Integrated Information and Communication System as a Basis for Strategic Partnership in Agribusiness

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Abstract. The article is devoted to the study of the conditions for information and communication system (ICS) implementation into the practice of agribusiness management. ICS is proposed to be integrated on micro-, meso- and macrolevels by means of joint bases creating and modern geoinformation systems applying. Organizational and economic preparedness of agribusiness companies for the integrated ICS implementation is researched. There have been distinguished the seven factors which contain the appropriate combination of variables and substantiate the allocation of management influence priorities in the context of the integrated ICS implementation. It is assumed that the integrated ICS will make possible to provide the strategic partnership between agribusiness companies, public bodies and society. The integrated ICS could also serve as a basis for consolidated strategic planning in agribusiness.

Keywords: information and communication system (ICS), organizational and economic preparedness, agribusiness companies, geoinformation system, precedent base.

1 Introduction

Agrarian sector is currently facing the unceasing diffusion of information and communication innovations which prospectively enable the emerging of research problem on accessibility preconditions for information and expert maintenance of agribusiness companies' processes.

Problems of the system approach to information and communication providing of agrarian production processes were considered in works of number of scientists such as S. Meera[1]; M. Salampasis, A. Theodoridis [2]; K. McNamara, C. Belden, T. Kelly, E. Pehu, K. Donovan [3]; C. Brewster, S. Wolfert, H. Sundmaeker [4]; F. Teye, H. Holster, L. Pesonen, S. Horakova [5]. The problem of the establishing of information and communication processes in agrarian production management not once became the subject of discussion among the Ukrainian scientists: in terms of state regulatory policy [6] as well as in terms of the configuration of geoinformation systems for agrarian production [7].

There is a need for a conceptual solution to the issue of developing the integrated ICS, based on the implementation of geoinformation technologies. It is anticipated that such an integrated system will enable the operative access to geoinformation knowledge bases for as many users as possible.

2 The Analytic Foundation for ICS Implementation Conditions in Agribusiness

Efficiency of applying of ICS in agribusiness is considered in the spectrum of social, financial and managerial problems, and according to the conditions of the agriculture economy development. There is a rich experience in implementing ICS in agribusiness of different countries. But this experience is unique for each country due to the unique combination of such conditions as conglomerate of opportunities, individual perception, level of qualification, financial capacity, forecasting of the implementation results, national economy dynamics etc. Therefore, this study is aimed to uncover the combination of the factors for perception and possibility to implement ICT in agribusiness companies of Southern Ukraine.

Enhancing the efficiency of agribusiness companies is undoubtedly in the scope of prior public interests; therefore, the idea of developing a corporate (based on the integration of public and private efforts) ICS for agribusiness management is proposed. These studies could become a platform for establishing of a state program for ICT development in agribusiness.

There is a notion of "farmers' perception of the ICT effectiveness in information disseminating» appears in the professional literature source [8]. The significance of factor for understanding the strategies of information communication by agricultural production subjects in relation to the climatic risks management is emphasized in the work of Churi, A.J., Mlozi, M.R. S., Tumbo, S.D., Casmir R. [9]. The obstacles for information and communication projects implementation are revealed by J. Aker; these obstacles are the low motivation of staff, the weak connections between research centers and agrarian structures, lack of funds etc [10].

Within the framework of International conferences and discussions, problems of agro-geoinformatics were considered in the context of government agricultural policy making and decision support [11]. L. Brazil [12] observes some specific influences (availability and prices of inputs; markets for and prices of products; climate change; government policies and regulations; access to credit and availability of loans and grants), and decision constraints (public perception / reaction; international agreements; market access) within the framework of the Decision Support Systems (DSS).

Regarding the experience of using geographic information systems, it is to be mentioned that the program of Global Monitoring for Environment and Security program (GMES) is expected to be implemented in the European Union. This program includes the Global Crop Monitoring project, the updating of terrestrial cover maps (EUROLAND), and the monitoring of rational use of cultivated lands (Agri Environmental Monitoring). In Ukraine, the works in the field of agrarian monitoring automation is carried out unsystematically; especially the development of DSS for agrarian purposes is at the insufficient level. This obviously affects the investment attractiveness of agribusiness.

