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Function and Significance of Reparcelling in Czech Republic

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Abstract

The law No. 139/2002 Col., on reparcelling and land offices can be consider as one of the most important tools of active land law in the CR. In frame of administrative procedure in public interest, the law enables to re-parcel lands and ownership relations to them in order to create conditions for consequential management. A property right to newly defined parcels is acquired by a decision of the appropriate land office which is an administrative authority. By means of reparcelling, also „modern" ecological problems are solved. Reparcelling is necessary for renewal of statutory land registration, clearing and delimitation of borders in the landscape, and so it is a significant contribution for renewal of peace in land ownership in the CR shaken in 1948 – 1989. Reparcelling shows only secondary economic impact, it is more suitable to assess the effectiveness only from the point of view of effectiveness of the financial means expended for reparcelling.

The pieces of knowledge presented in the paper are a result of solution of the research intention 6046070906 „Economics of Czech agriculture resources and their efficient use in frame of multifunctional agri-food systems".

Key words

Land law, land office, reparcelling, ownership, real estate cadastre.

Anotace

Zákon č..139/2002 Sb., o pozemkových úpravách a pozemkových úřadech lze pokládat za jeden z nejvýznamnějších nástrojů platného pozemkového práva v ČR. Zákon umožňuje v rámci správního řízení ve veřejném zájmu znovu prostorově uspořádat pozemky a vlastnické vztahy k nim, tak aby byly vytvořeny podmínky pro racionální hospodaření. Vlastnické právo k nově definovaným pozemkům se nabývá rozhodnutím příslušného pozemkového úřadu, který je správním úřadem. Pomocí pozemkových úprav se řeší i "moderní" ekologické problémy. Pozemkové úpravy jsou nezbytné pro obnovu veřejnoprávní evidence pozemků, vyjasnění a vytyčení hranic v krajině a jsou tedy významným přínosem pro obnovení právní jistoty v pozemkovém vlastnictví v ČR, otřesené v letech 1948 – 1989. Pozemkové úpravy mají pouze zprostředkovaný ekonomický dopad, efektivnost je vhodnější hodnotit případně pouze z pohledu efektivity peněžních prostředků vynakládaných na pozemkové úpravy.

Poznatky prezentované v článku jsou výsledkem řešení výzkumného záměru 6046070906 "Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systémů".

Klíčová slova

Pozemkové právo, pozemkové úřady, pozemkové úpravy, vlastnictví, katastr nemovitostí.

Introduction

Reparcelling as it is understood by the active legal regulation is a relatively „new" legal institute. It continues in agrarian operation known since 19th century whose purpose was to achieve a better arrangement of parcels from a view-point of their consequent use. The agrarian operations "*served for marking of various arrangement of land possession whose aim was to remove obstructions (diffuseness of parcels, unsuitable shape of parcels etc.) restraining to consequent land use. The main kinds of agrarian operations were: a)a land consolidation (comassation), b) a division of*

community lands (agrarian associations) and adjustment of rights of use to common lands, c) a clearance of forests from foreign enclaves and straightening of forest boundaries" (Pekárek, 2003). In frame of agrarian operation also ownership rights to parcels were often exchanged. At time of "real socialism" a different conception was created which conformed to then official attitude to the land ownership. It was contained in the government regulation No. 47/1955 Col., on techno-economic adjustments, which was based on an exchange of rights of use to parcels. Owners of agriculturally cultivated land were legally detached from the possibility to use their land and the exchange of ownership rights should have not really solved the need of rational land use.

The adjustment dating back to a period before 1989 was cancelled in 1991 and a legal regulation followed, contained in the law of Czech National Council (CNC) No. 284/1991 Col., on reparcelling and land offices and attendant regulations. The law No. 284/1991 Col. was then, after more than ten years, replaced by the law still in force No. 139/2002 Col., *on reparcelling and land offices* (further LR). The need of a new law arose from the development of situation in area of reparcelling and connected also with a public service reform, i.e. the cancellation of district authorities to 31.12.2002. Their departments had been land offices by the time and there was a need to constitute a new system represented now by agricultural agencies of the Ministry of Agriculture (MA). Importance of this partial and functional arrangement of parcels, which is carried out in public interest according to statutes at large, is expressed also by the state support in form of various endowment titles to participants of procedure who can share in defrayal of costs for reparcelling, whereas, a principle is hold that reparcelling is reimbursed by the state.

A significant qualitative change occurred after 1990 when restitutions started and reparcelling gradually returned to its original function. The state undertook an important and responsible task partially in property restitution but also a facilitation of its use by owners (Procházka 2009).

A long-term aim of reparcelling is setting conditions for considerate treatment with landscape and sustainable farming on soil. This is a public interest declared by law and it is a duty of all participating persons and administrative authorities to keep it (Mazín 2009).

Reparcelling is an immensely complicated process, and at present we are absolutely unable to predict in what way this legal procedure will develop in the future, when the problems connected with renewal of ownership relations to the land, arisen as a result of political changes after the year 1989, will cease to exist. The issue to what extent the ownership rights to land will be restricted in the future is very complicated, and it does not relate to the reparcelling only, but it relates also to procedure of the zoning, building permitions, or possibly expropriation procedures.

The issue of the suitable extent of limitation of private ownership of land by public authorities is a philosophical and political issue. It cannot be solved by economic methods, although it will have obvious impact on agricultural companies, and agricultural economists should be aware of importance of also such issues.

A simple quantification of economic impact, for example ecological measures or establishment of an access road for individual farmers may theoretically be calculated, although productivity of an agricultural company is influence by many other facts (it is generally well known that many agricultural companies achieve the profit thanks to subsidies only).

It shall be seen that renewal of ownership relations is unavoidable, but also that it cannot be an economic contribution as such. The setting (renewal) of borders of the nature and in cadastral maps is a costly activity without any immediate effect. It is well known that in the Czech republic farmers carry out business on leased land (87 % of agricultural land are leased. When compared with the EU countries, the percentage of leased land is almost double in the Czech Republic.) (Situational and perspective report Land, 2009).

As far as the extent of reparcelling in a concrete cadastral area is concerned, the results of negotiations between the cadastral authority and the land authority are very important (under section 64 of the cadastral decree and section 4 of the act No. 545/2002 Col (Janeček, 2009).

Reparcelling is carried out mostly in the form of a complex reparcelling (CR) comprising not only solution ownership rights to land included in the reparcelling, but also solution of antierosion measures, proposal of road network, improvement of ecological stability of the country, and measures of protection and creation of land are adopted generally. The complex reparcelling is usually made on the whole cadastral area. Simple reparceling (SR) solves only some economic needs (for example a speedy unification of lands, making lands accessible), or ecological needs in the landscape (for example antierosion or antiflood measures), or it relates to a part of cadastral area only, or it makes land allocation more precise, or reconstructs such allocation; at a simple reparcelling, the formalities of proposal and realization of reparcelling may be regulated otherwise than as prescribed by a special legal regulation (Terminological vocabulary of land surveying and land register).

Aim and methodology

An aim of this paper is assessment of functions and significance of realized reparcelling in the Czech Republic. There is a hypothesis that the volume of spent financial means is not reflected in the accomplished and begun reparcelling made by the land authorities. This main monitoring line is then divided into a review from a view-point of legal adjustment and a review of selected indicators with extent of applied reparcelling. Methods of analyzing documents, comparing some relations in legal regulations and in correlations of the state endowment policy have been used. As information resources, legal regulations referring to the researched problems are used, as well as special literature and statistical data about realized reparcelling and its basic analysis in the sense of the given hypothesis.

Results

Functions of reparcelling

The existence of present legal regulation of reparcelling is substantiated by various facts. Above all it continues in authorization in § 19 of the law No. 229/1991 Col., on adjustment of ownership relations to the land and other agricultural property. It represents a crowning of the process of agricultural property restitution and further it has a cardinal importance from a view-point of environment conservation. „*Since 90´s of the 20th century by the help of land offices most of agricultural and forest property has been successfully restituted. However, it has to be usable for owners, therefore it is necessary to merge them, to assess and to make them accessible for farming...“Important in the same way is in the landscape space to make accessible parcels by roads, to minimize erosion, to increase a share of scattered greenery in the landscape etc.*“ (Šarapatka et al, 2008).

The valid legal regulation of reparcelling far exceeds the importance of traditional consolidating laws. A traditional legal institute was used here to reach much more complex aims on historical connections of renewal of market economy and renewal of private ownership. The purpose of reparcelling can be derived above all from § 2 LR which according to an argumentative report contains a reparcelling definition. The reparcelling fulfills several tasks. First of all it arranges spatially and functionally parcels (i.e. it consolidates or divides) in public interest and the accessibility of parcels, their use and lining-up of their boundaries is secured. The purpose in principle is **to create conditions for rationale farming of land owners**. In this direction, reparcelling creates conditions for renewal of content of the ownership right in relation to agricultural and forest land, it means, renewal of connection of ownership right with the real possibility to use the land as property subject. In this context the law enables the land office, which is a bearer of public power, to arrange ownership rights and with them connecting real burdens to parcels. Other functions of reparcelling are according to LR **a security of conditions for improvement of the environment, for protection and fertilization of the land fund, for water management, for increase of ecological stability of landscape**, so „modern“ tasks in the area of environment conservation.

In connection with an emergent need of renewal of order in ownership relations to land and peace, other important function of reparcelling consists in that its results serve for renewal of cadastral documentation. Finally, also results of reparcelling should serve as an obligatory **data for landscape planning** (according to the law No. 183/2006 Col., on landscape planning and building regulations subsequently amended). However, by the above

mentioned the possibilities of administrative procedure on reparcelling are not spent. In frame of reparcelling it is possible to take measures of certain special legal problems which are a heritage after the foregoing historical period. In proceedings about reparcelling it is possible to solve **the problem of duplicate record of owners of one real property in a real estate cadastre, a reconstruction of land allotment** according to decrees of the president of republic No. 12/1945 Col. and No. 28/1945 Col. and the law No. 142/1947 Col. and No. 46/1948 ((§4 article 2 and §13 LR) and **the problem of till tis time unfinished consolidating procedure** according to the law No. 47/1948 Col. and governmental regulation No. 171/1940 Col. (§ 14 LR).

In frame of the only administrative procedure about complex reparcelling it is real to solve up situations which otherwise would have to be solved even in several law suits as proprietary pleas and at the same time this solution is marked in the landscape an the decision of the land office is subsequently registered in the Real Estate Cadastre of the CR. Further the law counts on that the need of realization of reparcelling can be invoked by a **building activity** (§17 LR) which can be e.g. highway building, owing to which some parcels are separated from access roads.

A reason of concrete administrative procedure on reparcelling has to be determined by the land office in start of the reparcelling. The start of reparcelling is always considered as opening by virtue of office even when an application for the start went before, and even at that time when it was dealt with a qualified application of owners of more than one half of land in cadastral area on base of which the land office is obliged to start reparcelling.

The removal of reason for reparcelling will be the reason for discontinuance of proceedings. The reparcelling reason influences also the form of reparcelling which will be used (simple or complex reparcelling according to §4 LR).

Interconnection of reparcelling with registration of real estates

The reparcelling process has a complex impact on clarification and renewal of ownership relations in many directions. It is not dealt only with a measurement, a demarcation of parcels and making accessible the parcels which were released to authorized persons according to the law No. 229/1991 Col., but the results of reparcelling serve generally for data renewal in the Real Estate Cadastre of the CR according to §13 and §15a of the Cadastral law No. 344/1992 Col. (further CL). **The renewal of cadastral documentation** represents an execution of new collection of geodetic information (in form of a graphical computer file) and a new collection of descriptive information of the cadastral documentation. Reparcelling has the importance of principle for all agricultural and forestry parcels, boundaries of which do not exist in terrain and are merged in bigger land complexes, and which were not registered in cadastral maps according to the law No. 22/1964 Col. These parcels are registered by simplified way (without depiction in a cadastral map) according to § 29 CL by the time of termination of reparcelling at the least.

LR and CL in force contain regulations in many places which interconnect the reparcelling process with registration of data on real estates in the cadastre. However, from a view-point of **acquisition of ownership right** it is necessary to know that ownership of newly spatially determined parcels in reparcelling is acquired by a decision of a state authority (a land office) and **an insertion of right in the cadastre** is not carried out ((§132 the Civil Code). Nevertheless, from a view-point of a principle of honest belief in data registered in the real estate cadastre of the CR (§ 11 CL) it is necessary to secure the truth of registration of ownership right and other tenures in the real estate cadastre, and further it is necessary to solve „competitiveness“ of reparcelling and other possible transfers and transmissions of parcels. Reparcelling represents a relatively long process and during it a fundamental change of owners by reparcelling of the respective parcels can happen. The cadastre records the start of reparcelling (§ 9 article 7 LR) to be obvious what parcels will be or can be touched by the reparcelling. Further, a decision about approval of reparcelling proposal is recorded, which came in force („approved proposal“) according to § 11 article 5 LR. Eventually, also so called implementation decision of the land office is registered by which owners acquire the newly defined parcels.

Interconnection with landscape planning

The approved proposal of reparcelling impacts the area of building law rule. For changes of kinds of parcels, building of field and forest roads, protection and fertilization of land fund and other common arrangements included in the approved reparcelling proposal it is waived rendering of territorial decision on placement of the building and a of decision on the territory use.

Acquisition of ownership right to parcels included in reparcelling

The decision of land office on acquisition of ownership rights is sometimes marked as two-stage. However, it is not dealt with a decision making in two steps, i.e. a decision of authority of the first stage and a decision of a higher administrative authority on appeal. It is dealt with two different decisions consecutive in certain dosing interval. The are made by the same land office which will decide at first on approval of reparcelling proposal, and then, on base of the approved reparcelling proposal it will decide on an exchange or transfer of ownership rights, possibly on creation or cancellation of real burden to the respective parcels.

While participants of the proceedings can appeal against the decision on approval of reparcelling proposal (which is conditional on agreement of owners of ¾ of land), it is not possible to appeal against the decision on exchange or transition of ownership rights, possibly on creation or cancellation of real burden issued on base of the approved proposal.

This „second“ decision only formally crowns the process of changes in ownership relations which happen within reparcelling. In accordance with the Civil Code and the law No. 265/1992, the ownership rights are acquired to the exchanged parcels to the day of virtue of this („second“) decision of the land office, possibly to the date mentioned there and a subsequent record in the real estate cadastre is realized by a record, not by an insertion.

The approved reparcelling proposal has also other legal impacts on owners. The owner of particular parcels or their parts can not burden or steal after the approval of reparcelling proposal without agreement of the land office. The legal state according to the approved reparcelling proposal is obligatory even for legal successor of land owners ((§ 11 article 12 LR). In papers on acquisition of ownership or other possessory title to parcels (for example in a contract of buying, in a court ruling on acquisition of inheritance, in a mortgage contract) besides the acquired parcels also to them corresponding parcels according to the approved reparcelling proposal can be brought

A part of reparcelling is so called plan of common arrangements which creates the future skeleton of organization of the agricultural landscape and is a sort of form of landscape plan inside reparcelling. This plan includes technical and other measures for making the parcels accessible, flood-protection measures, water-management measures and measure for conservation and creation of the environment. Generally, the measures have a multifunctional character. For the common arrangement at first the land in state ownership is used and than of municipality. Other owners share in them possibly by an aliquot part according to the total acreage of their exchanged parcels (MA, Reparcelling, 2009).

Financing

An essential aim of the current LR was, according to the explanatory report to its proposal submitted in the Parliament of the CR, also clarification of financing of reparcelling by the state. The term of costs for reparcelling is determined in details by LR in (§ 17 article 4. The costs include not only own costs for preparation of the start of reparcelling, an identification of parcels, a local investigation, a measurement of the real state, elaboration of a proposal, a demarcation of parcels, an execution of geometric plans, records of detailed measurement of changes, a description of new collection of geodetic information, but also costs for creation of real burdens, a realization of common arrangements and technical help in creation of comprehensive economic units, and finally also cash compensations provided by the land office according to LR.

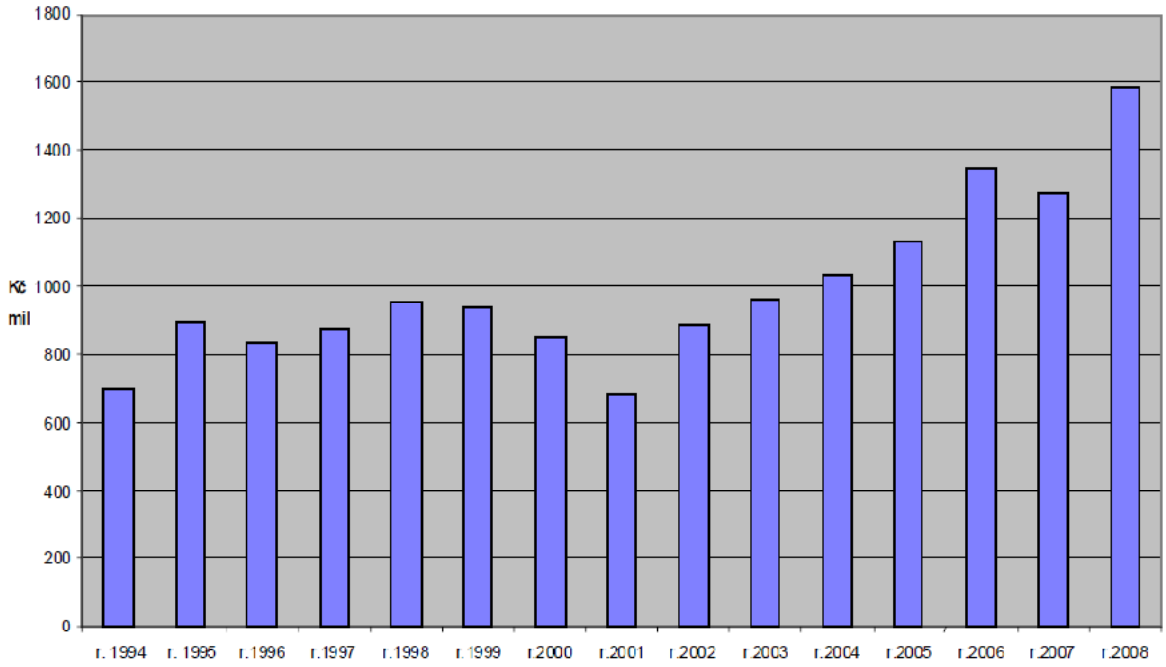
The reparcelling cost are covered according to § 17 LR by the state. It is dealt with a principle from which some exceptions are possible. Always it is possible to finance elaboration of financial projects, building inspections etc from the state budget. However, also the reparcelling participant themselves as well as other natural and legal

persons interested in its realization can share in covering of the costs. In these cases the state can provide subventions or grants to the persons according to special legal regulations. When the need of reparcelling is invoked by building activity, the builder is who pays the cost in principle in dependence on the extent of area touched by the building. The financing is crucial also for finishing of allotment and consolidation proceedings in more than one thousand cadastral areas determined by the Land Fund (it is required for c. 600 cadastral areas whereas the Land Fund does not have any problem with release of financial means for the reparcelling, rather there is an anxiety that land offices will not spend these means because of insufficient capacity of own and project sphere on base of experience from last years) in which reparcelling has to be carried out expeditiously mainly because of acceleration of privatization of land in the state ownership (agricultural land fund in the CR has approximately 16 mil. pieces of land, so, it is considerably fragmented). From view-point of land offices, the reaparcelling is financially the most demanding activity, above all the realization of common arrangements and geodetic activities.

The resources of financing of reparcelling are differentiated (see in the text), the total resources used for reparcelling are shown in the graph 1.

Simple and complex reparcelling is so far realized on roughly 14,0 % of acreage of the agricultural land fund; other 13.0 % of this land is investigated now concerning the reparcelling. Expressed by concrete numbers, in 2008 in total 914 cases of complex reparcelling was finished (the acreage 386,770 ha) and 3,358 cases of simple reparcelling (the acreage 209,517). 998 cases of complex reparcelling with the total acreage 448,292 ha and 248 cases of simple reparcelling with acreage 99,504 ha were developed to the end of 2008 (SPR Land, 2009).

In frame of this programme it is possible to ask for a direct non-refundable grant for reparcelling. It is governed legislatively in the Council Regulation No. 1698/2005 on support for rural development from European Agricultural Fund for Rural Development (EAFRD). In the Rural Development Programme (RDP) for the period 2007 – 2013) this is in frame of measure I. of axis „1.4. Reparcelling“, which continues the support in frame of sub-measure 2.1.1. Reparcelling in frame of the Operational programme Agriculture in 2004 – 2006; further also pre-accession programme SAPARD. In frame of this measure it is possible to spend means in within following intentions: (i) a measurement of territory and all layout elements and other geodetic work for creation of reparcelling



Source: Situation and Perspective Report Land (SPR), Ministry of Agriculture 2009

Graph 1: Volume of financial means for reparcelling (mil CZK).

proposal (ii) demarcation of newly suggested parcels stemming from the approved reparcelling proposal; (iii) measurement of parcels according to §21a) of the law No. 229/1991 Col., and (iii) realization of plans of common arrangements of reparcelling. The endowment title is referred to the entire CR territory, except the area of the city Prague. The support receivers are land offices and it is possible to ask for these two groups of projects: (i) Realization of plans of common arrangements on base of the approved reparcelling proposal and (ii) Geodetic projects. The grant height can be from 300 thous. CZK to 50 mil. CZK (according to RDP („Rules...“ – see the literature review) the highest sum is a grant 25 mil. CZK) per one project to 100 % of qualified expenditures. The means are from 75 % covered by the EU contribution, 25 % is from CR public resources. The main aim of reparcelling carried out in frame of the agri-environmental common policy of the EU is improvement of life of rural inhabitants, conservation of culturally historical values and an increase of landscape bio-diversity, resp. maintenance of settlement of he country as a social space. During the financing from EAFRD program for the current period there is a presumption that c. 180-200 proceedings on complex reparcelling will be started and finished annually which represents c. 100 thousand ha yearly. A proposal of simple reparcelling is realization of c. 120 proceedings, resp. c. 40 thousand ha yearly. EU resources in frame of RDP are focused first of all in the realization part of reparcelling (the building of common facilities, or technical measures) on the basis of approved proposals of reparcelling, therefore it is essential to proceed in elaboration of the proposals in such a way to be able to spend these means in maximal possible height (in total over the period 2007 – 2013 approx. 5.1 bil. CZK are available from EAFRD means). Other financing resources are following: almost 1 bil. CZK yearly is provided from the state budget and over the period 2009-2013 the aggregate amount of 800 mil. CZK was granted from the state budget and the National Property Fund for flood-protection measures, approx. 700 mil. CZK from the Directorate of Roads and Highways, and originally approx. 400 mil. CZK from the Land Fund of the Czech Republic. The total need of financial means from different sources (the sources are: VPS is from state budget, PPEO is from National Property Fund for flood-protection measures, PRV is from RDP, RSD is from Directorate of Roads and Highways and PF CR is from the Land Fund of the Czech Republic) and the assumption of financial means for the time period 2010 – 2013 can be seen in the table No. 1 and in the table No. 2. This new data about financial means are based on the document „Activity plan of Land offices and financial means for the period 2010 – 2013“, which was prepared by the Central land office and was discussed in February 2010 in the Ministry of Agriculture.

From a point of view of the common arrangements in the period 2006 – 2008, it was dealt with realization of following concrete measures in frame of realized reparcelling: 1,227 field roads, 927 territorial systems of ecological stability and other greenery, 632 erosion-protection and other measures, and 310 water-management measures (Journal of the Land Office, 2006).

The list of cases of complex reparcelling to the 31.12.2008 is shown in the table No. 4. For idea on average financial costs per one projects it is possible to mention a case from 2009 when the State Agricultural Intervention Fund (SZIF)

Year	VPS	PPEO	PRV	RSD	PF CR	other	total
2010	928,210	478,645	644,083	152,858	282,293	2,662	2,478,832
2011	1,027,794	629,712	1,421,030	235,932	214,449	2,240	3,531,156
2012	1,078,585	491,710	1,599,511	225,605	203,723	33,080	3,677,214
2013	1,129,121	522,944	1,501,963	251,060	144,881	31,901	3,584,870

Source: Report of Ministry of Agriculture of the CR 2/2010, Ministry of Agriculture 2009

Table 1: Total need of financial means from different sources (thousand CZK).

Sources	2010–2013	only 2010
State budget (VPS)	3,600,000	700,000
State budget – PPEO	780,000	400,000
PF CR	1,000,000	350,000
RSD	900,000	180,000
PRV	2,580,000	700,000
Total	**8,860,000**	**2,330,000**

Source: Report of Ministry of Agriculture of the CR 2/2010, Ministry of Agriculture 2009

Table 2: Assumption of financial means for the time period 2010 – 2013 (thousand CZK).

Applications for grant in frame of the fifth and the second (from this round it concerned the originally disapproved applications) round of reception of RDP applications – the measure I.1.4. Reparcelling in the total support height 657,994,084 CZK – the average height of endowment amounted to 6,266,610 CZK, whereas the lowest asked sum was 341,382 CZK for reconstruction of a field road and the highest 20,638,891 CZK for a project of field roads (generally just the building or reconstruction of field roads are the most frequent in frame of the applied projects).

