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MARKET ANALYSIS OF SOFTWARE TO SUPPORT DECISION MAKING FOR FARMS IN POLAND

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Abstract

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The article analyses the market of computer software offered to farms to support production and management decisions. It is the first Polish attempt to make a complex quantitative and functional analysis of the supply of such software. It comprises the offer of 25 major companies and scientific institutions manufacturing and offering software for agriculture. Eighty applications of different types and usage were subjected to analysis. The investigations proved that nearly 73% of the applications were used to support decision making in plant production, 21% in animal production and only 6% were the applications used for management of the whole farm. The results of the analysis revealed that the most applications, i.e. 30.6% were used in precision agriculture, nearly 22.5% in herd management and slightly more than 13% in plant production. As far as the aspect of the functional mobility of the software is concerned, the results of the analysis showed that 13.7% of the applications had a mobile character, whereas in 86.3% of the cases it is the software for desktop computers. Besides, some applications are compatible with on-board computers installed in machines and appliances and with the Personal Digital Assistant (PDA). As results from the analysis, more than 81.3% of the applications under consideration are offered by private businesses and 18.7% are offered by scientific institutions. As far as the licence cost is concerned, the companies provided licence fees on websites for 40% of the applications. Furthermore, in consequence of the analysis the most important functionalities of individual applications were presented with division into the areas of use in farms. The market of computer applications for agriculture is developing dynamically in Poland, mainly due to the development of the significance of precision agriculture and decision-making support systems.

Key words: market analysis, software, farm, decision-making support system

Introduction

In 2010, the total value of the Polish IT market was nearly 30 billion dollars, 12% of which was the value of software manufactured and licensed. There is no data on the share of the software for farms in the total value of the software market. The marginal share of such applications in the total value of the software market causes this fact. However, this does not depreciate the role and dynamics of the development of software for agriculture. For many years, we have observed the development of different types of decision support system (DSS) software in production management on farms. The development of software goes along with general trends in the development of farming equipment, machines and appliances. More and more often, the software is compatible with positioning technologies - Global Positioning System (GPS), identification technologies - Radio Frequency Identification (RFID), data transfer technologies - General Packet Radio Service (GPRS) or on-board computers installed in machines. The basic trend in the development of software is technological and equipment progress in precision agriculture (PA).

From the point of view of farmers and manufacturers of means of production the greatest challenge precision agriculture faces is to make production cost-effective. It is difficult to estimate the economic viability of investments in precision agriculture systems although the advantages for the environment are obvious. Politicians have positive opinion about them, but the industry will make large-scale investments only on condition they are profitable (Stafford, 2007).

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The role of IT solutions in controlling internal processes in the enterprises of the farming and food sectors should provide monitoring, control and support of the effectiveness of actions. Moreover, complex process management (Schiefer, 2004) should support the complex development of IT solutions.

Information management is becoming a more and more challenging task for farmers, especially as far as the quantity of data and complexity of precision agriculture processes are concerned. One of the most demanding functions is data acquisition. The mobile phone and other mobile devices and various sensors in farming devices are capable of collecting a large amount of data at work. The automated data collection process may be the basis of the control of agricultural production by information transfer. However, the use of this information is limited due to the lack of full hardware and software compatibility and due to different data formats (Steinberger et al., 2009).

Due to the complexity and complication of information technologies, including decision support systems (DSS), farmers have generally pessimistic approach to them. In some decision-making areas the use of models is intensified by the user's awareness of the problem, thus providing extra insight into the usually complicated decision space. However, if farmers want to make their production more cost-effective, decision support systems need to be further developed and improved. Interdisciplinary research and orientation to the end user's needs seems to be key factors to further progress (Kuhlmann and Brodersen, 2001). In order to take effective management actions, which may be decisive to the future and development of the enterprise, the managing staff should have appropriate IT tools supporting the management process and strategy. The system should facilitate collection of information and give possibilities to make appropriate analyses and assessments of the activity of the enterprise and their results should enable the application of alternative solutions in the management process (Wajszczuk et al., 2009). In order to achieve higher and higher levels of clients' satisfaction, allowing for continuous changes, IT systems are subject to continuous evolution (Ullah et al., 2010).

