

Information and knowledge systems in the operation of agricultural and food-processing enterprises

Informačné a znalostné systémy v riadení poľnohospodárskych a potravinárskych podnikov

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Abstract: The utility value presents the main competitive advantage in the knowledge and digital economy. It cannot be achieved without modern technologies, modern organization and operation of the production and social processes. One of the Slovak government's precedences is to establish favourable conditions for the development of knowledge economy in every section. The informatisation level of the agricultural sector is continually increasing. As perspective, we can see the implementation of the knowledge systems in agricultural and food-processing enterprises. The main contribution is mainly the possibility to forecast the development and the state toward the future and the use of knowledge base for ensuring of the operational, tactic as well as strategic management.

Key words: knowledge, economics, information systems, software, management

Abstrakt: V znalostnej a digitálnej ekonomike je hlavným konkurenčným faktorom úžitková hodnota. Tú nemožno dosiahnuť bez moderných technológií, modernej organizácie a riadenia výrobných i spoločenských procesov. Jednou z priorit vlády Slovenskej republiky je vytvoriť priaznivé prostredie pre rozvoj takejto ekonomiky v každom rezorte. Úroveň informatizácie rezortu pôdohospodárstva sa stále zvyšuje. Za perspektívnu považujeme implementáciu znalostných systémov v poľnohospodárskych a potravinárskych podnikoch. Hlavný prínos je predovšetkým v uplatnení znalostnej bázy pre manažment pri zabezpečovaní operatívneho, taktického i strategického riadenia.

Klíčové slová: znalosť, ekonomika, informačné systémy, softvér, manažment

The present situation is not only characterized by the attribute of information society but also by knowledge economy.

Knowledge economy is considered to be a level in the society's progress, it supports the ability of the people to use the human potential and its knowledge to generate capital. Its origin is closely connected to the development of information technologies (IT), that denote at present one of the basic pillars of a successful enterprise and the whole society as well. The knowledge economy is measured by the National bank through 76 indicators that describe the 4 basics of the knowledge economy:

- economic stimulus and legislative surroundings,
- education and human potential,
- innovation system,
- informational infrastructure.

In April 2005, the European Commission submitted the General Programme for competitiveness and

innovation (2007–2013) that provides the essential and continuous legal foundations for the activities of the Association, having the common overarching goals increasing competitiveness and innovation. The subprogramme: assistance to the politics of *information ad communication technologies (ICT)* indicates a significant element within the programme and it is seen as the base of *knowledge economy*.

Setting out the arranged directions into the practise should assure long-term prosperity for enterprises on international markets. It demands skilled managers and perpetual innovation of the company's information system. According to many authors (Vymětal et al. 2006; Bielik 2001; Tiruneh et al. 2004) in developed economies, it is no longer the main goal to make the manual labour more effective, but to increase the productivity of knowledge employees, whose main instrument denotes the information technology.

Basl (2002) states that the goal of knowledge management is to create a learning system that is integrated to the information and logistic system of the company monitoring data- and information flows and improving the decision-making and operation in the enterprise. According to Katolický (2005), the knowledge management denotes a purposeful operation of creating, gaining, delivering and using of the knowledge. A crucial task should be maintained by the positive influence on the internal environment for development and the use of the intellectual capital together with the modern technology.

In our paper, we focus our attention toward the issue of knowledge in companies. Our perspective is to present the outcomes of our research in this field and to point out the importance of information and knowledge systems at present concerning:

- the support of state politics,
- the informatisation of the agricultural sector,
- the solutions for knowledge systems by software,
- the actual state of expertise systems in agriculture,
- the contributions emerging from the application of knowledge systems for the operation.

MATERIALS AND METHODS

For the solution of the presented issue, there were used information sources concerning the domestic and foreign literature and the up to date internet sources both domestic and foreign.

There were analysed company's information systems from a chosen group of enterprises with accordance to their ability to provide data for management. Next, we carried out an analysis of the current state of the chosen company's information systems on our market (Softteam, Aurus, Datalock, LCS Helios, Softip, Pro-fit, Stormware, ISS Bratislava s.r.o., NOVEKON s.r.o., SAP). We focused chiefly on the observation of the system's conceptions, its components, elements, integrity and functional characteristics, quality, the possibilities of further development and their reliability and stability.

