in the variable of attitude towards organic farming and 0.755 unit of change in the standard deviation of the dependent variable (application of organic farming operation).Other variables, in order of importance to influence the dependent variable (application of organic farming operations) include: information and communicative sources and channels with Beta value of 0.625, and the application of educational publications on farming with beta value of 0.396. Therefore, information and communicative sources and channels, attitude toward organic farming and the application of educational-extensional publications have large effects on the application of organic farming operations. That is, the more favorable the farmers' attitude towards organic farming is and the more they enjoy information and communicative sources and channels, literacy, and educational-extensional publications, the more they'll apply the organic farming operations.

Conclusion

An increase in the needs of human communities to food security, increasing population growth and the development of science and new technologies, such as production of high yielding varieties, use of chemical fertilizers and pesticides, genetic engineering and biotechnology has led to a massive imbalance in and promotion of agriculture. Alongside the increase in farm

production and resolving food shortages in many developed and developing countries, new problems have emerged in the field of agricultural ecosystems. Water pollution, affected health of the soil and a decrease in the absorption rate of certain micronutrients, such as zinc, copper and iron, and the disturbance of the biological balance of ecosystems, pest resistance to chemical pesticides and the appearance of new pests, and ultimately reduction of the quality of agricultural products are of great importance among these problems. The set of these factors has caused the environmental protection and security of food health turn into one of the challenges in the present era. The international community considers sustainable agriculture systems as the most appropriate strategy to resolve these problems. In this regard, considering farmers as the farming administrators, responsible for remarkable functions, therefore a prerequisite for any planning by them is to be aware of the current situation. Accordingly, the overall aim of this study was to identify the factors affecting the application of organic farming operations among farmers in city of Divandarreh. The results showed that farmers apply organic farming operations at low and middle levels. The results of correlation analysis showed that there is a positive and significant relationship between the variables of application of organic farming operations with the variables of farming experience, level of education, application of communicative media, attitude toward organic farming, knowledge and awareness of organic farming, participation in educational-extensional courses, and application of educational publications. The results of this section are consistent with the findings of Bagheri et al (2008), Fakoya et al (2007) and Makoha et al (1999). Additionally, the results of multiple regression analysis showed that the variables of application of information and communicative sources and channels, attitude toward organic farming, and application of educational publications are able to predict 61.2% of the variance in the dependent variable (application of organic farming operations). According to the results of this study, it can be recommended that:

1. Since there is a positive and significant relationship between the farmers' attitude and application of organic farming operations by them, we can take steps to change their attitude towards sustainability through holding educational courses on organic farming and its benefits. This will eventually help them with the adoption of organic farming.

2. As there was a significant positive relationship between the knowledge of farmers and application of organic farming operations, it is recommended that the concepts and operations of organic farming should be emphasized in the educational-extensional courses held for the farmers, so that farmers can get familiar with this type farming.

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Using of Automatic Metadata Providing

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Anotace

Příspěvek prezentuje nezbytnost systémového řešení pro poskytování metadat lokálními archívy do centrálních repozitařů a jeho následnou realizaci Katedrou informačních technologií Provozně ekonomické fakulty České zemědělské univerzity v Praze pro potřeby agrárního WWW portálu AGRIS. Systém podporuje OAI-PMH (Open Archive Initiative – Protocol for Metadata Harvesting), více metadatových formátů a tezaurů a vyhovuje jakostním požadavkům v podobě funkčnosti, bezporuchovosti, použitelnosti, udržitelnosti a přenositelnosti. SW aplikace pro obsluhu žádostí OAI-PMH je provozována v prostředí WWW serveru Apache s využitím výkonného PHP frameworku Nette a databázové vrstvy dibi.

Klíčová slova

Metadata, OAI-PMH, archiv, agrární portál, distribuce metadat.

Abstract

The paper deals with the necessity of systemic solution for metadata providing by local archives into central repositories and its subsequent implementatiton by the Department of Information Technologies, Faculty of Economics and Management, Czech University of Life Sciences in Prague, for the needs of the agrarian WWW AGRIS portal. The system supports the OAI-PMH (Open Archive Initiative – Protocol for Metadata Harvesting) protocol, several metadata formats and thesauri and meets the quality requirements: functionality, high level of reliability, applicability, sustainability and transferability. The SW application for the OAI-PMH requests' servicing is run in the setting of the WWW Apache server using an efficient PHP framework Nette and database dibi layer.

Key words

Metadata, OAI-PMH, archive, agrarian portal, metadata distribution.

Introduction

Current on information and knowledge based society (economy) is characterized by an increasing number of information sources in all spheres of human activity, in various shapes and rather different quality and accessibility. New data are created not only by humans but more and more also automatically, e.g. by means of various sensors, cameras etc. There is need for effective semantic data description, their storing, administration and processing or their automated distribution in standardized formats. Another problem is that in agriculture, aquaculture, food industry, environment and rural development very heterogeneous data are collected. These can be both structured and unstructured data integrating database entries, texts, charts, figures, photographs, audio and video files, records from measuring devices and sensors, geolocation data, text messages, websites, presentations, animations etc. For efficient and brief data characterization metadata (data about data content) are being used. Via metadata we can describe all electronic objects or database entries. Thus, metadata provide efficient data characteristics and subsequently facilitate data processing, classification, search etc. According to T. Berners-Lee metadata are in fact machines of meaningful information (Berners-Lee, 1997).

There have been dynamic changes not only in the number of sources but mainly in their form and structure. It has led to stricter demands on local archives, e.g. independent data stores such
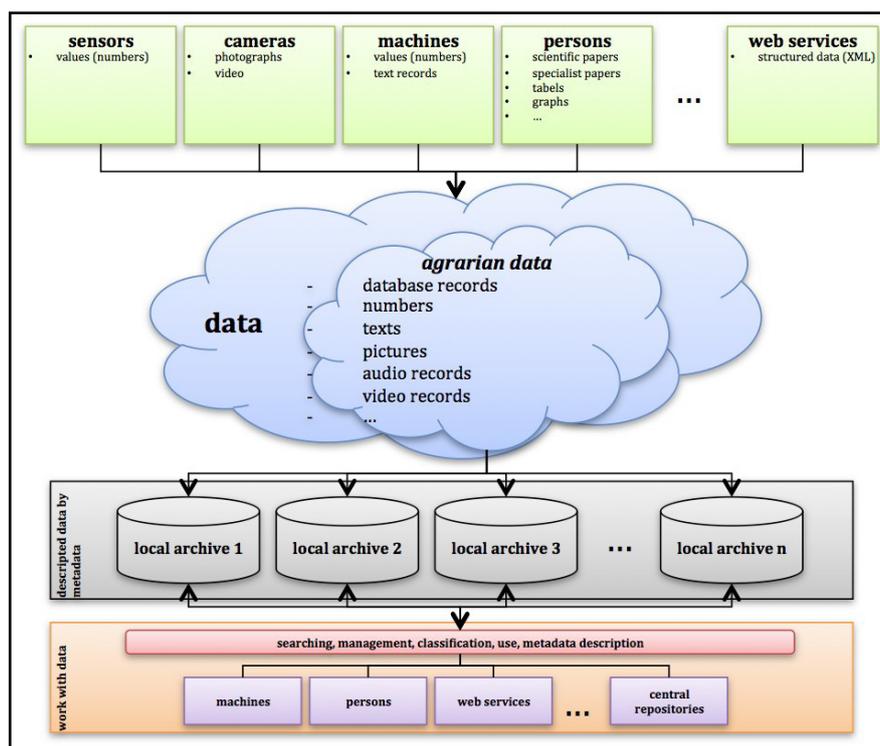
Source: own processing

Figure 1: The principle of data and metadata creation and distribution.

as archives of scientific and scholarly research journals, the agrarian www portal etc. Metadata help to aggregate local archives into thematically and technically oriented central repositories. Nevertheless, the aggregation of metadata from various sources often leads to problems such as incompatibility between and among various metadata APs (application profile) or metadata quality. The existence of significantly different metadata APs is the main source of problems with the stores interconnecting (Protonatorios, 2011). In order for the local archives to be utilizable and competitive in the future, their content must be described by metadata and it must provide support for automatic metadata harvesting. However, metadata harvesting itself requires the timely provision of up-to-date records via global networks with minimal demands on both the metadata providing machine and the harvesting machine (Adly, 2009). For the users themselves it is much more comfortable and efficient if they can run their search in one central repository than in many independent local archives and digital libraries (Kadury, 2007).

Materials and methods

Modern systems in libraries and archives have

at their disposal various devices for automatic content providing and sharing. Even local archives of technical or scientific and scholarly research journals, web portals, news agencies'servers etc. have been more and more equipped with these systems which enable metadata creation, administration and subsequently automatic distribution. Key requirements for these systems are the following:

- support of several metadata formats, but at least the DC (Dublin Core) and the VOA3R Metadata AP (Virtual Open Access Agriculture and Aquaculture Repository Metadata Application Profile) plus the support of the AGROVOC thesaurus

- the OAI-PMH (Open Archive Initiative – Protocol for Metadata Harvesting) support

- quality requirements for IS (Information System)

Metadata formats and AGROVOC thesaurus support

Nowadays, there has been more and more pressure on the metadata content and the content characteristics to be described by thesauri or dictionaries not only because of easier access and faster search by users but mainly because

of the automatic accessibility of the content to various machines, web services and databases. Based on analyzing metadata formats for the needs of the agrarian sector the following were chosen (Šimek, 2013):

- metadata format VOA3R Metadata AP,
- international DC standard,
- AGROVOC thesaurus.

