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Informational system of monitoring of the region's scientific and technical potential *

In the article the characteristics of the modern state of the problem of informational monitoring systems' development are represented, the primary goals of information technologies' application to monitoring scientific and technical potential are formulated. On the analysis' basis the functional system model is based, the mechanism of its basic modules' work is represented. The problems of the program's developing and realizing of the informational system for the regional scientific and technical potential's monitoring are considered. The information system is represented as the programming-informational complex based on the principle of the united information space and providing the operative analytical account and the control of the development parameters of the scientific and technical potential.

Scientific and technical potential of a region, informational monitoring system, data formation and processing, use organizing.

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Transformation of the scientific and technical potential (STP) into one of the basic resources of the steady economic growth in Russia became prevalent. Recently the Russian researchers have achieved significant progress in studying the essence and the structure of the mentioned problem. There appeared the techniques of estimating regional scientific and technical potential, which differ from the western ones. Such works include: the technique of the factorial analysis of the innovational regional potential (E.P. Amosenok, V.A. Bazhanov) [2]; the technique of regions' clustering and the parameters of the innovational system's development (A.E. Varshavsky) [3]; the methodology of the regional innovativeness' index (Independent Institute of the Social Policy of the Russian Federation) [4]; the technique of

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rating regions according to the level of their innovational development (A.B. Gusev) [5]. Among the latest researches we should note the technique of the comparative estimation of the regional scientific and technical potential; this technique was developed at the Institute of the Socio-Economic Development of Territories of the Russian Academy of Science (K.A. Zadumkin, I.A. Kondakov) [1].

At the same time it becomes more and more clear, that the realization of the techniques on the research of the regional scientific and technical potential cannot be carried out without timely, total and reliable information. One of the ways of its getting is monitoring. We can define monitoring of the regional scientific and technical potential as the activity on providing information of managerial processes in the regional scientific and technical development, based on gathering, keeping, processing and transferring information with the purpose of its use for the solution of the following problems:

- determining of the available resources and the achieved results of the scientific and technical development of a region;
- revealing problems of the scientific and technical development and elaborating the effective policy for their decision;
- making up the list of all possible directions of the development in science, mechanics (technical equipment) and critical technologies, and also the forecasts' development and their realization in a region.

Unfortunately, in the majority of Russia's regions there practically don't exist the systems of constant monitoring of the scientific and technical potential, which are capable to deliver the necessary information. It is caused by the underdevelopment of the home statistical supervision system, its limitation and discrepancy to the requirements of managing the scientific and technical sphere; and also by the absence or incompleteness of the available databases on the carried out researches and projects. The Russian market of IT-services is characterized by a rather small choice of decisions in the sphere of monitoring and analysis of the socio-economic processes occurring in regions and the process of the new elaborations' creati on cannot be characterized as a single whole.

The absence of the set of measures providing monitoring makes difficulties for the process of getting and analyzing information. There passes too much time from the moment of getting information and to the moment of analyzing the processed data; it leads to the backward administrative decisions. Therefore it becomes possible to raise the quality and the efficiency of the monitoring organization only with the use of information technologies.

The information resources of the monitoring systems considerably differ from the resources of electronic libraries and other information systems focused on users' helping service. The main difference is that in users' helping service they use kinds of documents in the scientific sphere which, as a rule, are already available. However for monitoring systems it is insufficient, there is the need for generation of new information objects.

Studying the matter of informational monitoring system's creation towards to STP allowed us to the reveal the key tasks of informational monitoring technologies' creation. They are [6, 7, 8]:

- ➲ creating the general protected informational space, allowing to check the data integrity, their urgency and the contents;
- ➲ getting data by telecommunication channels from distant users through web-interface with the opportunity of differentiation of the proxy and access levels;
- ➲ formation of the initial information files necessary for carrying out mathematical analysis and calculations;
- ➲ generation of the high-grade reports in the widespread formats with the opportunity of further work with them.