The applied methods included direct interviews with the management, analysis, synthesis and comparison.

In the paper, there were used the data and partial outcomes of the research task E-XI carried out within the Department of Accounting and Finance: The transformation of information systems in enterprises operating in agriculture connected to the entrance into the EU.

RESULTS

All countries within the EU strive for a purposeful usage of the ICT for accelerating the development of their countries and economies. They are directly related to the Programme for Competitiveness and Innovation submitted by the European Commission. A new digital and acquaintance economy is formed that begins to be decisive in the global competition for the position worldwide.

The government of the Slovak Republic (similarly to other governments in the EU) is aware of the need of formulating its policy concerning the development of information society in Slovakia and one of the priority goals represents the participation in the forming knowledge and digital economy.

Investments towards the IT sector in our republic are growing, however, compared with other countries this rise is insufficient – the proportion of investments into the IT sector was only 1.59% compared to the gross domestic product in 1995 what is under the average of the countries within the EU. In 2000, there were invested into the IT 2.17% of the GDP and the International Data Corporation estimated that this proportion should rise up to 2.93% in 2006 (1,207 mld. USD).

The expenditures on the IT per one inhabitant reached 161 USD in Slovakia 2003. This forms only 76% of the expenditures per one inhabitant in Czech Republic, 55% in Slovenia and 70% in Hungary. It is anticipated that in 2006, the expenditures will raise up to 216 USD per one inhabitant.

The informatisation of the Slovak society into the real life is enforced through the individual sectors. As a disadvantage of this process, there can be mentioned the lack of coordination – sectors aim to build separate information systems and it often leads to the duplicity of data processed. The solution is on the level of the individual sector ministries with the collaboration of the selected government.

The realization of the Conception and the Programme is seen through the operation of the ministry and the individual sectors as well as through creating the necessary information and communication relations are one of the crucial strategic tasks of the Ministry of Agriculture in Slovakia. The mentioned two documents contribute to the development programme of the sector that is focused on the systematic application of information and communication technologies of building information systems (IS) and creating the necessary instruments.

The objectives of the Programme is to create gradually the IS sector as a complex and integrated system of connected and cooperating IS's, that will be able

to provide information and services crucial to the needs of operating the sector, cooperating with the other sectors and with the public.

The structure of information systems in the field of agriculture and food-processing industry we depicted in the scheme (Figure 1).

By the change of Slovak agriculture towards market conditions, there was abandoned in the agricultural sector the united automated data processing for ag-

ricultural enterprises and the middle segments of management. There are offered different software products, which preserve information systems partially or completely, but they are different from the original project by their structure and various functions for facilitation user's work. We mention the information systems from home software companies such as the Softteam, Aurus, Datalock, Kubiko, AGRARIS s.r.o., but also from foreign companies: the