Dublin Core (DC)

The Dublin Core (Dublin Core Metadata Initiative) is one of the most universal metadata formats for data description. It consists of 15 basic (recommended) elements that are suitable for describing almost any kind of object. The elements are following:

contributor	publisher
Coverage	relation
Creator	rights
Date	source
description	subject
Format	title
Identifier	type
Language	

Source: The Dublin Core Metadata Initiative, 2010

Table 1: The list of 15 DC elements.

The authors of the DC metadata specification (semantics) didn't just modify the existing MARC format but proposed a completely new data file to describe digital documents (Grandmann, 1998).

Virtual Open Access Agriculture and Aquaculture Repository Metadata Application Profile (VOA3R Metadata AP)

The VOA3R Metadata AP Format was developed with a view to improve data description and sharing in the domains of agriculture, aquaculture, environment and rural development within the framework of the Virtual Open Access Agriculture and Aquaculture Repository project (Sgouropoulou, 2011).

A complex data or object description can be acquired by means of compulsory and highly recommended elements. In order to create more detailed characteristics it is appropriate to include recommended or even optional elements, too. The VOA3R Metadata AP was based on the methodology and elements of Singapore Framework for the DC AP such as function demands, domain model, description set profile, data format and use instructions (N. Diamantopoulos, 2011). This metadata format is primarily based on the DC standard (Šimek, 2012).

AGROVOC thesaurus support

The AGROVOC is the most comprehensive thesaurus containing more than 32,000 entries in 22 languages[1] covering topics related to food industry, nutrition, agriculture, fishery, forestry, environment and other related domains. It serves to indexing documents in agricultural information

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[1] as at September 1, 2013

Mandatory	Highly recommended	Recommended	Optional
Title	creator	description	alternativeTitle
Date	contributor	bibliographicCitation	abstract
language	publisher	accessRights	relation
Type	identifier	Licence	conformsTo
Name	format	Rights	references
	isShownBy	reviewStatus	isReferencedBy
	isShownAt	publicationStatus	hasPart
	subject	hasMetametadata	isPartOf
	firstName	personalMailbox	hasVersion
	lastName	objectOfInterest	isVersionOf
		variable	hasTranslation
		Method	isTranslationOf
		protocol	
		instrument	
		techniques	

Source: Sgouropoulou, 2011

Table 2: The list of VOA3R Metadata AP elements.

systems, primarily in the international AGRIS system. The AGROVOC thesaurus development and maintenance is coordinated by the FAO (Food and Agriculture Organization of the United Nations) within the framework of AIMS (Agricultural Information Management Standards).

The whole thesaurus is formulated as the SKOS conceptual system (Simple Knowledge Organization System) and published as Linked Data (linked, interconnected data) which presents a data model for structured dictionaries. The AGROVOC thesaurus conceptual scheme contains full and extensive KOS (Soergel, 2004) using three levels of depiction:

- terms have abstract meaning and are also often described using the URI address (Uniform Resource Identifier): e.g. for maize in the sense of cereals „Concept12322" is used,

- terms are specified linguistically, e.g. corn, maize, 玉米, maïs,

- terms have specific options (range) such as spelling variations or singulars and plurals, e.g. hen, hens, cow, cows etc. (Agricultural Information Management Standards).

This system secures terminological relations between and among terms and their specific meanings. The AGROVOC is therefore suitable for the description of scientific and scholarly research papers, technical papers, information and news from the agrarian sector, audiovisual data etc. The AGROVOC has one more advantage: it is accessible via web service which can be called from all clients' applications. When using web service, changes on AGROVOC Concept Server can be accessible immediately after their application (Sini, 2008).

OAI-PMH (Open Archive Initiative – Protocol for Metadata Harvesting)

There are a lot of tools for providing local archives' content and they were analysed in detail. Based on this analysis one of the most universal ways of the contents' providing - the OAI-PMH protocol (Open Archive Initiative – Protocol for Metadata Harvesting) was chosen. Sets of these tools which provide a coherent information presentation across various standards are important not only for data search, but also for data access itself (Devarakonda, 2011). The OAI-PMH defines the mechanism of the metadata records harvesting from various repositories. It means that the OAI-PMH provides a simple technical means to data providers to make

its metadata open to services based on widely-spread standards HTTP (Hypertext Transport Protocol) and XML (Extensible Markup Language). The OAI-PMH was originally developed as a tool for an easy access to various e-print archives via metadata harvesting and aggregation. The protocol proved its usefulness and potential for a wide range of usability just two years after the publication of its permanent version (2.0) (Shreeves, 2005).

Quality requirements

The key quality requirements for IS are following:

- *Functionality:* the ability to tend functions which secure users' implied or set needs while operating the system.

- *High level of reliability:* the ability to maintain the specified level of performance while using the system.

- *Applicability:* the ability to be comprehensive with easy and user friendly operation, and to be attractive while using the system.

- *Sustainability:* the ability to be modified including errors correction, improvements and adjustments needed because of the changes in environment, requirements and functional specification.

- *Transferability:* the ability to be transferred from one environment to another.

Results and discussion

Before the implementation of the OAI-PMH solution itself for the needs of local repository of the agrarian WWW Agris portal or perhaps other local repositories of the Faculty of Economics and Management, the Czech University of Life Sciences, an analysis of freely accessible and the OAI-PMH supporting software (SW) was carried out - for example DSpace, Drupal, etc. The result of the analysis proved that - because of technical reasons - it is not possible to install freely accessible SW and run it in the environment of the Czech University of Life Sciences. It also showed that the analysed software doesn't provide the service required in adequate scale. Freely accessible SW is unsuitable mainly because it can be run on database platforms different from those which are available at the Czech University of Life Sciences or which are supported there. Freely accessible SW was not satisfactorily transferable. Above mentioned problems and errors often appear in other public and private organizations, too. They are usually solved

by the implementation and operation of another platform, together with the provision of staff and material.

The Department of Information Technologies at the Faculty of Economics and Management developed an intuitive system for the semantic description of objects (e.g. scientific and scholarly photographs, statistical and economic data, text messages etc.) by metadata format VOA3R Metadata APs Level 1 – Level 4 and international DC standard. For some metadata elements the AGROVOC thesaurus is being used.

The whole process of metadata collecting, administration and distribution can be characterized by the following diagram (Figure 2).

SW application for the OAI-PMH request operation is run in the setting of WWW Apache server using an efficient PHP framework Nette and a database dibi layer. The Nette Framework was chosen because the final application has the requested quality, and to eliminate security risks. The local metadata repository has been developed and is run on the MySQL database server. The whole SW solution on the World Wide Web platform has been created as a robust modern application with a possibility of further extension and development.

The SW application for the OAI-PMH servicing itself is run separately from the original local archives of the Faculty of Economics and Management. The main reason of this solution has

been the possibility of using the new metadata repository by other local archives run by the Czech University of Life Sciences. The web application supporting metadata harvesting provides a simple interface for manual obtaining of concrete objects' metadata stored in local databases and archives.

The WWW application for metadata providing has been proposed in such a way that it can - without problems and without huge time demands - send back a valid XML file for all Open Archives Initiative standardized requests including some additional parametres or reports on errors or exceptional conditions.

In order to have a simple metadata administration, the users have at their disposal an SW layer in the shape of users' superstructure above their own database. The users can therefore search in metadata with the help of simple forms. The same applies to their setting or modifying. To enable more comfortable work with the AGROVOC thesaurus, AJAX (Asynchronous JavaScript and XML) has been used. The advantage of this approach is that it is not necessary to download all the dictionary entries into a web browser; a JavaScript code on the background of the form requests from the server relevant terms which it shows to the user. (based on key words filled in by the user). Then the user with a mere click of his mouse on the appropriate icon either matches the chosen AGROVOC term to the described object or alternatively deletes it (Figure 3).
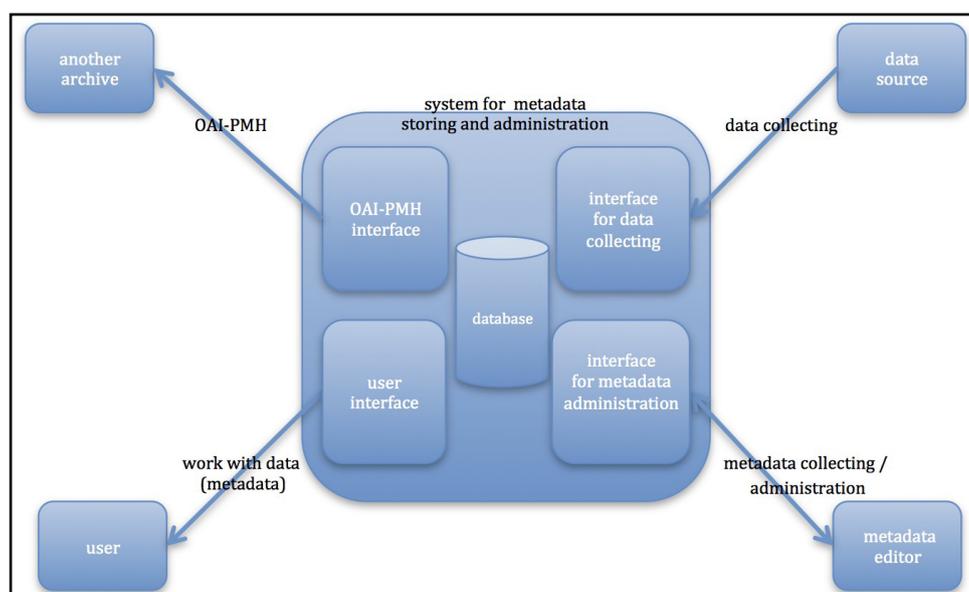
Source: own processing

Figure 2: Metadata administration in the environment of the Faculty of Economics and Management, the Czech University of Life Sciences.