Besides, the information and communication providing of the agribusiness management has its value features; it is important to consider it as a component of the intangible assets which displays the tendencies for the value formation, capitalization and competitiveness increasing of agribusiness companies. At present it is noticed that the intangible assets are considerably underestimated in the structure of balancesheets of domestic company; thence the opportunity for enhancing of the resource potential due to knowledge-factor is being lost. In Ukraine it is being observed the persistent imbalance in the ratio of investments in tangible assets to the investments in intangible assets (IA), which include the investments in software and databases (fig. 1).

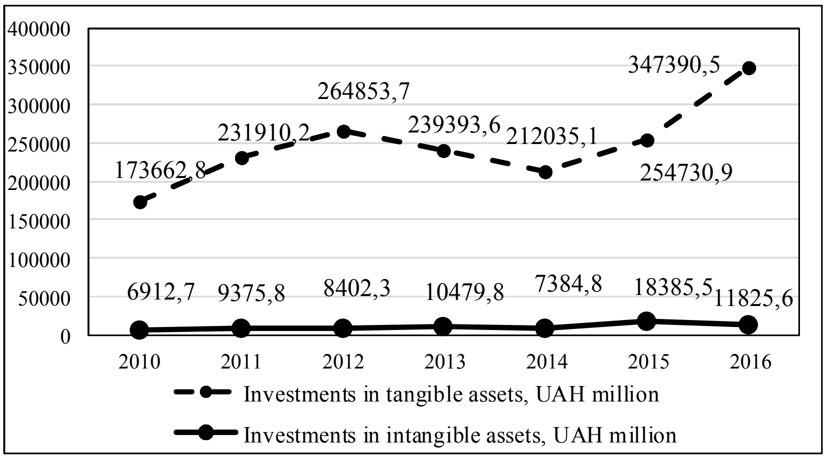

Fig. 1. Dynamics of Capital Investments in Ukraine by the Types of Assets, 2010-2016 [13]

Share of investments in tangible assets remains at level 93.3% - 96.9%. During the period from 2010 to 2016 years the share of investments in software and databases increased barely on 6%. If we compare the amounts of capital investments in software and databases in the regions of Southern Ukraine, it could be seen that Kherson and Odessa regions are the leaders in intellectual potential enhancing (capital investments multiplied by 9 and 2 times respectively). Share of investments in IA is fluctuating between 3 and 6% of overall volume of capital investments. The tendency is positive but not as progressive as we can see from the experience of the leading countries, where the volumes of capitalization due to the intangible assets are being enhanced. Obviously, to enhance the volume of capitalization of agribusiness companies it is necessary to expand and improve their intellectual potential. One of the ways to implement this idea is to establish the integrated ICS that is arranged on the principle of creation of the joint precedent base (knowledge bases) at all management levels of agribusiness companies.

Set of knowledge databases in their interaction forms the ICS knowledge framework. From the methodological point, there can be distinguished the five problem areas of the ICS knowledge framework, presented as A-E sets of methodological basis $\mu_A \div \mu_E \in N$ (Table 1).

Principles of designing and constructing a management hierarchy as the area of ICS knowledge framework impose requirements on production and technological knowledge of agrarian managers, respectively, the potential of the set A is increasing. The specifics of management technologies (set B) assume the development of integrated projects management for rationalization of managerial decisions (on soil tillage, fertilization, crop yield analysis etc.). The methodology for providing stability, adaptation and development of the system (set C) reveals the potential of maintaining the fertility of lands and managing operational processes. The values of set D are related to the intellectual potential formation and aim to increase the share of intangible assets in the total value of business and further business capitalization growth. Set E is responsible for the disclosure of the personnel potential (involvement of project managers, increase of specialists' saturation level, MBO, namely the KPI system.