Pl@nteInfo® software is a good example of a decision support system which uses the World Wide Web to provide farmers and advisors with agricultural information in order to support decisions in crop management. The subscription system of use enables individualised information. Basic data are collected from different sources. Then they are processed by the decision support system and the results are integrated with experts' interpretations and links to extra information. The presented solution shows a system of appliances supporting the decision-making process and a subscription system by means of cooperating web servers and technological solutions for creation of real-time personalised information. An example of this software shows that it is possible to build Internet decision support systems, where individual counselling is provided in real time, on the basis of users' profiles from dispersed data and decision models (Jensen et al., 2000).

As results from the analyses made in Poland so far, farmers are ready to accept IT solutions supporting the production process on their farms. Both computer owners and those without the equipment know that computer software may be useful in farming. This also applies to small area farms. Farmers exchange useful software and they often do not realise the fact that there are appropriate applications and it is only necessary to find them. Thus, indirectly the investigations revealed the low effectiveness of software manufacturers' marketing actions addressed to farmers. Probably farming counselling centres are also to blame, as they do not spread such information (Cupiał, 2008).

Other research showed the possibilities to apply specialised engineering software to support risk management and analysis in farming production. The research describes the problem of risk in farming production and services related with agriculture. It also presents individual stages or risk management. Next, there is an overview of the possibilities to apply computer software to support risk management in farming production. The researchers found interesting computer systems for the management of certain risk types and they observed the absence of a complex approach to risk management support (Grudziński, 2008).

Separate research concerning the use of decision support systems by Polish farmers proved that 17% of respondents heard of decision support systems but only 11% used the systems. The size of the farms under investigation may also influence the rare use of decision support systems. In small farms, which largely do not produce commodities, there is small demand for professional decision-supporting software. Farmers are insufficiently informed about the availability of programs which might help them manage their farms and which would let them gain measurable advantages. The vast majority – 77% of the surveyed farmers appreciate the significance of computer support in running a farm. However, the younger the farmers, the higher the percentage of positive answers to the question about the purposefulness of the application of computer programs in a farm. Access to the Internet in rural areas is growing and 97% of the farmers who have access to the Internet list it as the chief source of specialised information concerning agricultural production (Francik, 2010). The application of computer software to gain and sort necessary information in farming production processes considerably accelerates and facilitates the decision-making process. However, the practical application of the software encounters certain barriers. It is necessary to provide wider

promotion of computer applications as a tool supporting decision-making processes in farming production and facilitating the possibility to obtain rapid and reliable information. Another barrier to the use of computer applications supporting decision-making processes in farming production is the price of software licences and the complexity of their use, which requires training courses for farmers provided by software dealers (Rybacki, et al., 2011).

Having taken the abovementioned considerations into account, the aim of the article was to make a complex analysis of the market of computer software offered to Polish farms to support production and management decisions. The second aim was to present the major functionalities of individual applications with division into areas of use in farms.

Materials and Methods

For the time being there, is no research or analyses concerning the situation on the market of computer applications for farms. The market of IT tools for agriculture is dispersed. As of today, neither state institutions nor Internet portals responsible for promoting information in the agricultural sector have kept a register of IT tools or businesses.

In order to analyse the output data basic statistical analysis was applied as well as graphic and descriptive presentation of the data. In order to collect complex information concerning the software offered to farmers on the Polish market the researchers analysed the software for agriculture offered by 25 major companies and scientific institutions working in this branch in Poland. The purposive sampling criteria were the availability of information about the applications on the Internet, up-to-date offer and the farmer as the target client. 80 applications offered to farming enterprises were identified, excluding the finance and accounting applications whose use is obligatory, according to the accountancy regulations. Such software was omitted in the research due to its universal application in other branches. The analysis comprised all categories of the software applied and in all fields of the farming activity. The collected information mainly concerned the field of production where the software is used and the purpose of the software offered to enterprises. Besides, the form of availability of the software, software manufacturers, the problem of technical support and the costs of licensing fees were all verified. Additionally, the possibilities of cooperation between IT tools and other transfer and object positioning technologies were assessed, such as GPS, GPRS, as well as forms of data transfer, e.g. Bluetooth, and identification, e.g. RFID. The analysis also comprised determination of the three most common functionalities of those applications, which recurred in the identified applications.