Problems - discussion

Regarding the scope of problems which reparcelling solves it is not possible so that this process would take place quite without conflict and so that question would not been put for which there are not immediate sufficient answers. For example, in a given area which represents a reparcelling district according to § 3 of the Act on Land Offices, there will be a possibility of various options of solution, of course, and then a compiler of the reparcelling proposal has in fact a very important position. The law tries to solve security of expertness of the compiler. However, in the same way important can be also a question of his/her objectivity and a possible „unofficial“ suggestibility from the seize of participants of the proceedings or other persons.

From the view-point of reparcelling realization, the position of reparcelling participants is unclear in relation to endowment titles. For example, in frame of subsidies for reparcelling according to RDP there is a presumption that particular applicants (land offices) will ask a complete reimbursement of costs for the project – however, regarding a maximum limitation of the subsidy amount, reparcelling of more complex dimensions within the frame of one project are in such case realizable with more difficulties. (The cost can be paid by other particular participants (see above), nevertheless, from the view-point of the application character not as a co-sharing in the project – rather within the frame of other project which will supplement that for which is asked for a grant.)

Yet, the legislatively unsold issue of restitution to churches represents a certain (in some cadastral territories quite considerable) obstruction in the process of creation of functional units of land suitable for agricultural farming. Section 3 sub-section 5 of the current Act on Land Offices should offer a partial solution. The property originally owned by churches, religious institutions and congregations which is currently in the state ownership and in administration of the Land Fund of the Czech Republic is not excluded from reparcelling. The law only prohibits its use for common facilities. However, in use of this property by way according to LR there can be felt an anxiety, logically, that results of reparcelling could be legally attacked in the future just from the side of church entities. There is still uncertainty regarding to the redress of property grievances caused churches and other church subjects. A bill proposed in this matter for discussion in the

Parliament of the Czech Republic has been negotiated for already more than one year (see www.psp.cz).

From view-point of **protection of owners**, it is obvious that the position of owners of bigger acreage of agricultural land is generally strengthened against the position of owners of smaller parcels. Whereas, the same protection in frame of constitutional law appertains also to owners of smaller parcels. A rehabilitation of incorrect administrative decisions in frame of reparcelling is a complicated question which can considerably complicate their realization. Even in issuing of own decision of a land office on an exchange or a transition of ownership rights a misconduct can happen, even a breach of the law and even if a regular legal remedy is not given, a possibility of rehabilitation of such a decision has to be given. Owners of parcels touched by reparcelling and decision making of a land office are provided with wardship, of course, in frame of court control of the public administration. However, in this area, many questions are let to court judicature without an express solution in the law which probably is not too transparent for land owners and it does not strengthen the peace (Sládeček, 2009). Regarding imprescriptibility of ownership right, the problems of parcels not quite without conflicts, marked as "pieces of land whose owner is not known" and which should fall to the state, are interesting. It is also important to hold a discussion and negotiations referring to the task of security of land reserves for reparcelling needs, i.e. to decide which parcels the state will keep in its ownership in the given locality, if it owns still some land there, and so it will not privatize this land.

From the total area of agricultural land of the Czech Republic, 23 % of reparcelling have already been made or are in process, how it is possible to know in the table No. 3 - List of finished, planned and reparcelling in-process in the regional division on the date 1.1.2010.

It follows from comparison of the above tables No. 3 and No. 4 that in the area of reparcelling in the year 2009, there were less reparcellings than in the year 2008 (96 as against 126), and also the overall area decreased from 58,636 ha to 54,929 ha. From the point of view of commenced and unfinished reparcelling, there was again a lower activity in the year 2009, when compared with the year 2008. Whereas at the end of the year 2008 872 complex reparcellings were in process on the area of 389,656 ha, at the end of the year 2009 747 complex reparcellings were in process on the area of 395,446 ha. The structure of financial means for the years 2008 and 2009 is similar to other years shown in the table No. 2, total amount increased, but in the comparison with the activity of Land offices in the field of reparcelling, it does not looks like the improvement of effectiveness of reparcelling.

Region	Finished CR		Finished SR		CR in-process		SR in-process		Planned CR		Planned SR	
	on the date 1. 1. 2010								2010	2011–2013	2010	2011–2013
	Count	Acreage	Count	Acreage	Count	Acreage	Count	Acreage	Count		Count	
Středočeský+Praha	162	65,314	83	9,221	108	50,082	17	5,812	54	106	2	0
Jihočeský	155	59,083	104	27,050	109	45,793	36	11,819	32	62	10	10
Karlovarský	43	13,138	461	43,663	26	8,202	3	32	7	23	1	0
Plzeňský	98	34,303	138	21,337	101	41,019	11	192	17	42	2	0
Liberecký	17	5,455	97	2,631	26	11,255	4	427	12	33	5	6
Ústecký	44	17,500	139	23,602	45	25,857	16	3,709	22	27	0	0

Královéhradecký	80	30,781	125	9,391	46	25,133	12	3,690	23	62	3	1
Pardubický	65	29,460	23	10,362	50	34,707	12	10,836	30	51	1	0
Jihomoravský	146	91,485	445	37,938	65	48,212	39	25,144	10	41	10	8
Zlínský	27	11,617	90	2,995	36	20,173	15	1,023	7	40	1	1
Vysočina	90	41,199	70	4,349	40	21,555	5	160	7	24	2	0
Olomoucký	69	33,970	46	4,251	53	26,494	8	587	18	44	0	0
Moravskoslezský	14	8,393	158	7,505	42	36,966	18	3,231	13	47	4	6
CR total	**1,010**	**441,699**	**1 979**	**204,294**	**747**	**395,446**	**196**	**66,662**	**252**	**602**	**41**	**32**

Source: Report of Ministry of Agriculture of the CR 2/2010, Ministry of Agriculture 2009

Table 3: List of finished, planned and reparcelling in-process in the regional division (acreage in ha).

Land offices	finished				in-process and planned			
	in the year 2008	total on the date 31.12.2008	in the year 2008	total on the date 31.12.2008	in the year 2008	total on the date 31.12.2008	in the year 2008	total on the date 31.12.2008
	Count	Count	Acreage	Acreage	Count	Count	Acreage	Acreage
Středočeský kraj	25	164	12,754	66,221	22	140	10,052	52,777
Jihočeský kraj	11	128	5,192	48,565	21	137	5,897	39,750
Karlovarský kraj	7	40	2,236	12,223	7	29	1,687	9,949
Plzeňský kraj	11	78	3,871	24,706	16	120	6,557	47,166
Liberecký kraj	1	13	793	4,383	6	25	2,248	9,387
Ústecký kraj	10	45	4,840	17,559	15	58	5,307	20,057
Královéhradecký kraj	11	74	3,816	26,506	11	47	7,276	23,588
Pardubický kraj	6	56	2,102	24,967	17	48	10,489	28,750
Jihomoravský kraj	12	128	9,282	74,101	23	99	15,161	65,029
Zlínský kraj	5	24	3,128	10,242	7	32	4,347	17,913
Kraj Vysočina	12	89	5,497	39,909	2	34	1,143	11,968
Olomoucký kraj	10	62	2,213	29,881	15	60	7,549	27,302
Moravskoslezský kraj	5	13	2,912	7,505	12	43	9,179	36,021
CR total	**126**	**914**	**58,636**	**386,770**	**174**	**872**	**86,890**	**389,656**

Source: Ministry of Agriculture of the CR

Table 4: Complex reparcelling on the date 31.12.2008.

Conclusions

In the legal and factual respect, the reparcelling can be considered as one of the most important tools of land law in the CR. It represents an alive legal institute frequently used which helps not only to renew ownership relations to restored agricultural property but also to solve many other factual and legal problems connected with land ownership including renewal of boundaries of parcels in the landscape, a renewal of reliable statutory registration of parcels, and a renewal of disintegration of land fund.

Reparcelling is one of priorities in the department of agriculture in the CR at present. An evidence of it is for example that the Ministry of Agriculture initiated an amendment of act on the Land Fund of the CR (LF CR) which enables the Land Fund to provide financial means for reparcelling up to 400 million crowns annually (a press release from 21.12.2009). The Minister of Agriculture stated to that that „Reparcelling represents now and in perspective for next at least 15 years an answer to an intensive pressure of the society on a real termination of the restitution process, clearance and stabilization of ownership". The proposal should be approved as soon as possible because its sense is so that the means which the Land Fund will generate „from the land" would be also returned in it.

As it results from the mentioned release, the financial means for realization of reparcelling will be the main problem in its faster course. Its shortage shows itself partly in limits, how many projects can be realized at the given time, and also in that it influences organizational size of appropriate land offices and their capacity possibility in realization of restructuring. Both these consequences of lack of financial means show themselves also at relatively long time for which according to presumptions an allocation of realized reparcelling is planned. The process is long-term; however, from the view-point of further use of agricultural land is purposeful to continue.

As a certain negative respect of reparcelling can be felt a fact that this legal institute undoubtedly strengthens an influence of centralized bureaucracy on arrangement of statutory relations to the land and at all on organization of all the territory. However, it seems that this is not felt much by the public because problems of uncertainty of ownership relations and functionless arrangement of agricultural land are very burning. In the relation of given hypothesis, it can be spoken that in spite of increasing of financial means in the last two years, the activity in reparcelling, expressed in the comparison of finished and started reparcelling in the years 2008 and 2009, does not make the proof for the increasing effectiveness, but positive is that the acreage of started and reparcelling in-progress is increasing and also, that the average need of financial means per hectare is decreasing (from 15,000 CZK to 7,000 CZK).

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Analysis of the causes of price fluctuations of dairy products at individual levels of the product vertical

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Abstract

The paper analyzes the reasons for the prices of milk and milk products in the Czech Republic for the period 2008 – 2009. In January 2008, the purchase price of raw milk was 10.08 CZK/l, and in the subsequent period it began to decline. At the end of 2008, the price was more than 3 crowns lower, and still the decrease continued. The research determined that the essential reason for the price fluctuations is the impact of the economic crisis. A substantial portion of the article was devoted to analyzing the behavior of supermarket chains toward their suppliers. It was discovered that even here there is a lot of room for the creation of pricing policy. Margin trading networks up to 25% of the delivered goods. Price negotiations affect the position papers in the manufacturing vertical. The power of suppliers and processors is based on the establishment of a strong integration unit. In the conclusion the author discusses possible future developments in price, sales policy, and the self-sufficiency of milk production in the Czech Republic. The paper was processed within the framework of the Research Project of MSM 6046070906 "The economics of Czech agricultural resources and their effective use within the framework of multifunctional agri-food systems".

Key words

Milk, price depression, price scissors, chain store, retail revenues from food, self-sufficiency.

Anotace

Příspěvek analyzuje důvody propadů cen mléka a mléčných výrobků v České republice v období 2008-2009. V lednu 2008 byla výkupní cena surového mléka 10,08 Kč/l a v následujícím období začala klesat. Na konci roku 2008 byla cena více než o 3 koruny nižší a pokles stále pokračoval. Zkoumáním bylo zjištěno, že podstatnými důvody cenových výkyvů byl dopad světové ekonomické krize. Podstatná část článku byla věnována rozboru chování obchodních řetězců vůči jejich dodavatelům. Bylo zjištěno, že i zde je velký prostor na utváření cenové politiky. Marže obchodních sítí tvoří až 25% z ceny dodávaného zboží. Vyjednávání o ceně ovlivňuje pozice článků ve výrobní vertikále. Síla dodavatelů a zpracovatelů spočívá ve vytvoření silného integračního celku. V závěru tohoto článku byla provedena diskuse budoucího možného vývoje cen, politiky odbytu a soběstačnosti výroby mléka v České republice. Příspěvek byl zpracován v rámci VZ MSM 6046070906 „Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systému“

Klíčová slova

Mléko, cenový propad, cenové nůžky, obchodní řetězec, maloobchodní tržby za potraviny, soběstačnost.

Introduction and aims

In Europe, or across the world as the case may be, a significant growth in prices revealed itself in 2007, especially in the food sector. This growth subsequently resulted in a higher inflation rate. Countries throughout the world fumbled with high inflation at the turn of 2007 and 2008. Petroleum prices as well as the prices of basic foodstuffs (corn, wheat, soybeans, rice) grew in China, Russia, the USA and Japan, and much more significantly in poor developing countries. Their situation was generally worse because economically weak countries are more sensitive to a rise in food prices.At the beginning of 2008, the situation began to change. Global and domestic commodityprices declined significantly. The aim of the paper was to

map the price status for milk and milk products on the domestic market in 2007-2009, and furthermore to analyze the causes and consequences of low purchasing prices for milk. The paper has the task of monitoring price developments in the manufacturing vertical and evaluating opportunities arising from teamwork between actors in the vertical. Equally important is the task of describing the behavior of supermarket chains in the Czech Republic, and giving a real-life example of a supplier - business network relationship.

The scientific article continues research published by Krízová, /6/. The article deals with a food market analysis at the level of consumer price structure, through an identification of margins in selected food verticals and through an analysis of consumer behaviour associated with changes in prices and in the income of the population. /Krížová (2009); 6/ The problems of price disparities were also addressed for the manufacturing vertical grain - bakery products. Analysis has also confirmed that the decisive subjects in the milling industry become bigger mills, joined to the raw commodity supplier and the subsequent processing stages. It can largely eliminate the low flour price that becomes a competitive advantage, since the raw commodities become cheaper for the subsequent processing /Blažková, (2010); 1/ The dismal price situation is confirmed by other authors. /Foltyn et al, (2009); 2/.

Materials and methods

Materials and data for the analyses were drawn from web pages of the Czech Statistical Office: data concerning the price development of milk and milk products in the domestic market, and information on retail sales. Information from commodity reports, reports on the state of agriculture, and price statistics published by the Ministry of Agriculture (MZe) was used. The paper drew from press releases of the State Agricultural Intervention Fund (SZIF), as well as information from the FAO and the World Bank. For data analyses, general statistical methods and a calculation of year-on-year price indices were used, in order to see developments in time series. Besides the study and analyses of data, information from suppliers of milk products to business networks in the CR was used. The experience of suppliers, resulting from multi-year cooperation with business entities, was described.

Results and discussion

The causes of the rise in food prices in 2007 were to be found in the increasing volume of money in the world economy. The demand for foods and raw materials grew faster than the production of raw materials and the subsequent food production. There were significant food shortages worldwide due to the low reserves of agricultural crops and the high demand, especially from the developing world, where economies are growing very rapidly. Calculations using FAO /3/ and World Bank /15/ data show that the world food production per capita decreased only very slightly (a decrease of 0.1 kg per inhabitant). For soybeans, the worldwide year-on-year decrease in 2007 amounted to 0.2 kg/inhabitant. For other significant agricultural commodities such as cow's milk and corn, an increase in per-capita production was recorded. This figure for cow's milk was only 0.9 kg/inhabitant, whereas corn production grew by 11 kg/inhabitant. Despite the fact that according to FAO statistics the production of basic foods actually increased, their prices also increased considerably, and the world began to speak about a food crisis.

Bio-fuels, which are blended into petrol and diesel, are produced from sugar, cereals and oil plants. Bio-fuel production is supported by the USA and the EU countries. Unfortunately, more and more negatives are being revealed in connection with their production and use. In addition, developing countries have largely concentrated on growing commodities for bio-fuel production at the expense of foods for domestic consumption, and the felling of forests damages the eco-system. Furthermore, bio-fuels demonstrably increase the presence of greenhouse gases in the atmosphere. Thanks to an increased demand for the cereals, oil seeds and sugar necessary for the production of bio-fuels, prices of agricultural products, mainly cereals, could increase on a worldwide scale by as much as 20 – 50 percent in the next ten years, according to UNO and FAO studies. However, this state of food shortages did not arise only through an unbalanced supply and demand for food. Speculators in the world markets also tried to profit from this situation. At a time of financial and banking crisis

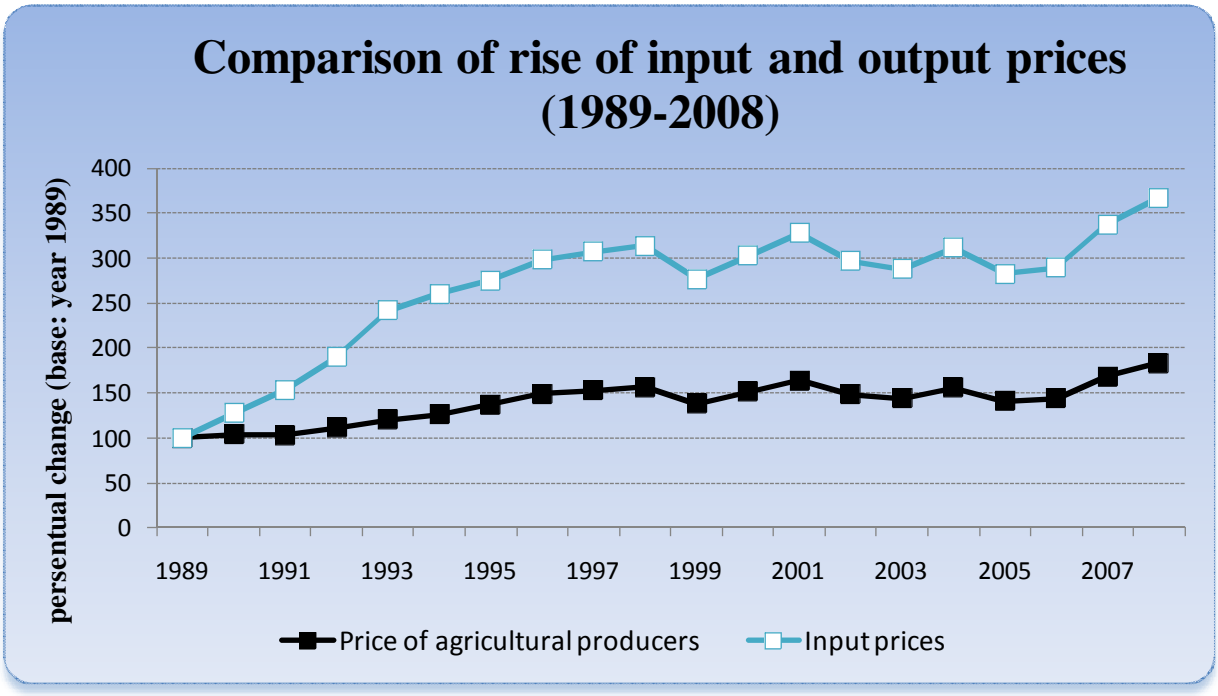
when stock markets were collapsing, speculators shifted their attention to a safer area – the commodity markets. A substantial increase in commodity prices could be recorded at the time when the world financial crisis broke out. As its development worsened, the pace of commodity price growth increased. The world food crisis was also reflected in the CR in 2007. There was increased pricing pressure on dairies from milk producers and sales cooperatives. The dairies feared that they would have to compensate for this pressure by increasing the selling prices of products in retail networks. The company MADETA, a.s. announced in November 2007 that its plant would make 250 g of butter for 51.50 CZK starting in the new year of 2008. The industrial producer price was 30.06 CZK / 250 g butter / 5/ in November 2007. It should be noted that the price increase of 20 CZK for one pack of butter is not in the current price time series and was not viable. Other dairies thus planned to raise prices. At he beginning of 2008, the purchase prices of raw milk stopped rising, and prices of dairy products did not increase. The world prices of dry skim and whole milk no longer rose significantly. Since their peak from June to August 2007, world prices have significantly decreased; a slight recovery was evident in May and June 2008. Further developments showed a decreasing trend.

The milk market in the Czech Republic started to show price fluctuations in the 1st quarter of 2008. The milk purchase price of 10.08 Kč/1 in January 2008 fell. At the end of 2008, the price was more than 3 crowns lower and still the decrease continued. After half a year, in July 2009, the purchase price of raw milk of 1st-class quality decreased to a historic low of 5.90 CZK/l.

The critical state of the dairy industry could be influenced by a situation called "open price scissors".

1. Price scissors

The price scissors describes the relationship between the prices of inputs and outputs in a given industrial sector. In the case under consideration, prices of agricultural inputs /PAI/ were tracked in contrast with prices of agricultural producers. For graphics processing, price indices /Graph1/ were used, which evaluate developments with regard to the year 1989. As a result of this monitoring, it was found that PAI increased by 83.4 % compared to 1989. Input prices increased by 368 %, more than



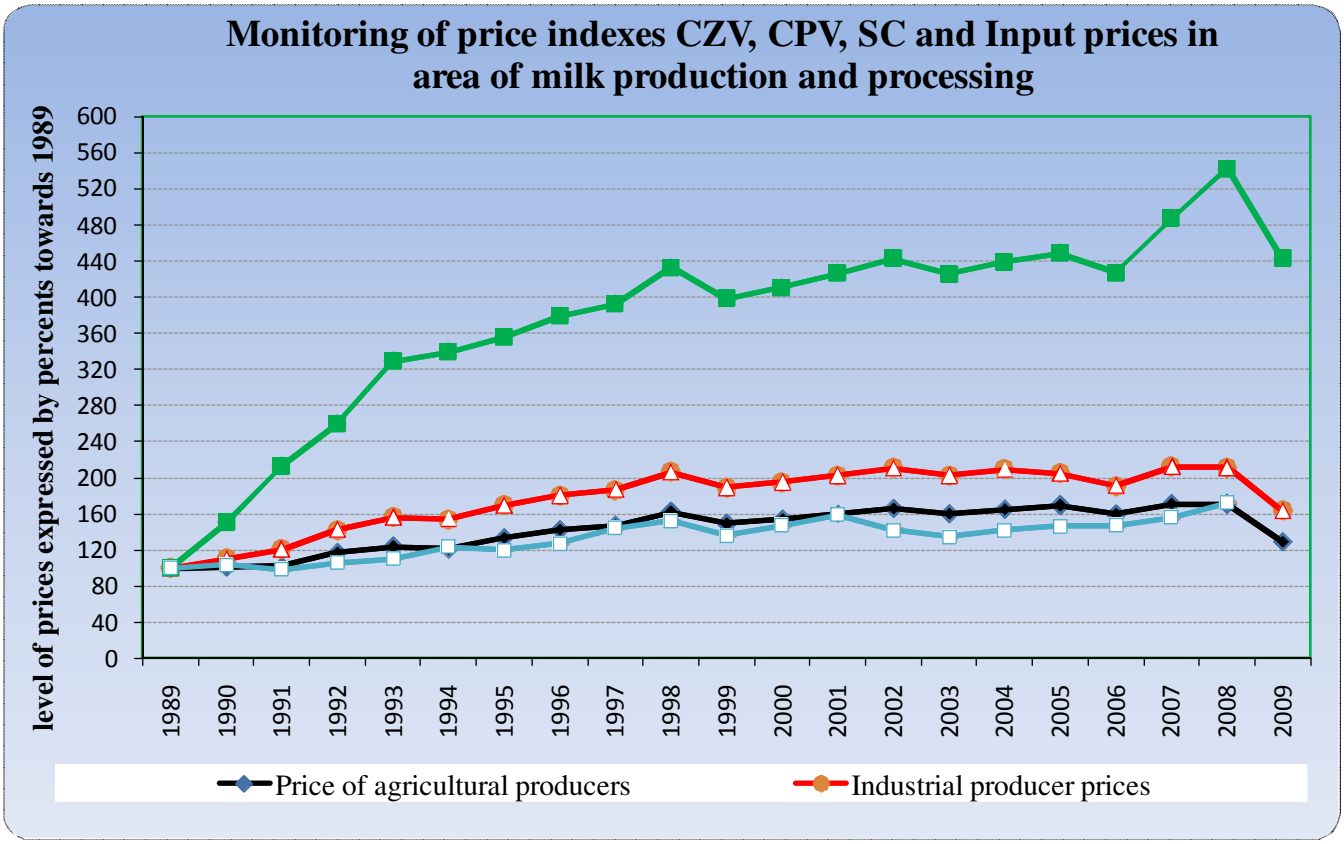
Source:
Own calculationsof price changes on base of price indexes from sources:
1) Czech Statistic Office (CSO) /10/
2) Report on state of Czech agriculture: Mze, Prague /further: ZZ/, ZZ 1995, ZZ 1996, ZZ 2000, ZZ 2004, ZZ 2006. /9/

Graph 1.

three times as much. Given the numbers by which prices for materials, facilities, machines, energy, wages and so on move,and the unit prices in which prices per liter or kilogram of agricultural production develop, there is clearly a significant decline in the available financial resources as well as in profit. The biggest price increase in the whole agricultural sector happened in the first half of the 90s. In 1992, the input price index had a value of 189.7 % compared to the year 1989, and in 1994 this value was 260.1 %.

Price developments in livestock production were much different. In livestock production in 1992, a growth of 16 % was recorded compared to 1989, and in 1994 this growth was 21 %. The livestock sector did not dispose of such financial resources to be able to accept the increased requirements for financing of inputs, and had to use existing opportunities and resources. The price scissors problem is really significant because it clearly describes the situation of farmers. Costs of milk production increase. If the purchase price of milk stagnates or decreases, farmers are forced to reduce spending on inputs. They can do this for some items, but not over the long term. In the long run, unprofitable enterprises can not survive the pricing crisis. Price developments in livestock production, expressed by price indices, are related in /Graph 2/.