Table 1. Areas of Knowledge Framework Realization within the Facilities of the ICS Decision Support Systems

Areas of ICS Knowledge Framework $\mu_A \div \mu_E \in N$	**Facilities of ICS Decision Support Systems** $\sum P_{\overline{A;Z}} \to \max$
Principles of designing and constructing a management hierarchy $A = \{x; \mu_A x > 0, x \in X\}$	Increasing requirements for productive knowledge of the management hierarchy subjects $P_A = \mu(X_A) \in A$
Methods and technologies of management based on systems of information and communication support $B = \{x; \mu_B x > 0, x \in X\}$	Implementation of integrated project management methods
	Rationalization of managerial decisions: soil tillage (b_1), fertilization (b_2), crop yield analysis (b_n) $P_B = \begin{cases} \mu(X_{B_1}) \in B_1; \\ \mu(X_{B_2}) \in B_2 \end{cases} (b_1 \cap b_2 \ldots b_n)$
Conditions for providing stability, adaptation and development of the system $C = \{x; \mu_C x > 0, x \in X\}$	Maintaining the fertility of lands (c_1) and managing operational processes (c_2) $P_C = \mu(X_C) \in C; (c_1 \to c_2)$
Intellectual potential formation $D = \{x; \mu_D x > 0, x \in X\}$	Increasing share of intangible assets in the total value of business (d), business capitalization growth (k) $P_D = \mu(X_D) \in D; (d \to \max k)$
Personnel potential formation $E = \{x; \mu_E x > 0, x \in X\}$	Involvement of project managers (e_1), increase of the level of saturation by specialists (e_2), management by objectives (e_3) $P_E = \mu(X_E) \in E; e_1 \cup e_2 \cup e_3$

The consolidation of the DSS facilities forms the aggregate potential of the ICS effectiveness, which is revealed in the synergistic combination of integrated projecting, management of operational processes for agribusiness, the effective management of intangible assets (software, know-how, and databases) and the introduction of personnel management system based on key performance indicators and project management.

3 Analysis of Agribusiness Companies Preparedness for ICS Implementation

In purpose to study the preconditions and to evaluate the preparedness of agribusiness companies to join the integrated ICS (with relevant tools of actual state of agribusiness analysis; planning of technological operations with use of modern GIS and neurotechnologies; opportunities of permanent remote access to geo database), there was conducted the marketing research and analysis of customers preferences among potential participants of the given information and communication process.

Sample aggregation was composed of 120 companies of different types of activities and organizational forms (business associations, private companies, farming companies, production cooperatives) of Kherson, Odessa, and Mykolayiv regions. The initial data array for multivariate analysis was formed according to the results of questionnaire survey where production and financial activities of the companies were described.

There are the following indicators have been integrated in the base of variables:

x_1 – net sales income (NI), UAH million;

x_2 – area of land use (AL), ha.;

x_3 – average account number of full-time employees (FE), persons;

x_4 – share of expenditures on information and technical support in the total expenditures structure (ITS),%;

x_5 – average annual expenditures for information and consulting services (ICS), UAH;

x_6 – coefficient of specialists saturation in the organization (SS);

x_7 – coefficient of share of specialists in the total number of the organization's personnel (ST);

x_8 – profitability of equity capital (PEC), %;

x_9 – profitability of sold agricultural products (PSP),%;

x_{10} – coefficient of autonomy (CA);

x_{11} – coefficient of maneuverability of equity capital (CM);

x_{12} – coefficient of absolute liquidity (CAL);

x_{13} – capital productivity (CP), UAH;

x_{14} – indicator of erosion of arable land (EAL),%;

x_{15} – index of volume of production to previous year (IVP), %;

x_{16} – qualitative estimation of lands by natural fertility (EL), points;

x_{17} – annual volume of investments in information technologies development (VI_{IT}), UAH;

x_{18} – technical and informational armament of labor (TIA), units per person;

x_{19} – coefficient of mechanization and automation (MA);

x_{20} – coefficient of intellectual manufacturability of production (IMP).

Factorial multivariate analysis provided defining the structure of interconnections among output variables; it was based on 120 observations. The obtained data array was verified according to the measure of selective adequacy by Kaiser-Meyer-Olkin (0.627) which testifies to the expediency of factor analysis conducting. As a result of the principal component analysis application, the total variance allocation table was obtained. There are distinguished 7 main components which describe 71.0% of the total variance, with the eigenvalues bigger than 1. As a result of conducted analysis the seven factors have been interpreted (Table 2).

According to the set of variables, the first factor, which has the largest total variance contribution (25.4% of the total variance), is assigned with a linguistic description "Company Size – Investments in Information Technologies". The variables x_2, x_3, x_8, x_{17} have been integrated here; these variables characterize the scale of the company depending on the number of full-time employees, land use, profitability of equity capital, annual volume of investments in information technologies development. In such a combination, these variables demonstrate a pattern that the size of the company is potentially interconnected with the size of investments in information and communication technologies. Indeed, the largest investigated company with 13300 ha of the land use area and 174 persons of full-time employees has a return on equity capital of 25.5%, which is 15% higher than the average among 120 observation objects.