Results

This article is the first Polish attempt to make a complex quantitative and functional analysis. It comprises the offer of 25 major companies and scientific institutions offering software for agriculture. The analysis enabled the researchers to group the companies in the following order:

- companies manufacturing software only for agriculture
- agricultural counselling companies which also manufactured specialised software
- companies offering farming equipment and software to operate it
- companies offering appliances for precision agriculture with software
- scientific units conducting research for agriculture.

Of the companies' offer under analysis 80 most popular applications of different type and use were compared. The analyses of the research enabled evaluation of the software market with several aspects taken into consideration.

The research enabled determination of the areas to which the software for farms is offered. As results from the data shown in Figure 1, 72.5% of the applications were meant to support the decision-making in the branches of plant production. The software was mainly used to register data on soil richness, to keep the register of land plots, to plan sowing, fertilisation, to optimise plant protection and for other purposes. Some of the software was used to register and process data in integrated decision support systems. Nearly 21.2% of computer software was applied in animal production. It was used for such purposes as the registration of animals for veterinary treatment and state of health, registration of milk production, body weight gain and analysis of fertility of livestock. Nearly 6.3% of the computer software under analysis was used for complex management and support of production and management decisions in the whole farm. The functionality of the latter is very wide, which causes them to be time-consuming to operate. As a result, they less popular with

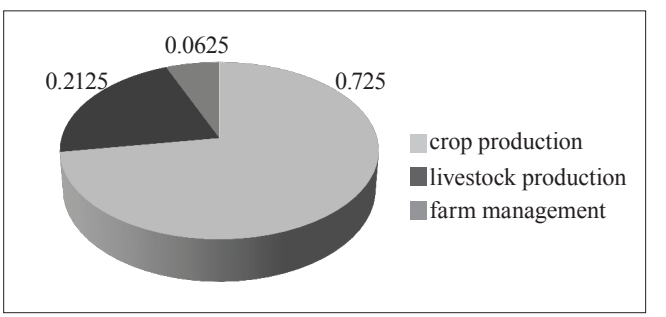

Fig. 1. The areas of use of software in farms
Source: Authors' own research

farmers. Besides, these applications require large quantities of input data at the implementation stage.

Figure 2 presents the results of the analysis concerning the application of software in individual branches of agricultural production. The analysis proved that 30.6% of the applications were meant to support production processes in precision agriculture. The main functionality of such software is used to import, register and process the data concerning the mapping of processes from most GPS appliances. Sowing, fertilisation, spraying, corn density maps are made on this basis. This enables the application of variable doses of crop protection products, fertilisers, seeds or machine operating parameters in order to optimise the use of soil resources and plant production potential. Another group of applications was used for herd management and it made nearly 22.5% of all of the programs under analysis. The range of functionality of such software enables the user to record and register basic data concerning animals, e.g. tag number, origin, breed, age, type. Other functions of the program include the possibility to collect data concerning the nutrition, animal weight gain and milk production volume. The smallest number of applications supports the machine park management, fertilisation planning and chemical plant protection. The share of each of these groups was 4-5% of the total number of applications on offer. Other applications included solutions supporting the calculation of the demand for biomass or risk assessment in agriculture. All information collected in the data registers of the applications, especially the data concerning fertilisation, the use of crop protection products, animal production and feeds applied, is useful as the information for the traceability process, i.e. the monitoring of food origin in farms.

Figure 3 shows the available ways of using the applications. It is possible to use the applications on desktop and laptop computers, on-board computers installed in farming machines, Personal Digital Assistants (PDA) and online. The installation of applications on desktop computers concerns 65 out of 80 computer programs under analysis. 7 companies offered applications for on-board computers. It is possible to access 8 products on the Internet. The companies offered 6 applications for PDAs. Besides, the analysis comprised the possibility of cooperation of individual applications with GPS, GPRS or RFID appliances. The results showed that 12 of the applications under analysis were capable of importing data from positioning and identification devices. As results from the analysis of the types of software according to mobile access, 13% of them are mobile, whereas 87% of them are non-mobile tools (Figure 4). Mobile applications are chiefly found in measurement devices used in the field and in on-board computers in the machines and devices used in precision field work.

