COMPUTERIZED SYSTEM OF ECONOMICAL INFORMATION: ITS INVESTIGATION AND ORGANIZATION IN AGRICULTURE

Povilas Domeika

Lithuanian University of Agriculture Lithuania

Agricultural management information mostly consists of economical information. As it has been proved by Lithuanian and foreign researchers, it provides up to 60 per cent (and more) of the knowledge necessary for agricultural enterprises management. This article shows the organization of computer-based information system (CBIS) to get the economical information in agriculture. The contents of the works done on CBIS functional organization and the achieved advantages are given in the article. The presented results are based on the author’s investigations of primary information received in agricultural enterprises and farmers’ farms in different levels of control and referring to the analysis of published articles by Lithuanian and foreign researchers.

Key words: economical information, computer-based information system (CBIS), computerized database (CDB), users of information, Lithuania.

JEL Classification: C81.

Introduction

Information as well as money, job and other traditional reserves has become very important. Information technology depends on hardware and software used to collect data, to transmit and to process it as well as to disseminate it in the enterprise and other organizations. The methods determining the ways, how to use the equipment are also very important [Barckute, et al, 1997].

The management information system depends on a lot of enterprises, farmers’ farms and organizations, which supply information, and on a number of users. This system contains technical, technological, economical, geographical information as well as the information about studies (specialist training), production, etc. The economical information makes up about 60 per cent (and more) of all the information necessary in agricultural enterprises management. That is why it is important to investigate the structure of economical information and the needs for it in different levels of control in agriculture.

The economical information systems in agriculture until CBIS creation had the following shortcomings:

• economical information was stored in various institutions and it took much time to find and to use it;
• a shortage of operative economical information prevented the analysis of agricultural production development, it forecasting and to make reasonable management decisions in different regions of the country.

Organization of computer-based information system has enabled to avoid all the above mentioned difficulties and to improve the information supply to managers in agriculture.

The object of investigation is the needs (torrent) for economical information and CBIS functional conditions.

The aim of research is to investigate the torrent of operative economical information in agriculture and to define the main aspects of CBIS organization in practice.

Methods of research. The research was carried out by using several methods. The needs and the torrent of economical information were analysed with the help of questionnaire and literature studies. The forms of accumulation and dissemination of the primary information were analysed by means of the projection-calculation method. The structure of economical information was investigated by using statistical methods. Monographic method was used in common analysis.

Information system and the cycle of its existence

Information system may be defined as a set of interrelated components that collect, process, store and distribute information to support the enterprise activity, decision making and control. Information is the basis of the enterprise activity and therefore the systems of information must be developed, especially in the country which companies were privatised and process of transition from command to market economy has been started [Vamosi, 2005].

1 Prof. Dr. Habil. Lithuanian University of Agriculture, Department of Accounting and Finance, Universiteto g. 10, Akademija, LT-53361 Kauno r., Lithuania; tel.: +370 37 752249; e-mail: povilas.domeika@lzuu.lt
Information system can not exist without people – the creators and users. This system is a set of people, data and procedures that work together to supply useful information [Lucey, 1991]. The parts of this system contain different business operations such as information transmission, economic control and decision making. Modern information systems can not do without computers and other technical means to put information in order. In this case they are called as computer-based information systems (CBIS).

An information system (IS) is a data processing system including people, technical means and financial resources. It is the system, which creates and distributes information [Lithuanian Ministry, 1998]. IS performs such common functions as taking the data from the enterprise, processing it into information, storing it in the computer memory and at last giving it to users (specialists, producers, managers, etc.). The Americans, who investigated IS [Landon, et al, 1994] have distinguished following 4 components which perform some functions (Figure 1):

- **input** when primary data are collected from the enterprise or environment and transmitted to IS;
- **processing** when the data are classified, calculated and IS gives the results;
- **output** gives the results of processing, i.e. the new knowledge, which is necessary to control a certain system. They are transmitted to managers, specialists, etc.;
- **feedback** is a report to the system, which influences the final result and enables to change the operations of the system.