Table 2. Organizational and Economic Preparedness if ICS Implementation in Agribusiness Management: Interpretation of Factors

	Interpretation of factors / total variance contribution	***Factor load***	***Combination of variables***
F1	"Company Size – Investments in Information Technologies" / 25,4%	0.862	x_2 – area of land use
		0.869	x_3 – average account number of full-time employees
		0.697	x_8 – profitability of equity capital
		0.671	x_{17} – annual volume of investments in information technologies development
F2	"Potential Quality of Land Resources" / 12,3%	0.872	x_{14} – indicator of erosion of arable land
		0.862	x_{16} – qualitative estimation of lands by natural fertility
		0.539	x_1 – net sales income
F3	"Financial Capacity for Investing in Information Technologies" / 7,5%	0.695	x_{11} – coefficient of maneuverability of equity capital
		0.684	x_{13} – capital productivity
		0.543	x_{12} – coefficient of absolute liquidity
F4	"Integration of Production into the Field of New Technologies" / 7,0%	0.739	x_{20} – coefficient of intellectual manufacturability of production
		0.708	x_{19} – coefficient of mechanization and automation
		0.627	x_4 – share of expenditures on information and technical support in the structure of total expenditures
F5	"Staff Provision for Science-Intensity of Labor" / 6,8%	0.626	x_6 – coefficient of specialists saturation in the organization
		0.611	x_7 – share of specialists in the total number of the organization’s personnel
		0.575	x_{18} – technical and informational armament of labor
F6	"Volume of Production Concentration" / 6,1%	0.701	x_9 – profitability of sold agricultural products
		0.566	x_{12} – coefficient of absolute liquidity
		0.535	x_{15} – index of volume of production to

			previous year
F7	"Financial Independence of the Info-Communication System Development" / 5,6 %	0.658	x_{10} –coefficient of autonomy
		0.554	x_1 – net sales income
		0.513	x_5 – average annual expenditures for information and consulting services
		0.507	x_7 – share of specialists in the total number of the organization's personnel

The second factor got the interpretation as "Potential Quality of Land Resources" (12.3%), where variables x1, x14, x16 (net sales income, indicator of erosion of arable land and qualitative estimation of lands by natural fertility) have been integrated. The methods of soil-technological zoning of lands and agro-physical observation of land plots were applied to substantiate the positions of precise farming. Such a correspondence is being defined through high correlation between the weighted average bonitet point and the profitability indicator, which is important in considering the companies needs in the information system for correction of anti-degradation measures and the implementation of measures to stabilize land productivity.

The third factor is interpreted as "Financial Capacity for Investing in Information Technologies" (7.5%). Three variables are grouped here: x_{11} – coefficient of maneuverability of equity capital; x_{12} – coefficient of absolute liquidity; x_{13} – capital productivity, UAH. The potential of financing of the information technologies development may be revealed through these indicators.

The fourth factor "Integration of Production into the Field of New Technologies" has 7.0% of the total variance. Here are integrated the indicators of share of expenditures on information and technical support in the structure of total expenditures (0.627 in the component, 1.9% on the average); coefficient of mechanization and automation (0.708 in the component, 0.75 on the average); coefficient of intellectual manufacturability of production as a ratio of the value of intangible assets to the value of fixed assets (0.739 in the component, 0.05 on the average).

Presented combination of variables demonstrates the level of automation in processes of agribusiness companies as well as their preparedness for inclusion in automated production management system based on integrative unity of the ICS. For majority of the investigated companies, the coefficient of intellectual manufacturability of production is lower than 1.5%, which indicates that the intangible assets accounting is incomplete; the intangible assets are underestimated and unconsidered in the turnover. Least of all "banks and databases", "utility models", "innovative offers", "trademarks", "goodwill" are represented among the intangible assets; instead, "software", "rights of property/ land use" are included here the most often.