In the area of milk production, the situation is known and is as follows. The annual index of consumer prices for milk and milk products continues to grow. Consumer prices culminated in January 2008. Eventually they began to decrease, however not so significantly as for agricultural producer prices. At the end of 2009, consumer prices were roughly at the level of mid-2007, and the price for raw milk of 1st-class quality reached the level of prices for the year 1994. Reasons for this significant fall in prices can be found in the decreased demand for foods, the surplus of raw



Source: Own calculations of price changes on base of price indexes and price development from sources:

1) Report on state of Czech agriculture 1995-2008, MZe CR, Prague /9/
2) Czech Statistic Office (CSO) /10/
3) Portal e-AGRI /11/

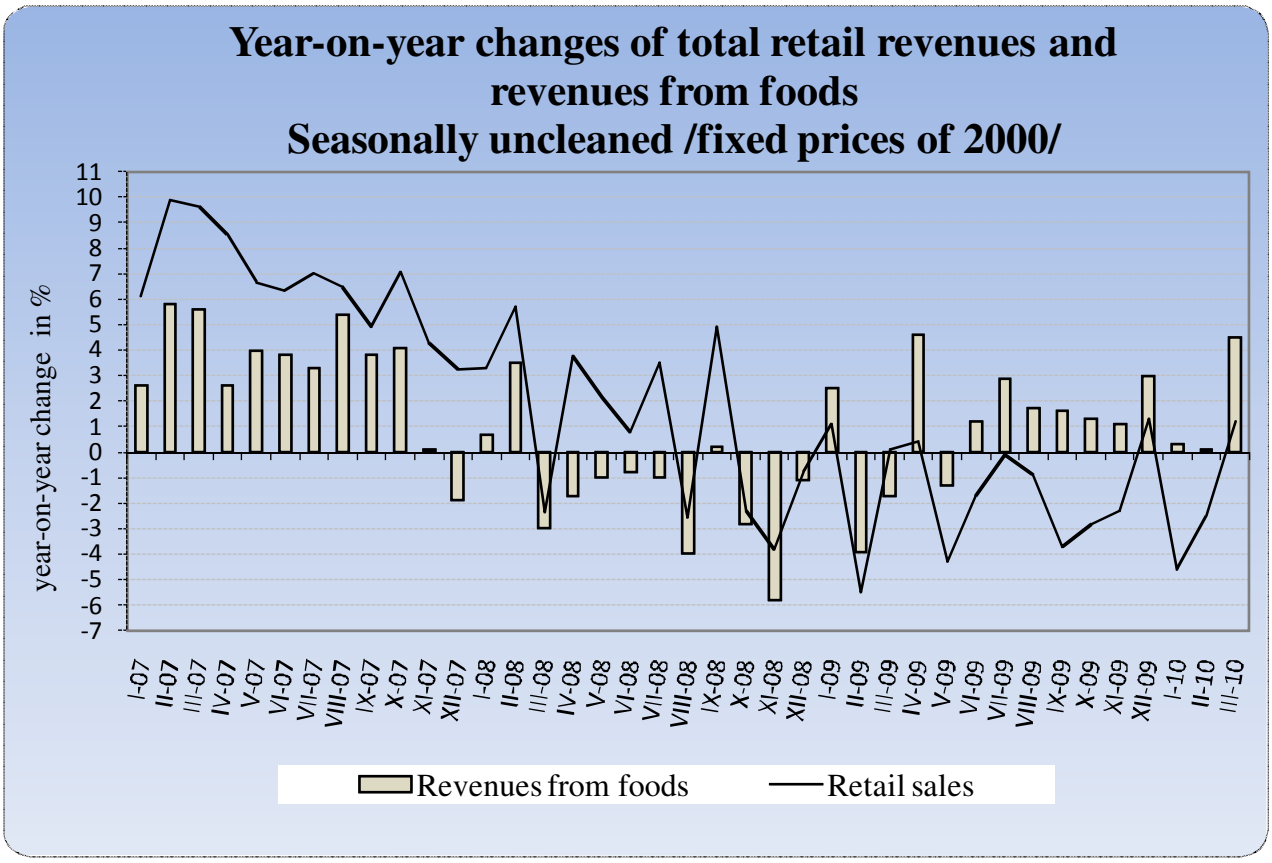
Graph 2.

materials, and the reduction in intervening purchases in Europe. Further reasons include the significant impact of the economic and banking crisis in the CR, the unbalanced position of subjects in agrarian markets, the quota system, the imbalance of direct supports for agriculture in particular EU member states, and the development of world prices for dairy products.

2. The economic crisis and its influence on the price of raw milk

A certain reflection of the crisis in household budgets is evident. Gross wages in the CR are not decreasing year-on-year; however, job security and long-term financial security are declining. Along with people's growing fears, expenditures for food are also decreasing. The consumer could be less willing to spend money for purchasing food and may choose cheaper products, or prefer smaller packages. Generally, the crisis is changing the consumer´s idea of the price which he/she is going to accept when shopping, as well as the amount which he/she is going to buy. This was traced back to the start of falling prices for milk and milk products, and also the decrease in retail sales from foods in 2008 /Graph 3 /

In January 2007, the year-on-year growth of retail sales was 6.1 %, and in February 2007 it was as much as 9.9 %. The growth in retail sales for foods was not so significant; however, it was positive. The year 2007 still did not indicate a problem. The crisis in food purchasing appeared just at the beginning of 2008. Retail sales started to show significant variations, although only seasonal at first. Revenues from foods also showed a permanent decrease, and did not get into positive numbers throughout the whole year. The situation changed again in January 2009. Retail sales showed predominantly negative changes, except for the periods of Easter and Christmas when there was a slight recovery. Revenues from foods also increased during Easter and showed positive gains by the end of the year. Retail sales showed a negative change in 2009.



Source: CSO /13/

Graph 3.

This confirms the fact that when there is an active economic crisis, households confine their spending only to essential items. Total expenditures, including expenditures for food, decrease. In times of lingering financial uncertainty, households confine themselves only to the purchase of food and, for example, pharmaceuticals.

Retail sales of foods increased in 2009 and often had a higher growth rate than total retail sales. Unfortunately, this cannot be said about the price of raw milk. Its biggest decrease was seen in that very year, 2009. Revenues from foods were already growing and the purchase prices of raw milk still decreased.

3. Unbalanced position of players within the framework of the production business vertical

Some elements of the entrepreneurial environment can be influenced by their own farmers. One possible way to cope with a problematic situation is to change positions in the product verticals. This creates business relationships such that primary producers can be sure they will be able to achieve their production with an adequate price and time-frame.

The unbalanced position of particular market players is obvious. A need for association, cooperation and communication arises. Various levels of cooperation are offered in an agri-food complex:

A: farmer-farmer - *Sales cooperatives*
A cooperation among primary producers, common sales among members of the processing industry. Example: sales of milk, meat, vegetables.

B: farmer-processor - *Cooperative processing businesses*
A cooperation of primary producers and processors, in which producers have a property interest in members of the processing industry.

C: processor-farmer - *Cooperation in EU known as vertical integration*
An enterprise of the processing industry manages and organizes production on one or more farms. They are separate but economically dependent on the integrator.

D: processor-processor - *Association of processors*
A cooperation of processors who can significantly enforce their requirements towards chain stores.

Of course, there is no certainty that all integration types will be formed. However, it is certain that these types of cooperation can provide an important non-price support for Czech agriculture. Terminology throughout the whole Western world which indicates that producers cooperate on the sale of their products is absolutely heterogeneous. The names that are used include marketing organization of producers, marketing group of farmers, sales cooperative, and cooperative association, among others. In many cases (not all) this name does not describe a legal form of organization but gives a general picture of its main objectives, i.e., an organization securing the sale of production for particular members.

In the Czech Republic, the largest integrated dairy complex at the present time is the company MLECOOP – a sales cooperative. It includes 8 separate dairy sales cooperatives from throughout the Czech Republic. Its main task is central trading. It can contribute to clearing the market by stopping deliveries to processors who do not pay on time, or are unable to react to the required rise in prices. However, the bargaining ability of a central sales organization is not always unambiguously successful. A couple of cases in the history of Mlecoop itself confirm that. For example, the year 2001. A price increase pushed through by a central sale organization was not accepted at the time by producers, nor later by chain stores. Dairies held by farmers in Moravia were not able to obtain a higher price either. The central organization had the option of bargaining for the price and reducing it, or shifting milk to dairies with a better price. The effort to convince all members of Mlecoop that raw milk should be shifted to other dairies was unsuccessful. Concerns were obvious. If a milk customer changed and the newly-accepted customer got into trouble, it would be difficult to return to the original customer. This problem arose mainly in high-lying southern Bohemian regions where the problem of collection places is complicated. Some members of Mlecoop then closed separate contracts directly with dairies and eliminated the sales trade organization from negotiations.

In the past, Czech farmers have already strongly criticized the pressure which chain stores exert on them. The Czech Republic has taken legislative action. A law regarding significant market power and its misuse was submitted by members of parliament as early as 2008, and a draft law was supported by the Food Chamber. After complicated negotiations, even the veto of the CR president was overridden. In November 2009, the law was adopted. The new law prohibits, for example, the collection of unfounded charges, and bans the action of selling at a price lower than the purchase price (supplements to the law No. 1-4). In the case of misuse of market power, chains are faced with a fine as high as ten million crowns, or have to pay a penalty of ten percent of their sales. In more detail about particular kinds of payments which exist within business relationships between suppliers and chain stores now: Management, headed by a general manager, decides on the size of the financial sum received from all suppliers for the whole chain store. The level of payments is budgeted within particular departments. Some payments are covered by suppliers of consumable goods, different ones by suppliers of electronics, and other bonuses are paid by food suppliers. It all depends on the turnover rate of goods and their price. Individual purchasers know the exact monetary sum which they have to document for the business link and to settle accounts. If they do not fulfill this task, they are afflicted financially or positionally. Every contract for the delivery of goods, which is always valid from Jan. 1 of the given calendar year even though it can in fact be signed at any later date, contains points laid out by the Commercial Code. In the contract, a list and range of marketing (fixed) payments is agreed on as a percentage of turnover. The marketing payment is made at the beginning of the year and is dealt with, e.g., by an entry fee to a chain store. A listed payment is levied for each given product. The supplier pays any additional charges for promotion (advertisement leaflets, shows or tasting of goods), a payment for enlargement of the sales area, and a payment for the label „New“ or „Lowest Price“. Bonus payments (variable payments) constitute the second part of the payments. They are not listed exactly in the annex to the contract. Their level is not known in advance. They are collected at any time throughout the year, whenever buyers address suppliers. They are represented by, for example: unspecified spring or autumn discounts, Christmas and Easter events, annual discounts, discounts for celebrating mothers, or the start of the school year. If the supplier fails to make any of the mentioned payments by return, it foregoes any further opportunities of supplying goods to the chain. And not only that; there can be more reasons. Any omission, objections to contractual and non-contractual conditions, or the proposal of a judicial process on the part of the supplier. Beware of some problems connected with the implementation of goods in chains. It can happen that buyers themselves decrease the price of products without the knowledge of the supplier. In the case of a planned action the seller can deliver the goods, but it does not have to take care of the actual implementation of the action. Finally, the seller returns the goods to the supplier with the information that the goods were not sold. The return of the goods is charged to the suppliers, who then have to secure re-sale of the products in another way, with a cost increase. In the worst case, the foodstuffs which enable this (e.g. bread) are again „recycled“ in production.

„One of the new methods used by chain stores is timely payment of invoices. If customers pay their invoices in time, they will receive a certain percentage of the invoiced sum back from the supplier.“ /7/

This is one of the options used by chains in their search for new income. The law regarding significant market power does not prohibit it.

However, there are also positives to the newly-applicable law. Chains try to make the payments more transparent; some business networks decrease bonuses or cancel them for selected kinds of products. An example of a company which undertakes deliveries of dairy products to chains in the CR is shown below. Information was anonymously provided by a mid-sized Czech supplier of dairy products. The data obtained are not yet a reality; they are a plan for 2010. Their amount is not final; it can move upwards several times during the year. It is not expected that chains would decrease the bonus percentage, already agreed on in advance, during the year.

It can be seen from the table that not every chain always requires bonuses for the appropriate kind of goods. On the other hand, the total bonus of some chains for a selected kind of goods can reach more

		BONUSES					
	total turnover (CZK)	**Percentual pyments (fixed)**		**Marketing payments (variable)**		**In total (fixed + variable)**	
		% of turnover	CZK	% of turnover	CZK	% of turnover	CZK
A /1/	11 649 518	14,8	1 724 129	1,03	119 990	15,83	1 844 119
B /1/	10 003 493	12,43	1 243 434	0	0	12,43	1 243 434
B /2/	54 623 424	12,43	6 789 692	0	0	12,43	6 789 692
B /3/	363 253	7,5	27 244	0	0	7,5	27 244
C /1/	22 990 895	0	0	0	0	0	0
D /1/	4 321 352	22,23	960 637	4,63	200 079	**26,86**	1 160 715
D /2/							
- a	7 188 428	14,05	1 009 974	1,15	82 667	**15,20**	1 092 641
- b	4 476 867	0	0	0	0	0,00	0
- c	6 549 545	0	0	0	0	0	0
	974 084	1	9 741	0	0	1	9 741
E /1/	5 197 017	1,23	63 923	1,88	97 704	3,11	161 627
F /1/	15 375 427	16,3	2 506 195	4,52	694 969	**20,82**	3 201 164
G /1/	10 825 504	14,2	1 537 222	1,34	145 062	**15,54**	1 682 283
H /1/	3 354 242	15,45	518 230	4,02	134 841	**19,47**	653 071
I /1/	1 674 026	3,5	58 591	6,57	109 984	10,07	168 574
J /1/							
- a	1 270 304	4,5	57 164	0	0	4,50	57 164
- b	27 662 624	0	0	0	0	0,00	0
- c	5 200 717	0	0	0	0	0	0
K /1/	72 250 316	0	0	0,13	93 925	0,13	93 925
Total	**265 951 036**	**6,2**	**16 506 174**	**0,63**	**1 679 220**	**6,84**	**18 185 394**

Notice.

A - K Business network

/1/ Kind of product: Butter 82 % of fat

/2/ and /3/ Kind of product: Flavoured milk beverages

a, b, c Localities in Central Bohemia region – a placement of links of business network

Source: Czech supplier of milk products in business networks in the CR

Table 1: Planned height of bunuses in chains in the CR for 2010 (milk prducts).

than 25 % of turnover. It is necessary to repeat that this is the case for dairy products. Other sectors and products with a different added value have different bonus values, of course. In that case it is possible to identify with the following statement: „*Suppliers levy various fees and discounts on chains at an average of 20-30 % of each order. Roughly 15 % is part of the invoice and the rest is part of marketing payments*“…./7/

Chain stores are still pushing for a decrease in consumer prices. They want to lure customers with low prices. But the pricing pressure of chains negatively and incorrectly affects primarily their own customers. It enables the customer to buy goods in a lower price relation, but are the goods of such a quality as the customer imagines? Probably not. With low purchase prices for goods in markets, food producers cannot achieve production costs

which conform to the high quality of the product. In foods, where it is not common, there is a higher percentage of potato starch, more soybean fat than milk fat, and food supplements of type „E“. The substitutes are significantly cheaper than real milk protein or meat. They are added only in a proportion of a few percents, but even at that level they make the goods cheaper. The use of food supplements of type „E“ does not directly damage the health of consumers, but on the other hand, these supplements do reduce the qualitative value of the product. The result: lower consumer prices and in some cases considerably lower quality.

Conclusion

According to experts, there should not be any considerable production price revival because worldwide prices for dry milk will not rise in the near future. This price stagnation is indicated by the world's biggest milk seller, the New Zealand company „Fonterra“. It has decreased prices of dry whole milk for the period from March to September 2010 by an average of more than seven percent. Worldwide commodity prices influence price developments in particular countries, because the world is economically and informationally interconnected. Nevertheless, price developments have to be looked at in a wider context, in order to emphasize a country's own national practices, traditions, current realities and needs. Czech farmers have already reached the pricing bottom, with regard to the purchase price of milk in dairies. Prices begin to rise slowly. However, it is not yet enough. In the topical area of "price scissors" it is still suitable to answer the question, what percent do operational and investment subsidies, a resource of additional income for farmers, make up in the revenues gained from the sale of agricultural production. Direct subsidies alone, as in the case of fixed income for farmers, seem to be another cause of the volatility in the prices of agricultural commodities.

Retail sales for food has shown a growing development in the period from mid-2009. The willingness to buy is increasing again. Therefore it is pointless for chains to create space for the low purchase price of dairy products. Business networks reap profits and consumers accept low prices, often even at the cost of lower quality. The realized loss in the area of raw milk sales is leading to the killing of cattle herds. The numbers of dairy cows is decreasing. A loss was registered against the previous year; in 2007 this loss was 9,968 head (a decrease of 2.45%), in 2008 it was 7,703 head (a decrease of 1.9%), and in 2009 the number of dairy cows decreased by 15,849 head (a decrease of 4.12%). The argument of increasing milk yields is not sufficient. The average annual milk yield is growing. However, in 2009 it grew by only 93.6 liters per dairy cow, while in previous years, the growth was around the value of 200 liters per dairy cow per year. The result of what has been mentioned could be that the Czech Republic will have a problem with the amount of milk produced in the near future. Milk production is decreasing and a slightly growing milk yield will not maintain it. Advocating the development regarding milk quotas is not in place. Since the quota year 2006/2007, the Czech Republic has not totally spent the allotted amount of milk. Despite the fact that the validity of milk quotas runs until March 31, 2015.

On the other hand, direct supports also have to be reduced, since it is necessary to support quality and prosperous businesses. Chain stores can no longer lower retail prices without restraint; purchase prices for milk will have to go up. There is a chance for a slight improvement in the situation.

Czech legislation also tries to prevent chain stores from using coercive techniques on suppliers. A price decrease is not tolerable, and the law on bigger market power will probably not be the solution. It is necessary to allow a much faster natural concentration in agriculture so that really strong concentrated players with a significant position can grow here. It is not possible to subsidize weak businesses. It is not possible to guarantee their survival under conditions which would be liquidating for them in an undeformed market environment. It is essential to reduce operational and investment subsidies in these businesses and to accelerate their exit from the market.

The association at particular stages of the production vertical works in our republic. There are sales organizations as well as processing companies with the equity interests of farmers. It is logical that sometimes even they cannot reach the required price for processors, because even they have to calculate. To calculate for how much they will be

able to implement a product in chain stores. How much they will have to pay in bonuses every month. Again, the solution could be in integration. For example, the creation of a Central Dairy Organization which would negotiate supplier and pricing conditions with chain stores. In case the chains are not satisfied with the price, they cannot refuse the all-Czech assortment and replace it with a cheaper foreign one. At a minimum, goods with a short consumption time must only be produced in the CR. With regard to other products, there is a risk of cheaper competition. Other speculation includes letting processing companies create their own trade and sales networks.

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Modelling The Cattle Breeding Production in the Czech Republic

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Abstract

This paper proves that the use of the Cobb-Douglas form of production function is suitable for modelling the technological efficiency of selected production factors used in cattle breeding. Furthermore, it is possible to use the estimated function to analyse economic efficiency, considering also the prices of the production factors. The results of the econometric estimation show that higher initial weight affects negatively the dynamics of weight gain. Analysing the efficiency of the two main feedstuff components, i.e. the haylage and hay, it was found out that the increases in weight react inelastically with respect to the volume of feedstuffs, which is in line with the physiological limits of the animal production. The results further reveal that the increases in weight react more sensitively to haylage compared to hay. Thus, it is possible to conclude, that haylage provides technologically more efficient way of cattle breeding in comparison to hay.

This paper resulted from contribution to an institutional research project MSM 6046070906 "Economics of resources of Czech agriculture and their efficient use in the framework of multifunctional agri-food systems".

Key words

Cobb-Douglas production function, panel data, fixed effects, gain in weight, beef fattening.

Anotace

Tento příspěvek potvrzuje vhodnost využití Cobb-Douglasovy funkce pro modelování chovu skotu. Sestavenou funkci je dále možné využít pro optimalizační výpočty za účelem zjištění ekonomické efektivnosti výkrmu býků v souvislosti s cenovými relacemi jednotlivých výrobních faktorů. Výsledky ekonometrického odhadu ukazují, že vyšší hmotnost býků při zařazení do produkčního procesu snižuje dynamiku výkrmu. Při posouzení efektivity využívání dvou hlavních skupin krmiv a to senáže a sena bylo zjištěno, že přírůstky reagují nepružně na změny objemu krmiv, což odpovídá fyziologickým limitům živočišné výroby. Z výsledků však také vyplývá, že při krmení senáží reagují přírůstky citlivěji než při krmení senem. Je tedy je možné zobecnit, že senáž představuje technologicky efektivnější způsob výkrmu v porovnání se senem.

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Klíčová slova

Cobb-Douglasova produkční funkce, panelová data, fixní efekty, hmotnostní přírůstek, výkrm skotu.

Introduction

In the context of the Czech Republic's accession to the European Union, the performance of the agricultural sector has presented itself in economic debates. In view of this, the debates address both the amount of subsidies, which are granted to Czech farmers, and the competitiveness of the agricultural produce. Even though, so far Czech agricultural producers cannot benefit from the equal amount of subsidies as their "EU-15 fellows", the support given to agriculture has increased noticeably since EU enlargement. In the accession year of 2004, the EU subsidies represented a 40% share of the total support envelope dedicated to Czech agriculture.

This is to say, the conditions for doing business in the agrifood sector have improved as the income stability in agriculture increased. However, concerning the outcome of the agricultural companies, the results are not so convincing. There has been supporting evidence that the growth of agricultural output is still more attributable to the

crop production sector than the animal production sector. The Green Report on agriculture highlights the record of harvest in 2005 and at the same time it reports a 7% decrease of beef and 5.7% decrease of pork production (Ministry of Agriculture, 2005).

One reason why the animal production sector is gradually losing its competitiveness in the internal EU market is its inefficiency in using resources, which in this sector is mostly determined by the efficiency of feedstuff use. As the European Commission points out, the conversion coefficient for the use of cereal feedstuffs ranges around 6 t per ton of produced meat in the newly accessed EU countries, while in the EU15 it is only 3.5 t (European Commission, 2002).

Taking into account the growing price inflation of the main cereal commodities in the world markets, the efforts to minimise feeding costs require flexibility on the part of producers to substitute traditional feedstuffs for cheaper ones.

In view of this, special attention should be paid to the economics of animal production, especially regarding the efficiency of feedstuff usage. This notion is fully addressed in this paper. The main aim of the paper is, with the use of appropriate econometric techniques, to estimate the relationship between the use of primary production factors representing different kinds of feedstuffs, and cattle production, as the cattle breeding sector belongs to the traditional sectors of agricultural production in the Czech Republic. The estimation of the production function will thus enable the efficiency of feedstuffs used in the cattle production process in the Czech Republic to be analysed.

Aim and methodology

On the basis of a survey carried out across the agricultural companies in the Czech Republic, a set of data providing production characteristics of 23 agricultural companies within the period 2004–2007 was obtained. The set provides 92 observations for each production characteristic, concerning the number of head of cattle entering and leaving the production process, the number of sold cattle, the average gain in weight in the breed, the amount of feedstuffs consumed in the particular year and the company, and the total costs incurred in the respective breeding group.

Due to the arrangement of the set of data, the estimation of the production function was carried out by means of a fixed effect method instead of the regular OLS, since the method of fixed effects takes into account a heterogeneity of different agricultural farms included in the panel of data providers. It is assumed that the slopes of the production functions are identical for all observed farms, thus the farm heterogeneity is expressed by different constants for every farm. The differences are measured in relation to a chosen, baseline farm, whose constant represents a benchmark for the other farms. The differences in constant measure the heterogeneity of technologies used in the data panel.

In order to model the relationship between the production factors used in the cattle breeding production process and the cattle production, a Cobb-Douglas type of production function was chosen. In economic terms, the function models the dependence of cattle weight gain relative to the initial weight as of the cattle entering the production process, the consumption of hay and the consumption of haylage. In logarithmic form, the Cobb-Douglas function is expressed as follows:

$$\ln YK_{it} = \ln \alpha 0 + \beta 1 \ln Naklhmt_{it} + \beta 2 \ln SNKD_{it} + \beta 3 \ln SEKD_{it} + \alpha 1 \ln I1 + \alpha 2 \ln I2 + \ldots + \alpha n\text{-}1 \ln In\text{-}1 + u_{it} \quad (1)$$

where:

YP gain in weight in grams per feeding day and per head (dependent variable),

Naklhmtinitial weight of the breed at the beginning of the production period in tons,

SNKD consumption of hay in kg per feeding day,

SEKD consumption of haylage in kg per feeding day,

$\alpha 0$ constant of the baseline farm,

$\beta 1$ $\beta 2$ $\beta 3$ regression parameters of each independent variable,

Ii (i=1…n-1) the respective dummy variables characterising each farm,

αi (i=1…n-1) the differences from the baseline farm's constant measuring farms' technology.

The model was estimated with the use of PcGive 12 software.

Results

Characteristics of the panel data

Before presenting the results of the estimation, chosen production characteristics of the respective farms included in the panel are described. First of all, it is possible to provide an overview about the type of housing the different farms use. In the analysed panel, the type of free cattle housing prevails and represents a share of 87%, whereas only 13% of farms use a hutch type of housing. With respect to the preferred type of breed, 30% of farms are specialized in Czech Pied (Czech Fleckvieh) type, 22% of the farms breed Holstein type, and the rest which counts for almost 50%, uses hybrid breeds or combines multiple kinds of breeds. The cattle was fed with the normal feeding dose, (e.g. silage, cereals, hay and haylage), but statistically significant gains of weight were observed only in case of feeding with hay and haylage. It could be attributed to the type of housing. Therefore, only hay and haylage was considered in the model, being the cheapest feeding components.