In our opinion, the informational monitoring system should represent the program-information complex organized by common principles on the basis of indivisible information space with the support of the concept of

the single data input into the system, and also providing the efficient analytical account and control of the scientific and technical potential parameters. The system functions in the outer conditions and operates with huge amount of information, therefore the most convenient form of organizing information keeping and access are databases.

The basic requirements to the informational monitoring system's software are the following ones [9, 10]:

⇨ providing diagnostic messages at input, control and update of information;

⇨ the opportunity of partial and full printing of the entered information;

⇨ revealing control points on the quantity indicators at loading and distributing information, i.e. correspondence of the downloaded and extracted information;

⇨ righ requirements to all characteristics of the infrastructure hardware elements;

⇨ protection against the non-authorized actions, independence of the functional subsystem within the informational monitoring system from infrastructure changes;

⇨ code, program and technical compatibility of devices, coordination of productivity, throughput and capacities of subsystems and infrastructure elements.

Besides that the informational monitoring system of STP should have the following features:

➢ adaptability for a wide range of parameters, each of which has quantitative and qualitative features;

➢ succession of the new information technologies with the ones used in the existing informational monitoring system;

➢ automation of the considerable number of the functions necessary at estimating the scientific and technical potential.

The informational system's design is made within the framework of the dynamic environment, in view of technical progress, of the reduced terms of technical innovations' life; therefore the information model supported in informational monitoring systems is dynamical.

While carrying out the project of an informational system it is necessary to determine its structure, i.e. to allocate subsystems, elements, their relations and informational connections.

The process of information analysis should determine all the procedures of getting, transforming, keeping, transferring and representation of information, starting from its downloading into the informational system and resulting in its representation to a consumer.

According to the order of carrying out all technological processes fall into three groups; they are preliminary, computing and post-computing information analysis [9]. Each group provides carrying out a corresponding process stage of the analysis and is characterized by certain download and extract forms of the information representation. Preliminary analysis provides the operations on getting, registration, initial information analysis, downloading data to the computers.

Computer analysis is determined by the character of the processes which are carried out for the realization of the tasks of the informational monitoring system, and by the organization of controlling information files. The certain role is played by the type of the mentioned information files' structures and by the structure of the system software which operates the computing process.

At the stage of post-computing analysis the registration of the final forms, their control and transfer to users is made. After the analysis of the initial data those people who are interested can receive the documents with the data on the basic results of carrying out the region's STP estimation.

According to the positions mentioned above, at the stage of studying the subject automation domain the generalized functional structure of informational system *(fig. 1)* was made up. The system will consist of 2 modules, the module of the expert in the STP field and the user's module. The primary goals which are carried out by the modules are also represented in figure.