 Depending on the type of feedback the system may be closed or open one. Closed systems are the ones, which have feedback only inside them. In open systems feedback also functions from the outside. The carried out investigations prove that the computerized system of economical information in agriculture is open. It has the following general characteristics of IS:

- centralized accumulation of data, its storage and processing;
- full accessibility and operative transmission of information to users according to their inquiry and needs;
- providing enough information and it help in avoiding the redundancy of information when the same data may be duplicated;
- flexibility, i.e. capability to easily modify CBIS parameters taking into account the needs of users [Tiori, 1985];
- capacity and efficiency [Meilus, 1993] when having a lot of users.

It is difficult to give a brief description of desired IS when information must be provided to state institutions and to regional or county users. This problem can be solved by analyzing the accumulation of information in the most common state and territorial levels [Buitkus, et al, 1996; Simanauskas, 1997].

IS of enterprises is the most known and investigated one. The structure of a specific IS depends on the characteristics of the managerial work. All IS of this kind are autonomous, nevertheless the problem of their integration and expansion must be solved [Domeika, et al, 2004]. IS of enterprises can get some service from other (higher) systems and to use their technical and programming means or the reserves of information. IS of enterprises is the source of information for many other IS in territorial and state control institutions. All IS are created by observing the same requirements for the procedures of accumulation, storage and transmission of information to the users of various levels. Organization of IS requires observing the same requirements for the procedures of accumulation, storage and transmission of information to the users of various levels. Organization of IS requires observing the cycle of its existence, which shows the stages of a computer network, programs and databases development, the ways of document forming and control.
All this must be done to unify the order of the system organization and to bring it closer to the world standards [Lithuanian Ministry, 1998].

Foreign researchers [O’Leary, et al, 1989] give five steps of the system existence [Figure 2]:
1) system investigation, when the needs for information and the ways to give it are determined;
2) system analysis, i.e. the investigation of the torrent of information;
3) system design;
4) system implementation in practice, i.e. software creation and testing, personnel teaching and, if is necessary, project (technology) improvement – the so called testing cycle;
5) maintenance of the system (maintenance cycle) when IS is estimated to find out how it satisfies the informational requirements of various users and, if is necessary, is modified.

The above analysed IS characteristics helped methodologically in preparing of CBIS. The computerized databases of economical information in agriculture must be organized following the common principles of CBIS organization and based on evaluation of the specifics of primary data collection, its registration, transmission and dissemination.

Investigation of the needs for economical information

According to the European Union standards and FADN (Farm Accountancy Data Network) requirements the accumulated information should enable to estimate the activity and the results of agricultural enterprises and farmers’ farms and help to forecast their expansion. Moreover, CBIS should satisfy the needs of information users inside of country. The legitimation of agricultural accounting methods, its protection by Government and advisory institutions [Jack, 2006] became indeed very important in process of organization of CBIS.

The needs and the torrent of economical information have been investigated in agricultural departments of six regions of Kaunas County, in the departments of Lithuanian Ministry of Agriculture, in Lithuanian Agricultural Advisory Service (LAAS) bureaus, in agricultural enterprises and farmers’ farms. In addition the investigation of torrents of economical information has been carried out observing the requirements of the European Union Commission and taking into account the experience of such Nordic states – EU members as Denmark, Finland and Sweden [Domeika, 1997, 1998].

The torrent of economical information may be expressed by various indices – in different units of measurement [Landon, et al, 1994]. Different methods, found in scientific publications, may be used to measure the torrent of information. Lately such economical index as an integrated unit of measurement has been used for this purpose. This index consists of two parts, the numerical bases and property indications. The numerical bases characterize the quantitative features of every object or process. Property indications describe the circumstances of the formation of numerical bases, i.e. they show qualitative properties of the object. The torrent of economical information may be expressed by the quantity of numerical bases, which may be grouped according to coded property indications.

The economical information received from the respondents of agricultural enterprises and farmers’ farms is the main torrent of information forming the information system of economics.