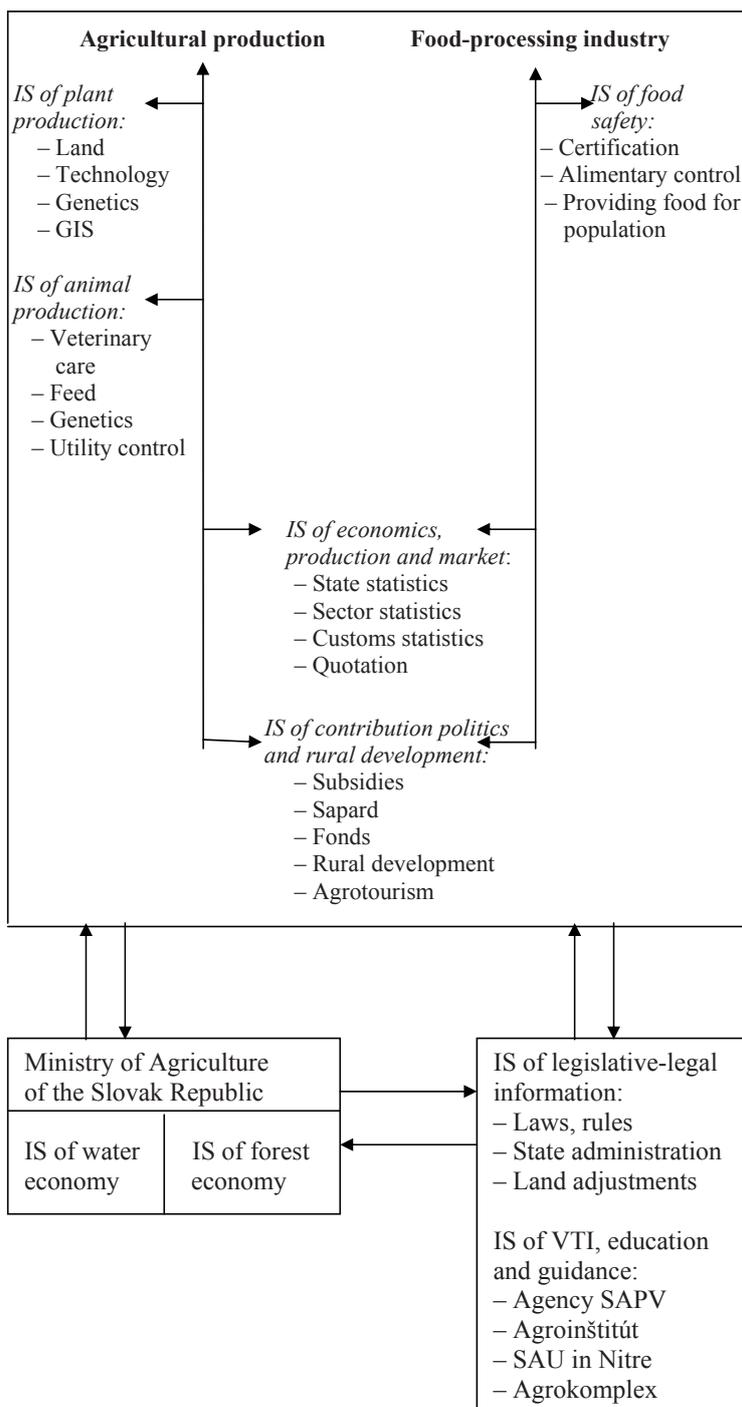


Figure 1. Information systems in agriculture

Source: MPSR and authors

Agrosys from the Siemens company and information system from the KW company.

Information technologies are common ingredients of life of each enterprise nowadays, and the opinions of managers certify the asset of investments into IT – from the results of the research executed under the patronage of the Faculty of Business Economics of the University of Economics in Bratislava which is in residence in Košice in the year 2004, it follows that 23.1% of managers completely agree with the opinion that investments into IT bring the appropriate profits, 55.7% of managers agree with that statement, 18.4% of managers do not know, 2% of managers do not agree and 0.7% completely do not agree, that investments into IT bring the appropriate profits. Most positively, profits of IT are evaluated by the managers from the financial sector, the least profits from the application of IT are expected by the managers from the sector of forestry. Managers from the agricultural sector expressed the agreement with the profits of IT in average.

The originally supportive function of IT is changed into a strong instrument in the hands of managers – there exists a strong dependency between entrepreneurial strategy and information system in the enterprise. The possibilities of IS in the enterprise condition the future development of the company – promotion in the market, the price of products and the growth of labour productivity are more and more dependent on the applied information technologies and systems. This is the reason, why knowledge systems are in prominence recently, which we can briefly characterise as “computers equipped with certain knowledge”. Foundation of these systems is the basis of knowledge, which is made by specialists. Knowledge systems which require mainly specialized knowledge to solve professional problems are named expert systems.

Expert system is a computer program which uses knowledge and solving methods to solve problems, because they are insofar complicated that their solution requires a considerable human and professional knowledge. Expert systems use heuristics to simulate the process of decision making of human expert at solving the complicated tasks and using professional knowledge accepted from the expert and enciphered by an appropriate method with the aim to reach the quality at the level of expert in the chosen area of problems. Expert system is a program demanding a lot of knowledge, which solves problems requiring human expertise. The common characteristic of expert systems represents:

– separation of knowledge and mechanisms of their using,

- basis of knowledge,
- dialogic regime,
- uncertainty in the basis of knowledge and data,
- explaining activity.