Concerning the size of the breed in a yearly breeding cycle, the farms have on average 232 head with an average weight gain of 886 g per feeding day. With respect to the study published by the Institute of Agricultural Economics and Informatics (2008), the average weight growth of cattle in the Czech Republic reaches around 800 g, suggesting that the farms included in the panel have approximately comparable production results to the country's average.

Information about consumed feedstuffs, initial weight and average weight gain of the farms included in the panel is shown in Table 1. With respect to the gain of weight, it can be seen that 95% of values are in the range of 590 g to 1,192 g per feeding day.

With regards to the consumption of feedstuffs in the chosen farms, considerable variability of data can be found, which could be explained by possible substitutability of the feeding components. The average consumption of haylage per feeding day is 6 kg, whereas some farms register haylage consumption up to 16 kg. The highest variability can be seen in case of hay consumption, which has also the lowest number of observations. Hay represents an important part of the animal's nutrition; however, it can be substituted by other dietetic components corresponding to its availability at each farm.

The initial weight was chosen as another variable due its to expected influence on the dynamics of growth. In the sample of farms, the initial weight reaches 40 t ranging from 11 t to 79 t.

The descriptive overview of the analysed data leads to the assumption that the explanatory variables of feedstuff components and initial weight will not have a homogenous influence, but rather it is possible to expect certain deviations in explaining gain of weight. The high variability of consumed feedstuffs is, to a certain extent, a positive finding since it better explains the efficiency in reaching production growth.

Econometric estimation and statistical verification of the model

The estimated econometric model has a following form:

Variable	Number of	Mean	Min	Max
YP	90	886	438	1200
SEKD	86	6,043	0,72673	16,353
Naklhmt	74	40,596	10,993	79,476

SNKD	63	1,1941	0,029734	8,1028

Table 1: Description of variables included in the econometric estimation.

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Econometric estimation and statistical verification of the model

The estimated econometric model has a following form:

$$YP = -0.1125*Naklhmt^{**} + 0.03915*SNKD^{**} + 0.07989*SEKD^{**} + 7.197^{**} + 0.03757*I_1 + 0.04287*I_2$$
(SE) (0.0471) (0.0178) (0.0348) (0.154) (0.0472) (0.0328)

$$+ 0.06629*I_3^{**} - 0.2185*I_4^{**} - 0.03142*I_5^{**} - 0.2693*I_6^{**} + 0.1586*I_7^{**} - 0.1329*I_8 + 0.05317*I_9$$
(0.0239) (0.0207) (0.012) (0.0571) (0.0247) (0.0735) (0.0277)

$$- 0.1278*I_{10}^{**} - 0.02454*I_{11} - 0.3956*I_{12}^{**} - 0.3894*I_{13}^{**} - 0.1599*I_{14}^{**} - 0.1539*I_{15} - 0.03364*I_{16}$$
(0.0283) (0.0191) (0.0587) (0.0667) (0.0378) (0.0776) (0.0174)

$$+ 0.1763*I_{17}^{**} - 0.1132*I_{18}^{**} - 0.6025*I_{19}^{**} - 0.2714*I_{20}^{**}$$
(0.05) (0.00454) (0.164) (0.0293) **(2)**

sigma	0.078989	sigma^2	0.006240
R^2	0.8071448		
RSS	0.193419	TSS	1.002924
no. of observations	55	no. of parameters	24
Using robust standard errors			

Table 2: Statistical characteristics of the estimation.

Wald (joint):	Chi^2(3)	=	14.97 [0.002] **
Wald (dummy):	Chi^2(21)	=	2094. [0.000] **
AR(1) test:	N(0,1)	=	-1.808 [0.071]
AR(2) test:	N(0,1)	=	-2.732 [0.006] **

Table 3: Wald test and AR test.

The values in brackets display standard errors of the parameters. The parameters which are significant on the level of $\alpha = 0.05$ are marked with two stars.

The results of the statistical verification of the estimated model are displayed in Table 2. In total, there are 55 observations and 24 variables in the model (including the dummy variables). The index of determination indicates that changes in weight gain can be explained by the changes in initial weight and use of feedstuffs by 81%, thus suggesting a relatively strong relationship between the endogenous variable and the included exogenous variables.

Concerning the significance of each parameter, the t-test shows that all the parameters linked to the exogenous variables of initial weight and feedstuff components as well as the constant are significant (tested for $\alpha = 0.05$). Furthermore, 13 out of 20 parameters linked with dummy variables are also significant.

The results of the Wald test show the impact of total fixed effects in the model, which confirms the significance of the whole equation (Table 3). Thus it is possible to conclude that statistically significant differences exist between the constants of each farms, and hence between their particular technologies.

In order to assess the dependence of random errors in time, the autoregressive test of first and second order was carried out. The results of AR(1) do not prove the presence of autocorrelation of residuals expressed in the first order differences. This finding is supported by the autocorrelation function displayed in Figure 1. The results of the autoregressive test AR (2) show that the dependence of residuals in time is proved when considering second order differences. However, the transformation to second order differences significantly reduces the length of the time series, thus the informative value of the AR(2) test is very low.

Figure 2 provides comparison of the model's residuals with the curve of normal distribution. As Figure 2 shows, it is possible to assume normal distribution of the residuals, with only a minor skew.

Comparison of the real values of weight growth (YP) and the theoretical values estimated by the function (Fitted) is shown in Figure 3. It is necessary to take into account that the values are expressed in their logarithmical forms, thus they do not directly provide the value of weight gain. As Figure 3 shows, the estimated model captures relatively well the variation of real values of the endogenous variable. This finding is also supported by the index of determination, as already mentioned. Another view on the quality of the estimation is given in Figure 4, where the development of the residuals is displayed. As observed, most of the residuals are located in the range of (-0.5, 0.5), only a smaller number of residuals have extreme values.

Economic interpretation

The interpretation of the estimated function considers the influence of both the included explanatory variables as the main production factors which explain the production level, and the parameters regarding the dummy variables, which indicate the differences in technological level of the farms included in the panel. The parameters which concern the impact of each production factor on the growth of weight are as follows:

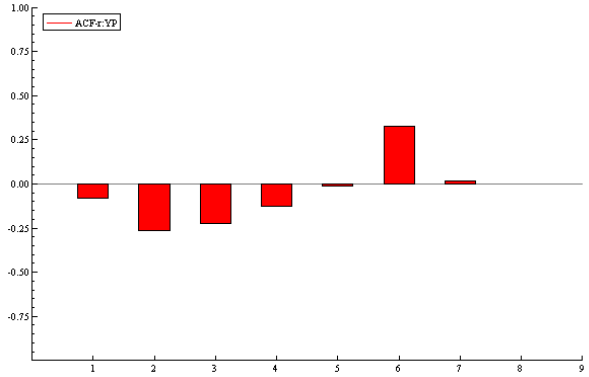

Figure 1: Autocorrelation function.

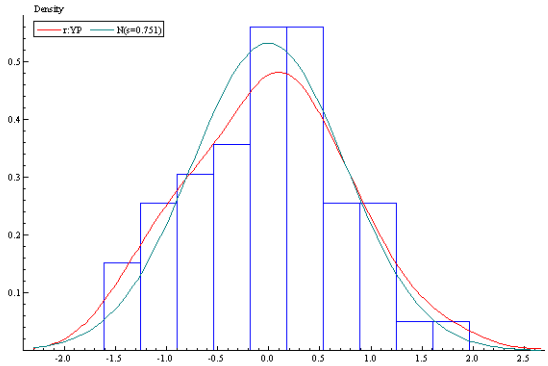

Figure 2: Distribution of the model's residuals.

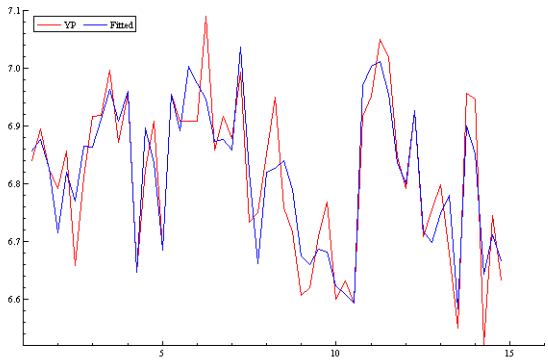

Figure 3: Real and fitted values.

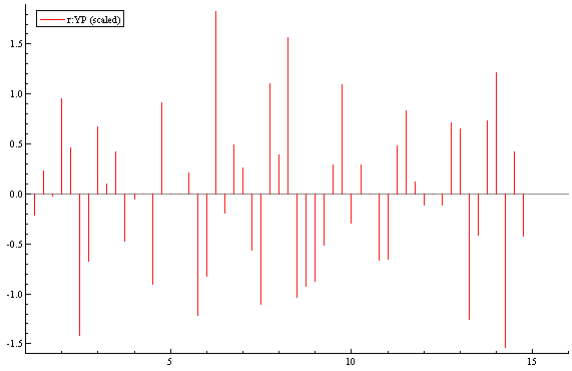

Figure 4: Model residuals.

1. Parameter of Naklhmt $\beta_1 = -0.1125$

The value of the parameter β1 indicates that a growth of input weight by 1% leads to a decrease of the weight by 0.1125%. This is to say that, with increasing initial weight, the efficiency of the production process decreases. This foundation is supported by the following reasons:

Following the production growth curve, breeds with a lower initial weight of cattle entering the production process reach higher dynamics of growth as compared to breeds with a higher weighted cattle, which is in line with the physiological maximum.

Concerning the nutrition process, only a part of the energy is used for the growth; the rest is saved as a maintenance dosage.

Based on the above arguments, it is possible to conclude that the results of the estimation correspond to the real production process, taking into account its physiological aspect. With respect to the intensity of reaction, the weight growth of cattle does not react elastically on the change of the initial weight.

2. Parameter of SNKD $\beta_2 = 0.03915$

This parameter quantifies the impact of hay consumption on the growth of weight and indicates that with a 1% increase of consumption of hay, the weight increases by 0.04%. In this case the results show that hay contributes positively to the cattle weight gain, however, the production elasticity is very low.

3. Parameter of SEKD β3 = 0.07989

Parameter β3 indicates that with a 1% increase of haylage use, the weight increases by 0.08%. In comparison to the elasticity of hay feeding, the consumption of haylage has a higher contribution to the production growth level.

It can be summarised that the initial weight of cattle entering the production process is the strongest factor influencing the development of cattle production, where the breeds with lower initial weights have a higher dynamics of growth. The main feedstuff components, represented by hay and haylage, lead to a continuous weight growth, however, with only marginal contribution.

The estimated Cobb-Douglas function also enables one to calculate the returns to scale reached in the cattle breeding sector. As the sum of the parameters shows, with increasing volume of input factors – i.e. the combination of input weight and the feedstuffs, the returns to scale decrease thus indicating that the dynamics of production growth goes down.

4. The constant and the dummy variables

In logarithmic form, the constant has a value of 7.197 which corresponds to the amount of weight increase of the baseline farm at zero level of input variables.

Parameters αi, attached to the dummy variables, represent the estimated fixed effects across the panel of farms. They represent the difference of each farms´ individual constant from the constant of the baseline farm. The higher the value of constant, the higher the levels of increment in weight are reached with the same amount of inputs (assuming equality of the regression parameters β). It therefore follows that the production process in farms with higher constants is more efficient in comparison to other farms.

In the interpretation, only parameters with accepted levels of significance are considered relevant. The farms with no statistical difference of their estimated constant from the constant of the baseline farm are assumed to have homogenous technology. In Figure 5, representation of farms with homogenous technology coincides with the baseline constant at the level of 7.2. The farms with a statistically different level of constant from the baseline, which are assumed to have a heterogeneous technology, are displayed by columns with respective deviation from the baseline. From the total of 20 enterprises, 13 farms were found to have a heterogeneous technology, where 10 farms were registered to reach a lower technological level. The biggest difference from the baseline constant (0.6) is observed in the case of farm 19. On the other hand, three farms reach a higher technological level against the baseline farm. However, the values of the deviations range in the interval of (0.60, 0.18) suggesting that the farms in the panel are not burdened with substantial technological differences.

The results of the technological differences in the panel of farms were further analysed with respect to a possible relationship to some qualitative characteristics of the farms, concerning both the type of cattle housing and the type of breed.

The baseline farm, representing the benchmark for assessing the technological differences, uses free type of housing. Seven out of ten farms with lower technological levels operate with the same type of housing. However two farms out of three which have above average technology also prefer free type of housing. Based on these facts, it is clear that the type of cattle housing does not play a substantial role in determining the level of technology.

The relationship between the technology and type of breed was also assessed. Concerning the baseline farm, the Holstein type of breed prevails. The farms having their technology homogeneous with the baseline farm also use Holstein type of breed, while the farms with different technology are those specialised in breeding of the Czech Pied type.

Following these findings, the type of cattle breed might have considerable influence on the production process of cattle breeding.

Characteristics of production function

Estimated production function should be verified in terms of the existence of continuous first and second order partial derivations. It is assumed that the first partial derivation is positive as the gain in weight increases together with the increasing input of production factors. Conversely, the second order partial derivation is negative as the rise of the first factor leads to the decreasing marginal productivity when fixing the second factor at the constant level – ceteris paribus.

Due to marginal technological differences in the panel, it was abstracted from the fixed effects and the production function is defined by:

$$YP = 7.197\ Naklhmt^{-0.1125}\ SNKD^{0.03915}\ SEKD^{0.07989}\ e^{uit} \quad \textbf{(3)}$$

After modifications we obtain first order partial derivations of the first explanatory variable:

$$\partial YP/\partial Naklhmt = -0.1125 * YP/Naklhmt \quad \textbf{(4)}$$

Analogically, it is possible to obtain the first partial derivations of other explanatory variables:

$$\partial YP/\partial SNKD = 0.03915 * YP/SNKD \quad \textbf{(5)}$$

$$\partial YP/\partial SEKD = 0.07989 * YP/SEKD \quad \textbf{(6)}$$

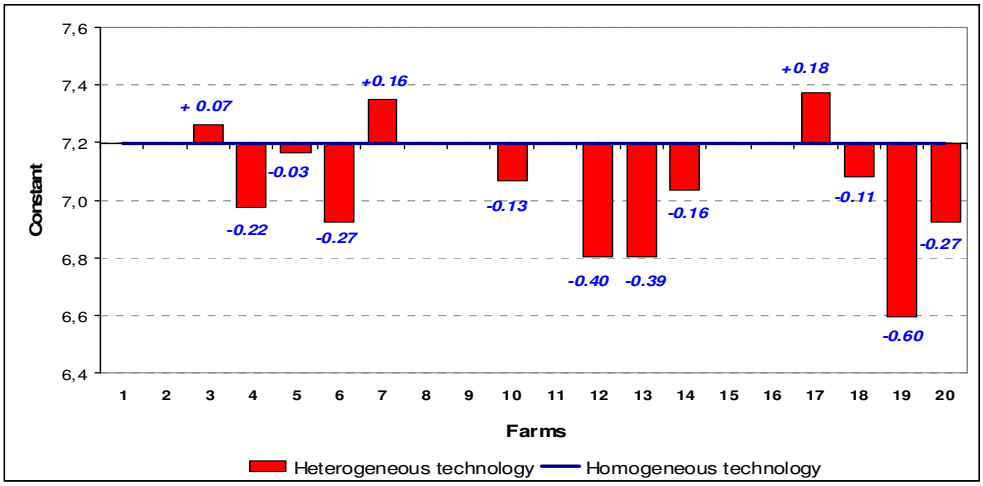

Figure 5: Technological differences of the analysed farms (source: authors´ elaboration).

Whereas the first partial derivations represent marginal production of a given factor, it is evident that each additional metric ton of initial weight induces, ceteris paribus, a reduction in the gain in weight. On the other hand, concerning the consumption of hay and haylage, their marginal productions will be always positive. From the form of the marginal production it is also possible to observe that with the increase in growth of weight, the marginal production of haylage will rise faster than the marginal production of hay consumption. This is explained by the higher value of elasticity of haylage as opposed to hay.

It is also possible to find the relationship between derived marginal productions and the unit productions of each factor. The term YP/SNKD represents the gain of weight per consumption unit of hay, i.e. unit production of hay consumption. Thus it is evident, that the production elasticities determine the share of marginal production from the unit production. In the case of hay and haylage consumption, their marginal productions will always be below the level of their respective unit productions.

The behaviour of the marginal productions can be evaluated by means of the second order partial derivation of the production function. The second order partial derivation of weight increase with respect to the initial weight can be subsequently derived:

$$\partial^2 YP/\partial Naklhmt^2 = -0.1125(-0.1125-1).YP/Naklhmt^2 \quad \textbf{(7)}$$

Analogically for the other production factors:

$$\partial^2 YP/\partial SNKD^2 = 0.03915\ (0.03915-1).YP/SNKD^2 \quad \textbf{(8)}$$

$$\partial^2 YP/\partial SEKD^2 = 0.07989\ (0.07989-1).YP/SEKD^2 \quad \textbf{(9)}$$

With the second order partial derivation assessment of the weight growth relative to the initial weight it follows, that the second order derivation will always be positive, with positive values of variables YP and Naklhmt. In other words marginal production will be negative and convex if reaching the point of minimum. From the form of the marginal production derivations for fodder consumption results, that if the growth of weight and the quantity of fodder spent is positive, the second order partial derivations of the production function will be negative (given that both parameters $\beta 2$ and $\beta 3 < 1$). This fact acknowledges the conditions set on the production functions with the assumption that with an increasing quantity of consumed fodder (providing constant inputs of others production factors), the slope of marginal production declines and thus the efficiency of the input factors.

Discussion

From the mathematical point of view, the estimated production function of fattening bulls is acceptable. However, it is also necessary question the behaviour of the function from an agronomical point of view, where, above all, the decreasing gain in weights with growing initial weight must be

explained. Therefore, it is necessary to discuss the growth curve in a more general form.

The growth curve is a graphical expression of real behaviour of growth, characterised by the phases of sigmoid (acceleration), break-even point and retardation at a different growth of the intensity level concerning various body parts in a given term (i.e. the non-homogeneity of growth). From the calf birth, there is a relatively intensive growth of skeleton replaced gradually by raising of musculature growth followed by the final phase where the accumulation of body fat dominates, which further continues at the age when the mass of muscles and especially the mass of bones is already unchanged. After reaching the inflexion point of the growth curve, the intensive stage starts with an increasing share of the fat components.

In the postnatal period, the growth of body depends especially on the health conditions, i.e. on the hygienic conditions, and on the level of nutrition. If the nutrition is not a limiting factor, then the live weight depends on the age according to the classic sigmoid curve, which accelerates at about 9 months of age and at a live weight of about 300 kg. Mathematically, this behaviour can be best described by the Gompertz equation:

$$yt = A.e^{-b.e^{-kt}} \quad \textbf{(10)}$$

where yt represents weight in time t, the parameter A represents asymptotical weight, which can be understood as the average weight of the individual in his adult age and the parameter k defines the rate of growth change; the parameter b has not a specific biological meaning.

The derivation of the Gompertz function provides a growth rate, usually called average daily gain in weight. However, the growth curve and its mathematical model may be applied only in ideal environmental conditions. In reality, the growth curve shows the different accelerations and retardations, especially in relation to the level of nutrition and health conditions (Thornley and France, 2007).

In some cases it is sufficient to model growth only in a specific period of the organism evolution where it is easier to achieve the compliance of real data with estimated data from the growth curve. The Gompertz function was used for simulation of the bull-calf growth of Czech Pied cattle from the birth to the adult age by Pulkrábek (1980, 1985). Richards´s function, which uses four parameters, was applied by Nešetřilová (2005) for bull-calf of Czech Pied cattle from approx. 30 days up to 1400 days of age.

Nešetřilová with Pulkrábek (1995) have estimated parameters of growth function for bull-calves of Czech Pied cattle, and in a data base from 90 days of bull age they have determined the inflexion point (on the basis of Gompertz function), to be situated around 298 days (near the weight of 345 kg) as shown in Figure 6.

From the shape of the curve in Figure 6 it is evident, that from a certain level of weight corresponding to the inflexion point on the growth curve, the gain in weight begins to decrease subsequently. Realized negative dependence of gain in weights on the initial weight is then in accordance with the behaviour of the estimated growth function of the cattle breeding.

From the findings above it would be also possible to derive an explanation for higher values reached in fattening of the Holstein breed, in comparison to the Czech Pied cattle breed. The average initial weight in companies specialising in fattening the Holstein breed, was 44.7 tons, and was the lowest, with exclusion of the “others” category, which forms only 17% from total observations (Table 4). This is in contrary to the companies, which focus on fattening of the traditional Czech Pied cattle breed and crossbreeds that start the fattening at a higher initial weight.

Within the context of these observations, the question of fattening effectiveness may arise, given that the smaller initial weight could bring higher gains in weight to the company. However, it is necessary to approach this problem comprehensively and in relation to other production factors considered in the production function.

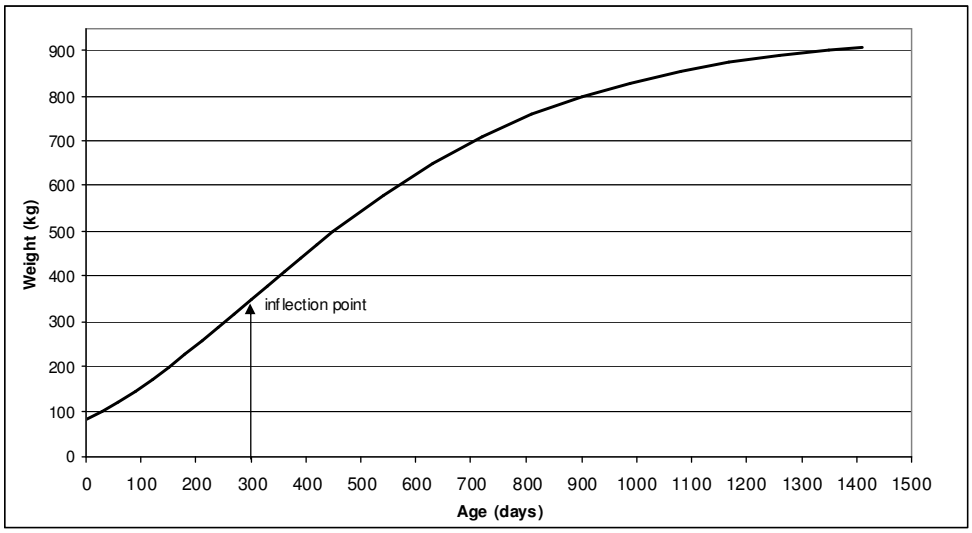

Figure 6: Gompertz function for bulls of Czech Pied cattle breed from 90 days of age (based on Nešetřilová and Pulkrábek, 1995).

Breeds	Average initial weight (t)
Holstein	44,7
CPC	46,7
Crossbreds	48,9
Others*	35,4

* Others are values, where the breed was not stated or where there was an incompetent value

Table 4: Initial weight of chosen breeds in selection data set (tons of live weight).

Conclusion

Based on the results of the estimation it can be concluded, that the Cobb-Douglas function is suitable for modelling the production process of cattle breeding. The method of fixed effects managed to address the issue of technological differences among the companies very well. Even though the monitored farms show certain variability with respect to the analysed variables, the estimation involving the fixed effects revealed very low levels of technological differences, thus the selective data set may be considered as homogenous.

When comparing the effect of the considered production factors – the initial weight, the haylage consumption, and the hay consumption – the first factor causes a gradual fall of gain in weight level as opposed to the positive effects of the other variables. However, this finding has been confronted with the biological behaviour of cattle growth showing that the empirically estimated production function is in compliance with biological aspects of the cattle livestock production.

The comparison of values in time shows, that maximum level of gain in weight was achieved at a higher feeding intensity level and with a lower initial weight, whereas in the less productive periods, the initial weight rises on account of the fodder consumption.

When monitoring the fattening efficiency, the haylage consumption brings more additional gain in weight than the hay consumption. This notion should be further analysed with respect to possible alternatives of reaching economic efficiency while taking into account the prices of the respective feedstuff components.

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Method of Component Depreciation of Fixed Assetsts and Its Comparision with Traditional Methods

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Abstract

This contribution analyzes, based on specific examples, accounting procedures and tax implications of depreciation of tangible fixed assets. It compares the component method, which has recently appeared in the Czech legal regulations, with the traditional methods. To compare the effects that the traditional methods have on profit or loss, or rather on the tax base, also the generation of provisions is used.

The use of component depreciation is governed solely by the accounting regulations while the Income Tax Act has not been changed in this respect. Profit of loss has to be adjusted by a difference amount between accounting depreciation and tax depreciation in tax return.

Key words

Component depreciation, tax depreciation, accounting depreciation, profit or loss, costs, expenses; provisions.

Anotace

Příspěvek na základě konkrétních příkladů analyzuje účetní postupy a daňové dopady odpisů dlouhodobého hmotného majetku. Srovnává komponentní metodu, která se nově objevuje v českých právních předpisech s metodami tradičními. Pro porovnání vlivu tradičních metod na výsledek hospodaření, respektive základ daně z příjmů je použito i tvorby rezerv.

Použití komponentních odpisů upravují pouze účetní předpisy, zatímco zákon o daních z příjmů nedoznal v tomto smyslu změny. O rozdíl mezi výší účetního odpisu a odpisu pro účely stanovení daně z příjmů je nutné upravit výsledek hospodaření v daňovém přiznání.