Figure 5 shows the results of the analysis concerning the manufacturers, terms of use and technical support referring

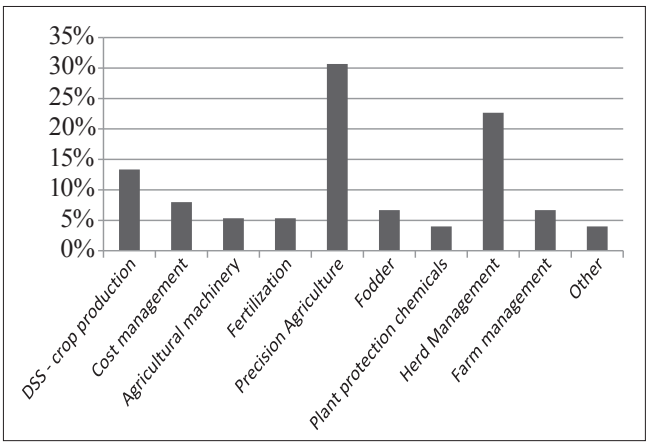

Fig. 2. The analysis of the application of software in farms
Source: Authors' own research

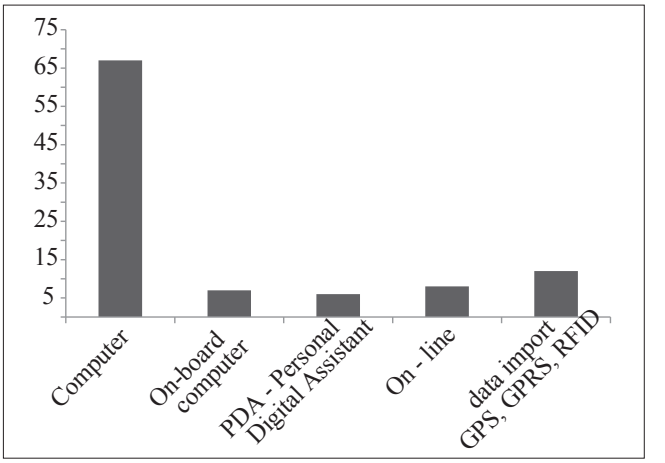

Fig. 3. The ways of using the software and cooperation with other technologies
Source: Authors' own research

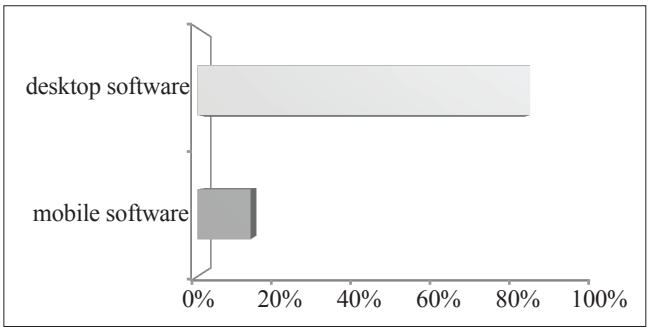

Fig. 4. Types of software according to mobile access
Source: Authors' own research

to the software for agriculture. As results from the analysis, more than 81.3% of the applications under consideration are offered by private businesses, whereas scientific institutions offer 18.7%. There is a similar relation concerning free and paid software. Companies mostly offer paid applications, whereas scientific institutions offer free software. 24% of the programs under analysis are offered with technical support provided via the Internet, whereas 76% of the applications are offered with standard support provided by technical consultants.

Table 1 describes the most common functionalities of the software offered to farms in Poland. The analysis indicated three most important functionalities supported by the programs according to the predefined areas for which the applications are created. The analysis showed that in the first group of functionalities the applications handle basic events in individual areas. Only further functionalities offer services that are more advanced. The most interesting technological functions included those connected with the applications provided to precision agriculture. Besides, the data registers of plant production software may provide numerous information about products in the primary location for traceability systems in food delivery chains.

Figure 6 shows the information on licence fees. In the sample of 80 applications under analysis the websites provided the prices of licence for 40% of them. The fees ranged