Source: own processing

Figure 3: Metadata (the key words of the AGROVOC thesaurus) administration by the user.

Source: own processing

Figure 4: An example of a metadata record of a selected paper from the agrarian WWW AGRIS portal.

The final solution was implanted - apart from others - on the agrarian WWW AGRIS portal which has in the long term held an important position among departmental information sources. The agrarian WWW AGRIS portal provides an integrated on-line platform for information publishing for the domain of the agrarian sector and rural areas. Currently, there are in the agrarian WWW portal database about 100,000 papers and there has been an incessant increase - about several dozens of papers a day. Daily summaries in English are described by metadata from the VOA3R Metadata AP and by the AGROVOC thesaurus.

Source: own processing

Figure 5: An example of a final paper from the agrarian WWW AGRIS portal.

Conclusion

An incessant increase in data volume in all spheres of human activity has been registered in recent years. It is necessary to describe these data in an efficient manner and to dispose of tools for their semantic description, storing, administration and processing or as the case may be also for their automated distribution. The key requirements for the metadata administration system in the environment of the Faculty of Economics and Management are its support of the OAI-PMH, the support of several metadata formats and thesauri and quality requirements in the shape of functionality, high level of reliability, applicability, sustainability and transferability. Transferability and in some cases applicability were

the most serious problems of the analysed freely accessible SW for metadata administration and distribution. In order to cope with these problems the Department of Information Technologies developed an interactive application for metadata creation and administration with a possibility of their automated distribution via the OAI-PMH protocol.

The whole application construction to support the OAI-PMH has been proposed in a universal but homogenous way. Because local archives and repositories often provide rather different content and functions, the developed metadata repository functions as an independent separate web application with its own database.

The implemented WWW application is able

to respond automatically and flexibly to all six types of the OAI-PMH requests including reports on errors and exceptional conditions. Even the content of the agrarian WWW AGRIS portal was implemented into the system. In the case of the local archive of the agrarian WWW AGRIS portal the metadata are stored in the Dublin Core and VOA3R Metadata AP formats using the AGROVOC thesaurus. Owing to these internationally recognized metadata formats the content of the agrarian WWW AGRIS portal is easily accessible to the users and machines worldwide.

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Farmland Loss and Poverty in Hanoi's Peri-Urban Areas, Vietnam: Evidence from Household Survey Data

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Abstract

Using a dataset from a 2010 field survey involving 477 households, this paper has contributed to the literature by providing the first econometric evidence for the impacts of farmland loss (due to urbanization and industrialization) on household poverty in Hanoi's peri-urban areas. Factors affecting poverty were examined using a logit regression model. Our econometric results indicate that the one and two-year effects of farmland loss on poverty are not statistically significant. These results, therefore, confirm that farmland loss has had no impact on poverty in the short-term. This study also found that factors contributing to poverty reduction include households' education, access to credit, ownership of productive assets and participation in nonfarm activities before farmland loss. We propose some policy implications that can help households escape poverty and improve their welfare.

Key words

Farmland loss, poverty effects, household welfare, peri-urban areas.

Introduction

Over the past two decades, escalated industrialization and urbanization have encroached on vast areas of agricultural land in Vietnam. Le (2007) estimated that, from 1990 to 2003, 697,417 hectares of land were compulsorily acquired by the State for the construction of industrial zones, urban areas and infrastructure and other national use purposes[1]. In the period from 2000 to 2007, about half a million hectares of agricultural land were converted for non-farm use purposes, accounting for 5 percent of the country's farmland (VietNamNet/ TN, 2009). In Vietnam, the majority of the poor are farmers whose livelihoods are mainly based on agriculture (World Bank [WB], 2012). As a result, the State's farmland acquisition has a major effect on the poor in Vietnam's rural and peri-urban areas (Asian Development Bank [ADB], 2007).

In the context of increasing farmland loss due to urbanization and industrialization in Vietnam's developed provinces and cities, a number of studies have examined the impacts of farmland loss on poverty and household welfare (Do, 2006; Nguyen et al., 2011; Nguyen et al., 2013; Nguyen, 2009). In general, these studies indicated that farmland loss has mixed impacts on household welfare and poverty. On the one hand, the loss of farmland has caused the loss of farm jobs and income. On the other hand, farmland loss for urban expansion and industrial development has resulted in new urban areas, industrial zones and improved local infrastructure. Such changes have offered local households wide choices of non-farm jobs through which they can change their livelihoods and improve their welfare. Unfortunately, not all households have seized new livelihood opportunities triggered by urbanization and industrialization. Nguyen et al. (2005) found that while a number of land-losing farmers who resided close to newly urbanized areas earned higher cash income than farm work; other land-losing farmers, particularly those with low levels of education, became jobless and impoverished. Similar results were also reported by ADB (2007). About two thirds of land-losing households benefited

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[1] Compulsory land acquisition is applied to cases in which land is acquired for national or public projects; for projects with 100 percent contribution from foreign funds (including FDI (Foreign Direct Investment) and ODA (Official Development Assistance)); and for the implementation of projects with special economic investment such as building infrastructure for industrial and services zones, hi-tech parks, urban and residential areas and projects in the highest investment fund group (World Bank, 2011).

from higher job opportunities and upgraded infrastructure; for the rest, land acquisition resulted in serious economic interruption, particularly if all productive land was acquired or family members did not attain suitable education or vocational skills to switch to new jobs (ADB, 2007).

The results from a large-scale survey conducted by Le (2007) in Vietnam's eight developed cities and provinces with the highest level of farmland loss showed that after losing land, 25 percent of land-losing households obtained a higher level of income, while 44.5 percent maintained the same level and 30.5 percent experienced a decline. Nguyen et al. (2013) found that although the majority of land-losing households have changed to new livelihoods and earned a much higher level of income than before land loss, there have been a number of households with unchanged income or earned less income than before losing land. Mixed impacts of farmland loss are not confined to Vietnam. Some negative impacts of farmland loss on household welfare have been observed elsewhere, for example in China (Chen, 2007, Deng et al., 2006) and India (Fazal, 2000, 2001). Nevertheless, other studies found positive impacts of farmland loss on rural household welfare in China (Chen, 1998, Parish et al., 1995) and Bangladesh (Toufique and Turton, 2002).

The motivation to pursue this topic stems from two main reasons. First, while many studies investigated the impacts of farmland loss on household welfare and poverty, their findings are mixed. Second, all the studies indicated above used qualitative methods or descriptive statistics and this obviously limits our understanding. Using a dataset from a 2010 field survey, our study contributes to the literature by providing the first econometric evidence of the impact of farmland loss on poverty in Hanoi's peri-urban areas.

Materials and methods

1. Location and description of study area

Hoai Duc, a peri-urban district of Hanoi, was selected for this study. Of the districts of Hanoi, Hoai Duc has the biggest number of land acquisition projects (Huu Hoa, 2011). Hoai Duc is situated on the northwest side of Hanoi, 19 km from the Central Business District. The district has an extremely prime location, surrounded by many important roads, namely Thang Long highway (the country's biggest and most modern highway)

and National Way 32, and is in close proximity to new industrial zones, new urban areas and Bao Son Paradise Park (the biggest entertainment and tourism complex in North Vietnam). In the period 2006-2010, the State conducted the compulsory acquisition of around 1,560 hectares of agricultural land for 85 projects in the district (LH, 2010). As a result, the farmland acquisition has significantly reduced the size of farmland per households in the district. The average size of farmland per household in the district was about 840 m^2 in 2009 (Hoai Duc District People's Committee, 2010a) which was much lower than that in Ha Tay Province (1,975 m^2) and much smaller than that of other provinces (7,600 m^2) in 2008 (Central Institute for Economic Management [CIEM], 2009).

Prior to 1st August 2008, Hoai Duc was a district of Ha Tay Province, a neighbouring province of Hanoi Capital, which was merged into Hanoi on 1st August 2008. The district has 8,247 hectares of land, of which farmland makes up 4,272 hectares: 91 percent of this area is used by households and individuals (Hoai Duc District People's Committee, 2010a). There are 20 administrative units in the district, including 19 communes and 1 town. Hoai Duc has around 50,400 households with a population of 193,600 people. Prior to its transfer to Hanoi, Hoai Duc was the richest district in Ha Tay Province (Nguyen, 2007). In 2009, Hoai Duc's income per capita reached 15 million Vietnam Dong (VND) per year (Hoai Duc District People's Committee, 2010b), which is less than half of Hanoi's average (32 million VND per year) (Vietnam Government Web Portal, 2010)[2].

2. Sources and methods of data collection

Adapted from the General Statistical Office [GSO] (2006), we designed a household questionnaire to gather quantitative data on households' characteristics and assets, economic welfare (income and consumption expenditure) and their income-earning activities before and after the State conducted the compulsory acquisition of farmland in the commune in which they resided. A sample size set at 480 households from 6 communes, consisting of 80 households (40 with land loss and 40 without land loss) from each commune, was randomly selected for research purposes. Therefore, 600 households were selected, including 120 reserves, to obtain the target sample size of 480 households. A disproportionate stratified sampling

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[2] 1 USD equated to about 18,000 VND in 2009.

method was used with two steps as follows: First, 12 communes with farmland loss (due to the State's land acquisition) were partitioned into 3 groups based on their employment structure. The first group included three agricultural communes; the second one was characterised by five communes with a combination of both agricultural and non-agricultural production while the third one represented four non-agricultural communes. From each group, 2 communes were randomly chosen. Then, from each of these communes, 100 households (50 with land loss and 50 without land loss) including 20 reserves (10 with land loss and 10 without land loss) were randomly selected using Circular Systematic Sampling.