Klíčová slova

Komponentní odpisy, daňové odpisy, účetní odpisy, výsledek hospodaření, náklady, rezervy.

Introduction

It is the task of the accounting to provide information about the financial situation of a company and its profit or loss for the given period of time. From the accounting records, it can also be seen how successful the company management is in ensuring the financial management of the entity, whether it is achieving a reasonable return on investment, whether the entity is able to continuously repay its debts and whether the long-term stability of the entity is ensured. Increasingly, the emphasis is on the forecasting of the financial situation of an entity in the future.

In December 2008, Decree No. 469/2008 Coll. was published in the Collection of Laws which is an amendment of Decree No. 500/2002 Coll. for entrepreneurs applying the system of double-entry bookkeeping. The amendment is effective from 1 January 2009 while some of the enactments may be used by accounting entities in accounting periods commencing on 1 January 2010 and beyond. The amendment allows, inter alia, to determine the residual value of fixed assets and to apply the component depreciation of assets. [5] The above changes are the result of a gradual harmonization of global accounting. Similar principles are already incorporated and used in the long term in international accounting standards such as

International Financial Reporting Standards IAS/IFRS and the U.S. Generally Accepted Accounting Principles, U.S. GAAP [8]. IAS/IFRS [7] define component depreciation as the systematic allocation of the cost of each part of an item of property, plant and equipment when this cost is significant in relation to the total cost of the item. An entity should allocate the amount initially recognized as an item of property, plant and equipment to its significant parts and depreciate separately each such part.

Material and Methods

Depreciation of Fixed Assets

The existence of depreciation of tangible and intangible fixed assets is a result of two factors. The first factor is the economic and accounting expression of the (functional and physical) wear and tear of assets depending on their nature and use. The second factor stems from the fact that in the acquisition of fixed assets, it is not possible to include their cost into corporate costs. Depreciation is a tool by the means of which the acquisition cost of assets enters the corporate costs. The creation of depreciation can also be seen as the accumulation of resources to fund other assets. Depreciation is an internal source of funding (self-funding) of an entity.

In the area of depreciation, the requirements of accounting diverge from fiscal aspects. While the **accounting depreciation** should correspond to the actual wear and tear of assets and therefore the method of its calculation is the responsibility of the entity, **tax depreciation** does not take into account specific (operational, financial, etc.) conditions of the entity. In practice, a situation is no exception, especially in smaller companies, whereby tax depreciation enters the accounting system. However, this procedure is contrary to the requirement of fair presentation of facts that the accounting should provide.

Tax Depreciation of Fixed Assets

Depreciation which is in compliance with Act No. 586/1992 Coll. on Income Tax, as amended (hereinafter referred to only as the “Income Tax Act”), is called "tax depreciation". It is recognized as an expense incurred to generate, ensure and maintain taxable income and, in a tax return, it may be included in the tax base. Art 26 to Art 33 of the Income Tax Act provides generally applicable rules and procedures for the depreciation of tangible and intangible assets.

The Income Tax Act requires the taxpayer, in the first year of depreciation, to classify fixed assets, in compliance with the Annex to the Act, into six depreciation groups.

In tangible fixed assets, it is possible to choose straight-line depreciation (Art 31 of the Income Tax Act) or accelerated depreciation (Art 32 of the Income Tax Act). Calculated amounts of tax depreciation are rounded up to whole crowns. The taxpayer is not required to apply depreciation of tangible fixed assets for the purposes of the Income Tax Act. Tax depreciation may be suspended but, when continuing in it, it is necessary to maintain the original method of depreciation. In tax depreciation, what is applied is the so-called half-year convention. Tax depreciation does not take into account in which part of the year assets were acquired. Depreciation is always the same as if the assets were acquired in the middle of the year. [2]

Accounting Depreciation of Fixed Assets

The rules for determining the accounting depreciation of tangible and intangible fixed assets are set out in Art 28 of Act No. 563/1991 Coll. on Accounting, as amended, and in Art 56 of Decree No. 500/2002 Coll. implementing certain enactments of the Accounting Act, as amended, for accounting entities that are entrepreneurs applying the system of double-entry bookkeeping, as amended, (hereinafter referred to only as the "Decree"). Basic accounting practices of tangible and intangible fixed assets are processed in the Czech Accounting Standard for Entrepreneurs No. 013.

The calculation of the amount of accounting depreciation may be based either on a method taking for basis the estimated useful life of assets (time depreciation) or the method based on output (output depreciation). In time depreciation, it is possible to choose either straight-line or accelerated depreciation. In straight-line depreciation, the same amount is included in expenses each year, in accelerated depreciation, the depreciated amount gradually decreases. The depreciation base is the acquisition cost of assets or the acquisition cost less the residual value. [4]

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Book value of the machine at the end of the accounting period	3,300	3,000	2,700	2,400	2,100	1,800
Annual depreciation of the machine	300	300	300	300	300	300
Replacement of the clutch (material consumption)				200		
Effect on profit or loss	(300)	(300)	(300)	(500)	(300)	(300)

table continued:

Item	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Book value of the machine at the end of the accounting period	1,500	1,200	900	600	300	0
Annual depreciation of the machine	300	300	300	300	300	300
Replacement of the clutch (material consumption)		200				
Effect on profit or loss	(300)	(500)	(300)	(300)	(300)	(300)

Source: own.¨
Note 1: Calculation of straight-line depreciation includes model example 1 (tab. No.1, tab. No.2).
Table1: Straight-line depreciation without a provision being generated (in CZK '000).

Residual value is defined by Art 56, par 3 of the Decree as a positive estimated amount justifiable by the accounting entity that the accounting entity could obtain at the time of the anticipated disposal of assets, for example by sale, after deducting the expected costs associated with the disposal. When an accounting entity decides to take into account the residual value of an asset, it should, in compliance with the Decree, update its depreciation schedule. The application should be made prospectively which means that it does not correct the amounts of reported depreciation and accumulated depreciation from the previous accounting periods. Residual value can be used by accounting entities in the accounting period beginning on 1 January 2009 and later. [6]

Decree No. 469/2008 Coll., amending Decree No. 500/2002 Coll., introduces, in new Art 56a the component depreciation method. The method may be applied to tangible fixed assets from 1 January 2010. The component depreciation method may be used by an accounting entity, with regard to the materiality and true and fair view of the accounting, in buildings, flats and non-residential premises, separate movable assets and sets thereof. [5] What we mean by a component (a major replacement part) is that part of an asset in which the amount of valuation is material in comparison with the amount of the valuation of the whole asset (set of assets) and whose useful life is significantly different from the useful life of the whole asset (set of assets). The component is then seen, in terms of depreciation, as a separate long-term asset which is depreciated over a period of anticipated use. When replacing the component, the valuation of assets is reduced by the value of the disposed component and increased by the valuation of a new component (the value of spare parts plus costs associated with the exchange). According to Stronová [9] the component can be replaced and therefore purchased separately, due to its different useful life compared to the life of the whole asset. Valuation of components should therefore not causes problems.The assets are accounted for as a single whole including the value of accumulated depreciation and, thus, also in the balance sheet, the assets depreciated by components are recognized as a whole. The component depreciation method is applied prospectively, i.e., the amounts of accumulated depreciation and depreciation of the previous periods are not corrected.

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Book value of the machine at the end of the accounting period	3,300	3,000	2,700	2,400	2,100	1,800
Annual depreciation of the machine	300	300	300	300	300	300
Generation of the provision {drawdown of the provision}	50	50	50	{(150)}	(50)	50
Replacement of the clutch (material consumption)				200		
Effect on profit or loss	(350)	(350)	(350)	(350)	(350)	(350)

table continued:

Item	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Book value of the machine at the end of the accounting period	1,750	1,400	1,050	700	350	0
Annual depreciation of the machine	300	300	300	300	300	300
Generation of the provision {drawdown of the provision}	50	{(150)}				
Replacement of the clutch		200				
Effect on profit or loss	(350)	(350)	(300)	(300)	(300)	(300)

Source: own.
Note 2: Calculation of the component depreciation includes model example 1 (tab. No. 3).
Table 2: Straight-line depreciation and generation of the provision (in CZK '000).

Provisions

Decree No. 500/2002 Coll. in Art 57 says about provisions:

(1) Provisions are intended to cover future obligations or expenditure in accordance with Art 26 of the Act (on Accounting, author's note), in which the purpose is known, it is likely that they will occur, however, the amount or the date as at which they will occur are uncertain. In provisions according to special legal regulations (Act No. 593/1992 Coll., on Provisions, author's note), it is proceed in accordance with these regulations.

(2) Generation of provisions is debited to costs, their utilization, reduction or cancellation for redundancy is credited to costs.

(3) Provision balances are carried forward to the next accounting period.

(4) Provisions must not have a credit balance.

(5) Provisions may not be used to adjust the amount of asset valuation.

(6) The amount of the generated provisions and their justification are verified by the accounting entity at least during every stock-taking. [6]

In order to achieve harmony in using accounting methods by accounting entities, basic accounting procedures concerning the generation and use of provisions are stipulated by Czech Accounting Standard for Entrepreneurs No. 004 Provisions. The Standard breaks provisions down to the following items: Provisions according to special regulations, Provision for pensions and similar obligations, Provision for the income tax and Other provisions. It includes among other provisions e.g. provisions for restructuring, provisions for risks and losses. [4]

The Income Tax Act recognizes the generation of provisions defined by the law as tax deductible expense. These are provisions defined by Act No. 593/1992 Coll., on Provisions for the Purposes of Determining Income Tax Base (hereinafter referred to only as the "Act on Provisions"). [2]

For the provisions which are expenditures (expenses) incurred to generate, ensure and maintain income, i.e., tax-deductible provisions, the designation of statutory provisions is used. Provisions that do not meet the definition of the Act on Provisions are not tax-deductible expenses and are designated as accounting provisions. A statutory provision can be considered a provision for cultivation activities in forests, a provision for pond mud removal, provision for redevelopment of lands affected by mining and, last but not least, a provision for repairs of tangible fixed assets. [3]

Provision for Repairs of Tangible Fixed Assets

According to Art 7 of the Act on Provisions, it is possible to generate a tax-deductible provision for the repair of tangible fixed assets provided that the provision is made in respect of assets for which the depreciation period is stipulated by the Income Tax Act for five years or more. A provision is not generated in respect of assets which are in liquidation or in respect of which the repairs are involved that are regularly repeated every year.

For provisions whose generation started in 2009, the tax deductibility is subject to the depositing of funds in the full amount of a provision appertaining to one fiscal period on a separate bank account (located on the territory of a member state of the European Union, maintained in crowns or euro, which is designed exclusively for depositing provisioning funds), namely no later than as at the deadline for filing a tax return. Funds on the account itself may be drawn only for the purposes for which the provision has been created. A provision for repairs of an individual tangible fixed asset must not be generated only for one fiscal period. The maximum period for which a provision is made is, in fixed assets classified under the 2nd depreciation group, 3 fiscal periods; in the 3rd depreciation group, 6 fiscal periods; in the 4th depreciation group, 8 fiscal periods; and, in the 5th and 6th depreciation groups, 10 fiscal periods. [3]

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Book value of the whole machine at the end of the accounting period	3,266	2,932	2,598	2,464	2,130	1,796
Annual depreciation of the machine without the clutch	284	284	284	284	284	284
Annual depreciation of the clutch	50	50	50	50	50	50
Effect on profit or loss (total annual depreciation)	(334)	(334)	(334)	(334)	(334)	(334)

table continued:

Item	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Book value of the whole machine at the end of the accounting period	1,462	1,328	994	660	326	0
Annual depreciation of the machine without the clutch	284	284	284	284	284	276**
Annual depreciation of the clutch	50	50	50	50	50	50
Effect on profit or loss (total annual depreciation)	(334)	(334)	(334)	(334)	(334)	(326)

Source: own.

Note 3: The generation of a provision for a repair of fixed assets includes model example 1 (tab. No. 2).

Table 3: Component Depreciation (in CZK '000).

** Cost of the machine without the safety clutch less depreciation for the previous eleven years.

Depreciation of year one to year eleven was rounded up to units, therefore the depreciation of the last, twelfth year will have a (negligibly) lower value.(3,600 – 200) – (11 * 284) = 3,400 – 3,124 = 276 in CZK '000

The depreciation of the machine is calculated based on the cost without the clutch: (3,600 - 200) / 12 = 284 (in CZK '000, rounded up) and, unless the conditions change, it will remain the same throughout the whole period (except for the last year, see **). The value of the clutch is spread, in depreciation, over the anticipated four years of the life of the clutch, i.e., 200 / 4 = 50 (in CZK '000). In drafting the above depreciation plan, it is necessary not to forget to increase the book value of the machine, each year when the replacement of the replacement part takes place, by CZK 200,000. In the given example, these years are the fourth and eighth year. For example, at the end of the fourth year, the book value of the whole machine is calculated as follows: the book value of the machine at the end of the third year of operation less total depreciation plus the value of the new clutch, i.e., 2,598 – 334 + 200 = 2,464 (in CZK '000). The procedure at the end of the eighth year of the machine's operation will be analogous.

Results

Effect of Chosen Depreciation Methods on Profit or Loss

The choice of the accounting method of depreciation of fixed assets will affect the amount of accounting depreciation in individual years when assets are used and therefore the amount of the reported profit or loss.

Comparison of the effect of traditional accounting depreciation and that of component depreciation on profit or loss

Starting from 1 January 2010, the accounting entity will be able to decide whether, when determining the amount of accounting depreciation, to follow the existing rules in force or whether to use the new option of accounting depreciation of tangible fixed assets which is allowed by the amendment of Decree 500/1992 Coll., i.e., whether to choose component depreciation.

Both methods of accounting depreciation are compared by the following model example.

Model Example 1

An entity manufacturing and distributing technical glass acquired a machine for pressing glass beads worth CZK 3,600,000. The anticipated useful life of the whole machine is 12 years. However, a safety clutch, which is part of the machine, has life of 4 years and it therefore needs to be replaced after the elapse of the given period. The anticipated cost of the clutch is CZK 200,000

The accounting entity decides whether to consider the safety clutch a so-called major replacement part or not. It must consider whether the value of the clutch is material in respect of the total value of the machine and whether the life of the clutch is materially different from the life (useful life) of the machine. In the event that the entity finds both the value and the life of the clutch immaterial, it chooses the traditional method of depreciation. In the event that the accounting entity identifies the clutch as a material replacement part, it will proceed in accordance with the rules of component depreciation.

Traditional Accounting Depreciation

The accounting entity does not consider the cost of the clutch and the difference between the life of the clutch and the useful life of the machine material. A replacement clutch, in replacement every four years, is considered, from the accounting point of view, an immaterial and its replacement thus enters the operating expenses as consumed material. The accounting entity proceeds in line with the rules of the "traditional" depreciation method.

For the model example, straight-line accounting depreciation was chosen.

Option A shows the calculation of the traditional straight-line depreciation and its effect on the profit or loss. The accounting entity does not generate a provision for repairs of tangible fixed assets (see tab. No. 1).

Option B shows the calculation of traditional straight-line depreciation, the generation of a statutory provision for repairs of tangible fixed assets and their effect on the profit or loss (see tab. No. 2)

A) Traditional Depreciation without a Provision Being Generated

The replacement of the clutch worth CZK 200,000 will be displayed in the accounting within costs as ordinary material consumption. Every fourth year after starting to use the machine, the value of the acquisition cost of the clutch will thus increase, by step, costs and, ultimately, it will decrease, by step, the profit or loss by CZK 200,000.

B) Traditional Depreciation and Generation of the Statutory Provision

As in the previous example, the replacement of the clutch worth CZK 200,000 will be charged against expenses and, by step, it will reduce the profit or loss every fourth year. The accounting entity uses the provisioning system. It can, by generating a provision for a repair of tangible fixed assets, spread the costs of the replacement of the clutch over several years. This will prevent fluctuations in the profit or loss due to the replacement of a spare part. While adhering to all rules stipulated by the law, it thus also regulates the fluctuations in the income tax base because the generation of the provision will also be a cost of generating, ensuring and maintaining income.

Component Depreciation

The accounting entity considers the clutch a material replacement part. The clutch is a component of the acquired asset, it is regarded as a fixed asset. According to the anticipated life of the clutch and the useful life of the whole machine, depreciation of the clutch and that of the machine are calculated separately (based on the value without the clutch). The accounting entity proceeds in compliance with the component depreciation rules (see tab. No. 3).

Comparison of Consequences of Selected Methods of Accounting Depreciation

One of the basic tasks of the accounting is the true presentation of facts. In continuous (regular) use of the machine, its wear and tear is relatively even. Components which have a significantly shorter life than the entire machine transmit their value to manufactured products during the period of their being used. They are then put out of service and replaced with new parts. Their value, at the time of the acquisition, will increase the value of the machine and will be gradually transferred to expenses again. Therefore, the component depreciation method, even on the basis of the above examples, seems like the one that presents the facts in the most fair a realistic way. Depreciation of fixed assets is, while using this method, spread evenly throughout the whole period of use of the assets and is also evenly charged against the profit or loss. Of course, a question arises of whether the accounting entity can reasonably estimate the period in which individual components are used. However, the risk brought about by making estimates poses a threat also in other methods of accounting depreciation. It seems practical to depreciate material parts of movable assets separately over their estimated useful lives.

When applying traditional accounting depreciation of tangible fixed assets, it is possible to ensure the spreading of expenses related to the replacement of a replacement part (qualified as a repair) by generating provisions. The task of the provision generation is to retain resources needed for an estimated future expenditure of the entity. The generation of a provision is charged against operating expenses, reduces profit or loss and thus does not allow using the required funds for other purposes such as the payout of dividends. However, this tool will resolve only the even distribution of expenses. The amount of depreciation applied each year remains somewhat misrepresented. The generation of provisions as per special regulations (the Act on Provisions) which are a tax-deductible cost, is subject to depositing funds on a separate bank account. This condition is restrictive for entities; they cannot dispose of the long-term deposited money. The situation may result in an entity getting into debt.

Relationship of Accounting and Tax Depreciation

Accounting depreciation enters (as an expense) into the accounting profit or loss. When adjusting the accounting profit or loss to the tax base, however, it is necessary to consider whether the amount accounted for is a tax deductible expense under the Income Tax Act. If the accounting depreciation exceeds the amount of tax depreciation, it is necessary to add the calculated difference to the profit or loss. The income tax base will thus be higher by the calculated amount than the profit or loss. In the case that the accounting depreciation is lower than the tax depreciation, the amount of the difference will be deducted from the profit or loss; the tax base will be lower by the deducted amount than the profit or loss.

In the accounting units defined by the law, the differences between the amount of the accounting and tax depreciation in individual years lead to the accounting for deferred tax. The generation of deferred tax works on the principle of generation of

provisions. The deferred tax liability enters into the expenses of the current year and, in the balance sheet, it is shown as a liability. Also an opposite situation may occur whereby it is accounted for a deferred tax receivable. In this case, expenses of the current period are reduced and, mostly, the tax liability from previous years is reduced.

Calculation of Straight-line and Accelerated Tax Depreciation

Model Example 2

An entity manufacturing and distributing technical glass acquired a machine for pressing glass beads worth CZK 3,600,000. As per Annex 1 to the Income Tax Act, this machine is classified under depreciation group 2, therefore, it will be depreciated, for tax purposes, for 5 years. The accounting entity selects A) a straight-line tax depreciation, B) a straight-line tax depreciation with 10% increase of the first year of depreciation. 1

The following tables show the amount of the annual depreciation for each year and the tax book value of fixed assets at the end of each fiscal period, with using the straight-line method (table No.4) and with using the straight-line method with 10% first year increase (table No.5).

Model Example 3

An entity manufacturing and distributing technical glass acquired a machine for pressing glass beads worth CZK 3,600,000. The machine is classified under depreciation group 2, therefore, it will be depreciated, for tax purposes, for 5 years. The accounting entity selects A) the accelerated tax depreciation, B) the accelerated tax depreciation with 10% first year increase.

The following tables show the amount of the annual depreciation for each year and the tax book value of fixed assets at the end of each fiscal period with using the accelerated method (table No.6) and with using the accelerated method with 10% first year increase (table No.7).

[1] According to Act No. 586/1992 Coll. on Income Tax, the first owner of the tangible fixed asset classified under depreciation group 2 can increase first year depreciation by 10% (exceptions are named), §31, (1), d) – rules for straight-line method, §32, (2), a) 3., b) – rules for accelerated method. [2]

The Effect of the Difference in the Value of Accounting and Tax Depreciation on the Tax Base

In this example, the period of depreciation of assets is stipulated by the Income Tax Act at 5 years. The entity estimates that it will use the assets for the period of 12 years. The difference in the amount of depreciation accounted for and depreciation considered the expense of generating, ensuring and maintaining taxable income (tax deductible expenses) will affect the amount of the income tax base and thus the income tax itself or rather the net profit. In the event that the value of accounting depreciation exceeds tax depreciation, the difference between them increases the profit or loss when adjusting to the tax base and vice versa. When analysing the model examples, it can be concluded that, in individual years, adjustments of the profit or loss to the income tax base will be made in the same direction, irrespective of the choice of the accounting method. If the accounting entity chooses straight-line tax depreciation, it will, in the first five years, always subtract the amount of the difference between accounting and tax depreciation from the profit or loss and, after five years, when the assets are already tax-depreciated, the amount of accounting depreciation will be added. When choosing accelerated depreciation, the profit or loss, in the transformation to the tax base, will be subtracted for the first four years and the situation will be reversed already as from the fifth year. In the fifth year, when applying any of the above accounting methods (straight-line and component ones), accounting depreciation exceeds tax depreciation.

Discussion

From the above example, it may seem that the differences in the reported depreciation as a result of the selection of different methods of depreciation are negligible. However, it is necessary to realize that it is possible to proceed similarly also in assets worth tens and hundreds of millions crowns. Such assets may be buildings (with components like elevators, roof, windows, ...), aircraft (engines), etc. The choice of the depreciation method affects the amount of depreciation accounted for each year and, subsequently, also the value of the profit or loss of each year, namely in a fundamental manner. Of course, this concerns the spreading of the total depreciated amount throughout the years.

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Tax book value of the machine at the end of the accounting period	3,204	2,403	1,602	801	0
Annual tax depreciation of the machine	396	801	801	801	801

Calculation of depreciation - Year 1: 3,600 * 0.11 = 396 in CZK '000
Calculation of depreciation – Year 2-5: 3,600 * 0.2225 = 801 in CZK '000

Table 4: Straight-line tax depreciation.

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Tax book value of the machine at the end of the accounting period	2,844	2,133	1,422	711	0
Annual tax depreciation of the machine	756	711	711	711	711

Calculation of depreciation - Year 1: 3,600 * 0.21 = 756 in CZK '000
Calculation of depreciation – Year 2-5: 3,600 * 0.1975 = 711 in CZK '000

Table 5: Straight-line tax depreciation with 10% increase of the first year depreciation.

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Tax book value of the machine at the end of the accounting period	2,880	1,728	864	288	0
Annual tax depreciation of the machine	720	1,152	864	576	288

Calculation of depreciation - Year 1: 3,600 / 5 = 720 in CZK '000
Calculation of depreciation - Year 2: 2 * (3,600 – 720) / (6 – 1) = 1,152 in CZK '000
Calculation of depreciation - Year 3: 2 * (2,880 – 1,152) / (6 – 2) = 864 in CZK '000
Calculation of depreciation - Year 4: 2 * (1,728 – 864) / (6 -3) = 576 in CZK '000
Calculation of depreciation - Year 5: 2 * (864 – 576) / (6-4) = 288 in CZK '000

Table 6: Accelerated tax depreciation.

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Tax book value of the machine at the end of the accounting period	2,520	1,512	756	252	0
Annual tax depreciation of the machine	1,080	1,008	756	504	252

Calculation of depreciation - Year 1: 3,600 / 5 + 360 (10% of 3,600) = 1,080 in CZK '000
Calculation of depreciation - Year 2: 2 * (3,600 – 1,080) / (6 – 1) = 1,008 in CZK '000
Calculation of depreciation - Year 3: 2 * (2,520 – 1,008) / (6 – 2) = 756 in CZK '000
Calculation of depreciation - Year 4: 2 * (1,512 – 756) / (6-3) = 504 in CZK '000
Calculation of depreciation - Year 5: 2 * (756 – 504) / (6-4) = 252 in CZK '000

Table 7: Accelerated tax depreciation with 10% increase of the first year depreciation.

Ultimately, the entire depreciation base is always depreciated. The depreciation base is either the acquisition cost of fixed assets or the acquisition cost less the estimated residual value of assets.

The use of the above methods of accounting depreciation of fixed assets is permitted by the Czech legal regulations starting from 1 January 2010. It is up to the accounting entity which method it chooses in order to ensure the as fair an accounting presentation of facts as possible. From the previous analysis, it ensues that the component depreciation method is a suitable method in case of a significant difference in the life of spare parts and the whole asset. It better reflects the actual wear and tear of a fixed asset.

The value of accounting depreciation plays its non-negligible role in preparing a cash flow statement using the indirect method and in the financial analysis of the entity. In preparing an overview of the cash flow in the operational area using the indirect method, in addition to other adjustments, the value of depreciation is added to the entity's net

income. Depreciation of individual years thus affects the amount of the reported cash flow of the entity. Part of the entity's financial analysis which serves to evaluate the economic results of the entity in the past, in the present and on the basis of which the future results are expected, is the assessment of the entity's financial stability. The value of depreciation enters for example into the evaluation of the credit exposure of the entity or affects the assessment of the debt repayment period. From the above, it ensues that the as fair as possible accounting presentation of depreciation helps achieve a more realistic presentation of the entity's cash flows and of some financial analysis indicators of the entity's economic results.

