

Information Stream Management in Organizations

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Abstract Effective corporation management is inconceivable without the use of information. But different subjects' need for information varies on levels of management. It is determined primarily by the tasks to be solved in management. Besides it also depends on scale and importance of accepted decisions. The more important the decision is, the greater information volume and diverse content is required for the preparation and adoption. Moreover, the information demanded depends on the number and character of operated, adjustable parameters; on quantity of variants of a possible condition and behavior of operated object; on size and diversity of internal and external influences; on quantity and quality of the indicators characterizing results of functioning. In this regard there is necessity to develop technologies, methods and information systems to support decision-making in terms of formalization of information exchange between the subjects management in corporations. In this paper the information system problem is considered on the basis of information streams control. Approaches to the organisation of an information exchange in corporation are offered.

Keywords Information, Information Stream, Information Model, Reconciliation, Information Control

1. Introduction

At the beginning of the third millennium, humanity revealed significant changes in the organizational strategy in terms of focus to sustainability as a means of organizational development. Big corporations having modern dynamic environment are looking for ways to resist other companies because of strengthening competition in the world markets.

To achieve sustainability organizations must change their business models and undergo a process of unprecedented organizational changes. Sustainability policy of management is a challenge for organizations and must create a framework to integrate social and environmental issues with economic performance[1].

Since there are extremely complicated business processes in corporations they need new ways to control them. The main resource of modern management is information technology.

The role of information resources in the management of corporations has significantly increased nowadays. This is due to speed exchange of information as well as to spatial distribution of structural units and multilevel management in corporations.

Information technologies are an important source for competitiveness growth of corporations in the international area.

The phenomenon of an information society is investigated

in works of such authors as Masuda Y.[2], Dahrendorf R.,[3] Castells M.[4] Muller M.[5] Poster M.[6]

They allocate a role of information streams as necessary ligament force in a society and in the organizations. In these studies the key characteristics of information flow of is their variability and speed. Thanks to digital convergence the cost of processing and delivery of information reduces along with improving the functionality of complex information and communication systems.

Important researches were carried out by E. Dijkstra,[10] G. Myers,[11] in the field of software engineering; by P. Drucker,[12] I. Ansoff,[13] M. H. Meskon, M. Albertu, F. Hedouri.[14] in the theory of management, information and management technologies; by M. Hammer, J. Champy,[15] F. J. Guyara, JN Kelly[16], R. Kaplan and D. Norton[17] in reengineering of business processes.

Information technology sector is developing faster than other sectors in the worldwide economics. It will increase three times by 2025 according to experts' estimation.

Productivity can be 3-5 times increased with the investment in information technology compared to capital investments[18]. Rates of information technology and innovation changes are constantly increasing. Information doubles every 20 months in global stock markets, the number of devices connected to the Internet reaches 12 billion, and quantity of payments via mobile phone are approaching \$ 1 trillion[19].

In Russia there is an annual growth of organizations implementing information technology in their operation (Table 1). The number of organizations using CRN, ERP and SCM - system has increased from 16118 in 2009 to 19678 in 2010 and there is the continuing growth[20]. It means that

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organizations are striving to improve their efficiency through streamlining information flows. Organizations try primarily to automate management processes, but the number of those that use information technology to solve such a problem decreases.

Table 1. Share of organizations using information technology of total number of surveyed organizations in percent

Organizations	2009	2010	2011
Organizations that used special software - total	88,7	89,1	89,8
Organizations that used computers	109,7	112	113,8
Organizations that used local area network	60,5	68,4	71,3
Organizations that used CRN, ERP, SCM - systems	6,4	7,6	10,2
Organizations that used information technology to manage automated production and/or the individual means and the process	15,2	18,1	18,1
Organizations that used information technology for solution the organizational, managerial and economical problems	60,6	59,7	60,3

This means that at present the potential of information technology cannot be fully realized because of absence of unified concept of information in the organization. Such features of corporations as multiple levels of management, functional units in different regions and sectors, complicated structure and content of the business processes lead to the need of models development for managing information flows with the use of modern technical means.