The amount and structure of primary economical information received from agricultural enterprises and farmers’ farms are identical. The carried out investigations [Domeika, et al, 1997-1999] showed that agricultural economical information, which characterizes the activity of an agricultural enterprises and farmers’ farms,
and satisfies the requirements of the European Union Commission and of Lithuanian agricultural control institutions, makes up 24079 economical indices (Table 1). The maximum quantity of economical indices received from agricultural enterprises and farmers’ farms and transmitted to computerized database (CDB) a month, a quarter, a year has been counted. In reality the number of indices transmitted to CDB is lower because respondents do not provide all foreseen indices of primary data except those, which grow up in the activity of an enterprise and which show its specialization.

Table 1. The torrent of primary economical information at agricultural enterprises and farmers’ farms respondents of Lithuania (in economical indices)

<table>
<thead>
<tr>
<th>Title of primary economical information</th>
<th>Amount of economical indices would be transmitted to CBIS per:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a month</td>
</tr>
<tr>
<td>1. Area of land ................................</td>
<td>-</td>
</tr>
<tr>
<td>2. Structure and change of long-term and current assets .......................</td>
<td>-</td>
</tr>
<tr>
<td>3. Labour expenditure at farmers’ farm ..................................</td>
<td>-</td>
</tr>
<tr>
<td>4. Average number of employees, labour expenditure and payment in agricultural companies ..................</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total resources of production:</strong> ......................................</td>
<td>-</td>
</tr>
<tr>
<td>5. Crop area and harvest .............................................</td>
<td>-</td>
</tr>
<tr>
<td>6. Variable costs in crop production ...................................</td>
<td>-</td>
</tr>
<tr>
<td>7. Balance sheet of crop production ...................................</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total in crop production:</strong> ......................................</td>
<td>-</td>
</tr>
<tr>
<td>8. Number of livestock and poultry and its change ..........................</td>
<td>3696</td>
</tr>
<tr>
<td>9. Variable costs in livestock production ..............................</td>
<td>-</td>
</tr>
<tr>
<td>10. Balance sheet of livestock production ..............................</td>
<td>-</td>
</tr>
<tr>
<td>11. Feed consumption ..................................................</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total in livestock production:</strong> ..................................</td>
<td>3696</td>
</tr>
<tr>
<td>12. Sale of crop production .............................................</td>
<td>-</td>
</tr>
<tr>
<td>13. Sale of livestock production ......................................</td>
<td>2032</td>
</tr>
<tr>
<td>14. Processing of agricultural products, sale of other products and services ..................</td>
<td>712</td>
</tr>
<tr>
<td><strong>Total in solds:</strong> ..................................................</td>
<td>2744</td>
</tr>
<tr>
<td>15. Private farms internal usage for own needs ................................</td>
<td>-</td>
</tr>
<tr>
<td>16. Stock at processing and agroservice enterprises ........................</td>
<td>-</td>
</tr>
<tr>
<td>17. Permanent costs in farm ...........................................</td>
<td>-</td>
</tr>
<tr>
<td>18. Money means and settlements ...........................................</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total in cash and settlements:</strong> ..................................</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total:</strong> ................................................................</td>
<td>6440</td>
</tr>
</tbody>
</table>

Analysis of economical information structure has determined that different sorts of economical information have various indices. The economical indices of cattle-breeding branch make up the largest part – 62.9 %, the selling of agricultural products and services – 25.7 %, plant-cultivation – 6.5 %, production recourses – 3.5 %, the economical indices of cash means and settlements – 1.4 % of the total amount of counted indices.

From the economical point of view economical indices given every month should make up to 26.8 %, every quarter – 46.3 %, and at the end of the year – up to 26.9 % of the total torrent of information. Economical information must be given to CDB and transmitted to users operatively. Therefore, the largest number of indices must be taken by CDB during all the year, but not at the end of it. CBIS hardware and software were chosen according to the size of the torrent of economical information.