The fifth factor got its interpretation as "Staff Provision for Science-Intensity of Labor" (6.8%) based on the combination of indicators x_6 – coefficient of specialists saturation in the organization (0.626 of factor load, 0.16 on the average), x_7 – share of specialists in the total number of the organization's personnel (0.611 of factor load, 0.12 on the average), x_{18} – technical and informational armament of labor (0.575 of factor load, 0.05 on the average). In such a combination there could be caught a sight on general tendency of company's expansion or stagnation in the issue of employees' qualification improvement, as well as of potential level of the company's integration into the info communication process.

The sixth factor demonstrates the combination of indicators corresponding to the "Volume of Production Concentration" (6.1%): x_9 – profitability of sold agricultural products (0.701; 19.5% on the average in sample aggregation), x_{12} – coefficient of absolute liquidity (0.566, 0.09 on the average in sample aggregation), x_{15} – index of volume of production to previous year (0.535, 104.5% on the average in sample aggregation).

The seventh factor demonstrates "Financial Independence of the ICS Development" (5.6%). The following indicators are integrated within this component: x_{10} – autonomy coefficient (0.658; 0.42 on the average in sample aggregation); x_1 – net sales income (0.554; 94.2 UAH million on the average in sample aggregation); x_5 – average annual expenditures for information and consulting services (0.513; 2179 UAH on the average in sample aggregation); x_7 – share of specialists in the total number of the organization's personnel (0.507; 0.12% on the average in sample aggregation). The factor reveals not just the financial independence but also the staff independence in the context of the new information and communication system development.

In order to obtain the homogeneous groups (120 companies are classified by 20 features), cluster analysis was applied as one of the methods of multidimensional statistics. As a result of the multivariate cluster analysis implementation, the final cluster centers (homogeneous groups of companies) are obtained. The clusters and appropriate indicator values are represented in Table 3.

Table 3. Evaluation of Agribusiness Companies' Organizational and Economic Preparedness to ICS Implementation: Final Cluster Centers of the Studied Aggregation

Features set	Conv. sign	Clusters			
		1	2	3	4
Net sales income (UAH million)	μ_{NI}	72.0	95.7	1.1	16.4
Area of land use (ha)	μ_{AL}	10812.5	4744.6	648.4	2119.3
Average account number of full-time employees (persons)	μ_{FE}	450.0	135.0	40.0	104
Share of expenditures on information and technical support in the structure of total expenditures (%)	μ_{ITS}	3.0	2.5	0.5	1.2
Average annual expenditures for information and consulting services (UAH)	μ_{ICS}	4000.0	3000.0	0.00	2000.0

Coefficient of specialists saturation in the organization	μ_{SS}	0.15	0.16	0.16	0.17
Coefficient of share of specialists in the total number of the organization's personnel (%)	μ_{ST}	0.13	0.12	0.12	0.11
Profitability of equity capital (%)	μ_{PEC}	38.3	30.5	16.0	21.0
Profitability of sold agricultural products (%)	μ_{PSP}	23.6	18.7	20.2	11.10
Autonomy coefficient	μ_{AC}	0.44	0.70	0.50	0.02
Coefficient of maneuverability of equity capital	μ_{CM}	0.42	0.38	0.35	-0.16
Coefficient of absolute liquidity	μ_{CAL}	0.15	0.19	0.08	0.09
Capital productivity (UAH)	μ_{CP}	1.60	2.12	1.70	2.03
Indicator of erosion of arable land (%)	μ_{EAL}	1.0	1.0	15.0	20.0
Index of volume of production to previous year (%)	μ_{IVP}	106.7	98.3	120.1	132.5
Qualitative estimation of lands by natural fertility (points)	μ_{EL}	45.0	43.0	38.0	40.0
Annual volume of investments in information technologies development (UAH)	μ_{VIIT}	34723	15067	9712	13899
Technical and informational armament of labor (units per person)	μ_{TIA}	0.03	0.08	0.04	0.01
Coefficient of mechanization and automation	μ_{MA}	0.75	0.88	0.72	0.70

Coefficient of intellectual manufacturability of production	μ_{IMP}	0.1	0.05	0.02	0.06
Number of companies		8	25	58	29
Share in sample aggregation, %		6.7	20.9	48.3	24.1

The first cluster includes 8 companies which are the largest according to the scale of production (6.7% of the total observation objects); they are characterized by significant land area (μ_{AL}=10812.5 hectares), large number of full-time employees (μ_{FE}=450 persons), the largest intellectual manufacturability of production (μ_{IMP}=0.1), the highest profitability of sold agricultural products (μ_{PSP}=23.6%), expenditures on information and consulting services (μ_{ICS}= 4000 UAH per year), high share of expenditures on information and technical support (μ_{ITS}=3%), the largest annual volume of investments in information technologies development (μ_{VIIT}= 34723 UAH). The first cluster of companies is inherent with a high share of equity capital (42%), which is a resource of working assets financing. It indicates the adequacy of own financial resources to finance non-current assets and part of working assets.