The survey was carried out from the beginning of April to the end of June 2010, and the data were collected by means of face-to-face interviews with the head of a household in the presence of other household members. In total, 477 households were successfully interviewed, among which 237 households had lost their farmland at different levels. Some had lost little, some had lost part of their land, whereas others had lost most or all of their land. Their farmland was compulsorily acquired by the State for a number of projects relating to the enlargement and improvement of Thang Long highway, the construction of industrial clusters, new urban areas and other non-farm use purposes (Ha Tay Province People's Committee, 2008). Due to some delays in the implementation of the farmland acquisition, of the 237 land-losing households, 124 households had farmland acquired in the first half of 2008 and 113 households had farmland acquired in early 2009. In the remainder of this paper, households whose farmland was lost partly or totally by the State's compulsory land acquisition will be referred to as "land-losing households".

3. Analytical model

Based on the 2010 poverty line for Vietnam proposed by GSO and WB (WB, 2012), we defined a household as poor if its monthly consumption expenditure per person is less than 653,000 VND. Once the household sample was clustered into poor and non-poor groups, statistical analyses were employed to compare the mean of assets and welfare between the poor and non-poor households. As indicated by Gujarati and Porter (2009), there is a variety of statistical techniques for examining the differences in two or more mean values, which generally have the name of analysis

of variance. Nevertheless, the same can be obtained within the framework of regression analysis. Therefore, regression analysis using Analysis of Variance (ANOVA) model was used to investigate the differences in the mean of assets and welfare between the poor and non-poor households. In addition, a chi-square test was used to determine whether a statistically significant relationship existed between two categorical variables such as the type of households (poor and non-poor households) and gender of household heads.

The study used a logit regression model with the dependent variable (poverty) being a binary variable that has a value of one if a household was found to be poor and a value of zero otherwise. The probability of households falling into poverty was assumed to be determined by their household characteristics and assets. In addition, other factors, in this case the loss of farmland and the participation by households in nonfarm activities before farmland acquisition were included as regressors in the model. Finally, commune dummy variables were also included in the model to control for fixed commune effects.

Table 1 describes the definition and measurements of variables included in the model. Empirical evidence in Vietnam's rural areas indicated that the larger household size, the greater likelihood of remaining in poverty (Van de Walle and Cratty, 2004). In addition, households with more dependent members were found to have higher chances of being poor (Nguyen et al., 2013). Therefore, households with more family members and a higher dependency ratio were expected to be more likely to be poor. Households with better education were found to be more likely to be non-poor (Nguyen et al., 2013). As a result, working age members with higher education levels were expected to increase the probability of their households escaping poverty. However, the poverty effect of the age of working age members might be ambiguous. Younger members were found to have higher chances to take up lucrative nonfarm jobs (Tuyen and Lim, 2011), which in turn might reduce the likelihood of being poor. Nevertheless, older members tend to have more work experience and can work more productive (Nghiem et al., 2012), which might reduce the probability of falling in poverty. Having more agricultural land increases rural household welfare in Vietnam (Van de Walle and Cratty, 2004). Hence, households owning more farmland per adult were expected to be more likely to escape

Independent variables	Definition	Measurement
Poverty status	A household is defined as poor if its monthly consumption expenditure per capita is less than 653,000 VND.	Poor = 1; non-poor = 0
Explanatory variables		
Farmland loss		
Land loss 2009	The proportion of farmland that was compulsorily acquired by the State in 2008.	Ratio
Land loss 2008	The proportion of farmland that was compulsorily acquired by the State in 2008.	Ratio
Household characteristics		
Household size	Total household members.	Number
Dependency ratio	This ratio is calculated by the number of household members aged under 15 years and over 59 years, divided by the number of household members aged 15-59 years.	Ratio
Age of household head	Age of household head.	Year
Gender of household head	Whether or not the household head is male.	Male = 1; Female = 0
Age of working age members	Average age of members aged 15-59 years.	Years
Education of working age members	Average years of formal schooling of members aged 15-59 years.	Years
Natural capital		
Farmland per adult	Owned farmland size per members aged 15 and over.	m^2
Physical capital		
Productive assets	Total value of productive assets.	Natural log
Financial capital		
Formal credit	Total value of loans borrowed from banks or credit institutions in the last 24 months.	1,000 VND
Informal credit	Total value of loans borrowed from friends, relatives or neighbours in the last 24 months.	1,000 VND
Non-farm participation in the past		Dummy variable
Formal wage work[1]	Whether or not the household took up formal wage work before farmland acquisition.	Yes = 1; otherwise = 0
Informal wage work[2]	Whether or not the household took up informal wage work before farmland acquisition.	Yes = 1; otherwise = 0
Nonfarm self-employment[5]	Whether or not the household took up nonfarm self-employment before farmland acquisition.	Yes = 1; otherwise = 0
Commune variables	The commune in which the household resided (Lai Yen Commune is the base group)	Dummy variable

Note:

[1] Formal wage work are paid jobs that are regular and relatively stable in factories, enterprises, state offices and other organizations with a formal labour contract and often require skills and higher levels of education.

[2] Informal wage work includes paid jobs that are often casual, low paid and without a formal labour contract. These jobs often require no education or low education levels.

[3] Nonfarm self-employment is self-employment in nonfarm activities.

Source: Source: own procesing

Table 1: Definition and measurements of variables included in the model.

poverty. Nghiem et al. (2012) found that ownership of more productive assets has a positive effect on household welfare in rural Vietnam. Thus, holding more productive assets was expected to increase the probability of households getting out of poverty. Finally, access to formal credit (Nguyen, 2008) and informal credit (Nguyen, 2009) was found to have a positive impact on household welfare in Vietnam. Consequently, households that received a higher amount of loans from formal or informal credit sources were expected to have a lower probability of being poor.

Nonfarm participation was found to be a determinant of poverty reduction and household welfare in Vietnam's rural areas (Pham, Bui, and Dao, 2010; Van de Walle and Cratty, 2004). However, the inclusion of households' nonfarm participation as an explanatory variable in the model might suffer from the potential endogeneity (Van de Walle and Cratty, 2004). This is because nonfarm participation might be determined by household characteristics, assets and other exogenous factors. Therefore, we included the past nonfarm participation variables (participation in nonfarm activities before farmland acquisition) in the model as explanatory variables instead of including the current nonfarm participation variables. Households with past participation in any non-farm activity were hypothesized to have a lower risk of being poor than those without past participation in any non-farm activity.

In the present study, the loss of farmland of households is an exogenous variable, resulting from the State's compulsory farmland acquisition[3]. The farmland acquisition by the State took place at two different times; therefore, land-losing households were clustered into two groups namely (i) those that had farmland acquired in 2008 and (ii) those that had farmland acquired in 2009. The reason for this division is that different lengths of time since farmland acquisition were expected to have different effects on poverty. In addition, the level of farmland loss was quite different between households because as already noted, some had lost little while others had lost all their land. Therefore, the level of farmland loss, as measured by the proportion of farmland acquired by the State in 2008 and in 2009, was used as the variable of interest.

Results and discussion

1. Background on household characteristics, assets and welfare

As shown in Table 2, the number of poor households was estimated at 64 households, accounting for 13.21 percent of the whole sample. The poverty gap and poverty severity (squared poverty gap) indexes were calculated at around 1.84 percent and 0.44 percent, respectively. The poverty rate of 13.21 percent in the study area is somewhat

higher than that in the Red River Delta (including Hanoi) (11.4 percent) in 2010 (WB, 2012). Table 2 provides some information about household income and consumption expenditure for the whole sample as well as for poor and non-poor households. The non-poor households earned nearly twice as much income per capita as the poor households did. A similar difference between two groups was also observed in the case of consumption expenditure per capita.

The differences between two groups of households in the loss of farmland in both years were found not to be statistically significant. Poor households had a much higher dependency ratio than that of non-poor households and this difference is highly statistically significant. The statistically significant difference in the age of household heads and education of working age members between the two groups were also recorded. On average, household heads of the non-poor households were fours year younger than those of the poor households. In addition, working age members of the non-poor households had attained a higher level of education than those of the poor households.

The disparities in farmland per adult and total value of productive assets between two groups are statistically significant. The size of farmland per adult owned by poor households was quite smaller than that owned by non-poor households. In addition, the poor-households owned approximately twice as much the total value of productive assets as that of the poor-households. Finally, the non-poor households also received a higher value of loans from both informal and formal credit sources than the poor households. Noticeable differences in some household characteristics and assets between the two groups were expected to be closely linked with the probability of households being poor.

The shares of households participating in nonfarm activities before farmland acquisition were very different between the two groups. The results show that a statistically significant association existed between the type of households and their participation in some type of nonfarm jobs before the farmland acquisition. Only nine percent of poor-households had taken up formal wage work before the farmland acquisition. This figure was only one third as compared to that of non-poor households. In addition, the proportion of the non-poor households that had participated in nonfarm self-employment before farmland loss was also much higher than that of the poor

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[3] According to Wooldridge (2013), an exogenous event is often a change in the State's policy that affects the environment in which individuals and households operate.