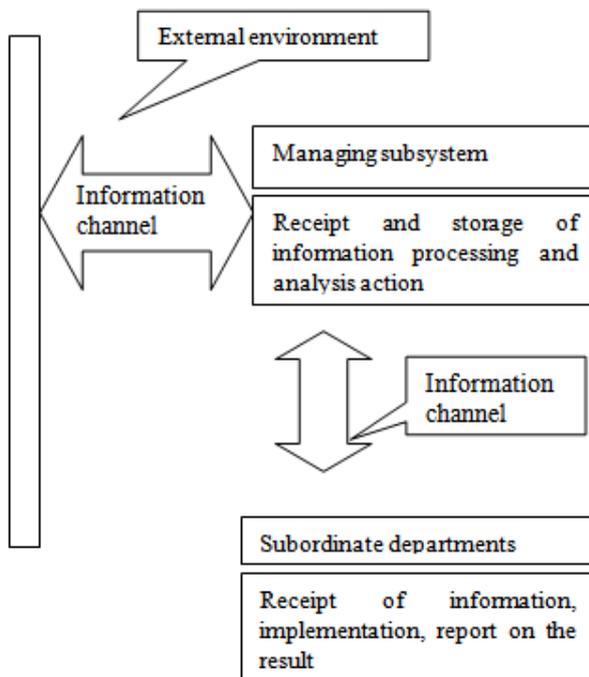


Figure 1. The scheme of information streams control in the corporation

Now there is volume increase of information that is used

by the corporation. All of its units are to receive and exchange the necessary information, in spite of the complexity of the structure and spatial remoteness of some units from the main control center. Besides qualitative non-homogeneity of information, its large amount makes it impossible to control all elements of the structure from a single center. So there is a need to use information technology to link all parts of the corporation for management to be effective.

Important information comes to corporation from an environment where departments can be divided into two groups: the control subsystem and the subordinate subsystem. So we imagine the process of corporate information streams managing as the interaction of environment with these two subsystems (Figure 1).

Through the communication channels the flow of information is coming into the control subsystem. The managers of these departments analyze the data taken and make the necessary decision. These solutions in the form of a stream of information are sent to the subordinate subsystem. Then the reverse flow of information - information on progress - out of the subordinate subsystem takes place. The top-managers receive two types of information: some streams are coming from the external environment, others - from the departments of corporations. All of them have different characteristics and it is very difficult to manage them at the same time. The only way is to use the informational technology. Information technology sector is developing very fast.

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Management in this context is the process of purposeful exchange of information flows between the various subsystems in multi-level companies. Defining the subsystem as a set of closely interrelated elements that implement certain functions we can distinguish "marketing", "manufacturing", "finance", "administrative impact", etc.

When to the top managers get the information from an environment they should analyze it at first and then they should give orders for all departments of organization. The velocity of orders plays a very important role as if the information does not come in time it will become outdated. But there is a problem of information lag in some organizations. The result - poor-quality decisions because of poor data exchange between departments. [21]

Summarizing reviews of Russian and foreign analysts' it is possible to conclude, that the global trend is to replace

separate isolated information technologies systems by the integrated means covering specialized tools and space of remote resources (Cloud Computing) involving business services and means of application manipulation working with various devices. These technologies will guide the work with data in organizations. A recognized authority in the field of IT Dennis Tsichritzis (1997)[22] suggests that the specificity of the IT sector specifies the need to cope better with constant updates. Automation and complexity of software will change the infrastructure of the organization, which would ensure its functioning in the face of rapid information growth. Technologies of processing and management of data great volumes should become the most demanded.

According to research of "Economist Intelligence Unit" (2013)[23], one of the key areas of business development is improvement the company's IT infrastructure.

The concept of the development of the company should be based not only upon the business strategy development, but also upon the development of information infrastructure strategy. Analyzing the current state of the company one needs to assess the state of information technology from the standpoint of its capability for company's business objectives, to analyze the prospects for new technologies implementation into the changing technological architecture, to evaluate the qualification of the personnel.

To use information technologies the right way it is necessary to form a common information space. If all streams of the information are connected among themselves management will be effective. Computer networks are good medium of exchange streams of the information between departments and connect all business units of organization. [24]

But sometimes only vertical levels of management are connected and in spite of the fact that orders and reports about the accomplishments are well transferred, departments cannot quickly exchange the necessary information. The hypothesis is: managers do not use common standards for information ensuring. Departments which are in different places have different information technologies; therefore their systems do not understand each other when they try to communicate. Automation of individual job places and the introduction of electronic document management system that accelerates the receipt and transmission of data is not sufficient.

For the corporation to be competitive in world markets it must meet international standards of not only final product quality, but of the entire manufacturing process.

To do this, corporations must use automated enterprise management system, electronic document management system, technologies to create function models making it possible to analyze and optimize the organization. It would not be possible to manage large amount of data that circulate in the corporation without the introduction of a corporate information system. Corporate information system - it is a set of individual business units information systems, united by a common flow of documents, such way that each system

performs the tasks of management decision-making, and all systems combine all the information streams together into a single space.

