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IMPROVING INFORMATION SUPPORT OF RESEARCH, TECHNICAL, AND INNOVATION DEVELOPMENT OF KHMELNYTSKYI OBLAST ECONOMY THROUGH CREATION OF CORPORATE INFORMATIONAL AND ANALYTICAL SYSTEM

The paper deals with a method for building up the data array of corporate informational and analytical system of Khmelnytskyi Oblast. This method is aimed at organizing information exchange between different information systems of member enterprises and institutions of the corporate information-analytical system.

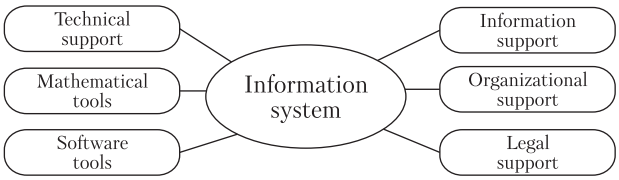
Key words: the corporate system, the technique, the information array, the infrastructure, the research, technical, and innovative companies, the data bank.

Innovative trend in science and industry of Ukraine requires improving the information support of scientific, technological, and innovative development of the national economy. The information infrastructure has been developed in order to implement the economic reform program for 2010—2014 «Prosperous Society, Competitive Economy, and Effective State» approved by the Decree of the President of Ukraine of 02.06.2010 (Chapter 11: Development of Research, Technical, and Innovative Sector) and to enhance the coordination of activities of government agencies [1].

Within the framework of application program the Khmelnytskyi Center for Science, Innovation, IT-Based Management, and Electronic Communication Development has been elaborating a regional corporate information system for R&D and innovation activities on the basis of software developed by the Chernihiv Center for Science, Innovation, IT-Based Management, and Electronic Communication Development. This is the first step towards the formation of information network as an element of system for managing the science, technology, and innovation at the government level.

The system involves the formation of primary data on research, technical, and innovative companies, as well as accumulation and systematization of these data. The data will be transferred to the system in accordance with the standard forms, directly by the research, technical, and innovative companies.

The creation of public information infrastructure has been planned through developing a common information network containing data on the subjects of innovation infrastructure, areas of their activities, pilot projects and possibilities of their practical application, as well as through facilitating access to information networks and data banks. Today, in Ukraine, there is a network of innovation centers; at many enterprises and



The structure of information system and the subsystems supporting its operation

organizations, there have been established the structural units responsible for technology transfer, which deal with individual research and technical areas. However, there is a lack of data on the innovation potential of the country as a whole [2].

The researches of Khmelnytskyi State Center of Science, Innovations, IT-Based Management, and Electronic Communication Development have been developing a corporate informational and analytical system of research, technical, and innovative activities in Khmelnytskyi Oblast as a part of the State Infrastructure for Innovations. The research is at the second phase of implementation. It involves testing and implementation of the regional segment of informational and analytical system of research, technical, and innovative activities in Oblast [3]. The Center has elaborated the methods for building up a data array of corporate informational and analytical system. It involves the organization of informational interaction between different information systems of member enterprises, institutions, and organizations, among themselves and with different user groups. The data are described in the same manner at different levels to solve the problem of their informational compatibility in the broadest sense: the documents, regulatory framework, and implemented decisions regarding the scope, placement, and forms of information used in the system during its operation.

The information array is aimed at building up a corporate informational and analytical system of business entities and R&D companies. The information can be recorded in the form of publications, reports, electronic records, microcopies, etc. The R&D companies form their information arrays by functional grounds. This allows us to perform continuous monitoring of scientific and technical potential in Oblast and to provide the administrative bodies with generalized, analytical, and forecast information for making balanced decisions.

The information array is created on the following basic principles: integrity, reliability, control, protection against unauthorized access, unity, flexibility, standardization and unification, adaptability, minimization of data input and output (single data input, principle of data input, etc.) [4, 5].

The information system is structured as a set of separate parts called *the subsystems*. The subsystem is a part of the system distinguished by certain feature. The general structure of information system can be considered as a set of subsystems regardless of application. In this case we deal with the structural features of classification of subsystems constituting the information system. Thus, the structure of any information system can be represented by a set of supporting subsystems (see Chart).

Usually, among the supporting subsystems there are mentioned the following ones: *the information support, the technical support, the mathematical tools, the software tools, the organizational support,* and *the legal support*. Let us consider the information support.

The information support is organized *vertically down* with respect to the overall planning and *vertically up* as regards the detail design. To encode information used in array the classifiers designed by the developer and provided to the customer are used. To encode the input information used at the top level the classifier of the same level is used. The information support of array is combined with the information support of systems interacting with it: content, addressing methods, data formats, and forms of representation of information received and issued by information systems.