The second cluster integrates 25 companies or 20.8% of the total number of investigated objects with the highest level of net sales income (μ_{NI}=95.7 UAH million), high degree of financial independence (μ_{AC}= 0.70), high level of absolute liquidity (μ_{CAL}= 0,19), as well as the high efficiency of the fixed assets exploitation (μ_{CP}= 2,12 UAH). The companies of this cluster are inherent with a high coefficient of production mechanization (88% of all works are performed in mechanized and automated ways).

The third cluster is represented by the companies with the lowest income level (the center of cluster is at 1.1 UAH million), the land area with the centroid of 648.4 hectares, the smallest indicators of staff number – 40 people, and share of expenditures on information and technical support – 0.5%. This group includes 58 companies, or 48.3% of their total number. Instead, the companies of this group have rather high level of the index of volume of production (μ_{IVP}=120.1%) and the profitability of sold agricultural products (μ_{PSP}= 20.2%).

The fourth cluster contains 29 of the investigated agribusiness companies (24.1% of aggregation). These companies are characterized by the most noticable features: high degree of erosion of arable land (μ_{EAL}= 20%), significant index of volume of production to previous year (μ_{IVP}=132.5%). Unlike the companies of the third cluster, these companies have the acceptable level of expenditures on information and consulting services (μ_{ICS}=2000 UAH), and share of expenditures on information and technical support in the structure of total expenditures (μ_{ITS}= 1.2%); land area of 2119.3 hectares and negative value of coefficient of maneuverability of equity capital (μ_{CM}=-0.16). The value of the last mentioned coefficient indicates the diversion of equity capital to the financing of non-current assets, that is why the borrowed funds are attracted to finance the working assets; therefore the level of financial stability is reflected (μ_{AC}= 0.02).

4 Integrated ICS for Agribusiness Management

ICS of agribusiness management (Fig. 2) would constitute a hierarchal three-level structure; it includes the micro level (company), the meso level (region, district), and the macro level or operational, tactic, and strategic management levels respectively.

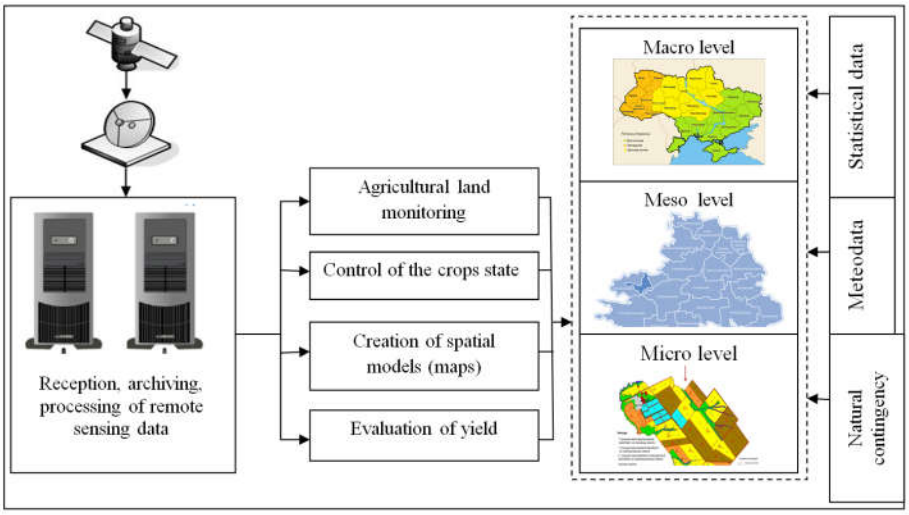

Fig. 2. Structure of ICS of Agribusiness Management

ICS should provide:

- the analysis of actual state of agribusiness and planning of technological operations based on technological cards;
- modeling and forecasting of agribusiness processes with use of modern geoinformation systems and neurotechnologies;
- the support of decision-making processes based on the integrated expert systems;
- providing the remote access for users by Web-oriented architecture and Internet exploitation.