The results show that despite some unsuccessful attempts to implement ERP the considerable number of organizations have got significant benefits. Implementation of ERP optimizes the flow of information and increase productivity. (Al-Fawaz at al. 2008)[25]. Analysts of Boston Consulting Group (BCG) considers the success of the information systems implementation depends on whether it was possible to adapt them in line with the objectives of the production process. The results of the survey of 100 top-managers of leading companies show that only one in three enterprise systems implementation satisfied with the results according to evaluation of criteria of pricing, cost-effectiveness, the real financial impact and achieving their goals. In particular company Hershey Foods which has spent \$112 million on introduction of complex system of automation, is very dissatisfied with a considerable deviation of implementation process of from the plan (this system includes software, hardware and services company SAP AG, Siebel Systems, Manugistics and IBM).

At the same time, according to Gartner Group, compliance of implementation projects to planned targets is estimated as 60% according to ERP systems (including "early" introduction - about 3%), and completely failed projects - 10%. [26].

In order to implement the system to be successful, you need to define the strategy of informatization clearly, to choose the configuration of the system, to determine the management structure of the project, to describe the business processes of the organization, to involve all users in the implementation process, to approve the methodology of implementation and monitoring of the process. (M. Haddara at al. 2012)[27]

Analysis of the views of experts in the field of IT (Anderson, L. 2013[28], Nyaga, 2011,[29] Aloiini, D. 2012 [30]) allows us to conclude that a distinctive feature of the project implementation of information systems is that it is implemented in the atmosphere of great uncertainty, which is due to the constant changes associated with the realization, so it is difficult to use conventional methods of management at such a project.

In corporations there is one more problem: individual units are automated by information tools which have different technology platforms and can not be connected together. This is a big disadvantage, because it does not allow collecting all the resulting reports into a single corporate standard and additional time is required to bring a variety of information to a uniform format of reports.

For example: the marketing division implements an information system that automates operations; finance division – an information system for financial accounting; production division - a system of resource management. Each division has received a good management system. But these systems can not communicate with each other. This was because the corporation has no general plan for the

introduction of information technology. Therefore, the top manager can not get a general report on the work of the corporation. He gets a lot of different reports from each division and has to spend a lot of time to make a report.

Some companies are introducing informational resources mostly in production departments. With the others a lot of information tools are sent to those divisions where the work is carried out directly with customers. This takes place when information needed for decision-making should be collected in the place of occurrence. Collected this way information is prompt and detailed. It allows refining the data on each client. Informational base becomes a source of analysis and allows preparation of individual programs for each client. For effective management information must arrive in time without delay and distortion. This requires special techniques and methods for transmitting and receiving information. Not all corporations use the best set of technical systems for the company though there is a wide range of information technologies. Since it is impossible to count economic benefit of information system introduction directly they use the most inexpensive tools. Not always the difference between expenses on introduction and incomes is visible at once.

Companies carry out many actions for reorganization of business processes, and create suitable model key business operations, selected for this purpose. Technical Support Division introduces currently existing software products that meet the needs of the company and thus creates a model of the business processes appropriate hardware system requirements. Office of Manufacture Expenses deals with optimization of storage, transportation, distribution and other operations creates logistical systems and accounting systems based on their requirements. At the same time Financial Office attempts to automate its operation using advanced tools of budgeting, accounting and workflow, creating thus centers of financial accounting which are not connected to other services. Thus, the problems of coordination in the company resulted in the application of modern management techniques, one of which is the re-engineering of business processes are not effective.

The solution to this problem is to apply an integrated approach to the creation of a unified system of controlled processes that will eliminate the contradictions.

2. Modeling

In this study it should be considered how to use information technology for to bring greater effect for the company. To do this, one must create models that will combine the processes of internal communication, providing document management. They will also help to ensure full access to the information for top managers but will limit other users' access to secret information.

To achieve positive result of management it is necessary to change structure of information control in corporation. All divisions of the company should operate the information streams itself, receiving the full information and processing

the received information. They should carry out their functions in changing conditions of business dealing well. It is necessary to ensure that the external noise does not affect the work of these departments.

By modeling of the corporative activity it is possible to describe the processes occurring in it more full for the sake of comprehensive approach to management and to information resources.

Effective management of information resource allows you to manage the organizational company development through the change management. In this case the model can be altered on the analysis basis of possible future changes in external conditions[31]. The use of simulation technology enables complex description of processes that in turn helps to reconfigure existing information technologies or to develop new ones.