Lately the regional departments of statistics have collected some data, which is necessary for control. This information contains various contents and is given at different periods of time. It includes a small part of production indices and it does not satisfy the needs of information users [Kriščiukaitienė, 1997].

Results of the investigations have determined that statistical information makes up to about 18 % of information needed in management. This is not sufficient and does not help to regulate and control agricultural production. Statistical accounting as a kind of economical information does not give operative news about the production expenses in the main production branches and it does
not present indices about the production estimation, money turnover, the state accounts in cash or other important economical indices.

CBIS also has the external torrents of information. External resources of information are the following: the decisions of the government of Lithuanian Republic; IS of statistics; classifiers of the kinds of economical activity and agricultural production; re-counting of foreign currency and other re-counting coefficients; reference books of comparable prices; reference books of current prices in market; normative books of material, work and money reserves, production expenses, etc.

The main part of external information is usually used for a long period of time for economical analysis, planning and activity forecasting. For this reason the information must be stored in CDB servers. The CBIS of economical information is systematically supplemented and modified. The new forms of coordination between the respondents and CBIS activity were prepared.

According to the experience of the USA (University of Minnesota, etc.) and European specialists the economical information must be accumulated and stored for the period of 10 years at least [Domeika, 1997]. This experience has been recommended to the CBIS of Lithuanian agricultural enterprises and farmers’ farms. The results based on scientific research and which would satisfy the needs of information users in Lithuania and the requirements of EU Commission have been used at the period of CBIS organization.

**Organization of CBIS of economical information and it’s functioning**

The scheme of CBIS of economical information functioning when the information is collected from respondents in agricultural enterprises and farmers’ farms has been prepared (Figure 3).

The number of enterprises (farms) was chosen by using the methods of the EU countries that have been adapted in Lithuania. There are two main indices by which the EU countries select farms-respondents: economical size and type of farming. The economical size is expressed in European Size Units (ESU). The EU Commission has determine that ESU is even to 1200 EUR, but this size may be changed under the influence of inflation. According to our calculation it is necessary to have at least 2500-3000 enterprises and farmers’ farms respondents in Lithuania.

Primary economical information is accumulated in two ways:

1) agricultural enterprises (farms) respondents make the calculations and book-keeping of their activity themselves, they fill the data collecting forms and provide them to regional bureau of Lithuanian Agricultural Advisory Service (LAAS), where the information is checked, decoded into personal computer (PC) and, later, transmitted to CDB servers;

2) calculations and accounting of the activity are made by LAAS bureaus; the primary economical information is automatically transmitted to CDB servers.

In both cases the respondents and information collecting LAAS regional bureaus control the truthfulness and reliability of information. The author of this paper has prepared the new forms according to which the primary economical data is transmitted to mentioned bureaus. According to the foreign countries experience the Electronic Data Interchange (EDI) as a function of information technology must be introduced into CBIS and used with higher effectiveness [Arunachalam, 2004; Hakansson, 2004].

A computerized information technology is related not only to PC usage for information processing. This technology also contains other important stages of information performance such as measurement of primary data, its collection, registration, transmission, storage, searching and processes of information presentation to users that directly (or indirectly) influence the effectiveness of computerization. The measurement of primary data, its collection and registration to different carriers of information are labor-consuming transactions. Therefore, some technical means may be used for automizing these operations. The economically efficient agricultural enterprises in foreign countries (Denmark, Germany, UK, etc.) use automatic counters for measurement, transmission and input of primary information into PC. Only separate Lithuanian agricultural enterprises use the mentioned means for this purpose [Domeika, 2002, 2003].

Nowadays receiving and transmission of economical information requires the use of Internet computer network. Accumulated information is processed in automatic way by using the package of applied programs and systematic software of database control.

There are prepared the reference books of permanent information (price-lists, various coefficients, etc.) and classifiers of economical information. Some legalized classifiers existing in Lithuania are known as “Classificatory of Types of Activities” and “Classificatory of Products According to the Type of Activity (CPA)”. CBIS of economical information satisfies not only the needs of the European Comission but also the needs of economical information inside country. To meet these needs are prepared the economical classifiers of the enterprise types, objects of assets, the objects of production expenses and other economical indications.