During the solving of research aim at our department, there was made an expert system for the chemical protection of field and garden plants. Its application is possible in large agricultural enterprises but also in independently managed farms, where it would be a tool for workers responsible for the protection of plants. The basis of knowledge is made in conformity with directives introduced in the list of permitted products for plant protection, it is easily modified and it is possible to expand it for new plants. From our results, it follows that the proposition and creation of expert systems requires considerable finances, from which the main part is spent on overheads and the settlement of operating expenses. It is necessary to give an extraordinary attention to the motivation of experts in the given problem area, for which the expert system is produced, because the acquisition and formularization of knowledge is one of the important building elements of expert system. The quality of the basis of knowledge influences the effectiveness of the whole expert system by the dominant way. It is always a lengthy process of recruitment knowledge from the expert and their coding into the form appropriate for the relevant expert system.

Nowadays, in the market of software products, there is the expert system made by the company AURUS s.r.o. signed as the Agroprofit, which is oriented on planning process in plant production. This system includes in the plan of production the latest results of science and research, products for protection of plants and the accepted strains. It permits to form the suggested situations.

The main advantages of expert systems for plant production are:

- facilitation of implementation of the planning process,
- economic evaluation of plans,
- determination and monitoring of direct costs,
- work only with the accepted strains,
- possibility to use only the registered chemical protective products,
- suggestion of the technological process of plant cultivation,
- realization of the multi-variation solution of plant cultivation with economic evaluation of different variants,
- optimisation of the amount of sidedressing according to the company's possibilities.

Processed basis of knowledge simultaneously permits to solve questions of plan, protection, techno-

logical method, sidedressing and selection of strains at the high professional level.

DISCUSSION AND CONCLUSION

Intensive implementation of information technologies into the varied areas of business in agriculture brings an assembly of a big amount of various data. Agricultural enterprises assemble the data from production, selling, administration and other internal and external areas. During the shorter or longer period of time, there is accumulated a lot of data depending on the intensity of the individual processes. The data in this basic form do not mean for the company information or knowledge, which are necessary for the management of company. Businesses concentrating, during the work with data, mainly on their collection are often in the situation when they know that they have certain data, they know where to find them approximately, but they do not get them in the appropriate form or combination and so mainly managers are impoverished.

From the realized analysis, we can state that information systems applied in agricultural enterprises do not provide enough necessary information either for operative or tactical management. They register and evaluate predominantly past activities for demands of the accounting evidence and controlling of plan fulfilment.

For the information needed in the decision making process at each level of the management, it is indispensable to make information systems on the basis of the united data base. The specific character of agriculture requires monitoring of biological information, too. In our conditions, it is important for farmers to obtain the information about various breeds of animals and their efficiency, about plants and conditions for their cultivation. Nowadays, it is actual to monitor the information concerning environment. In prominence there are the rules and standards to discover the quality of land, atmosphere, water, determination of the exact procedures and methods for the communication with international databases. It is needed to solve the complicated and algorithmically demanding tasks in the area of decision-making and management by using heuristic methods. In the area of economic decision-making, this trend results

into the constitution of a special type of systems on support of decision-making. We mean the systems equipped by programs permitted to solve problems on the basis of knowledge. Knowledge systems seem to be the perspective systems working on certain complicated specific knowledge – expert systems. While the classical program transforms input data according to the exactly defined program, there is the transformation of input data managed by the basis of knowledge in the expert system.

Creation of the expert system is useful when its creation substitutes, facilitates and supplements information needed for user to solve his concrete problems. The advantage of expert systems is the ability to offer the actual information selectively, pointedly and in the appropriate extent.

The future fine-tuning of management of each production system in agriculture will not be managed without the perfect awareness of the managers. In this case, there is a quantity of possibilities for the fulfilment of expert systems mainly in the area of operative, tactical and strategic management. The creation and application of expert systems in agriculture and food processing industry enables to exercise scientific methods in the management of agricultural and food processing enterprises and on the basis of the provided information to produce assumptions for steady reaching of prosperity.

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