It should be noted that the use of component depreciation is governed solely by the accounting regulations while the Income Tax Act has not been changed in this respect. Depreciation for tax purposes will continue to take place as per Art 26 and the following of the Income Tax Act and, if the amount of tax depreciation differs from the accounting depreciation of assets using the component depreciation method, it will be necessary to adjust the profit or loss by such a difference in the tax return.

Conclusion

This contribution analyzes, based on specific examples, accounting procedures and tax implications of depreciation of tangible fixed assets. It compares the component method, which has recently appeared in the Czech legal regulations, with the traditional methods. To compare the effects that the traditional methods have on profit or loss, or rather on the tax base, also the generation of provisions is used. From the results, it ensues that the application of the component method of depreciation of assets provides, under certain conditions, a fairer presentation of the assets' wear and tear. However, it must be borne in mind that component depreciation is not respected by the Income Tax Act. The amount of accounting depreciation plays its role in drawing up an overview of the entity's cash flows and in the calculation of some indicators of the entity's financial analysis.

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VLIT NODE Sensor Technology and Prefarm

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Abstract

Precision farming systems are based on a detailed monitoring of information and data that are necessary for successful decision-making in crop production. The system is designed for data collection from several resources. In past years an extensive research and development work has been done in the field of wireless sensor networks (WSN) in the world. When a wireless sensor network (WSN) is used for agricultural purposes, it has to provide first of all a long-reach signal. The present paper describes new long distance RFID based technology implementation - VLIT NODE.

Key words

Wireless Sensor Network, Precision Agriculture, RFID.

Anotace

Systémy precizního zemědělství jsou založené na detailním sledování údajů a informací, které jsou nezbytné pro úspěšné rozhodování v rostlinné výrobě. Systém vyžaduje integraci dat z různých zdrojů. V minulých letech začal ve světě výzkum a vývoj v oblasti bezdrátových senzorových sítí (WSN) Na bezdrátové senzorové sítě (WSN) jsou pro použití v zemědělství kladeny specifické požadavky na dlouhý dosah signálu. Článek popisuje novou technologii založenou na RFID dlouhého dosahu - VLIT NODE.

Klíčová slova

Bezdrátové senzorové sítě, přesné zemědělství, RFID.

Introduction

Current agri-food economy is focused on consumers and their food supply. Consumers should be enabled to make their choices upon such aspects as food safety, quality and sustainability. This means that agri-food production business environment is very dynamic, driven by various and changing needs of consumers and society. Production is becoming more and more demand-driven and though it has to be transparent while meeting quality and environmental standards. Moreover, agricultural markets in Europe are under pressure due to high land and labour costs and intensified global competition. Weather conditions are an important factor too. The importance of meteorology in agriculture has been increasing over last decades due to emerging need to access appropriate information as a consequence of the rapid weather condition changes. Although the quality of weather forecast has been improving constantly on a large scale and agriculture profits from it, in many European regions, currently available meteorological data are not sufficient for crop production as a lot of additional local scale data are to be integrated in the specific agro-meteorological models and to make correct decisions in any farm management system. To meet farmers' ambitions especially in areas with relatively small parcels involving the growth of “expensive” cultivars (e.g. wine production), there is a need for establishing networks of local sensors and meteorological stations. The ongoing significant advancements in sensor technologies and in-situ sensing are expected to support also the development of more systematic capabilities for assimilating all sort of in-situ measurements in agro-meteorological models, at relevant scales, to

generate immediately (in real time) useful information for farmer's decision. At the same time, the fusion of meteorological sensors data with the existing agro-production database and implementation of new online agro-meteorological models for farms could open new possibilities for farmers to increase quality of their production, to be more competitive on the market and in this way also to increase the sustainability and profit.

Agro meteorological parameters influence significantly not only the crop growth and development, but also the dynamics of other important biological elements, such as plant diseases and pests. Monitoring agro-meteorological variables on the territory together with the application of simulation models, represents the basis for a correct management of cultivation methods and sanitary treatments. Such monitoring requires the development of a reference detail climatologic study of the area in order to assess the climatic conditions and to identify the most representative sites where the meteorological stations for the measurements of the interested variables have to be placed. Once the strategic sites are monitored by stations, data can be collected for further processes, such as spatial interpolations and application of agro-meteorological simulation models.

Precision farming platform - Prefarm

The technology of precision farming guarantees its market success. Technological difficulties that currently and continually occur in this system argue against its practical use by farmers. In case of failure, a Service Company strives to offer a suitable environment not only for data collection and data processing, but also for high quality of other information related to farm management and crop production. Practical distribution of results to customers helps them ensure a variable application of the results on the field. The most important part of services is a data collection technology and data processing system. Remote sensing, crop scanning and soil sampling for management zones classification facilitate operations and recommendations, including economic calculations, to farmers and other users.

Professional services in this domain use the following tools:

- GPS navigation system with or without Differential GPS

- Geographic information system (GIS) environment

- Internet as a tool for data transport, data presentation

- map server technology, web mapping services (wms / raster)

A complex advisory and service system is based on the results of field trials in different crops and locations. The data for WEB processing are prepared and stored by a service organization and farmers. The following data are stored in the central database:

- soil measuring (EM 38 data, soil type data)

- soil sampling (lab analysis for Phosphor, Potash, Magnesium, Calcium, soil pH….)

- crop scanning (NDVI data created from satellite or airborne pictures)

- yield data from yield monitor created during harvest

- other remote sensing data (N-sensor scanning)

- agronomies, field management data (crop rotation, variety, data of applications, weather conditions…..)

The main point of the system is to collect different data in the easiest possible way on the field and farm, and then to reuse them for data processing via web tools.

Open source solution MapServer. A mobile interface of this Open Source solution was developed and there were also the OGC standards (WMS) implemented in order to use the data in the distributed system. A connection with other open source systems (GRASS etc.) was established. Current solutions are Internet Mobile Systems, including analytical tools. The most successful and currently used application from service system is „GIS server for precision farming application with mobile access". It is focused on increasing agricultural profitability and reducing bad influence of fertilizers and chemicals on the environment.

Sensors

A **sensor** is a device that measures physical quantity and converts it into a signal which can be read by an observer or by an instrument. There exist many kinds of sensors for surveillance and intrusion detection, such as infrared, other optical, microwave-based, or other types. They, for example, video cameras, can be effectively used to support manned surveillance. There are also video-based systems that sense changes in the image and will trigger an alert. Since every sensor used for this kind of applications can be characterised by its location coordinates (changeable) and a time component, the spatial extension and near-real-time availability of sensor-originated information layers in geospatial applications have a great potential.

Sensors are most commonly used to make quantifiable measurements, as opposed to qualitative detection or presence sensing. There are four criteria of sensor selection:

- measurement object – the measurement object influences the type of sensors to be used. Sensors could measure almost anything, but every phenomenon needs different kinds of sensing.

- measurement environment - different needs for outdoor and indoor sensors, and specific needs for sensors working in extreme conditions

- required measurement accuracy

- whether the system is calibrated/certified or not

These four aspects can influence not only the sensor selection but as well their cost.

Every sensor is described using the following characteristics:

- transfer function - functional relationship between a physical input signal and electrical output signal

- sensitivity - relationship between an input physical signal and output electrical signal

- span or dynamic range - range of input physical signals that may be converted to electrical signals by the sensor

- accuracy or inaccuracy - largest expected error between real and ideal output signals

- hysteresis - width of the expected error in terms of the quantity measured

- nonlinearity - maximum deviation from a linear transfer function over the specified dynamic range

- noise - sensors produce some output noise in addition to the output signal

- resolution - minimum detectable signal fluctuation

- bandwidth - response times to an instantaneous change in physical signal

While speaking about sensors, both parts – a sensor and a transducer, are usually taken into account; a sensor is a device that receives a signal or stimulus and responds with an electrical signal, a transducer on the other hand is a converter of one type of energy into another. From a signal conditioning point of view, it is useful to classify sensors as either active or passive. An active sensor requires an external source of excitation. A passive (or self-generating) one generates its own electrical output signal without requiring external voltages or currents.

Wireless Sensors Networks (WSN)

Future utilization of sensor technologies will be mostly based on Wireless Sensors Network which is an emerging technology made up from tiny, wireless sensors or “motes.” Eventually, these devices will be smart enough to communicate with other sensors yet small enough to fit on the head of a pin. Each mote is a tiny computer with a power supply, one or more sensors, and a communication system. The first one is the network independent module Smart Transducer Interface Module (STIM) that contains the transducers, its signal conditioning circuitry and a standard interface. The second one is a network specific module Network Capable Application Processor (NCAP) that implements the interface to the desired control network and also implements the standard interface of the transducer module. Sensor networks widely attract attention thanks to the numerous potential civilian and military applications they offer. The design of sensor networks faces a number of challenges resulting from very demanding requirements on one

side, such as high reliability of the decision taken by the network and robustness to node failure, and very limited resources on the other side, such as energy, bandwidth, and node complexity.

Sensor Network Systems provide a novel paradigm for managing, modelling and supporting complex systems requiring massive data gathering, with pervasive and persistent detection/monitoring capabilities. It is not therefore surprising that in recent years, a growing emphasis has been steered toward the employment of sensor networks in various technological fields: e.g. aerospace, environment monitoring, homeland security, smart buildings. A significant amount of resources has been allocated for national (USA, France, Germany) and international (e.g. European Commission) research programs targeted at developing innovative methodologies and emerging technologies in different application fields of wireless sensor network. Main features of a sensor network include the following:

- each node should have a very low power consumption, the capability of recharging its battery or scavenging energy from the environment, and very limited processing capabilities;

- each node should be allowed to function in stand-by mode (to save as much battery as possible) without severely degrading the connectivity of the whole network and without requiring complicated re-routing strategies;

- the estimation/measurement capabilities of the system as a whole should significantly outperform the capabilities of each sensor and the performance should improve as the number of sensors increases, with no mandatory requirement on the transmission of the data of each single sensor toward a centralised control/processing unit; in other words, the network must be scalable and self-organising, i.e. capable of maintaining its functionality (although modifying the performance) when the number of sensor is increased1;

- a sensor network is ultimately an event-driven system and so it is really necessary to guarantee that the information about events of interest reaches the appropriate control nodes, possibly through the simplest propagation mechanism, not necessarily bounded to the common OSI protocol stack layer;

- congestion around the sink nodes should be avoided by introducing some form of distributed processing;

- the information should flow through the network in the simplest possible way, not necessarily relying on sophisticated modulation or multiplexing techniques.

To sum it up, these are the fundamental requirements of a sensor network:

- very low complexity, elementary sensors, associated with low power consumption and low costs

- high reliability of the decision/estimation/measurement of the network as a whole;

- long network life-time for low maintenance and stand-alone operation;

- high scalability;

Problems of current technologies

In past years in world an extensive research and development work is being done to ensure information technology use in agriculture; long range wireless sensor network creation for specific agricultural use, would ensure a PA technological leap, would solve pressing problems for agriculture and would make PA widely available for farmers, even for a low scale use (cranberry fields, fruit gardens, bee-gardens etc.). However, as far as the existing solutions are concerned, the following problem areas remain:

- the existing WSN solutions are in experimental development phase; their implementation is not possible without the specific WSN technology developers' assistance.

- the existing WSNs have a short working range (ability to guarantee communication between sensors only at a range of several tens of meters); therefore their implementation in large area is very expensive.

- the existing WSN technology application programming is not possible without deep WSN operating system (open source Tiny OS, commercial ZigBee etc.) knowledge, that is possible only in specialized development centres;

- recently known WSN physical node technologies with several hundred meters working range don't support available Operating Systems;

- the existing WSNs are not suited for climatic and geographical factors, as well as production manufacturing problems;

- realistic WSN implementation is unthinkable without specific WSN technology that includes physical nodes, sensors, operating system, application programming environment, competence centre support.

It is then obvious that further development is necessary, especially in the following domains:

- new sensor nodes with communication ranges of 200-800m depending on the environment, weather conditions and sensor location that are suited for use in most European countries;

- development of operating system programming that would collect data from sensor nodes and transport them via wireless network to a base computer, such communication protocol configuration that would comply with respective usage target environment, as well as specific usage application programming development in to the utmost simplified environment (in language C with possibly minimal specific knowledge about operating system and WSN physical realization) that would ensure sensor control and communication between sensor nodes;

- development of network architecture

VLIT technology

Nowadays, there are many technologies for building wireless sensor networks available. They are implemented on different platforms, however, their common drawback is that they are able to guarantee the communication between sensors at a distance of only tens of meters.

The technology is internally known as VLIT. It is characterized by 868 MHz working frequency and by a protocol that supports communication mode Point-To-Point, Point-To-Multipoint and the relay station of long distance over several devices. In combination with the mobile gateway and the software interface that is being developed by the Czech Centre for Science and Society (CCSS), VLIT NODE represents a brand new and unique solution for building mobile sensor networks.

Technical specifications:

- the operating frequency of 868 MHz, divided into several sub bands

- bi-directional communication protocol of anti-collision

- communication distance of 200 - 800 meters depending on the environment, weather and location sensors

- different communication modes: challenge, selective call, communications event management

- support for communication Point-to-point, Point-to-multipoint, multi - hopping

- memory integration

- each tag contains a unique number (physical address)

- the calculation of simple operations

- easy connectivity measuring sensors

-very low power consumption

- lifetime of 6 months - 5 years (depending on battery size and type of communication)

- implementation of wireless sensor networks for collecting and transmission of data

- the ability to connect to the existing mobile solutions that ensure the collection of measurement and its transmission to the Internet environment

- integration into the Web environment, storing data in standardized formats

SWE for measurement integration

The concept of sensor web was introduced by NASA. It enables autonomous collaborative observation collections using a variety of sources. Typically, scientific events of interest trigger observation campaigns in an ad hoc sensor constellation and supply multiple data acquisitions as fast and to such extent as possible in a given time period. This is accomplished through a seamless set

of software and communication interactions in a system of linked sensors.

As the critical management is getting more and more up-to-date as far as the GIS tools communication is concerned, the OGC begins to release the Sensor Web Enablement (SWE) that should become a standard in integrating various kinds of sensors into one communication language and well-defined web environment. Open geospatial consortium SWE is intended to be a revolutionary approach for exploiting Web-connected sensors such as flood gauges, air pollution monitors, satellite-borne Earth imaging devices, etc. The goal of SWE is to create web-based sensor networks – the goal that implies making all sensors and repositories of sensor data discoverable, accessible and where applicable, controllable via the Internet. Open geospatial consortium defines a set of specifications and services for this goal. Short description of these services is shown below.

Sensor Observation Service

The SOS is an OGC standard that defines a web service interface for discovery and retrieval of real time or archived data. Data are gathered by many sensors, including mobile, stationary, in-situ or remote sensors. The data can take the form of observations or descriptions of the sensor (calibration information, positions, etc.). Observations return encoded as an O&M Observation and the information about the sensor returns encoded in SensorML or TML.

The operations of the SOS are divided into four profiles:

- core profile – three basic operations, provided by every SOS implementation

- transactional profile – operations to register sensors and insert observations into SOS

- enhanced profile – additional optional operations

- entire profile – implements all operations

The core profile has three mandatory core operations that provide its basic functionality:

- GetCapabilities – returns a service description containing information about the service interface and the available sensor data.

- DescribeSensor – returns a description of one specific sensor, sensor system or data producing procedure. The response returns information such as sensor position, calibration, in- and outputs encoded in SensorML or in TML.

- GetObservation – provides access to sensor observations and measurement-data.

Our recent work was focused on creating an SOS implementation which contains core operations. The communication between consumer and implementation is based on xml documents.

An XML schema describes the structure of an XML document. An XML schema

- defines elements that can appear in a document;

- defines attributes that can appear in a document;

- defines which elements are child elements;

- defines the order of child elements;

- defines the number of child elements;

- defines whether an element is empty or can include text;

- defines data types for elements and attributes;

- defines default and fixed values for elements and attributes.

For reading and parsing an XML document, JAXB utilities that are a core part of JAVA are used. JAXB constitutes a framework for processing XML documents. JAXB accesses the XML document from a Java program by presenting the XML document to the program in Java format. The first step in this process is to bind the schema for the XML document. Binding a schema means generating a set of Java classes that represents the schema. All JAXB implementations provide a tool called binding compiler to bind a schema. We have successfully generated all required classes, so now we can handle all SOS related XML documents. Further steps are concerned with adding a

convenient API to deal with specific requirements of SOS in a more comfortable way. This lets us publish the position or the track of the sensor and some of the measurements. To publish the measurements in a better way, we can access the data by SOS service (still in development). We have also implemented web service that generates charts from database query.

The OpenGIS® Web Processing Service (WPS) Interface Standard provides rules for standardizing inputs and outputs for geospatial processing services. The standard describes the way of distributing geospatial operations (referred to as "processes") across networks. WPS server can be configured to offer any sort of GIS functionality to clients across the network. The process can take the form of a simple calculation such as putting raster maps together or making buffer around vector feature, as well as complicated models, such as e.g. the climate change model. The main goal of WPS is that computational high-demanded operations are moved from client stations (general desktop PC) to server.

Three types of request-response pairs are defined. Request can be in Key-Value-Pairs (KVP) encoding, as well as an XML document. Server response is always formatted as an XML document.

- GetCapabilities - Server returns Capabilities document. The first part of the document includes metadata about the server provider and other server features. The second part of the document includes a list of processes available on the server.

- DescribeProcess - Server returns ProcessDescription document. Apart from the process identifier, title and abstract, process inputs and outputs are defined.

- Execute - Client hands over necessary inputs for partial process, the server provides geospatial calculations and returns document with all process outputs.

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Three basic types of input and output data are defined:

- LiteralData - character strings as well as integer or double numbers

- BoundingBoxData - two pairs of coordinates

- ComplexValue and ComplexValueReference - Input and output vector and/or raster data. Vector data (e.g. GML files) can be directly part of request/response execute document (then the input is of type ComplexValue). Client can specify only URL to input data (e.g. address to Web Coveradge Server (WCS)). In this case, the data are those of ComplexValueReference type.

Conclusion

Currently there have been 200 prototypes of sensors nodes developed and their deployment and filed testing started. Intensive filed testing is provided in the Czech Republic and Latvia. Testing in Italy is expected during this season too.

The research leading to the above results was accomplished thanks to the following funding:

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LEARNSENS - the solution was achieved with financial support provided by the Ministry of Industry and Trade of the Czech Republic within the framework of the "TIP-2009" programme under project number FR—TI1/332.

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Analysis of the Method for the Selection of Regions with Concentrated State Aid

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Abstract

The paper deals with the analysis of a method used by the Czech Government and the Ministry for Regional Development to select regions with concentrated state aid. It contains a comparison with several different basic methods of multi-criteria decision-making (MCDM). The analysis focuses on a mathematical algorithm of the established MCDM method and does not consider validity of any selected socioeconomic criteria and their weights. Both the strengths and weaknesses of the used MCDM method are presented.

The paper includes a simple proposal of the modification of the examined method that will prevent incorrect data normalisation used for region's evaluation before revision in 2010. Data used for all calculations were obtained from the Ministry for Regional Development.

Key words

The weighted sum approach, the TOPSIS, multi-criteria decision-making, regions with concentrated state aid, district.

Anotace

Článek je zaměřen na analýzu metody pro výběr regionů se soustředěnou podporou státu využívanou ministerstvem pro místní rozvoj a vládou ČR. Obsahuje srovnání s několika základními metodami vícekriteriálního rozhodování (multi-criteria decision-making (MCDM)). Analýza je zaměřena na matematický algoritmus využívané MCDM metody, předmětem článku není hodnocení správného výběru socioekonomických kriterií nebo jejich vah. Jsou prezentovány silné i slabé stránky zvolené metody.

Článek obsahuje návrh jednoduché úpravy zkoumané metody, která povede k prevenci chybné normalizace dat, která byla používána až do revize v roce 2010. Data použitá pro výpočet byla poskytnuta ministerstvem pro místní rozvoj ČR.

Klíčová slova

Metoda váženého součtu, TOPSIS, vícekriteriální rozhodování, regiony se soustředěnou podporou státu, okres.

Introduction

Regions with concentrated state aid are divided into three subcategories as structurally affected, economically weak and regions with highly excessive unemployment. Law on regional development support 248/2000 [14] sets demand for a balanced state development. These regions are chosen on the basis of expertly selected socioeconomic characteristics and the aid with the purpose of a negative disparity reduction is addressed to them in consequence.

It concerned mainly the support from European funds (e.g. Operational Programme Enterprise and Innovation, priority axis 2 –Development of Firms, is also focused on development in these regions) for the period of 2007 – 2009. The up-date for the period 2010 – 2013 represents, among others, additional national funds – the relief of 50 million Czech Crowns is prepared for the year 2010 [11], [13].

Analysis and comparison of regions is commonly connected with multiple criteria, multiple factor

evaluation. Campo et al. [2] uses multivariate analysis to identify socio-economic clusters of similar European NUTS 2 regions. Žižka et al. [16] applied factor analysis on data for all Czech municipalities and recognised eight factors which have a significant influence on disparities. Athanassopoulos [1] used Data envelope analysis (the DEA, common MCDM method) analysed comparative disadvantage of NUTS 2 and also proposed goal programming production function of social cohesion. Nevima and Ramík evaluated competitiveness of Czech NUTS 3 regions on basis of the MDCM method Analytic hierarchy process [6] and used the DEA for European NUTS 2 regions competitiveness and efficiency evaluation [7]. For detailed comparison of the MCDM methods see e.g. [9] or [15].

The paper deals with the analysis of a method which is used for the evaluation of individual districts and presents the basis for the government decision-making in the selection of regions with concentrated state aid. The paper investigates the method of analysing selected characteristics and the Czech Republic districts arrangement processing. The method is compared with other basic methods for multi-criteria decision making with cardinal information (the Weighted Sum Approach, the TOPSIS). The analysis focuses on computation algorithm and data values normalisation. Whereas, the normalization of data is one of many possible approaches that enable the comparison of indicators with different units of measurement or with same units but with non comparable values intervals. The aim of the paper is the presentation of strengths and weaknesses of the used MCDM and its comparison with other basic MCDM methods.

Material and methods

Currently used method is explained in Annex no. 2 on Regional Development Strategy of the Czech Republic for the Period 2004 – 2006 [8]. However, the described approach does not contain enough information about criteria values normalization. For that reason the used background data were analysed and normalization algorithm was examined. These data were provided on demand by the Ministry for Regional Development of the Czech Republic.

Used method does not focus only on the selection of the best (or worst) variant (for this case variant is district), but it is focused on arrangement of their order. From 2007, for first two subcategories (structurally affected, economically weak) the same criteria are used and the distribution takes place consequently upon order arrangement. Regions with highly excessive unemployment are selected from remaining regions, where the level of unemployment exceeds the Czech Republic average by 25% [10]. Moreover, municipalities with an extended scope of activities are additionally selected in the same manner if they do not fall into already selected districts.

For the current period, municipalities tax incomes from physical entities per an inhabitant, a number of entrepreneurs per one thousand inhabitants, a purchasing power and overall evaluation of unemployment are selected as criteria. These positive criteria are from cost because the aim of the evaluation is to find regions with unfavourable characteristics. The overall evaluation of unemployment consists of two partial indicators – unemployment and the number of applicants per one work place. It is obvious that these criteria are benefit. Besides the purchasing power, all criteria are taken as the average of 2006 – 2008. The purchasing power criterion was quantified by a private company Incoma GfK [10] on the basis of official data and statistical research for years 2005 and 2009. The weights of individual criteria are presented in Table 1. The changes of criteria against all previous periods are given by the cancellation of some surveys by the Czech Statistical Office. For more details see [8] and [10].

Overall unemployment evaluation		Tax income	Number of private	Purchasing
0.4		0.2	0.2	0.2
Unemployment level	Number of applicants per one			
0.8	0.2			

Source: The Strategy of regional development of the Czech Republic [10], Annex no. 2 On the Strategy of Regional Development in the CR: Types and limitations of regions with concentrated state support [8], the Ministry for Regional Development

Table 1. Criteria and their weights.

The originally used MCDM algorithm is similar to common Weighted Sum Approach (the WSA). The difference is in criteria normalization, i.e. in the transfer of values of criteria with different units and weights of these values to comparable ones. The normalization for the Weighted Sum Approach method [3] is based on the following formula:

$$r_{ij} = \frac{y_{ij} - D_j}{H_j - D_j} \quad \textbf{(1)}$$

Whereas Dj presents the lowest (negative ideal) value in criterion j, Hj stands for the highest (ideal) value, yij is the element of criterion matrix **Y** – an original value, which an i-th variant reaches in a j-th criterion, rij $\in\langle 0, 1\rangle$ is a normalised value of the j-th criterion for an i-th variant. Among others, formula (1) has one negative characteristic – it is possible to add a variant that will be assessed as the last one in a line, but it may affect the order of all preceding variants. That means this type of normalisation can be rather susceptible to negative ideal criteria values.

The Ministry reduced this susceptibility using another type of normalization – the ratio of an obtained value to an average in the whole republic [8]. For benefit criteria:

$$r_{ij} = \frac{y_{ij}}{\bar{y}_j} \quad \textbf{(2)}$$

And conversely for cost criteria:

$$r_{ij} = \frac{\bar{y}_j}{y_{ij}} \quad \textbf{(3)}$$

Upon this normalisation, the variants are arranged on the basis of the weighted sum of normalised values obtained in the criteria.