Figure 1. Functional structure of informational system

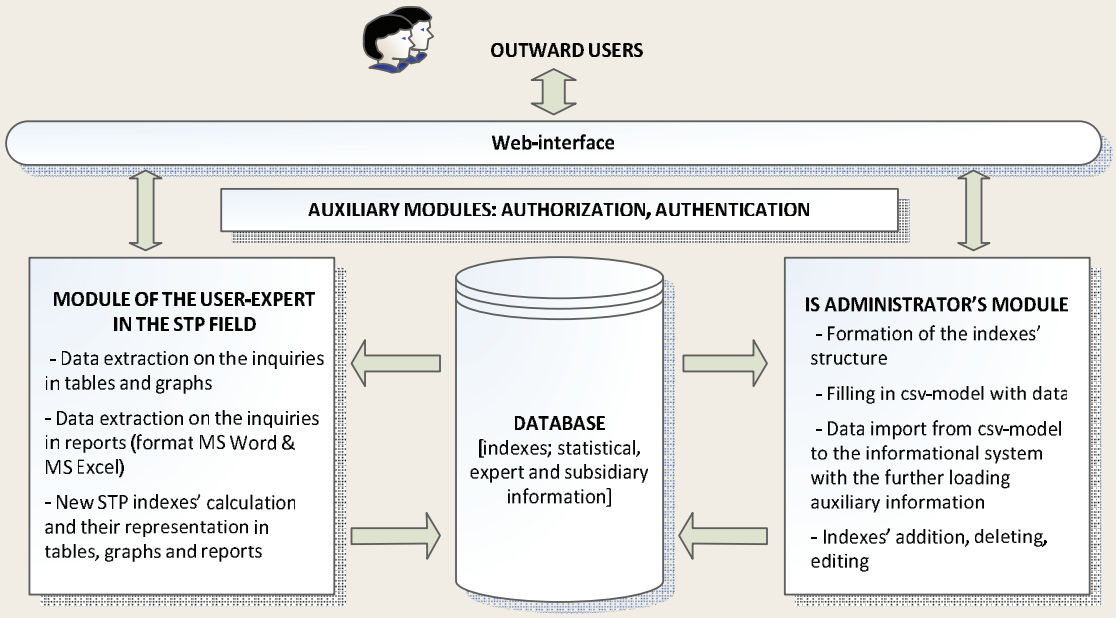
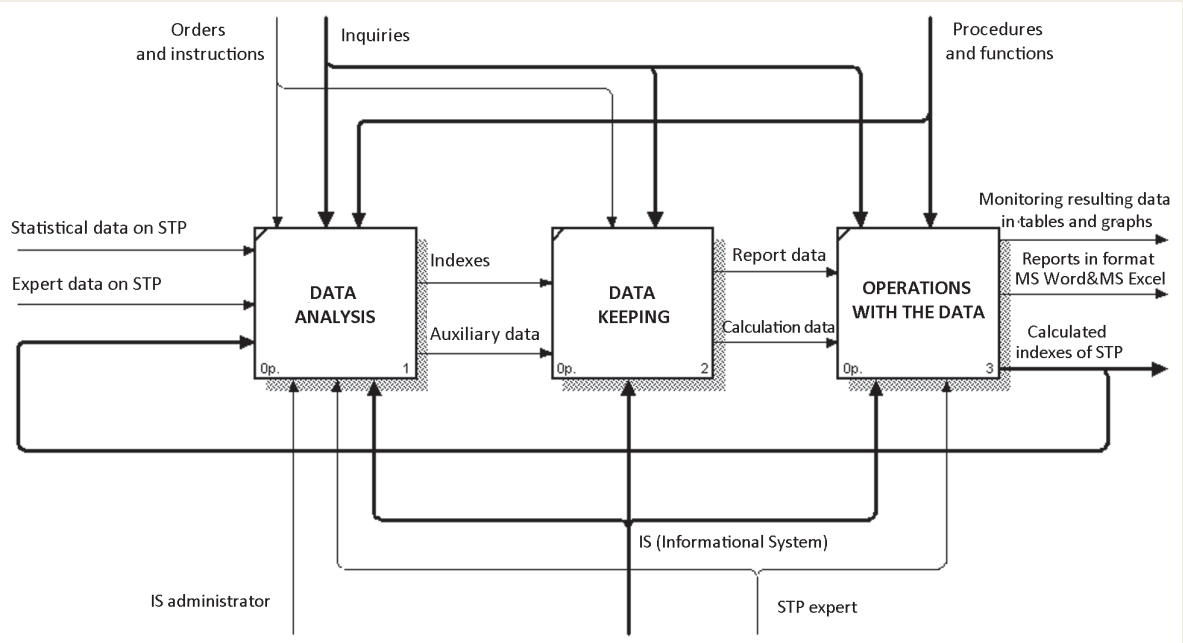


Figure 2. Decomposition of the contextual diagram of the informational monitoring system of the regional scientific and technical potential



At the stage of informational system's design the author applied the structural approach which consists in IS' consideration from the general position with the subsequent detailed elaboration and representation as a hierarchical structure [8]. The model was received with the use of CASE-means, and the circuit submitted in *figure 2*, was constructed with the help of program BPwin (means of the functional modeling realizing the IDEF methodology).