Table 1
Major functionalities of the software divided into areas of use

No.	Area of use	Functionality 1	Functionality 2	Functionality 3
1	Plant production	Agrotechnical procedure record	Sowing, fertilisation and plant protection record	Record of plant protection costs
2	Animal production	Herd record; age, weight, sex, traceability data	Health data record	Milk production record
3	Cost management	Resource consumption record	Calculation of plant and animal production costs	Analysis of production cost-effectiveness
4	Farming machines	Machine base	Designing machine units	Specifying demand for machine work
5	Fertilisation	Fertiliser dose setting	Fertilisation plans	Fertilisation history, traceability data
6	Feeds	Feed dose setting	Feed composition setting	Feed component database, traceability data
7	Farm management	Sowing, fertilisation and plant protection planning	Full record of field work	Record of plant and animal production costs
8	Plant protection products	Databases of authorised plant protection products	Data on pests and diseases	Treatment record, traceability data
9	Precision agriculture	Making maps of fertilisation, spraying, corn density, etc.	Plot measurement and registration	GPS, GPRS data record and analysis

Source: Authors' own research

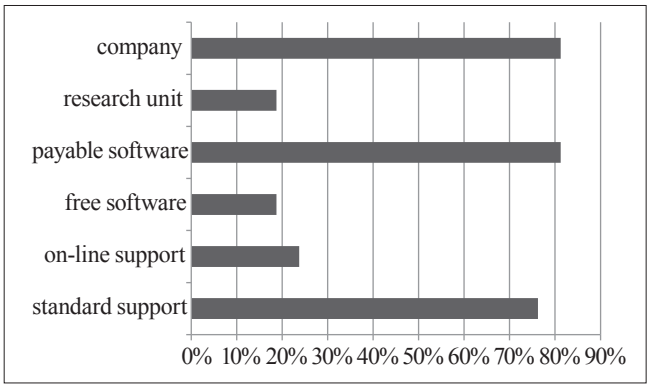

Fig. 5. Manufacturers, terms of use and technical support for the software for agriculture
Source: Authors' own research

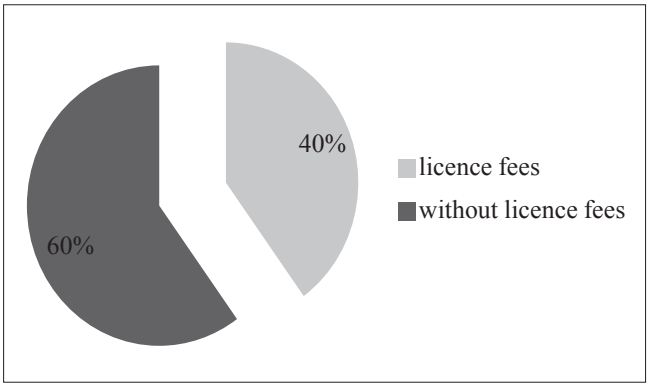

Fig. 6. Information on licence fees
Source: Authors' own research

between 20 and 1200 euros. The price of the licence depended on the number of PCs and on the range, the number of modules and functionalities of the application. On the other hand, 60% of the companies offering the applications did not provide the licence fees on their websites.

Conclusions

The analysis of the software enabled us to see the scale of use and the structure of the market of computer applications offered to agriculture. The results of the analysis showed the areas of agricultural production for which companies and scientific institutions offer the largest number of applications. At present 72.5% of applications in the Polish market are made in order to support the decision-making process in plant production, where some of them support the processes of production and management, whereas others are used to support the agrotechnical treatment in precision agriculture. As far as the areas of use of the software are concerned, 30.6% of the applications were meant for precision agriculture. Private companies offer more than 81.3% of the applications under consideration, whereas research units provide 18.7% of them. According to distribution, scientific institutions usually offer their software free, whereas companies charge fees. Companies offer technical support for the operation and development of applications via the Internet for 24% of the software under analysis, whereas for 76% of the applications they offer standard support. 6 out of 80 applications under consideration can be used on mobile PDA appliances. Twelve of the applications under analysis can be used with such positioning and identification appliances as GPS, GPRS or RFID. The research showed that 13% of the applications were meant for mobile use, whereas 87% of them could only be used on desktop computers. The analysis of the functionalities of the applications in individual areas of use resulted in a presentation of the software capability of cooperation with modern identification, positioning, data transfer and reception technologies as well as its capability of collection and storage of the data necessary to monitor the origin of agricultural products to ensure food safety. The prospect for development of the software for farms includes trends in the development of precision agriculture and, in consequence, the technological progress in agricultural infrastructure, traceability system and electronic platforms of agricultural information and data exchange. The results of the research showed that the market of software for farmers offers a relatively wide range of applications, thus meeting farmers' needs. The market of applications for precision agriculture is developing particularly dynamically.

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