The classifiers enable to group economical information automatically. They help to form the search of information in CDB servers according to the users request and information, which is needed in management control. Foreign researchers [Malyhina, 2004] attach great importance to the data base management system (DBMS), which contains software. DBMS is used for creation of database, maintain its content, make it suitable for the one who makes decisions (user) and protects data resources against unauthorized access.
Various specialists and managers in their computerized working places constantly form the requests for receiving secondary information, e.g. about existing material and financial resources on certain date, direct production expenditure, cash flows, financial results of certain activity, etc. [Argiles, 2003]. The forms of secondary information for its users have been projected by author and implemented into CBIS of economical information of agricul-
ture. The CDB server administrators determine the possibilities and the users rights to receive certain economical information.

**CBIS advantages and its effectiveness**

CBIS of economical information after it implementation in practice is useful in many aspects. Its availability may be expressed not only in qualitative but in quantitative indexes [Domeika, et al, 2000, 2002]. It is convenient to group the expenses into the granted (paid only once) and current ones. The efficiency of the mentioned systems is characterized by direct, relative and hardly predictable benefit indexes. An achieved quantitative effect could be calculated by comparing CBIS work income and expenses. The income may be calculated according to the determined valuation rates, which have not been determined yet. The most appropriate one is the Expenses-Benefit method, which separately calculates expenses and benefit. The efficient governance of companies is based on operative use of financial and management accounting information [Bushman, 2001].

The experience of the economists in Japan, USA [Korolev, 1968] and other countries shows that the direct quantitative effect of any CBIS is negative in spite of the fact that this effect may be calculated and expressed in some sum. The losses of CBIS work are usually covered by state subsidies or by the special fund for this purpose.

The main indexes of CBIS efficiency are qualitative indexes, i.e. the availability and the reliability of the information itself. Other very important indexes are:

- operative and automated accumulation and processing of economical information in CDB servers;
- operative supply of the producers of agricultural products with information about the expenditure of production, market prices, etc.;
- provision of operative economical information about the agricultural production (and other kinds of business) development trends, accounts in cash, etc. to managers and specialists of all levels (region, county, republic);
- transmition of economical information from CDB servers to users working place according to their formed inquiry when the volume of information and period of time are indicated;
- possibility to analyze and forecast the development of agricultural activity in republic or in its separate regions because the information of the last ten years is stored in CDB servers;
- meeting the needs of economical information not only in our country but in the EU information systems;
- other qualitative indexes.

These qualitative parameters are expressed as the factors of efficiency. A graphical method or method of calculated factor may be used for more integrated technologies, which would be organized in the nearest future.

**Conclusions**

On the basis of the carried out investigations on the organization of CBIS of economical information the following conclusions have been made:

1. The needs and the torrent of economical information have been investigated observing the requirements of Lithuanian users and the EU Commission taking into account CBIS organization peculiarities and the experience of Nordic states (Denmark, Finland, Sweden, etc.).

2. The technology of CBIS of economical information has been prepared on the basis of the results of investigations and adaptation of the programs used in EU countries.

3. Investigations and implementation of CBIS of economical information have given the following results of great practical importance:
   - defined the torrent of operative economical information, which meets the needs of both the information users in Lithuania and the EU Commission;
   - implemented newly projected forms to collect and transmit primary economical information to CDB servers; based its contents and periodicity of presentation;
   - implemented the forms of secondary economical information transmission to users;
   - the main requirements to the computer network, servers, control system and applied software have been newly implemented or adapted;
   - the advantages and expenses for CBIS organization and its maintenance have been determined.

4. Observing the experience of the USA and European countries accumulation and storage of the economical information in CDB for at least 10 years have been proposed.

5. The effectiveness of CBIS of economical information may be expressed in the quantitative and qualitative indexes. Integration of the main kinds of economical information in CBIS is one of the factors influencing the efficiency of information systems. At the same time these elements of CBIS functioning required to continue our investigations in the nearest future.