The forms of documents created on the basis of information array are harmonized with the standards and regulatory and technical documentation

of the customer. The forms of documents and video pictures input or adjusted through the terminals of array are harmonized with the corresponding technical specifications of terminals. The body of information data is given in the form of database on data media. The forms of submission of input information are harmonized with the system customer (user).

The terms and abbreviations used in the input notification are generally accepted in this area and agreed with the system customer. The necessary measures are established to control and update data in the information array, to resume it after the failure of technical means, as well as to control the identity of cognominal information in databases. In addition, the media for specific user may be established [4, 5].

The information support is developed in three stages.

At the first stage (decision on information base/ data bank), the composition and scope of reference data are determined; the proposals related to the improvement of current document workflow, the structure of the database system for collecting and transmitting information, and the solutions for the organization and management of databases are elaborated; composition and characteristics of input and output information (signals, documents, and data) are defined.

At the second stage (choice of nomenclature and reference to the system of classification and data encryption), the list of types of information objects to be identified and the list of required classifiers are defined; classification of information objects and encryption system are selected and developed; the system for revising and amending the classifiers is defined; the principles and algorithms of automated keeping of classifiers are elaborated.

At the third stage (decisions to ensure the exchange of information in the system) the flow chart of information support is developed.

The information array is formed either as the structured (systematic) array or the unstructured (ad hoc) one. If the R&D company has a task to automate the operations with data array, this array is structured and stored on electronic media and organized for a common language of data description. If these requirements are met it is a basic data array underlying the information data bank.

The information array is built-up with the use of relational database (or relation, a mathematical term for the irregular set of similar records or tables of certain specific type). All the tables of any relational database consist of the lines of header columns and one or more data values under these headings. These columns and lines should have the following properties:

- Any column of the table is assigned with name that must be unique for the table;
- The table columns are arranged from left to right, i.e., column 1, column 2, column n (from the mathematical point of view, this statement is incorrect because the columns are not ordered in the relation system. Nevertheless, from the user perspective, the order in which the column names are defined corresponds to the order in which data is input unless each value is preceded with name of the column during data input);
- The lines are not ordered, their sequence is determined only by the sequence of input in the table;
- The field at the intersection of line and column of any table should always have only one data value (this «atomic» value can be quite extensive);
- All the lines in table must have the same set of columns, although in certain columns any line can contain empty values (null values) i.e. it may have no values for these columns;
- All the lines must differ from each other, at least, by one value (key props) by which one can uniquely identify any line of this table;
- When performing operations with the table lines and columns one can do this in any order, irrespective of their information content.

The elements in array may be numbered starting with 0 or 1. Saving of one-dimensional array in memory is trivial, because the computer mem-

ory is a one-dimensional array. Saving of multidimensional array is more complicated.

Let us assume that we need to store a two-dimensional array:

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

- The most common ways of organizing the two-dimensional array in memory are as follows: Line-by-line location (the most common method today, one can find it in the majority of programming languages);
- Column-by-column location (the location method used particularly in Fortran language): array of arrays. The multidimensional arrays are represented by one-dimensional arrays of pointers to one-dimensional arrays. Location can be realized either by the line-by-line or by the column-by-column principle.

These methods make it possible to place the data in a more compact manner, but at the same time, bear a limitation: such arrays are «rectangular», i.e. each line contains the same number of elements. On the other hand, «array of arrays» location is not very efficient regarding memory usage (it is necessary to keep additional information on pointers), but removes the limitation on the «rectangular shape» of the array.

The SQL language (non-procedural language SQL) is used to work with the data array [6, 7]. The Structured Query Language is focused on operations with real data presented as logically interrelated sets of tables. Distinctive feature of queries in this language is that they are focused mainly on the ultimate result of data processing and the procedure of processing. This language determines where the data are located and what indices are necessary. The file server administrators allow the multiple users of different computers to have access to the same databases.

To eliminate the mentioned above shortcomings and some other flaws the *client-server* technology is used within the framework of which the customer queries are processed at special database server, with only the ultimate processing results returning to the customer.

The *client-server* technology is widely used when working with databases within network. It has been well-known for a long time and is often used by large organizations. Today, as Internet advances, this technology is increasingly attracting the software developers insofar as in the world there has been accumulated a lot of information on various issues and, as a rule, this information is stored in databases. The *client-server* technology can be described by the following algorithm:

- The client generates and sends a query to the database application server processing the requests;
- The application server manipulates with databases in accordance with the request, generates the result and sends it to the client;
- The client receives the result, displays it on screen, and waits for further user action. The cycle is repeated until the user completes working with the server.