Input represents the information, transformed by the functional block. For the given model the primary entrance information are the statistical information (separate parameters and the summary index) and the results of the experts' interrogations (for example, the heads of enterprises and higher schools). The informational system, the informational system administrator and the expert in the STP field will be the managing mechanism. The executive mechanisms are orders and instructions on the informational system use, developed at ISEDT RAS, the SQL-inquiries addressed to the base of the statistical and expert data, procedures and functions of the data analysis. The extracted information is submitted as the data of monitoring result in tables and graphs, designed as reports in format MS Word and MS Excel; and also as the calculated parameters and indexes characterizing the level of the scientific and technical potential of a region.

To consider the contents of the informational system and its opportunities, we shall analyze the mechanism of work of each of three basic functional blocks.

For the process "Data analysis" the statistical information and the results of the experts' interrogations are used. According to the technique all statistical information in the system should be divided into four blocks: 1) science and innovations, 2) education, 3) informational infrastructure and communications, 4) general characteristics. Each block includes groups of the describing parameters submitted in the official statistical collections (for example, the block "Science and innovations" includes such groups of parameters, as staff, financing, material base, innovational activity and scientific productivity). By this day about 60 basic parameters have been formulated.

At realization of the informational system's interface for the hierarchy's precise and evident representation was made the decision to display all the parameters' set as a tree. The system administrator's task will be to generate a tree of parameters, and then to import the data to the system.

The data received after analyzing are kept in the block "Data keeping". By means of inquiries a user takes the necessary information for the report or calculation from the database and chooses how to represent it. Inquiries' processing occurs as a result of procedures and functions operating in the block "Operations with the data".

Monitoring results can be represented in the following forms:

1. Table, representing the summary information on the chosen parameter for any territory in view of years and units.
2. Graph which is represented by a picture (diagram) on the chosen parameter for any territory in view of years and units. Graphic visualization is realized with the help of RNR library JPGRAPH. Now the system can make graphs, circular and columnar diagrams.
3. The format of documents MS Word and MS Excel – export to this formats is realized with the help of RNR library PEAR.

Besides that, the block is intended for carrying out operations with the initial data for calculation of the new parameters or indexes according to the developed technique.

Realization of any operations (multiplication, division, addition, subtraction) with the initial data in the system should be carried out under the following pattern: first separate parameters are chosen, then the actions for them in view of a territory (country, district, and region), the required accounting period (a year or years) and units.

At the final stage while developing the information and the software of the system the information-and-logical model of the data was created; afterwards it was transformed into the physical model on the base SUBD MySQL. The choice is caused by the following factors: multithreading, support of several simultaneous inquiries; records of the fixed and variable length; flexible support of numbers' formats, lines of variable length and labels of time; fast work, scalability, interface with RNR.

The informational system represents the web-appendix. The web-appendix is the client-

server appendix in which the client is browser and the server is web-server. The logic of the web-appendix is distributed among the server and the client, the data keeping is mainly carried out on the server, information interchange occurs on the network. One of the advantages of such approach is that clients do not depend on the concrete operational system of a user; therefore webs-appendices are inter-platform services. RNR carries the server part of the web-appendix. The client's part is realized on HTML, JavaScript, and RNR. It is necessary to note, that while working on the project the new approach to the web-appendices' development Ajax was actively and widely used. While using Ajax the web-appendix page was not reloaded entirely, and was only loaded to add the necessary data from the server that makes them more interactive and productive. The user's access to the information is carried out with the help of the informational system modules' connection to the BD server. Therefore the only condition of the system's use is that the clients' automated workplaces BD server should be accessible to each other. This software can be applied in any networks functioning on the basis of the report TCP/IP. To begin the work with the system, it is enough to have the modern browser (the system works in MS Windows IE, Opera 9.x-10.x, Mozilla Firefox 2.x-4).

The developed system is recommended for use by the scientific divisions of ISEDT RAS. It can be applied to the practical activities of the authorities and at various levels, scientific and engineering organizations, higher educational institutions and other organizations.

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