**References**

ment in Economic Systems // "Ekonomika" ["Economics"]; Proceedings of Vilnius University (Lithuanian language – L.I., sum-
agement Informatization in Lithuania // "Ekonomika" ["Economi-
cs"]; Proceedings of Vilnius University (L.I., s.E.). ISSN 1392-
corporate governance // Journal of Accounting & Eco-
nomical Information in Agricultural Enterprises and Farmers’
Farms respondents in Regions of Kaunas County // Annual report of
the scientific research. Chairman – prof. P.Domeika, Lithuanian
University of Agriculture (L.I., s.E.). – Kaunas: Akademija. – 244 p.
ture of the Economical Information in Agricultural Enterprises and
Farmers’ Farms for the Projection of Lithuanian Agricultural In-
formation System // Annual report of the scientific research.
Chairman – prof. P.Domeika, Lithuanian University of Agricult-
9. Domeika P. (1998) Torrent of Economical Information and Its In-
vestigation in the Management Systems of Agriculture // Proceed-
ing of the International scientific conference “Economics and
Management ’98”, Kaunas University of Technology (L.I., s.E.). –
Kaunas: Technologija. – P. 89-90.
and Outlines of Its Projection // Proceedings of the scientific confer-
ce “Agrarian Economics and Management”, Lithuanian Uni-
nomical Information, Its Content and Projecting in Agriculture //
Proceedings of International scientific conference "Science of
Agrarian Economics: Development and Problems", Lithuanian
tion in Agriculture: Its Investigation, Projecting and Conception of
Organization // "Inžinerinė ekonomika" ["Engineering Econom-
icss"]; Proceedings of Kaunas University of Technology (L.I., s.E.).
of Computerised Accounting Technologies // "Inžinerinė ekon-
omika" ["Engineering Economics"]; Proceedings of Kaunas
University of Technology (L.I., s.E.). ISSN 1392-2785. Nr. 4(19).
Technology at Integrated Agricultural Accounting Systems //
"Vagos": Proceedings of Lithuanian University of Agriculture
(L.I., s.E.). ISSN 1648-116X, Vol. 54(7). – Akademija: LUA
printing-house.- P. 21-27.
of Economical Information and the Trends of Its Improvement //
"Vagos": Proceedings of Lithuanian University of Agriculture
(L.I., s.E.). ISSN 1648-116X, Vol. 56(9). – Akademija: LUA
printing-house – P. 55-61.
16. Domeika P. (2003) Computerization of Primary Economical In-
formation in an Enterprise // "Vagos": Proceedings of Lithuanian
University of Agriculture (L.I., s.E.). ISSN 1648-116X, Vol.
Economical Information in Enterprise: Types, Integration and De-
velopment // "Vagos": Proceedings of Lithuanian University of
Akademija: LUA printing-house. – P. 79-84.
18. Hakansson, Hakan et al. (2004). Accounting and network coordi-
nation // Accounting, Organizations and Society, Vol. 29, Issue 1,
p. 51-72.
Create an European Information System (L.I.) // Journal "Žem-
ąkis" ["Agriculture"], Nr. 4. – P. 9-10.
tion Systems: Organization and Technology. Third ed. – New
22. Lithuanian Ministry of Communications' and Informatics (1998)
p.
23. Lithuanian Ministry of Communications' and Informatics (1998)
Information Systems. Requirements for Project Specifications
a new reality of everyday life // The British Accounting Review,
Vol. 37, Issue 4, p. 443-470.
Сокращенный перевод с японского. Под общей редакцией с
предисловием М.А. Королева. – Москва: "Прогресс", – 184 c.
29. Тюрин Т., Фрай Дж. (1985). Проектирование структуры баз
данных. В 2-х кн. Кн. 1. Пер. с англ. – Москва: Мир. – 287 c.
30. Малыхина, М.П. (2004) Базы данных: основы, проектирование,