Variables	Whole sample		Poor households		Non-poor households		t-value	Pearson chi2 (1)
	Mean	SD	Mean	SD	Mean	SD		
Household welfare								
Monthly income per capita[a]	1,126	*591*	597	170	1,211	590	-15.43***	
Monthly consumption								
expenditure per capita[a]	938	*290*	555	77	1,000	263	-23.19***	
Farmland loss (%)								
Land loss 2009	10.27	*24.50*	9.60	*26.00*	10.40	*24.33*	-0.19	
Land loss 2008	10.50	*24.00*	13.26	*28.12*	10.06	*23.26*	0.81	
Household characteristics								
Household size	4.49	*1.61*	4.71	*1.65*	4.45	*1.61*	0.97	
Dependency ratio	60.58	*66.78*	90.00	*87.46*	56.43	*62.31*	2.17**	
Gender of household head[b]	0.78	*0.48*	0.78	*0.42*	0.77	*0.42*		2.69
Age of household head	51.21	*13.24*	54.70	*13.58*	50.67	*12.06*	1.90*	
Age of working age members	35.00	*6.61*	33.63	*7.07*	35.20	*6.50*	-1.31	
Education of working age members	9.07	*2.54*	8.03	*2.63*	9.23	*2.50*	-2.79***	
Natural capital								
Farmland per adult	343.00	*278.00*	265.00	*196.00*	355.00	*287.00*	-2.66 ***	
Physical capital								
Total value of productive assets[a]	22,081	*20,090*	11,232	*13,103*	23,733	*20,426*	-5.17***	
Financial capital								
Formal credit	8,533	*33,333*	3,182	*6,746*	9,347	*35,618*	-2.74***	
Informal credit	4,685	*14,836*	2,805	*6,249*	4,971	*15,723*	-1.80*	
Participation in nonfarm activities in the past								
Formal wage work[b]	0.24	*0.43*	0.09	*0.30*	0.27	*0.44*		5.61**
Informal wage work[b]	0.33	*0.47*	0.37	*0.48*	0.33	*0.47*		0.09
Nonfarm self-employment[b]	0.34	*0.47*	0.20	*0.40*	0.36	*0.48*		10.97***
Total	477		64		413			

Note: Refer to Table 1 for definitions and measurements of variables.

[a] Household welfare, physical and financial capital measured in 1,000 VND.(1 USD equated to about 18,000 VND in 2009).

[b] Indicate dummy variables. Means and standard deviations (SD) are adjusted for sampling weights.

*, **, ** * mean statistically significant at 10%, 5 % and 1 %, respectively.

Source: Field survey, 2010.

Table 2: Descriptive statistics of household demographic characteristics, assets and welfare.

households (36 percent versus 20 percent). These findings suggest that households' past participation in some type of nonfarm jobs was expected to be closely associated with the likelihood of being poor.

2. Determinants of household poverty

Table 3 reports the estimation results from the logit model. The results indicate that many explanatory variables are statistically significant at 10 percent or lower level, with their signs as expected. Surprisingly, the results show that the coefficients on the land loss variables in both years are not statistically significant. These confirm that

farmland loss has not affected poverty in the short-term. This phenomenon might be explained by two main reasons. First, many land-losing households have used part of their compensation money (for land loss) for smoothing consumption. As revealed by surveyed households, 61 percent of land-losing households reported spending part of their compensation money for daily expenses[4]. Second, land-losing households have actively

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[4] As revealed by the surveyed households, each household on average received a total compensation of 98,412,000 VND. The minimum and maximum amounts were 4,000,000 VND and 326,000,000 VND, respectively.

diversified their labour into various nonfarm activities in order to supplement their income with nonfarm income sources. As a result, incomes earned from nonfarm sources might have compensated for a shortfall of income due to farmland loss. This explanation is well supported by the econometric findings obtained by Tuyen and Lim (2011) and Tuyen and Huong (2013), who found that under the impact of land loss, land-losing households have intensively participated in different nonfarm activities. Their research findings also indicated that while farmland loss

has a negative effect on farm income source; it has a positive effect on various nonfarm income sources. In addition, other survey result findings also showed that after losing land, households' income from agriculture significantly declined but their income from nonfarm sources considerably increased (Le, 2007).

As expected, households having more members and more dependent members are more likely to be poor. An additional member increases the odds of a household being poor by around 28 percent,

Explanatory variables	Coefficient	SE	Odds ratio	SE
Farmland loss				
Land loss 2009	-1.593	(1.313)	0.203	(0.267)
Land loss 2008	-1.534	(0.963)	0.216	(0.208)
Household characteristics/human capital				
Household size	0.252*	(0.134)	1.286*	(0.172)
Dependency ratio	0.492*	(0.269)	1.636*	(0.441)
Household head's gender	-0.005	(0.420)	0.995	(0.418)
Education of working age members	-0.071*	(0.040)	0.932*	(0.037)
Age of working age members	-0.200**	(0.089)	0.818**	(0.073)
Natural capital				
Farmland per adult	-0.443**	(0.192)	0.642**	(0.123)
Physical capital				
Productive assets	-0.908***	(0.208)	0.403***	(0.084)
Financial capital				
Formal loans	-0.028*	(0.016)	0.972*	(0.016)
Informal loans	-0.051**	(0.021)	0.950**	(0.020)
Participation in nonfarm activities in the past				
Formal wage work	-1.729***	(0.642)	0.177***	(0.114)
Informal wage work	-1.498**	(0.757)	0.224**	(0.169)
Nonfarm self-employment	-1.682***	(0.570)	0.186***	(0.106)
Commune				
Song Phuong	-1.511**	(0.601)	0.221**	(0.133)
Kim Chung	-3.484***	(1.247)	0.031***	(0.038)
An Thuong	-0.440	(0.574)	0.644	(0.370)
Duc Thuong	-2.230***	(0.680)	0.108***	(0.073)
Van Con	-0.785	(0.592)	0.456	(0.270)
Constant	13.315***	(3.456)	605,936.740***	(2,093,896.363)
Wald chi2(19)		58.73		
Pseudo R2		0.3268		
Prob > chi2		0.0000		
Observations		460		

Note: Robust standard errors in parentheses. Estimates are adjusted for sampling weights. *,**,*** mean statistically significant at 10%, 5%, and 1%, respectively. NA: non-applicable

Source: Field survey, 2010

Table 3: Logit estimation for determinants of poverty.

holding all other things constant. Households with working age members having a younger average age were found to be more likely to be non-poor. In accordance with the previous findings in Hanoi and Ho Chi Minh Cities by Nguyen et al. (2013), the current study found that households with better education are less likely to be poor. For a one year increase in the average years of formal schooling of working age members, it is expected to see about a 7 percent decrease in the odds of a household being poor, holding all other factors constant. Regarding the role of household assets in poverty reduction, the results show that households with more farmland are less likely to be poor. Households that owned more productive assets are more likely to get out of poverty. Finally, the probability of households being poor is also reduced by receiving a higher amount of formal or informal loans. In general, these findings are similar to that of the previous findings by Nghiem et al. (2012) who found that households' farmland size, ownership of assets and access to credit all have a positive effect on poverty reduction in Vietnam.

The results indicate that households that participated in any nonfarm activity in the past (before farmland acquisition) are much less likely to be poor. For example, holding all other variables constant, the odds of being poor for households with past participation in formal wage work is about 82 percent lower than the odds of those without past participation in formal wage work. The results confirm the importance of nonfarm participation to poverty reduction in peri-urban areas. Overall, this finding is partly in line with that in rural Vietnam by Van de Walle and Cratty (2004) and Pham et al. (2010). Finally, some commune dummy variables being statistically significant suggests that there may be variable (s) which were not explicitly specified in the model but were captured by the dummy variables for some communes. This implies that poverty may be affected by many factors at commune-level such as land fertility, access to markets, population density and nonfarm opportunities.

Conclusion

The relationship between farmland loss (due to urbanization and industrialization) and household poverty has been examined in previous studies using qualitative analysis or descriptive statistics. Going beyond the literature, the current study has quantified this relationship by using

a household-level dataset from a 2010 field survey and econometric tools. Econometric analyses indicated that the one and two-year effects of farmland loss on poverty are not statistically significant. These results confirmed that the loss of farmland has not led to a short-term increase in poverty in Hanoi's peri-urban areas. However, one might argue that the long-term poverty effects of farmland loss would occur among land-losing households when they have run out of compensation money and been unable to find alternative livelihoods. Thus, this suggests that further studies should examine the long-term effects of farmland loss on poverty using data observed for the longer period of time.

The study showed that some asset-related variables have a positive relationship with poverty reduction. Education, productive assets, and access to credit all have a positive effect on the reduction of poverty. A possible policy implication here is that governmental support for local households' access to formal credit can help them to have more financial resources and to accumulate more productive assets; these, in turn, allow them to escape poverty. Encouraging parental investment in their children's education will also be a way to improve living standards for the next generation.

This study confirms the important role of nonfarm participation in poverty reduction in peri-urban areas. This finding implies that if the government wants to help local poor households get out of poverty and improve their living standards, government assistance in improving their access to nonfarm activities can be an effective way. Nevertheless, access to lucrative nonfarm activities in Hanoi's peri-urban areas has been found to be determined by a number of factors such as education, access to formal credit, a prime location for doing nonfarm businesses (Tuyen and Huong, 2013; Tuyen and Lim, 2011), access to local markets (Bich Ngoc, 2004), and the level of development of local infrastructure (Nguyen, 2009). As a result, policy intervention in these factors in terms of providing favourable conditions for them to diversify into more profitable nonfarm activities can help local poor households escape out of poverty and improve their welfare.