The regional data were also analysed using the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) [3], [5]. The TOPSIS arranges an order of variants on the basis of a distance from an ideal value of criterion Hj and negative ideal value of Dj. During the normalisation, it uses the formula which transfers the columns of the criterion matrix to vectors of a unit distance [3] [5]:

$$r_{ij} = \frac{y_{ij}}{\left(\sum_{i=1}^{p} (y_{ij})^2\right)^{1/2}} \quad \textbf{(4)}$$

Order of variants results from a falling indicator of a relative distance from a negative ideal solution:

$$c_i = \frac{d_i^-}{d_i^+ + d_i^-} \quad \textbf{(5)}$$

where respective variables in the formula present a distance from an ideal solution:

$$d_i^+ = \left(\sum_{j=1}^{k} (w_{ij} - H_j)^2\right)^{1/2} \quad \textbf{(6)}$$

and a distance from a negative ideal solution:

$$d_i^- = \left(\sum_{j=1}^{k} (w_{ij} - D_j)^2\right)^{1/2} \quad \textbf{(7)}$$

The variable wij is a normalised value rij multiplied by a corresponding weight, constant p is the number of variants and constant k is the number of criteria. For the needs of the TOPSIS, Hj and Dj are calculated from the matrix W, which consists of wij.

If some criteria are benefit and some are cost, there is a general transforming formula [3]:

$$y'_{ij} = \max_{i=1}^{m} (y_{ij}) - y_{ij} \quad \textbf{(8)}$$

Such transformation is usually being interpreted as savings, or by how much is this variant better in this criterion than the worst one. However, this changes a relative distance to an ideal variant, which may even causes opposite results. Therefore, according to the [4] the use of the following formula is the most convenient:

$$y'_{ij} = 2\bar{y}_j - y_{ij} \quad \textbf{(9)}$$

Results and discussion

For the previous periods, there appeared an error in the overall calculation of unemployment. For the period 2001 – 2009 (originally, it was also for the whole period of 2007 – 2013), this indicator

consisted of the unemployment, long-term unemployment and pressure for work places (i.e. (applicants – job vacancies available)/work force) [8] and [10]. For the sum of this overall indicator, the weighted sum was again employed, using the given weights; however, no normalisation was implied. Thus dimensionless pressure was added up to unemployment with units representing unemployed people. The normalization using (2) and (3) was used only for the result – the overall evaluation of the unemployment necessary for final district arrangement. This caused the deformation of selected weights.

Multiplication of the overall criterion weight and partial criteria weights do not present increase in computation hardness and prevent the mistake that occurred in previous periods. Such an easy modification will transform two calculations into one and still guarantees that the sum of all weights will equal one. Although the normalization for the period of 2010 – 2013 is correct, it would be convenient to cancel a redundant double weighted sum. This will prevent the repetition of the error from the previous period in further periods. The weights for the period of 2010 – 2013 would then correspond to Table 2.

Transformation of the problem into the criterion matrix results into matrix that has 77 variants/rows all districts in the Czech Republic) and for the comparison calculations five criteria/columns – the overall evaluation of unemployment was divided into two criteria with weights based on Table 2.

Although the data were erroneously normalised in the original method, the selection of regions for the previous periods was not affected (only the order changed, but the set of selected regions as a total did not change). For the period 2001 – 2003, the false result was the closest. The difference in value of coefficient identifying an economically weak region between the last economically week and the worst non-economically week was 0.002 (i.e. 0.2% of average coefficient value).

The current method was compared with the WSA, with the normalisation based on the formula (1). To support assumption about the stability of the solution, both approaches were applied to the table without the variant with the lowest obtained criteria values (Prague). The TOPSIS method was calculated twice, with the transformation criteria according to the formula (8) and consequently using the formula (9). The results are presented in Table 3.

Unemployment level	Number of applicants per one work place	Tax income	Number of private entrepreneurs	Purchasing power
0.32	0.08	0.2	0.2	0.2

Table 2. Modified criteria and their weights.

	Original	Original II	WSA	WSA II	TOPSIS	TOPSIS II	Original III
1	Karviná	Karviná	Karviná	Karviná	Karviná	Karviná	Karviná
2	Děčín	Most	Most	Bruntál	Bruntál	Bruntál	Most
3	Bruntál	Bruntál	Bruntál	Most	Most	Most	Bruntál
4	Most	Děčín	Hodonín	Hodonín	Děčín	Děčín	Hodonín
5	Teplice	Teplice	Děčín	Děčín	Teplice	Teplice	Děčín
6	Jeseník	Hodonín	Teplice	Teplice	Hodonín	Hodonín	Chomutov
7	Hodonín	Jeseník	Chomutov	Chomutov	Chomutov	Jeseník	Nový Jičín
8	Přerov	Přerov	Třebíč	Třebíč	Šumperk	Šumperk	Znojmo
9	Nový Jičín	Tachov	Znojmo	Znojmo	Znojmo	Tachov	Šumperk
10	Tachov	Nový Jičín	Šumperk	Šumperk	Tachov	Chomutov	Teplice
11	Třebíč	Šumperk	Přerov	Přerov	Třebíč	Znojmo	Ústí nad Labem

12	Šumperk	Chomutov	Nový Jičín	Nový Jičín	Přerov	Ústí nad Labem	Tachov
13	Znojmo	Znojmo	Tachov	***Svitavy***	Sokolov	***Česká Lípa***	Přerov
14	Chomutov	Třebíč	***Svitavy***	Tachov	Ústí nad Labem	Sokolov	***Česká Lípa***
15	Sokolov	Sokolov	Sokolov	Blansko	Nový Jičín	Přerov	Jeseník
16	Ústí nad Labem	Ústí nad Labem	Blansko	Sokolov	***Svitavy***	Nový Jičín	Sokolov
17	Blansko	***Česká Lípa***	Ústí nad Labem	***Kroměříž***	Blansko	Třebíč	***Svitavy***
		Blansko (18)	Jeseník (21)	Ústí nad Labem	Jeseník (21)	Blansko (21)	Třebíč (19)
				Jeseník (23)			Blansko (23)

Source: Column Original Resolution of Czech government no. 141/2010 on the definition of regions with concentrated state support for years 2010 – 2013 [11] completed with a respective calculation, other columns own calculation.

Table 3: District order 2010 – 2013.

The column Original illustrates structurally affected and economically weak regions, i.e. the first two categories of regions with the concentrated state aid, as they are currently used. Column Original II illustrates first 17 variants upon the removal of Prague. The WSA presents the Weighted Sum Approach with the normalisation based on the formula (1). The WSA II illustrates the order of variants upon the removal of Prague. The order in the column TOPSIS is given by the application of the algorithm and the cost criteria transformation based on the formula (8). The formula (9) was used for the column TOPSIS II.

Eight highlighted districts are those that were originally not on the position till the seventeenth bar. Additionally, regions with concentrated state aid, which other approaches transferred to more remote positions (position eighteen and higher), are at the end of the table and their order is in the brackets following their names.

All districts, which by using other methods enter the seventeenth bar, are districts presently selected for the category of Regions with highly excessive unemployment. Only Blansko dropped to lower position and simultaneously does not enter the highly excessive unemployment category and not even as an administration district of municipality with an extended activity.

In contrast to a previous period, the order of districts in the period 2010 – 2013 is much more stable. Also, the higher stability of used normalisation when omitting the Prague was not confirmed. The average absolute change in the order from Original to Original II is the same as an average absolute change from the WSA to the WSA II (d = 1.11). A maximum change is 7 and stands for a presupposed more stable normalisation based on formula (2) and (3). The average absolute change in the order is much higher for switch from Original to WSA (d = 4.47) and also to the TOPSIS II with corrected transformation (9) (d = 4.16). The maximum change is 19 for the WSA and 20 for the TOPSIS II. Nevertheless, the TOPSIS II gives same set of supported districts as the Original II.

The most obvious difference in results is position of Jeseník district. This district is originally placed on

the sixth position and falls to the position twenty-Column Original III is applied to test whether it is functional to use the criterion "number of applicants per a work place" with a weight 0.08 which is 2.5 times smaller than the second smallest weight. It is obvious that this criterion will relatively high correlate with unemployment (correlation coefficient r = 0.699). A distinct change in the order in this column unambiguously suggests the importance of this criterion irrespective of a low weight.

For the period 2007 – 2009 (table 4), there was confirmed a high susceptibility to negative ideal values for the WSA and the WSA II (e.g. Ostrava-City dropped from position 23 to position 40, while one when using the WSA. This is caused by mentioned susceptibility of formula (1). E.g. the tax

income criterion is mainly distributed in only 30% of data interval, which is the same for the

normalised data by (1). The formula (2) gives

nearly a bell shape distribution with fatter tails that must provide different results, see graph 1.

for the original method this district was selected on the position 13. In contrast, for the normalisation based on the formula (2) and (3) the stability of the solution was confirmed. See table 4 for more details. On the whole, a higher stability for a current period (independent of the used method) signals a sharper boundary for the denotation of problem regions. Column wOriginal illustrates structurally affected and economically weak regions with wrong (but used) normalisation of unemployment criterion. Column Original represents these regions after correction of algorithm. Although the order was distorted, the resulting set of regions was unaffected.

Conclusions

With regard to the intention to compare all districts, it is convenient to apply algorithm that will not be susceptible to extreme negative ideal values. Therefore the application of other than classical normalisation of criteria values (1) for the WSA appears to be the right choice. It was proved that normalisation would significantly distort results in previous periods. The TOPSIS method as a representative of alternative methods results in almost the same districts on first 17 positions as the method used by Ministry for the period 2010 – 2013 and absolutely same districts for the period 2007 – 2009.

There is a plenty of MCDM (see e.g. [9] or [15]). The calculation algorithms presented in this article belongs among the simplest ones. The use of any other method than the used one will very probably cause different order. The advantage of herein presented methods is, besides relatively simple calculations, also an easy interpretation of results and easy comprehension of the whole procedure. For this decision-making situation the method selected by the ministry is sufficient enough.

New evaluation caused not only the update of regions with concentrated state aid, but also, within this up-date, it caused the correction of the applied method. However, the definition of partial criteria without the denotation of weights multiplication seems to be an open path back to the original error. Till now, the erroneously applied normalisation has had no impact on the overall correctness of results. The output of the generally correctly defined algorithm can be degraded because of processional error. It would be also convenient to introduce some computation control procedures at Ministry for Regional Development to avoid more of such errors.

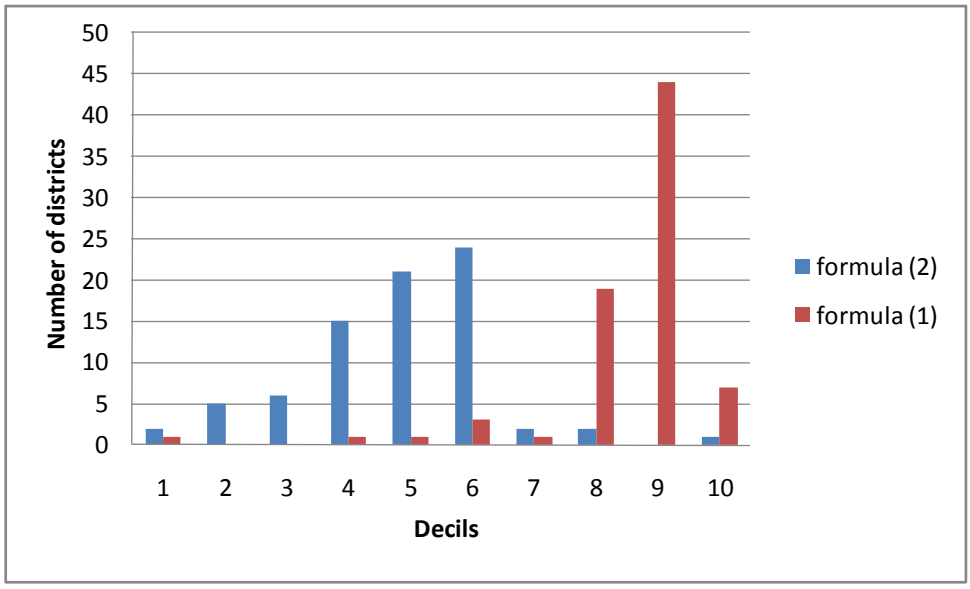

Figure 1: Tax income dostribution after normalization.

	wOriginal	Original	Original II	WSA	WSA II	TOPSIS	TOPSIS II
1	Most	Most	Most	Karviná	Karviná	Most	Most
2	Karviná	Karviná	Karviná	Most	Most	Karviná	Karviná
3	Bruntál	Teplice	Teplice	Bruntál	Bruntál	Teplice	Teplice
4	Teplice	Bruntál	Bruntál	Teplice	Frýdek-Místek	Bruntál	Bruntál
5	Louny	Chomutov	Louny	Chomutov	Třebíč	Chomutov	Chomutov
6	Chomutov	Louny	Chomutov	Louny	Louny	Louny	Louny
7	Jeseník	Jeseník	Jeseník	Frýdek-Místek	Hodonín	Ostrava-město	Jeseník
8	Hodonín	Hodonín	Hodonín	Hodonín	Teplice	Hodonín	Hodonín
9	Frýdek-	Frýdek-Místek	Frýdek-Místek	Třebíč	Chomutov	Frýdek-Místek	Děčín
10	Děčín	Ostrava-město	Děčín	Nový Jičín	Nový Jičín	Děčín	Frýdek-Místek
11	Nový Jičín	Děčín	Ostrava-město	Znojmo	Znojmo	Nový Jičín	Ostrava-město
12	Třebíč	Nový Jičín	Nový Jičín	Svitavy	Svitavy	Třebíč	Ústí nad Labem
13	Ostrava-	Třebíč	Třebíč	Přerov	Přerov	Znojmo	Nový Jičín
14	Znojmo	Znojmo	Znojmo	Děčín	Šumperk	Přerov	Třebíč
15	Přerov	Přerov	Přerov	Jeseník	Opava	Svitavy	Přerov
16	Svitavy	Ústí nad Labem	Ústí nad Labem	Šumperk	Jeseník	Ústí nad Labem	Znojmo
17	Šumperk	Svitavy	Svitavy	Opava	Děčín	Jeseník	Sokolov
18	Ústí nad	Šumperk	Šumperk	Sokolov	***Vyškov***	Šumperk	Šumperk
19	Sokolov	Sokolov	Sokolov	***Kroměříž***	***Kroměříž***	Sokolov	Litoměřice
20	Litoměřice	Litoměřice	Litoměřice	Ústí nad Labem	***Blansko***	Opava	Svitavy
21	Opava	Opava	Opava	***Vyškov***	***Žďár nad***	***Kroměříž***	Opava
…	…	…	…	Ostrava-město	Sokolov (22)	Litoměřice (23)	…
				Litoměřice (29)	Ústí nad Labem		
					Litoměřice (32)		
					Ostrava-město		

Table 4. District order 2007 – 2009.

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WCA Framework

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Abstract

This article deals with subject-matter and components of WCA Framework. Authors clarify individual elements of WCA. Article is being coupled with explaining of WCA Framework. Authors furthermore introduce differences between WCA Framework and additional analytical methods. Authors pay attention to relation among information technology, information system, work system, firm and business environment.

Key words

WCA Framework, customer, product, business process, information, participant, information technology.

Anotace

Tento článek pojednává o významu a prvcích analýzy WCA Framework. Autoři komentují prvky analýzy WCA. Článek je doplněn vysvětlením WCA Framework. Autoři dále uvádějí rozdíly mezi WCA Framework a dalšími analytickými metodami. Pozornost je též věnována vztahu mezi informačními technologiemi, informačním systémem, pracovním systémem, firmou a okolím podniku.

Klíčová slova

WCA Framework, zákazník, produkt, obchodní proces, informace, účastník, informační technologie.

Introduction

Topical IT specialists, copyreaders, teachers, students and readership use many methodical (formal) and analytical shells for understanding, describing and analyzing information systems and factors of using IS/IT in particular organizations. Some methodologies describe information systems as separated instrument (without system aim behavior, business environment, information requirements etc.). Nevertheless successful appreciation of information occasions of enterprise (employees, managers, users) result from understanding enterprise business processes sequence, enterprise environment, employee's mission in each process, competence and responsibility in analyzing subject.

S. Alter says in [1] about WCA framework: "…The WCA framework summarizes the elements any business professional should look at when analyzing an existing or potential system in an organization. The framework says that the system is much more than just technology. Instead, the system is actually a work system consisting of a business process performed by human participants using information and technology. Unless the purpose of the analysis is to improve the way the system operates internally without changing anything about what it produces or why it exists, the analysis of the system needs to include the product it produces and the customers it serves..."

Department of Information Technologies (Czech University of Life Sciences Prague) gives lessons from WCA Framework. This analytical framework supplements student's knowledge in all stage of building and implementing information systems to organization. WCA Framework is being instructed in lectures and seminars (presenting and discussing case studies).

Material and methods

Authors describe WCA Framework, present differences between WCA Framework and others methodologies and discuss reasons of instructing WCA Framework. Authors use method of studying literature resources.

The aim of this article is to present WCA Framework as relatively new, complex, modern and useful shell for analyzing information requirements and describing information systems. Authors show extended approach to using WCA Framework in pedagogical practice to prepare students for applying complex analyzes (economics and informatics).

Results and discussion

Work-Centered Analysis (WCA) by Steven Alter is a framework for thinking about business processes and the information systems that support them. It focuses on the work being done.

Work is the application of human and physical resources such as people, equipment, time, effort, and money to generate outputs used by internal or external customers. It ideas from several prominent management theories including Total Quality Management, business process reengineering, and systems theory. WCA framework result from Alter's definition of information system:

Alter (1992): An information system is a combination of: work practices, information, people, and information technologies organized to accomplish goals in an organization. [1]

Alter (1996): An information system is a system that uses information technology to capture, transmit, store, retrieve, manipulate, or display information that is used in one or more business processes.

Term **Business processes** define Alter as: A business process is a related group of steps or activities that use people, information, and other resources to create value for internal or external customers. Business Processes consist of steps related in time and place, have a beginning and end, and have inputs and outputs. Core processes are themselves divided into subprocesses, and the typical business unit might have seven to twenty core business processes.

For explanation of WCA Alter use term **Work system**. Alter defines it: A work system is a system that produces products for internal and external customers through a business process performed by human participants with the help of information technology.

The early focus on IS was for the support of operations, management, analysis and decision-making in organizations. A significant emphasis was on models of planning and control. The late 1980's and early 1990's saw IS expand from the support not only of decision-making, but for improved communication support as well. The explosion of the Web has added the important characteristic of providing information access. Today the emphasis in organizations is on the support of business processes.

Alter use terms: Information Technology, Firm and Business Environment. **Information Technology** means the hardware, software, and networks that make Information systems possible.

Firm (or organization): Consists of a large number of interdependent business processes that work together to generate products of services in a business environment.

Business environment: Includes the firm and everything else that affects its success, such as competitors, suppliers, customers, regulatory agencies, and demographic, social, and economic conditions.

The WCA framework implies that although people sometimes speak of computers as systems, the system business professionals should focus on is the system performing the work. The system performing the work is much broader than the technology. It includes the business processes, the participants, any information used, and any technology used. All elements create "pyramid" (the base create participants, information and technologies, second level is being created by business process, third stage represents products and on the top is position for customers).

The links are two-way, implying that the elements should be in balance. Also, changes in one place may result in changes in other elements.

This "pyramid" describes Work-centered Analysis (WCA), a conceptual framework developed, for "thinking about business processes and the systems that support them." WCA framework is an element of the business process reengineering. [3]

The product / service is provided by process. This can be either tangible or intangible and may include

services performed or information provided in conjunction with the physical product (e.g., status information, instructions for use).

In this model there are the internal and also the external customers. Those who use the outputs of a business process who may be either internal or external to the firm.

Special element represent human enablers – participants: According to Alter, these are the "people who enter, process, or use the information within the system."

All above mentioned elements is considered in first determining the scope of the study and then in looking at the system from a number of perspectives. These include:

- **Measuring** - the performance of the process being investigated. Performance analysis is central to business process reengineering. Unfortunately, many organizations fail to capture performance information on their processes. In examining the existing system it may be necessary to estimate performance metrics or to put in place temporary processes for measuring them.
- **Understanding the context of process:** The context within the system exists will shape both its design and its effective use. According to Alter, context includes things such as external stakeholders, organizational policies and practices, personal incentives, organizational culture, resource availability, business pressures, and laws and regulations.
- **Identifying the infrastructure:** Infrastructure, according to Alter consists of essential resources shared by many otherwise independent applications. Infrastructure related to technology, as in communications networks or shared computers are fairly easy to identify. New information systems themselves become candidate infrastructure for subsequent systems. For instance, a database developed to support an internal help line may be later made available to customers.
- **Examining the architecture of the various components:** Architecture, according to Alter "focuses on the components of the business process, how those components are linked, and how they operate together mechanically to produce business process outputs." Architecture is revealed through an interactive process of hierarchical decomposition in which, like pealing an onion, more and more detail is revealed as we bore further and further down into the hierarchy.
- **Assessing the Risks:** Information systems always are accompanied by some elements of risk. These can fall within each of the elements of the WCA framework and apply both to the current system and the system being envisioned. Risk is attached both to the system itself, as with machine malfunctions, software bugs, or undetected computer crime. But it may also come in failures in the process used to create the system - so called project management failures. The following are the kinds of risks that Alter has identified for the various stages of the framework. Customers: Customers may be dissatisfied with aspects of the current system or may become more dissatisfied as the system produces service that is inferior to competitors or the customer's typical expectations. But inattentive customers may also fail to reveal existing failings in the current system. New systems also can impact customers in unfavorable ways, particularly if they do not perform as anticipated. Products or Services: Systems can produce products that are wrong, fraudulent, or inadequate. For instance, a check writing system that prepares an insufficient check or a billing system that duns a customer for a bill that was already paid. Fraudulent activity, such as collusion, can also result in erroneous payments and so on. Business Processes: Processes often have elaborate controls built in to limit exposure. Still, many risks often are either unidentified or ineffectively planned for. Among those Alter identifies, are inadequate procedures for gathering and protecting data, unauthorized access to computers, programs, and data, inadequate skills to properly participate in the process, or

inadequate attention to backup and recovery.

Tomorrow's successful business professionals need more than the ability to do personal work on a computer and general familiarity with business and technical terms. Contributing fully to current organizations requires an ability to participate in systems, evaluate them, and contribute to system development efforts. This requires an organized approach for thinking about systems, an approach that can be used successfully today and will still be valid five or ten years from now when today's technical and business terms are no longer at the cutting edge.

The work system method was developed to address a void in established systems analysis and design approaches. The goal was to provide a set of ideas and a method that business professionals might use with or without the help of consultants or IT professionals in order to evaluate a system from a business perspective, think about system improvements, and communicate about realities faced by new or improved information systems. Successive versions of the work system method were developed based on direct and indirect feedback from hundreds of MBA and EMBA students writing papers about systems in their own organizations. [2]

The main difference between the usual IT models and the WCA approach is that the usual IT models are the frameworks for teaching about information systems, whereas the WCA approach is the basis of a method for analyzing a particular information system as an integral part of a work system it supports. The WCA approach recognizes the overlap between information systems and work systems and views the elements of the work system as the starting point for analyzing any particular information system.

We use WCA Framework in teaching subjects Strategy of IS and Enterprise IS. In teaching process we explain all WCA Framework components. Then we continue with applying this theory to case studies. Alter's case studies allow us to apply principles of WCA Framework to particular business situations. Students prepare own semestral team projects to exercise WCA Framework algorithm.

We lead students to considering about one particular business situation in context of cost, enterprise strategy, information requirements, IS architecture and schedule of implementation. Informatics considers usually only about architecture and information requirements. Cost and "manager´s dimension" solve usually accountant or economist. In point of wives Service Science theory choosing and implementing right information system needs to consider about all above issues. Managers need for right decisions general knowledge about technical and economic issues.

We build up student's capability to summarize all relevant information to understanding initial situation in enterprise. Students continue with describing of information requirements, with analyzing initial situation and the last chapter contains student's suggestions for changing applications / buying new SW and services. On last seminar students presents semestral project and defense own works.

We extend and combine WCA Framework theory with Cost Benefit Analyze and with others relevant methods. We perceive WCA Framework for shall not only for real business situations but also as a pedagogic shall for formation of student's analytics and decisions capabilities. WCA Framework can be used as shall for teaching about general process oriented view (describing workflow as a static structure of task and resources). Next possible approach is organization view. This view defines the enterprise roles, each role has links to particular set of tasks there are also links to information and resources. Next dimension is being created by performance view that is characterized by the objective structure and relations between tasks and goals.

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ICT in Agricultural Enterprises in the Czech Republic – Exploration 2010

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Abstract

The present paper brings an outline of the methodology and chosen results of an extensive ICT development survey in agricultural enterprises that was carried out in the second quarter of 2010 in the whole Czech Republic. The survey was aimed primarily at the analysis of internet connectivity development in rural areas (i.e. areas where the majority of enterprises operates), at the technical and program equipment and last but not least at the present state and current trends in ICT use. This follow-up survey prosecutes the studies that were administered within the last two years (2009 in particular). In comparison with previous years, it comprises two brand new domains (e.g. social networks and their use, program equipment used in different segments of animal production, crop production and economy). The research was prepared, carried out and administred by the Department of Information Technologies in cooperation with the Information and Consulting Center of the Faculty of Economics and Management of the Czech University of Life Sciences.