It is assumed that ICS will have the following tooling: database management system (DBMS) or geodatabase management system (GDBMS), geoinformation systems and technologies (GIS-technologies), neurotechnologies, expert systems of decision-making support, knowledge bases, bases of models, CALS-technologies.

Geoinformation-reference system of agribusiness management is recognized as a structural element of ICS and presented as multidimensional structural connections between the separate blocks of management system and technical means. Potential users will be able to improve the mechanism of own organizational and resource management based on geographical integration of the existed data, to use possibilities of joint exploitation of the data along with coordinated modification by different subdivisions.

Knowledge database (KDB) of the integrated ICS will serve as a starting point of expert decision support system that includes heuristic rules (and rules that generate "new rules") as well as simulation solutions to analyze the possible risks of agribusiness conditions. The basis of the expert knowledge representation in the integrated ICS will form a precedent task block (Fig. 3). Here the end consumer both modifies the system of rules within the frames of precedent database and acts as a consumer of processed information (via knowledge databases mining, database management system (DBMS) and database knowledge management system (DBKMS)). Thus, systematization of the user demands formulates the precedent database library; in case of the discrepancy of the slot to a certain precedent, a new rules format in frames is developing.

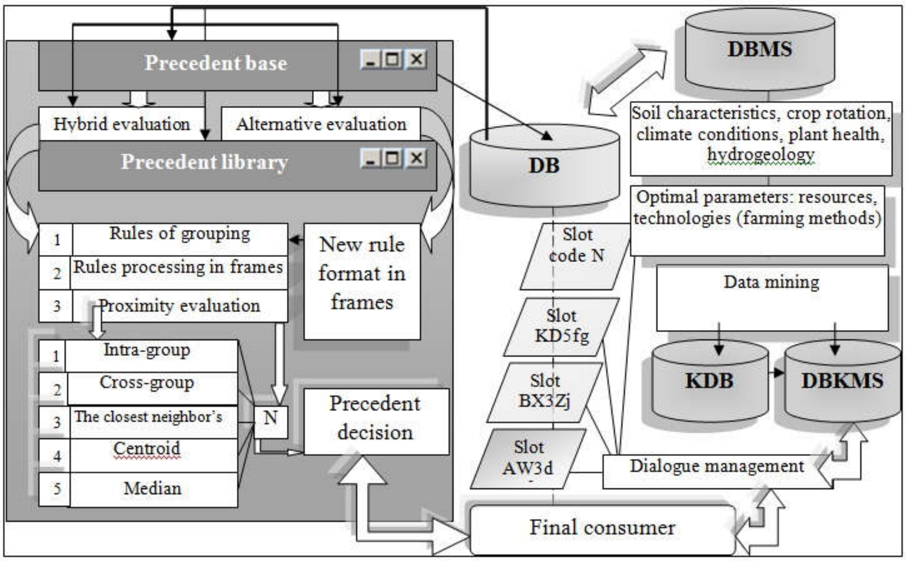

Fig. 3. Structure of Precedent Task Block in Joint ICS

The starting point of project development is the formation of a new precedent or the search for its analogues in precedent base. The set of possible states of the companies' agrarian system needs identification and projection into the future. After all, the database grouped according to the precedents will become the basis for the formation of the integrated planned decision. Extension of the knowledge database is carried out by means of new forward-looking information, which is obtained from the system participants in the form of slots of aggregated information. It is advisable for the author of the project to be independent in the determination of the assessment system for the company's multi-factor risk, which is based on the required degree of risk specification. Data array saturated be facts, automatically accesses the most informative multivariate risk analysis. There is occurring the possibility for access to databases of data mining: in this case, the active participant becomes not only the founder of a particular industrial precedent, but also an active expert of the decision support system.