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Agricultural E-Government: Design of Quality Evaluation Method Based on ISO SQuaRE quality Model

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Anotace

Článek stručně popisuje současný stav využití služeb e-governmentu v České republice se zaměřením na elektronické služby v zemědělství. V příspěvku je definován termín zemědělský e-government. Existuje několik metod pro hodnocení kvality služeb a e-služeb, ale nebyla dosud nalezena žádná metoda, která by pracovala s ISO standardy pro hodnocení kvality software. Navržená metodika CABAG (Communication between Agricultural Businesses and Government) umožňuje hodnotit kvalitu zemědělských elektronických služeb prostřednictvím ISO/IEC 25010 modelu kvality užití podle předem daného seznamu charakteristik a podcharakteristik kvality a požadavků na kvalitu. Celková kvalita zemědělských e-služeb je představena agregovaným výsledkem výpočtu rozdílu mezi očekávanou úrovní realizace a skutečnou úrovní realizace jednotlivých požadavků. Metoda může být využita pro koncové uživatele a poskytovale (nebo vlastníky) elektronických služeb. Část poznatků představených v tomto článku byla získána na základě řešení grantu Interní grantové agentury Provozně ekonomické fakulty České zemědělské univerzity v Praze pod evidenčním číslem 20131038 „Analýza a návrh modelu hodnocení kvality e-služeb v sektoru zemědělství".

Klíčová slova

Zemědělský e-government, elektronická služba, veřejná autorita, kvalita užití, ISO SQuaRE, charakteristika kvality, CABAG.

Abstract

The paper briefly describes the current use of e-government services in the Czech Republic with focus on use of e-services in agriculture. The term agricultural e-government is defined here. There are several methods for evaluation of service and e-service quality however, no relevant method based on ISO software quality standards was found yet. Proposed CABAG (Communication between Agricultural Businesses and Government) method enables to evaluate quality of agricultural electronic services by means of ISO/IEC 25010 quality in use model giving list of quality characteristics, sub characteristics and quality requirements. The overall quality of agricultural e-service is represented as an aggregated result of expected level minus actual level of implementation for each particular requirement. The method can be used both for end users and providers (or owners) of e-services. Pieces of knowledge introduced in this paper resulted from solution of Internal Grant Agency (IGA) of the Faculty of Economics and Management, Czech University of Life Sciences in Prague grant number 20131038 "Analýza a návrh modelu hodnocení kvality e-služeb v sektoru zemědělství" (Analysis and design of quality evaluation model of e-services in agriculture).

Key words

Agricultural e-government, electronic service, public authority, quality in use, ISO SQuaRE, quality characteristics, CABAG.

Introduction

Deployment of information and communication technologies (ICT) into communication between government and citizens and enterprises might be called as e-government even there the many various approaches of different authors as Grand and Chau (2005) mention. In general terms, e-government is based on the principle of enabling users to access government information and services, when and

how they want (24/7) through channels including the Internet (OECD, 2005). European Commission sees e-government as an enabler to transform the public sector, significantly changing their relations with citizens and businesses and harvesting the gains in efficiency and effectiveness of the services in the process. The ultimate goal is to get better public outcomes that can be achieved through e-government solutions (EC, 2010). More detailed review of e-government definitions and approaches of scholars can be found in (Špaček, 2012), (Ntaliani, et al., 2010) or (Lee et al., 2008).

E-government in the Czech Republic

The level of e-government in the Czech Republic according to UN E-government Development Database (UNPAN, 2012) was ranked globally on 47th position in 2012 which was a decrease from 33rd position in 2010, however the overall E-government Development Index that aggregates the level of online services, infrastructure, e-participation and human capital was slightly improved in 2012 (0,649) when compared to 2010 (0,606). The UN benchmark is focused on supply side of e-government and does not reveal users' perception of quality of delivered e-services.

The approach of the European Commission to e-government benchmarking is based on measurement of indicators in five areas: ICT sector, broadband and connectivity, ICT usage by individuals, ICT usage by enterprises and e-public services. Summary data can be accessed on the Eurostat web page on Information society (Eurostat, 2012). The percentage of individuals that used Internet for interacting with public authorities in 2012 was around 30 % while the percentage of enterprises (with 10 or more employees) was 94 % in the Czech Republic. The EU-28 averages are 44 % of individuals and 87 % of enterprises using Internet for communication with public authorities (Eurostat, 2012).

There was not much attention put so far to e-government and its impacts in agricultural sector (Lee at al., 2008). Both European and national statistics do not include agriculture and forestry businesses in the survey. In the Czech Republic, the only recent information about the level of ICT and public online services use among Czech agricultural enterprises can be obtained from the survey Agrocenzus conducted by the Czech Statistical Office and a complex survey made by Vaněk et al. (2010). Agrocenzus (CZSO, 2011) provides only the information about the number of computers possessed

by farmers. Vaněk et al. (2010) provided more detailed outlook of ICT use between agricultural enterprises. The evaluation of use and quality of electronic services among Czech agriculturists was firstly conducted in (Rysová et al. 2013).

The objectives of the Czech e-government have been stated in scattered and not properly actualized national strategies, in accompanying documents and covered by heterogeneous legislation. The recent overview of Czech e-government policies and projects with their links to international and supranational e-government activities are covered in (Špaček, 2012) and (Špaček and Malý, 2010).

Agricultural e-government

E-government services for agriculture should cover the needs and priorities of particular stakeholders, such as farmers and tourists. According Ntaliani et al. (2010) agricultural stakeholders' priorities mainly focus on agricultural emergency management (e. g. for disease outbreak, extreme weather conditions) and expert consulting (e. g. for cultivation techniques, market forecasting, new production standards). Particular attention should be paid to the provision of e-government services by local authorities given that most of agricultural stakeholders' transactions with them take place at local level (Ntaliani, 2010).

Many government agricultural agencies already developed and implemented portals where various electronic services for farmers are provided (Ntaliani, 2010). The portal solution for farmers is also maintained by the Czech Ministry of Agriculture at the website http://www.eagri.cz. But also the effort in providing different type of service than building portal solutions can be observed, particularly in the agricultural sector. Miah (2012) proposes a shift from the traditional information portal process to a new provision where citizens or primary producers can actively contribute in designing their useful services from the relevant government agencies.

The terms "e-government in agriculture" and "e-government services" will be further on called also as "agricultural e-government". Our definition of agricultural e-government is this: *"E-government in agriculture could be understood as a type of e-government that is based on use of information technology by state administration to facilitate reciprocal information exchange between the involved agricultural public authority and agricultural enterprise to improve efficiency*

of its internal use and to provide fast, accessible and quality information services."

Methods of service quality evaluation

The literature and work of other authors has produced plenty of methods of e-service quality evaluation. Papadomichelaki and Mentzas (2012) provided one of the recent overviews of all approaches. They put approaches into two groups: quality of e-government services and quality of e-services. Some of them are intended to be used for website quality evaluation such as SITEQUAL (Webb and Webb, 2004), Portal usage quality (Lin and Wu, 2002), some only for specific country public websites (Quality of Norwegian public websites by Jansen and Ølnes, 2004), or for specific type of websites (e-Commerce website quality by Bessa and Belchior, 2002).

A first attempt to identify service quality characteristics was published by Parasuraman, Zeithaml and Berry (1988) who designed method called SERVQUAL that identifies and measures quality requirements of non-electronic services. The key concept of SERVQUAL is based on comparison of expected service quality and perceived service quality by users of the service. Perceived quality is the consumer's judgment and results from a comparison of expectations with perceptions of performance (Parasuraman, Zeithaml and Berry, 1988). SERVQUAL later laid foundation for E-S-QUAL method for electronic service quality evaluation for private companies such as e-shops (Parasuraman, Zeithaml and Malhotry, 2005). E-S-QUAL provides multiple-item scale for measuring the service quality delivered by Web sites on which customers shop online. The method works with basic scale and contains eleven items grouped in four dimensions of quality: efficiency, fulfilment, reliability, and privacy. The second scale E-RecS-QUAL measures non-routine cases and recovery when using sites and works with eleven items in three dimensions: responsiveness, compensation, and contact. E-S-QUAL was applied by many authors in several different fields, such as travel agency e-commerce websites (Bernardo et al., 2012), evaluation of an e-learning service provided by the city (Pazalos et al., 2012), Internet banking services (Zavareh et al., 2012, Akinci et al., 2010), or evaluation of government tax online service in Ireland (Connolly and Bannister, 2007) among others.

Authors that strive for finding public e-services satisfaction criteria and design measuring tools and methods often draw on outputs of research

of e-commerce services. Some of the quality evaluation criteria will be generic when measuring e-government services while some may apply to only e-commerce and some may apply only to e-government (Papadomichelaki and Mentzas, 2012). Example of generic criteria evaluation of e-services in the domain of agriculture could be seen in (Rysová et al., 2013) where the rate of use, importance, usefulness and quality of e-services were evaluated from the users' perspective and analysed with basic descriptive statistics and regression analysis. Some of above mentioned e-government services measuring tools are based on SERVQUAL and E-S-QUAL methods (Papadomichelaki and Mentzas, 2012, Špaček, 2012) such as e-GovQual (Papadomichelaki and Mentzas, 2012), e-GovSqual (Kaisara and Pather, 2011). The implementation framework for agricultural e-government services was introduced by Ntaliani et al. (2010), but the method or tool for quality evaluation of agricultural e-government services was not presented yet.

ISO quality model

We suppose that agricultural e-government might become a part of strategic advantage for agricultural enterprises and farmers if it meets certain quality that is perceived as ability of a product, service, system, component, process to meet customer or user needs, expectations, or requirements (ISO, 2008). E-government is also represented by electronic services which quality can be evaluated as any other software product. In product quality evaluation or quality in use evaluation, it is always needed to start from required quality that the person expects from the product. The requirement is specified as a condition or capability that must be met or possessed by a system, system component, product, or service to satisfy an agreement, standard, specification, or other formally imposed documents (ISO, 2008).

ISO software quality models were introduced firstly in international standards ISO/IEC 9126, 14598 and 12119. In mid 2000s, a second generation of software quality models were released as a ISO/IEC 25000 series.

The aim of this article is to design new method of agricultural e-government quality evaluation based on ISO quality model that would identify possible differences between required and actual level of particular quality requirements and that would provide basis for their improvement. The methodology of the article is based on secondary information research. Based

on the theoretical knowledge and results the conclusions and generalization of the concept will be formulated.