Key words

Information and communication technologies, broadband, ADSL, Wi-Fi, 3G, LTE.

Anotace

Příspěvek prezentuje metodiku a vybrané výsledky rozsáhlého šetření rozvoje informačních a komunikačních technologií (ICT) v podnicích zemědělské výroby, které se uskutečnilo ve druhém čtvrtletí 2010 v rámci celé České republiky. Cílem je analyzovat rozvoj internetové konektivity ve venkovských regionech (zde působí naprostá většina podnikatelských subjektů), vybavenost technickým a programovým vybavením a dále zjistit stav a aktuální trendy využívání ICT. Průzkum navazuje na šetření provedená v předchozích dvou letech (především 2009). Proti minulým rokům zahrnuje nově zkoumané oblasti (například sociální sítě a jejich využití, používané programové vybavení v jednotlivých segmentech živočišné výroby, rostlinné výrobě a ekonomice). Výzkum připravila a realizovala Katedra informačních technologií ve spolupráci s Informačním a poradenským centrem Provozně ekonomické fakulty České zemědělské univerzity v Praze.

Klíčová slova

Informační a komunikační technologie, vysokorychlostní internet, ADSL, Wi-Fi, 3G, LTE.

Introduction

The process of building the information and knowledge society is first of all connected with the development of information and communication technologies. It has been recently going through a fast and turbulent development in basic domains, such as technical infrastructure and program equipment and is accompanied by an increasing volume and variety of available information, requirements concerning its effective use and new possibilities of its utilization.

The present paper brings an outline of the methodology and chosen results/outcomes of an extensive ICT development survey in agricultural enterprises that was carried out in the second quarter of 2010 in the whole Czech Republic. The survey was aimed primarily at the analysis of internet connectivity development in rural areas (i.e. areas where the majority of enterprises operates), at the technical and program equipment and last but not least at the present state and current trends in ICT use. The follow-up survey prosecutes the studies that were administered within the last two years (2009 in particular) [1], [2]. In

comparison with previous years, it comprises two brand new domains (e.g. social networks and their use, program equipment used in different segments of animal production, crop production and economy). The research was prepared, carried out and administred by the Department of Information Technologies in cooperation with the Information and Consulting Center of the Faculty of Economics and Management of the Czech University of Life Sciences.

The paper deals first and foremost with the methodology of the survey itself, internet connectivity accentuating the individual technologies, broadband connectivity and mobile communication. Other problematics is mentioned in less detail or just informationally and will be published later on.

Objectives and methods

The 2010 survey is a follow-up to ICT surveys that were carried out in previous years, firstly between the years 2000 and 2003, then in 2008 and 2009. The survey was prepared in the first quarter of 2010 and was carried out from 26th April to 31st May 2010. It was focused solely on the enterprises that manage at least 100ha of farmland. It means that 4,411 Czech corporate entities were addressed in the first half of 2010. These entities manage the total farmland area of 3, 096, 000 ha, out of which 2, 287, 000 ha of arable land, the area which represents 88% of farmland and 89% of arable land of the Czech Republic. Elementary company identification was based on the Czech LPIS register.

A comparable survey – i.e. a survey focused on agricultural enterprises or coutryside in general - has never been carried out in the Czech Republic. Nevertheless, this problematics is crucial while solving the so-called digital divide within the framework of Czech rural areas.

All selected respondents were posted a cover letter including the guidelines and a questionnaire to be filled-in and returned by post. The questionnaire was as well available as an on-line web form allowing to save changes continuously and to finish it later on. In comparison with previous years, the option of dowloading the form was withdrawn due to its redundancy. Even if 136 enterprises employed the above-mentioned option (i.e. downloading the form, filling it and sending it by email) in 2009, the new web form with interim saving of the questionnaire was supposed to replace it fully.

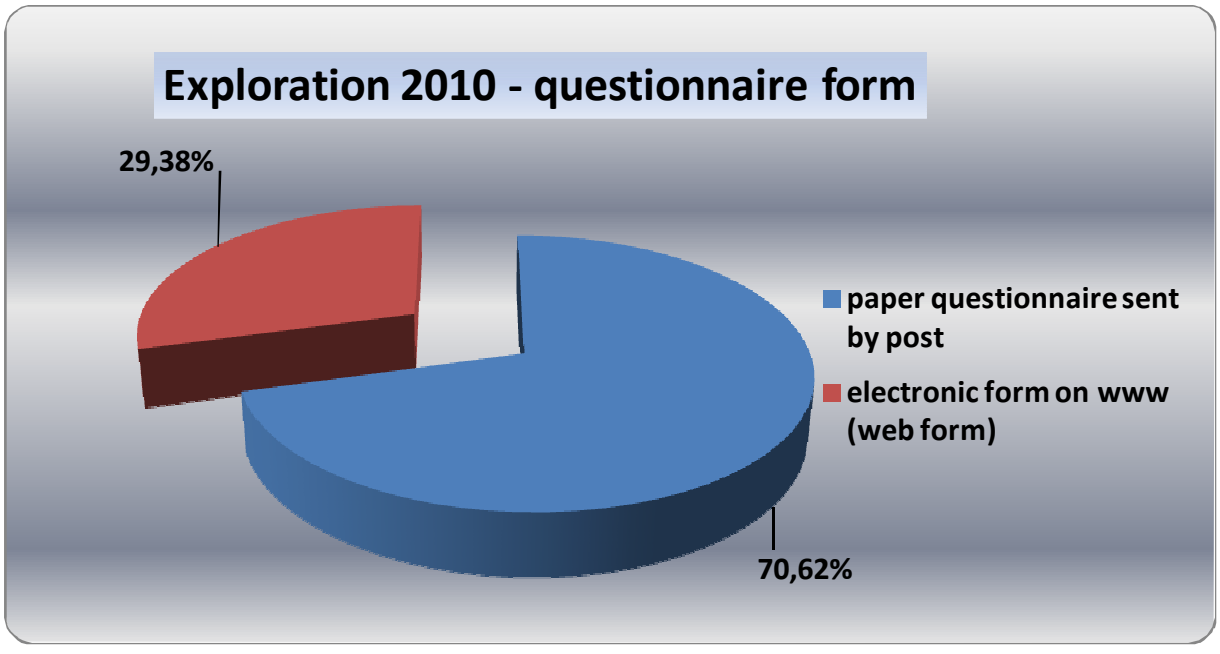
Internet data collection was carried out through the agrarian WWW portal AGRIS (http://www.agris.cz), portal provided and administered by the Information and Consulting Center FEM CULS in cooperation with the Department of Information Technologies. The portal is well-known to agriculture professionals in the long-term perspective. Figure 1 is a sample of 2010 WebForm that was available on http://www.agris.cz/pruzkum2010/.

When compared to 2009, the questionnaire was partly modified and significantly extended. While entries concerning the production as such were reduced, questions related to internet connectivity, internet use and mobile communication were extended and specified. Furthermore, new non-agricultural activities – such as e.g. agrotourism, wood processing and meat processing - were introduced. The ICT domain was not only extended towards social networks and their utilisation, the scope of program equipment used in the individual segments of animal production, crop production, economy and consultancy but as well towards collecting information for the sake of enterpreneurial activities.

Results and discussion

The total of 902 relevant questionnnaires was collected in 2010 survey, representing 20.5% of all the respondents (enterprises) addressed. These enterprises manage the area of 781,000 ha of farmland, i.e. 22% of the farmland in the Czech Republic (596,000 ha of arable land which is more than 23% of arable land in the Czech Republic). The way of obtaining results (i.e. questionnaire form) is shown in graph 1. Almost 71% of respondents preferred a classic paper form of the questionnaire to the electronic WebForm (29%). Similarly to previous years, a "conservative" approach of the focus group arises from the signifiant prevalence of the paper questionnaire.

Figure 1: Web form – Exploration 2010.



Graph 1.

Technical and program equipment

Technical equipment facilities – PC stations, notebooks, mobile equipment (PDA, smartphone) were monitored. In accordance with general current trends, we can observe (2010 againts 2009) a growth in notebook and PDA numbers. While the share of PCs decreased from 82.5% to 77.9%, the share of notebooks on the other hand increased from 16.5% to 20.5% and the PDA share went up the most significantly from 1% to 1.6%.

Furthermore, the number of printers was investigated. As far as the basic program equipment is concerned, operation systems and net systems instalment was inquired. Using office packages, economic and consultancy programs, program equipment for animal production (cattle, pigs etc.) and crop production programs was newly introduced to the questionnaire. The results of the above categories have not been included in the present paper. They will be of course analyzed and published later on.

The use of social networks represents a new and higly interesting questionnaire category which is being analyzed recently. However, several summary results can be presented here. The use of social networks is still relatively low – when used, Facebook is the most used network (as expected), followed by Google Buzz. Other social networks (Linkedln, MySpace, Twitter) are used only a little, each in 10-12 cases. The networks are used mostly for personal communication and information collecting but not really for company presentation, which is quite surprising. We can assume that the use of social networks go on spreading as well within agricultural enterprises but conservative approach is supposed to prevail for the moment, hindering their wider acceptance.

Internet connectivity and use of internet

Corporate internet connectivity (i.e. the number of enterprises having internet connection) has increased further to 94.6% and other enterprises are planning to establish it too (3.2%). Most connections are realized via broadband, i.e. the transmission speed of 256 kbps (according to the applicable broadband limit). High-speed connectivity then represents 70.5% of all reported connections. According to the survey, narrowband accounts for 29.5% of all connectivity – including ISDN, classic telephone line, mobile GPRS connection. Many enterprises of course use combine more kinds of connectivity at once. Details are shown in graph 2.

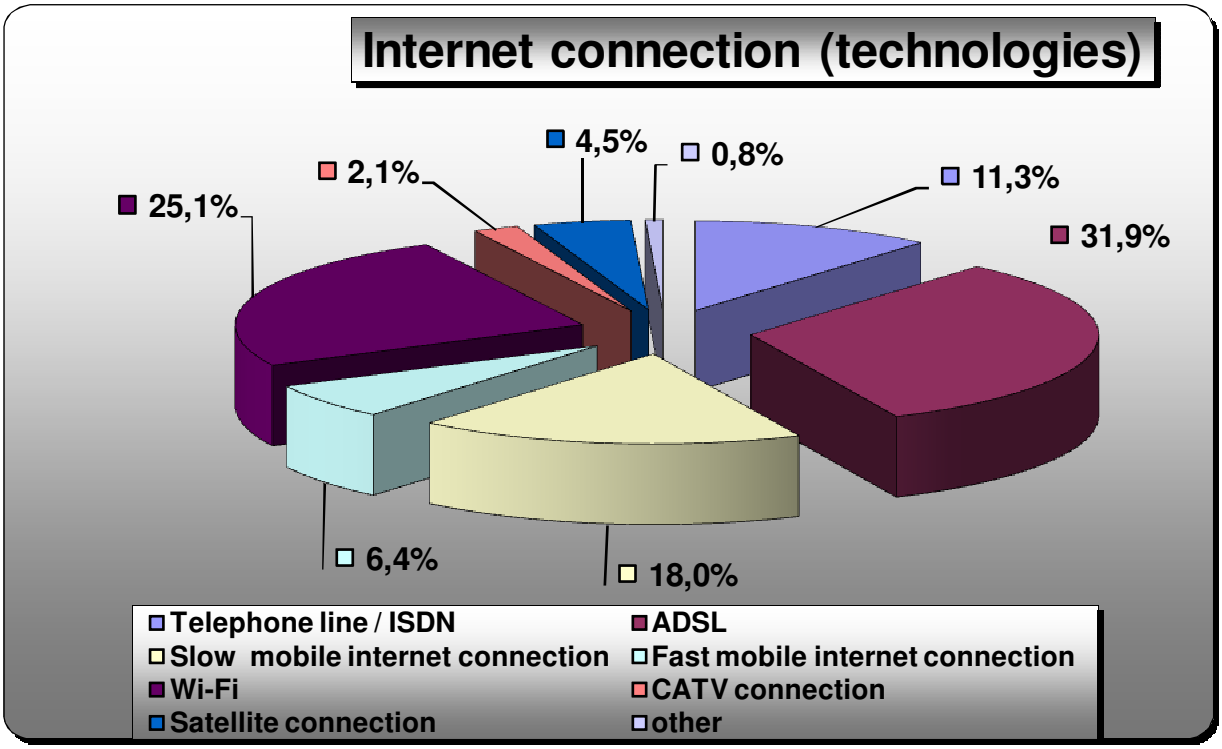
In 2010 (as opposed to previous surveys) all available internet connection technologies were taken into accoount even if some of them – e.g. cable internet (CATV) or satellite connection are not really widespread in rural areas and their role is quite marginal. However, the survey reported a surprisingly high share of this connectivity – namely 6.6%. In case of CATV connection with a share of 2.1%, enterprises seated in bigger towns or cities are involved. Satellite connection (4.5%) is obviously an acceptable option for some enterprises.

Mobile internet connection has been as well analyzed from the point of view of operators presence. 79% of narrowband and even 85% of broadband connection is provided by the Telefónica O2 company whose dominant market position is obvious. It is necessary to mention that high-speed mobile connection is reported only in 95 cases, i.e. 11.1% of the enterprises. However, at the time of the survey, this company offered adequate technologies and relatively the best coverage.

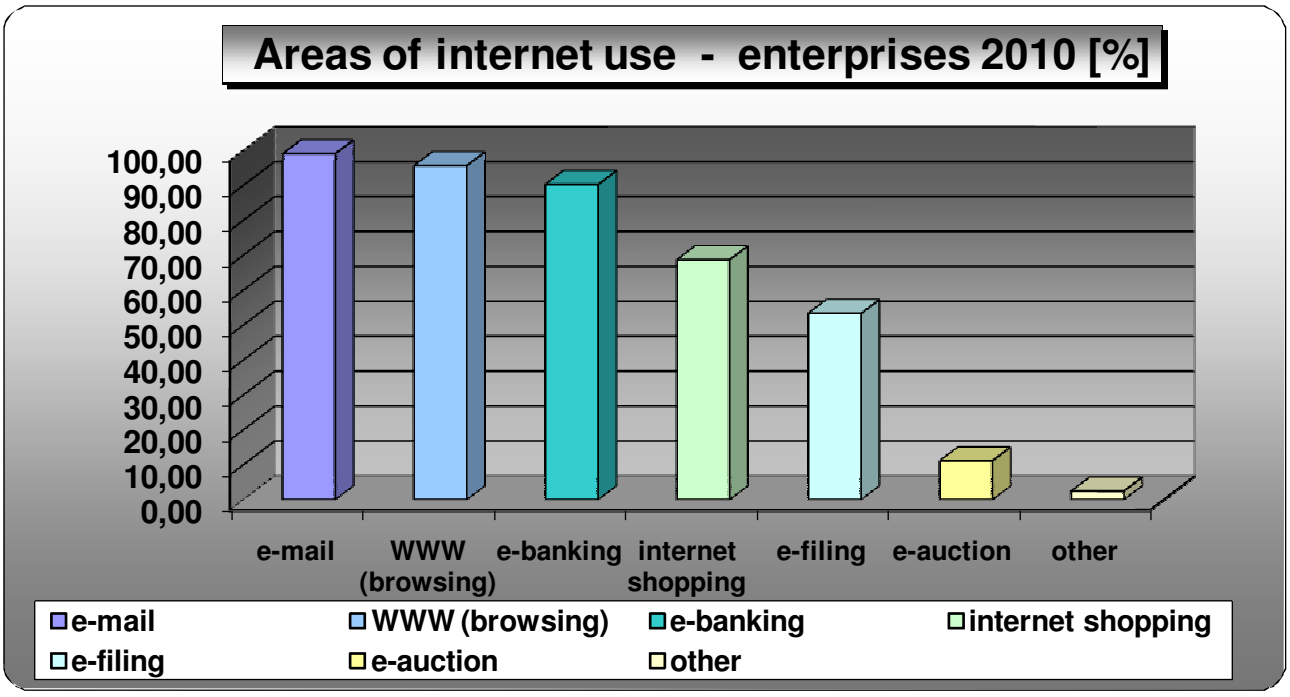
The fields of internet use are standard – nearly 100% of all enterprises (94%) with internet connection report using email the most, then browsing websites and e-banking services (more than 90%). Shopping over the internet is less common, however, it exceeded 68%. The use of e-auctions and e-submitting was a new criterion in 2010 survey. E-submitting is used in more than 54% of cases, e-auctions 11%. A detailed overview can be found in graph 3.

As a rule, just a small share stands for company presentation while only 23.5% of the connected companies have their own websites while other 12% are planning to create them (see graph 4). Only 3% of agricultural enterprises run their own e-shop but 5.6% have already made plans to open one too.

The survey brought some very interesting data concerning internet information services where awareness and use of goverment department information resources were analyzed. An essential

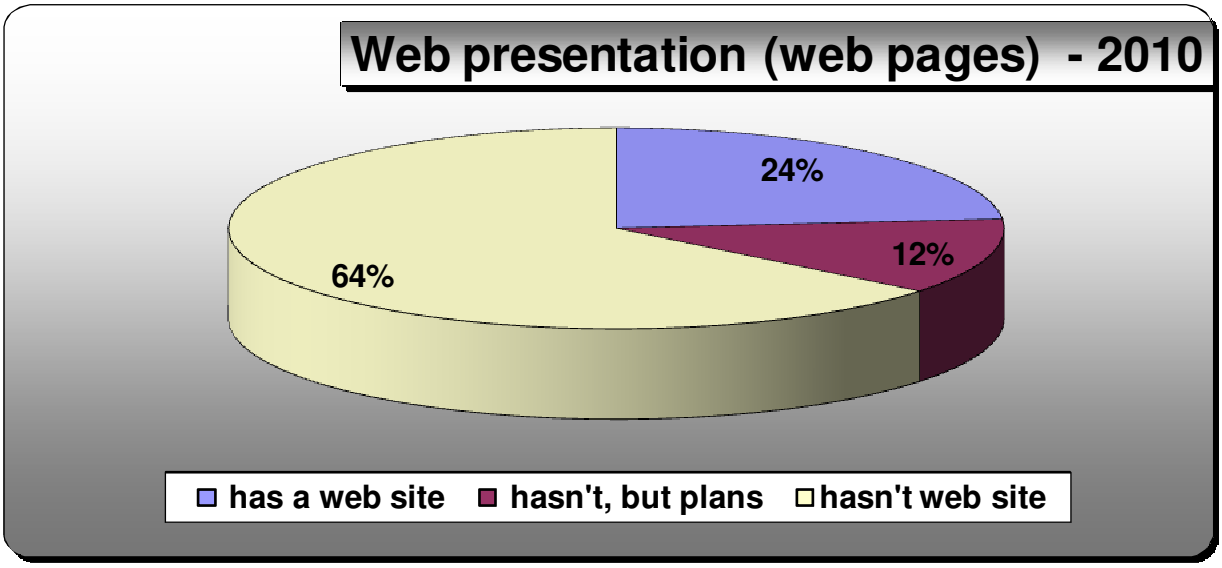


Graph 2.



Graph 3.

change happened thanks to the integration of all official information portals (in particular the Ministry of Agriculture of the Czech Republic and Farmer's Portal but except for the State Agricultural Intervention Fund!) into one-portal solution called eAGRI. This solution facilitates access to all official departmental information and should have been completed - for the sake of effectivity – a long time ago. Significant financial means were wasted recently on integrating the systems that have been developed independently (The Department of Information Technologies recommended the above



Graph 4.

mentioned one-portal solution to the employees of the Ministry of Agriculture more than ten years ago while developing the very first ministry portal…). Official government department portals – SZIF and eAGRI - are the most known among users, followed by specialized information portals Agroweb, AGRIS and then the Agronavigator portal and two portals of the Agrarian Chamber of the Czech Republic – Regional KIS and APIC-AK. The eAGRI portal fell behind the SZIF portal to the second place in 2010 (contrary to 2009) – it could mean that users are not fully accustomed to it yet.

Conclusions

The paper presents and discusses chosen results of a recent survey on ICT state and development in agricultural enterprises that was carried out in the first half of 2010. The paper is focused on the survey methodology and broadband connectivity.

As stated above, internet connectivity and especially its quality is a key factor of information society building. In spite of technological development and general European/global trends, internet connectivity in the Czech Republic is not developing fast enough towards broadband connection [3]. This is especially the case of rural regions where both local enterprises and inhabitants are remarquably affected by this lack. However, the survey shows quite a significant shift towards broadband in recent years. Broadband is nowadays represented first of all by ADSL and Wi-Fi technologies - new fast mobile technologies (3G and LTE) seem to be very perspective from the point of view of rural regions.

ADSL is the most widespread technology (with a share of almost 32% according to the survey). However, it is generally hindered by a low quality of lines and switchboard distances (length and quality of local loops). ADSL is now being offered not only by the O2 company but as well by other telephone operators, T-Mobile in particular (it goes without saying that the above-mentioned loop limitation applies here too as they are owned by the O2 company). ADSL price availability has increased too firstly thanks to providing the so-called naked ADS (ADSL without being obliged to pay for the fixed line for calls) and secondly thanks to promotional marketing actions and competition in general.

Wi-Fi (25% share according to the survey) is – in the long-term perspective - the most available technology in the country, including border regions where ADSL is not available at all due to technological or economic limitations. In cities, suburbs and urban areas, Wi-Fi suffers from disturbances that occur because of high number of nodes and stations. This problem actually does not exist in the country but general Wi-Fi technology limitations apply (the technology is not suitable for outdoor use, longer distances and its reliability is weather-conditioned). In comparison with other countries, including the EU, the number of Wi-Fi users in the Czech republic is a unique phenomenon.

Fast mobile internet connection is another means of connectivity that is now provided (or will be provided as soon as the infrastracture is built) by all operators. Until now, this technology has been restricted to big cities but step by step it starts being available in smaller towns too. We can suppose that wireless broadband based on fast mobile internet (conventional 3G network, perspective LTE etc.) will constitute the most convenient solution for rural areas and as a result, it will be given priority and support within the EU [4], [5].

A recent upsurge in EDGE mobile technology can be generally welcome and this technology is spreading massively in rural areas this year. Unfortunately its speed is even below the broadband speed limit (which is itself very low from today´s perspective). However, from the point of view of country connectivity, we can speak about a significant progress.

The survey was concerned with agricultural enterprises that actually all operate in rural areas. That is why some conclusions (internet connectivity, fields of internet use etc.) illustrate at the same time the situation in the country as such. It means that these conclusions are applicable also to non-agricultural enterprises and inhabitants in general. Other results, on the other hand, can be generalized only partially (basic technical and program equipment, use of browsers etc.) and some are unique and typical of agricultural enterprises (special program equipment, resort portals awareness and use etc.).

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Information – EFITA / WCCA, ECPA, ECPLF conference 2011

European Federation for Information Technology in Agriculture, Food and the Environment / World Congress on Computers in Agriculture

The international committee would like to inform you to join the 8th EFITA and 8th WCCA conferences. The conference will be held from 11th to 14th July 2011 at the Czech University of Life Sciences Prague, in the Czech Republic.

The key topic for EFITA/WCCA 2011 congress will be Rural Digital Agenda for 2020 and ICT-technologies, and knowledge management for integrated and sustainable farm management in the whole world

More information on the website EFITA / WCCA 2011 (http://www.efita2011.cz).

8th European Conference on Precision Agriculture

The conference will offer a unique insight into the most recent research and development in precision agriculture. At the same time, the latest scientific results from worldwide research, field studies and practical application of these important technologies will be presented.

The conference will be held from 11th to 14th July 2011 at the Czech University of Life Sciences Prague, in the Czech Republic.

More information on the website ECPA 2011 (http://www.ecpa2011.cz).

5th European Conference on Precision Livestock Farming

The conferences will offer a unique insight into the most recent research and development in precision livestock farming. At the same time, the latest scientific results from worldwide research, field studies and practical application of these new technologies will be presented.

The conference will be held from 11th to 14th July 2011 at the Czech University of Life Sciences Prague, in the Czech Republic.

More information on the website ECPLF 2011 (http://www.ecplf2011.cz).

Information – Journal of Agricultural Informatics

The Hungarian / English language journal publishes research and application results in advanced information technologies in agriculture. This niche journal improves scientific knowledge dissemination and innovation process. In Hungary in recent years, primarily for development and application of macro-systems (the EU information systems: IACS, Statistics, FADN, Market Price Information System, ...) there have been major achievements in this domain. However the companies and a significant part of farmers are lagging behind it. The aim of the journal is to fill this gap by delivering results of research and best practices to the companies and farms. The task of the journal is to assist the publication of the farm management information systems and technologies, applied methods and knowledge. In addition, besides a number of other application possibilities, the food safety, the internet and mobile application are also important domains for the agri-food sector. A number of research institutions, university doctoral schools work on related topics to agricultural informatics. The journal will be a medium to ensure publishing the research results and help the information exchange between researchers and practical professionals. The peer-reviewed journal is operating with editorial board and trustees-advisory board.

Deadlines of submissions and publications:

Vol. 1. Issue 1.: submission: 31 March, publication: 30 May
Vol. 1. Issue 2.: submission: 30 September, publication: 30 November

More information on the website Journal of Agricultural Informatics **(http://journal.magisz.org).**

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