The received project data is immediately checked to the required minimum of forward-looking information: a satisfactory result immediately leads to the formation of an intersectional database, i.e. to the cross-actualization of external and internal factors. Variants of the multi-factor risk assessment system depend on the information intensity of the project and the transaction of the participant himself. The user defines own target point in the integrated ICS – from background awareness to the possibility of participating in government development programs. The highest level of the factorial saturation of a frame assigns the status of an expert to the participant and characterizes its ultra-high need for a consolidated expert judgment. Each of his positions is recorded in the knowledge databases as a separate rule for the formation of expert evaluation at the level of data mining.

5 Conclusions

As the result of conducted analysis, some relevant conclusions can be formulated. Set of the indicators describing the organizational and economic preparedness of agribusiness companies for integrated ICS is divided on the seven components. The first one (25.4%) reflects the pattern between the existing investment in IT and the size of the company. This factor is especially demonstrative for the first cluster of companies, which recognize the integration into the ICS as a mean of increasing their competitive position. Their level is sufficient to be a participant of the integrated decision-making support system and have a permanent remote access to the geodatabase. The degree of preparedness is estimated by the indicators: μ_{IMP} = 0,1; μ_{PSP}=23.6%; μ_{ICS}= 4000 UAH; μ_{ITS} 3%; μ_{VIIT}=34723 UAH; μ_{CM}= 0.42.

The influence of "Potential Quality of Land Resources" factor (12.3%) is reflected on the third and fourth clusters. At the same time, companies of these clusters are demonstrating the low level of intellectual manufacturability of production and low share of expenditures on information and technical support in the structure of total expenditures: μ_{IMP}= 0,02 ÷ 0,06; μ_{ITS}= 0,5 ÷ 1,2%; μ_{EAL}= 15 ÷ 20%; μ_{EL}= 38 ÷ 40 points.

"Financial Capacity for Investing in Information Technologies" factor (17.5%) has a special impact on the results of the first and second clusters: μ_{CM}=0.38 ÷ 0.42; μ_{CP}= 1,60 ÷ 2,12 UAH; μ_{CAL}= 0.15 ÷ 0.19. "Integration of Production into the Field of New Technologies" factor (7%) is typical to demonstate the positive tendencies in the first and second clusters: μ_{ITS}= 2,5 ÷ 3,0%; μ_{MA}= 0.75 ÷ 0.88; μ_{IMP}= 0,05 ÷ 0,1. "Staff Provision for Science-Intensity of Labor" factor (6.8%) demonstrates the high need in specialists with higher education and qualification, including system administrators (μ_{SS}= 0.17), insufficiency of specialists (μ_{ST}= 0.11) and low technical and informational armament of labor (μ_{TIA}= 0.01) for companies of the fourth cluster.

"Volume of Production Concentration" (6.1%) could become the key factor for the fourth cluster due to the highest index of volume of production to previous year (μ_{IVP}= 132.5%). However, this factor is very loosely correlated to the indicators of intellectual production manufacturability (factor load is 0.125), the annual volume of investments in information technologies development (-0.142), as well as to the indicator of mechanization and automation of production (-0.049).

"Financial Independence of the Info-Communication System Development" factor (5.6%) demonstrates the predicted connection between the net income, coefficient of autonomy and the expenditures on information and consulting services. For the third cluster which is the largest by amount of objects, this connection shows the areas of the first-priority reacting when integrating into the info-communication system with tools for analysis of the actual state of agribusiness, modeling and forecasting of agrarian production processes.

Conducted combined multivariate analysis allowed interpreting of the potentially hidden factors that are responsible for the existence of the interconnection between variables, and measuring the impact of factors on the value of the resulting indicators in the features set. The seven distinguished components with optimal accuracy allow describing the organizational and economic potential of the investigated agribusiness companies. Cluster analysis conducted by means of *k*-averages method allowed to integrate a set of investigated objects into homogeneous groups. It makes possible to evaluate each variable of organizational and economic preparedness for the implementation of ICS. Each factor includes the appropriate combination of variables and substantiates the distribution of management priorities in terms of ICS implementation into management of agribusiness companies.

The proposed integrated ICS will be a transparent information and communication formation. Its essence is in the transactions consolidation (incoming messages) of the system participants, access to knowledge databases ensuring; knowledge databases are formed by standardized and alternative precedent scenarios, based on transaction information. The integrated ICS can be considered as a mean for implementing the information and communication strategic partnership between business entities, public administration and society. Such a system can also serve as the basis for consolidated strategic planning in agriculture.

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