Materials and methods

There was a survey among agricultural enterprises and farmers conducted by the Department of Information Engineering and Department of Information Technologies at the Faculty of Economics and Management at Czech University of Life Sciences in Prague in 2012. The results of the survey were as follows:

- Out of the sample (n=119), most of farmers had under 100 hectares of land and employed 10 or less people.

- Most often used electronic services for communication with state authorities were e-mail (79 %) and services provided at eAGRI Portal (more than 50 %) that were also evaluated the best in terms of importance, usefulness and quality.

- Farmers and agricultural businesses are not obliged by any law to use any of electronic services, and they can still opt for traditional paper mail or personal contact.

The main outcome of the survey is that agricultural businesses in the Czech Republic use e-government to various extent and some even do not use it at all (Rysová et al., 2013).

Based on the analysis of current state of e-government in the Czech agricultural sector there are particular relevant research questions:

- What are real benefits of e-government for agriculture?

- What are presumptions of effective electronic communication between the state authorities and agricultural enterprises?

- Is the electronic communication in agricultural enterprises a business process that could be measured and evaluated?

- Are there any basic requirements for quality evaluation of electronic communication between state authorities and agricultural businesses?

- Is it possible to conduct the assessment on the basis of the ISO SQuaRE software quality model?

The use of ISO quality model approach to build

a method for e-service quality evaluation has been already used in similar field such as e-business. Behkamal et al. (2009) built a quality evaluation method for B2B application based on ISO 9126 model. We propose to develop a quality evaluation method for agricultural e-government based on ISO SQuaRE 25000 that is a second generation of previous quality model standardized in ISO 9126 and ISO 14598 documents.

To answer aforementioned questions, it is needed to design a new method of quality evaluation of electronic services provided by the Ministry of Agriculture to agricultural enterprises. Reasons for designing such a method are following:

- There is a need to provide a tool to evaluate quality of electronic services maintained by the Ministry of Agriculture to farmers.

- There is an evidence that a tool to evaluate actual level of quality of electronic services in agriculture is needed so that the efficiency and financial costs can be measured and advocated.

- Previous analysis (Rysová et al., 2013) revealed that the electronic communication in agricultural sector lacks standards.

Software quality evaluation – ISO SQuaRE quality models

Designed method draws on definition of quality requirement stated in ISO 9000 quality management system and further uses quality characteristics introduced in ISO 25000 SQuaRE model. The quality of software can be characterized as a match of explicitly stated requirements for its function and behaviour, explicitly documented development standards and implicit characteristics that are expected from any professionally developed software.

Working group at ISO has developed the series of standards for software product quality requirements and evaluation (SQuaRE) that consists of 14 documents grouped in 5 divisions within SQuaRE model. The model comprises divisions of quality management, quality model, quality measurement, quality requirements and quality evaluation (ISO/IEC 25000:2005).

The quality of system is the degree to which the system satisfies the stated and implied need of its various stakeholders, and thus provides value. Currently there are three quality models: the software product quality model, the system

quality in use model and the data quality model. Among the stakeholders belong: software developers, system integrators, acquirers, owners, maintainers, contractors and end users. Together these models provide a comprehensive set of quality characteristics relevant to a wide range of stakeholders: software developers, system integrators, acquirers, owners, maintainers, contractors and end users. The full set of quality characteristics across these models may not be relevant to all stakeholders. Nonetheless, each stakeholder should review and consider the relevance of the quality characteristics in each model before finalizing the set of quality characteristics that will be used to establish product and system performance requirements or evaluation criteria (ISO/IEC 25010:2011).

The SQuaRE quality models categorise product quality into characteristics that are further subdivided into sub characteristics composed of attributes. An attribute is an inherent property or characteristic of an entity that can be distinguished quantitatively or qualitatively by human or automated means. Attributes can be measured by quality measure elements (ISO/IEC 25000:2005).

These models are useful for specifying requirements, establishing measures, and performing quality evaluations. The defined quality characteristics can be used as a checklist for ensuring a comprehensive coverage of quality requirements. We will try to propose a set of relevant quality characteristics for the end users of electronic services in agriculture.

The authors of the SQuaRE standards recommend developing the set of quality requirements from the perspective of stakeholders prior to design and implementation of software to gain early insight into software quality. Requirements for quality in use specify the required levels of quality from the users' point of view. These requirements are derived from the needs of users and other stakeholders (such as software developers, system integrators, acquirers, or owners). Quality in use requirements are used as the target for validation of the software product by the user (ISO/IEC 25010:2011).

However there is no evidence that these lists of desired quality requirements were developed for agricultural users of electronic services provided by Czech Ministry of Agriculture. Thus we would like to make a pilot list of requirements that could serve as a template for future advancements and development of online services for agriculture. Presented research is focused on quality of use of e-government services for agriculture where main stakeholders are farmers and state officers at the Ministry of Agriculture.

Quality in use is the extent to which a product used by specific users meets their needs to achieve specific goals with effectiveness, efficiency, satisfaction, freedom of risk and context coverage (ISO/IEC 25010:2011) - see Fig. 1. Jung (2007) brought evidence that the user satisfaction may be implied by external quality characteristics of executable software (such as web application). The quality
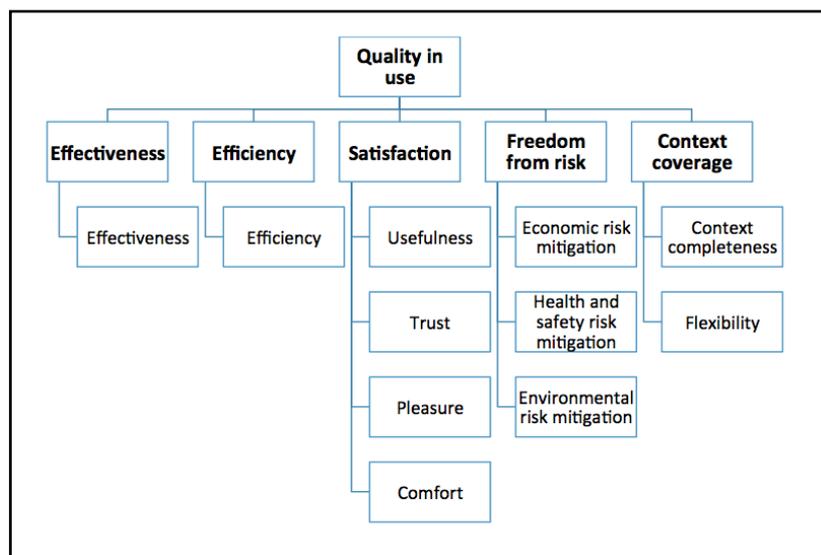
Source: ISO/IEC 25010:2011

Figure 1: Quality in use model according to ISO/IEC 25010:2011.

in use characteristics relate to the effect of the system in use, so are a starting point for requirements, and can be used to measure the impact of the quality of the system on use and maintenance.

The software product quality characteristics can be used to specify and evaluate detailed characteristics of the software product that are prerequisites for achieving desired levels of quality in use. We can conclude that ISO quality in use model is a proper tool to evaluate quality of e-government services in general and also in agriculture domain.

Results and discussion

The suggested method is intended to be used in quality evaluation of electronic services for agricultural enterprises (agricultural e-government). Users are interested mainly in overall benefit of using services therefore the method evaluates the quality in use. We suppose that the quality in use has a direct impact on users. The method is designed for both users and owners of the system, respectively the managers of both private agricultural enterprises and state officers. The new method is called CABAG (Communication between Agricultural Businesses And Government). The method is inspired by the method CBG (Ulman and Havlíček, 2010) and modified for agricultural sector. Original CBG method was previously designed and verified with subjects in industry field.

CABAG method

The following text is a description of steps how CABAG method should be used in evaluating quality of agricultural electronic services (agricultural e-government) - see Fig. 2. The method is designed to be used by independent evaluators such as consulting advisors, ICT auditors or public authority internal IT staff.

1. **Definition of relevant user groups of agricultural electronic services.** The step should be conducted by the evaluator in cooperation with representatives of end users. This could be done through the questionnaire survey and personal consultation.

2. **Identification of users' requirements.** Users's can be asked through a questionnarie or in personal interview or by any similar relevant mean.

3. **Categorization of user's requirements**

according the quality characteristics. There will be a list of sorted requirements assigned to particular quality characteristics as a result.

4. **Setting of individual weights for requirements.** Each requirement has different importance for various user groups (agricultural enterprises) while the statement of the importance is very subjective thereofe must be done in a responsible manner. The possible error in estimation must be taken into account. To minimize the error the following scale is suggested for requirement weights: very high importance – 100 %, high importance – 75 %, average importance – 50 %, little or fractional importance – 25 %, no importance – 0 %.

5. **Setting of required level of implementation of quality requirements.** This is done together by the evaluator and the end user representative. The quality measure represents the level of implementation of the given requirement and is evaluated with points according to the following scale: 1 point – fully done, 2 points – done with very good quality, 3 points – done with average quality, 4 points – done with low quality, 5 points – not done at all.

6. **Measurement of actual level of implementation of quality requirements.** Users are asked to evaluate actual level of implementation of given set of requirements on the same scale as in step no. 4. Gathered values are then weighted with values gained in step no. 3

7. **Comparison of required and actual weighted levels of quality requirements.** The difference between weighted required level (wre) and weighted actual level (wa) of particular requirement provides information whether the actual quality is coming near the required quality or is becoming distant from it. Results for each quality characteristic can be agreggated by sum, arithmetic mean and median. After the evaluator can provide overall assessment of quality of the whole system that is an arithmetic average of all characteristics. Because of the ordinal scale, it cannot be assured that the distance between particular classification grades has the same empirical meaning. The only one invariate aggregation is median, but not the arithmetic

mean. The overall quality assessment of whole system can be done by following scale:

| Overall quality	Absolute difference (wre – wa)
Excellent	> 0
Good	> 1
Acceptable	> 2
Not acceptable	> 3

Source: own processing

Table 1: Overall agricultural e-government system quality evaluation scale.