The standard software implementing the *client-server* technology has good scalability, i.e. the efficient use of extended hardware, steady operation, protection from unauthorized access, and high capacity when working with large projects in the field of database.

The *client-server* operation depends on the location of the client and the server and on the client's connection to the server. The user on the client computer in viewer fills out the form and selects further action. After pressing the button on the form the browser sends the data from completed form and re-displays results of certain operations. No matter, which network the client is connected to. It can be remote user connected via modem. The program accepts data, verifies them and generates a request to the database monitor or gets the results from it. Having received the request, the monitor processes it and sends the requested information to the program (unless an error appears). The database is stored on the server disc that is modified at the request of the client. In this mode, the safety of database is se-

cured from both hardware and software failures, as well as from unauthorized access. The load on network decreases, while the requirements to server get stricter.

The SQL uses the basic types of data formats which can slightly vary for different systems: *the text, the numeric*, and *the time formats* [6, 7].

The organization of interaction between the different information systems and the different groups of users (enterprises, institutions, and organizations) with the help of corporate information-analytical system is made by the following methods:

- Arbitrary interaction between two separate computers (e.g. via modem, with mandatory participation of operators of the transmitting and the receiving parties. Exchange in arbitrary but pre-specified format is possible;
- Interactive remote interaction between the computer and the information system (e.g., http protocol, with the obligatory presence of operator at the transmitting side). For this purpose a certain form of HTML document is used and the accepted documents are processed automatically;
- Controlled stream processing: receiving from e-mail; the file contains HTML-form whose run initiates either document processing or receiving by operator of electronic documents in specified format from e-mail with further run of the program [8].

ANALYSIS OF RESULTS AND CONCLUSIONS

The long-term effective development of innovative enterprises, institutions, and organizations in Khmelnytskyi Oblast is possible only with the help of scientific and technical progress and the timely and adequate provision of information. Therefore, the information support of innovation sphere through which the innovative achievements are put into practice is of paramount importance and claims attention.

Implementation of project «Development of Corporate Informational and Analytical System of Research, Technological, and Innovative Activities in Khmelnytskyi Oblast as a part of the state innovation infrastructure» lays the foundation for the formation of corporate information system. In the future, it will be used to monitor the scientific and technical potential of the region.

The obtained and partially updated data must:

- Provide generalized analytical and forecast information to make informed decisions on the research development;
- Increase the involvement of investors by providing wide access of stakeholders to relevant information;
- Study the demand for research and development activities;
- Facilitate the technology transfer;
- Ensure the cooperation in research, development, and technical sphere of region.

The regional corporate information system for research, technology, and innovation should be the first step towards joining the single electronic information network as an element of the management of research, technical, and innovative activities in Khmelnytskyi Oblast.

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ВДОСКОНАЛЕННЯ ІНФОРМАЦІЙНОГО ЗАБЕЗПЕЧЕННЯ НАУКОВО-ТЕХНІЧНОГО ТА ІННОВАЦІЙНОГО РОЗВИТКУ ЕКОНОМІКИ ХМЕЛЬНИЦЬКОЇ ОБЛАСТІ ЗАВДЯКИ СТВОРЕННЮ КОРПОРАТИВНОЇ ІНФОМАЦІЙНО-АНАЛІТИЧНОЇ СИСТЕМИ

Розглянуто методику, за якою формується інформаційний масив корпоративної інформаційно-аналітичної системи Хмельницької області. Методика передбачає організацію інформаційної взаємодії різних інформаційних систем підприємств, установ, організацій – учасників корпоративної інформаційно-аналітичної системи.

Ключові слова: корпоративна система, методика, інформаційний масив, інфраструктура, суб'єкти науково-технічної та інноваційної діяльності, банк даних.

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УСОВЕРШЕНСТВОВАНИЕ ИНФОРМАЦИОННОГО ОБЕСПЕЧЕНИЯ НАУЧНО-ТЕХНИЧЕСКОГО И ИННОВАЦИОННОГО РАЗВИТИЯ ЭКОНОМИКИ ХМЕЛЬНИЦКОЙ ОБЛАСТИ БЛАГОДАРЯ СОЗДАНИЮ КОРПОРАТИВНОЙ ИНФОМАЦИОННО-АНАЛИТИЧЕСКОЙ СИСТЕМЫ

В статье рассмотрена методика, помощью которой формируется информационный массив корпоративной информационно-аналитической системы Хмельницкой области.

Методика предусматривает организацию информационного взаимодействия разных информационных систем предприятий, учреждений, организаций — участников корпоративной информационно-аналитической системы.

Ключевые слова: корпоративная система, методика, информационный массив, инфраструктура, субъекты научно-технической и инновационной деятельности, банк данных.

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