8. **Repetition of steps no. 1 – 7 with the representative of state authority.** This step is optional when the evaluation process should be done also for the state authority, such as the Ministry of Agriculture.

9. **Summary and intersection of results in steps no. 6 and 7.** Here, the results for both end users (farmers) and owners (state officers) can be compared and further analysed (e. g. regression and correlation analysis)

10. **Final conclusion and agricultural e-government evaluation.** Summarization of resuls and formulation of recommendations for the owner (such as the Ministry of Agriculture) in the form of steps how to improve particular services and how to reach required values of electronic services quality.
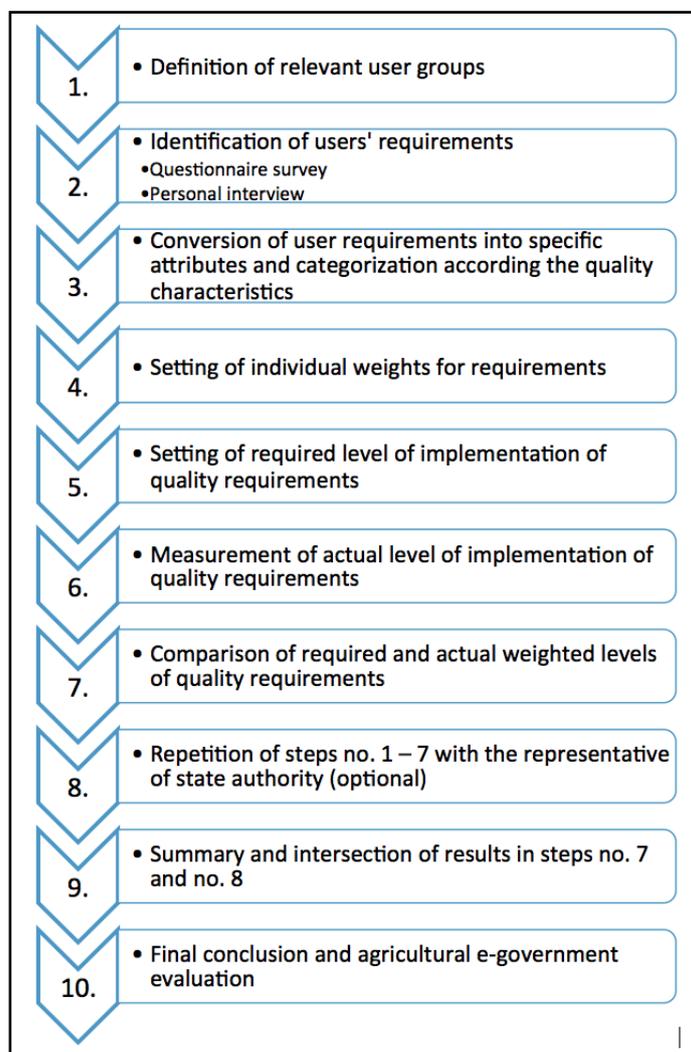
Source: own processing

Figure 2: Scheme of agricultural e-government services quality evaluation according to CABAG method.

Proposed list of user quality requirements according to ISO SQuaRE quality in use model

In the agriculture domain, we suppose that the level of notion and understanding of users of electronic services will be lower than in several other industries or services. The list was derived from ISO norm and adapted for agricultural users of e-services. That is why we developed and proposed a list of quality requirements sorted in sub characteristics and characteristics according to ISO/IEC 25010:2011. The list will be used to evaluate the actual quality from the users' perspective in the questionnaire. The use of the list for quality evaluation needs to be tested in practice and individual items need to be statistically analysed as to the dependence and reliability.

We suppose that the national agriculture authority perspective (such as Czech Ministry of Agriculture) may differ and in practice the proposed list for evaluation of agricultural e-government services can be different. The common requirements and characteristics from both evaluation processes (users and the owner) can be then compared and final recommendations can be formulated as seen in steps no. 8 and 9 of CABAG method (see above).

An inseparable part of quality evaluation is setting measures. Measures of quality in use measure the extent to which a product meets the needs of specific users with respect to their specific personal or business goals. These measures can only be made in a realistic and operational system environment. Quality in use measures relate to the impact of the system on stakeholders. These measures may be made by user testing, simulation or in actual use (ISO/IEC, 2011). For the use of CABAG we designed plain ordinal scale to evaluate expected and actual level of particular items (requirements) (Table 2). The scale works with five possible values: 1 point – fully done, 2 points – done with very good quality, 3 points – done with average quality, 4 points – done with low quality, 5 points – not done at all (also see above the CABAG method, step no. 5), except the item no. 3 ("How often do you use the service?") where different responses should be offered (such as daily, once a week, once a month, less often, do not use at all). The proposed measure is rather subjective and depending on the respondent's point of view. The development of an exact measure for particular quality requirement such as accuracy of services may become a subject of further research.

CABAG method contributions and comparison

The CABAG method was proposed with the following expected contributions:

1. Enables evaluation of the quality of agricultural e-government services

No.	Characteristics	Sub characteristics	Quality requirements
1	Effectiveness	Accuracy	How accurately the service works? Eg. Data precision, correct computation, land parcel display, etc.
2	Efficiency	Competitiveness	How big advantages are brought to you by the service? Eg. Faster dispatch, access to funds, more precise information about economics, better information about competition, etc.)
3		Frequency of use	How often do you use the service? (Daily, once a week, once a month, less often, not use at all)
4		Latency	How fast response does the service provide?
5	Satisfaction	Usefulness	How well does the service meet your requirements? Ie. It allows you to do what you need.
6		Comfort	To what extent is the service web site user friendly? Eg. Re-sizable font, colour contrast on the screen, comprehensible page navigation, easy to open, etc.
7		Pleasure	How are you satisfied with service functions?
8	Freedom from risk	Economic risk mitigation	To what extent is the use of service safe for you? Eg. The risk of loss of data, leakage or loss of sensitive figures, etc.
9	Context coverage	Information structure	How well are information organized on the website?
10		Navigation	How easy is to navigate on the page?
11		Learnability	To what extent does the page help you to understand its control? Eg. Such as user help, manual, guidelines, etc.

Source: own processing

Table 2: Agricultural e-government services quality requirements according to ISO/IEC 25010 quality in use model and own proposal.

that are provided by state authorities (e. g. The Ministry of Agriculture) and used by agricultural enterprises (or farmers). The method is based on the ISO model that provides five basic quality characteristics for quality of use of services.

2. Gives the opportunity to evaluate the agricultural e-government from the perspective of different stakeholders such as end users (state authority staff and farmers), owners (state authorities), developers, and independent evaluators.

3. The CABAG method aspires to become a tool for both sides of agricultural e-communication: agricultural enterprises (or farmers) and state authority officials (namely the Ministry of Agriculture).

4. Developers can use the CABAG method to better identify new ways of ICT utilization for communication between state authorities and agricultural enterprises.

5. Managers of state authorities will get a tool to analyse problems in communication and further enhancements in provision of electronic services. In the Czech Republic, when used in agricultural state administration, it can also provide a feedback for national e-government projects such as Czech POINT, information system of data boxes and information system of basic registers.

While CABAG is compared with other e-government service evaluation tools, it could be seen that the service with excellent quality is that where the difference between expected quality (w_{re}) and perceived quality (w_a) is equal or close to zero. e-GovSqual method declares a high quality service when the perception of quality (of particular website) is greater than expectation of quality of an ideal website (Kaisara and Pather, 2011, p.219). Questionnaire built according CABAG is based on assessment of services with ordinal classification scale, but e-GovSqual and e-GovQual methods work with statements that are evaluated by users on a Likert scale. Perceptions-expectations gap was suggested to determine the importance of each dimension and item (Parasuraman et al., 1988).

Numbers of dimensions and items that are evaluated are also different: CABAG (5 characteristics/dimensions and 11 items), e-GovSqual (6 dimensions and 31 items) vs. e-GovQual (4 dimensions and 21 items).

While CABAG is based on ISO software quality models that were firstly introduced in mid 1980´s and upgraded in 2000s (ISO SQuaRE), the e-GovSqual and similar methods are grounded in marketing research methods from 1980s. However, both service evaluation methods measure quality from the service user perspective and are intended to be used for decision-makers.

Conclusion

Our conclusion about agricultural e-government is that it is a type of e-government that is based on use of information technology by state administration (such as the Ministry of Agriculture), to facilitate reciprocal information exchange between the state authority and involved agricultural enterprises. The purpose of the agricultural e-government is to improve efficiency of state administration by its internal use and to provide fast, accessible and quality information services. E-government defined in such a way can be taken as a mean to qualitative enhancement of productivity of agricultural enterprises. It is needed to consider that implementation of new e-government tools brings certain requirements not only for legislation but also for private companies that will use them.

The CABAG method that was introduced in this paper is intended to become an empirical tool to evaluate agricultural e-government services quality and to contribute to their improvement. The CABAG method stems from user-centric approach to e-government where the demand side of services (end users) are taken into consideration and can participate in their design (Miah, 2012) and maintenance. The method needs to be tested in practice by using real users' data survey that is currently being conducted in the Czech Republic by our research team. We plan to publish the first results of the survey in the coming months.

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