We propose to identify the main information flows and to create a complex model of corporation management then. Thus the problem of different departments uncoordinated actions will disappear. Managers will be able to model business processes taking into account all the features of corporation information flows. They will be able to learn what processes the information is redundant for, where the speed of information is low and to remove not effective processes. They will be able to select information technologies that are appropriate to each business process and each division. They will be able to connect all the departments into the information space, and all departments will be able to exchange the necessary information. For this it is necessary to apply the method of process management - collecting information about the parameters of business process. Then there is the need in information analysis and management solutions. The control system should provide the possibility of adjusting the parameters of business processes in the direction of improvement and the opportunity to address the causes of deviations in the course of a business process.

It is necessary to make the scheme of individual business processes. This will help to trace the flow of information. Analysis of information flows will find out their kind and direction (figure 2).

Here in the presented scheme information flows have a different purpose and different sources of origin. To simulate these flows one needs to create an information model of the company where these flows are systematically described in terms of good governance (Figure 3).

The business model is a means of improving the structure of the system, which produces and corrects formats of reports in right time. It allows the control subsystem to receive data in a predefined format, and is increasing the speed of information processing in decision-making.

Model of organizational structure takes into account possible changes in business processes and analyzes the possible changes in the organizational structure in line with the changes taking place. Such a model will allow managers to integrate all information flows in a common space and use corporate information system of business management.

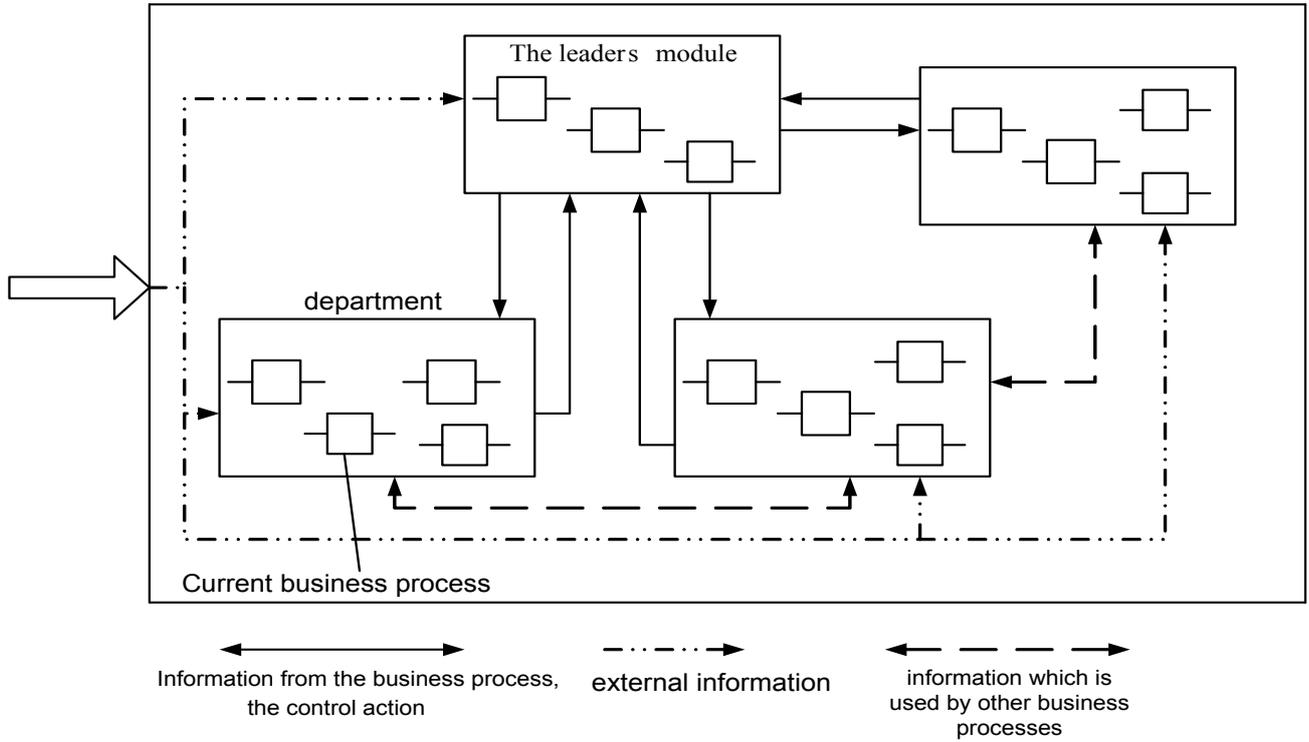


Figure 2. Corporation Information flows

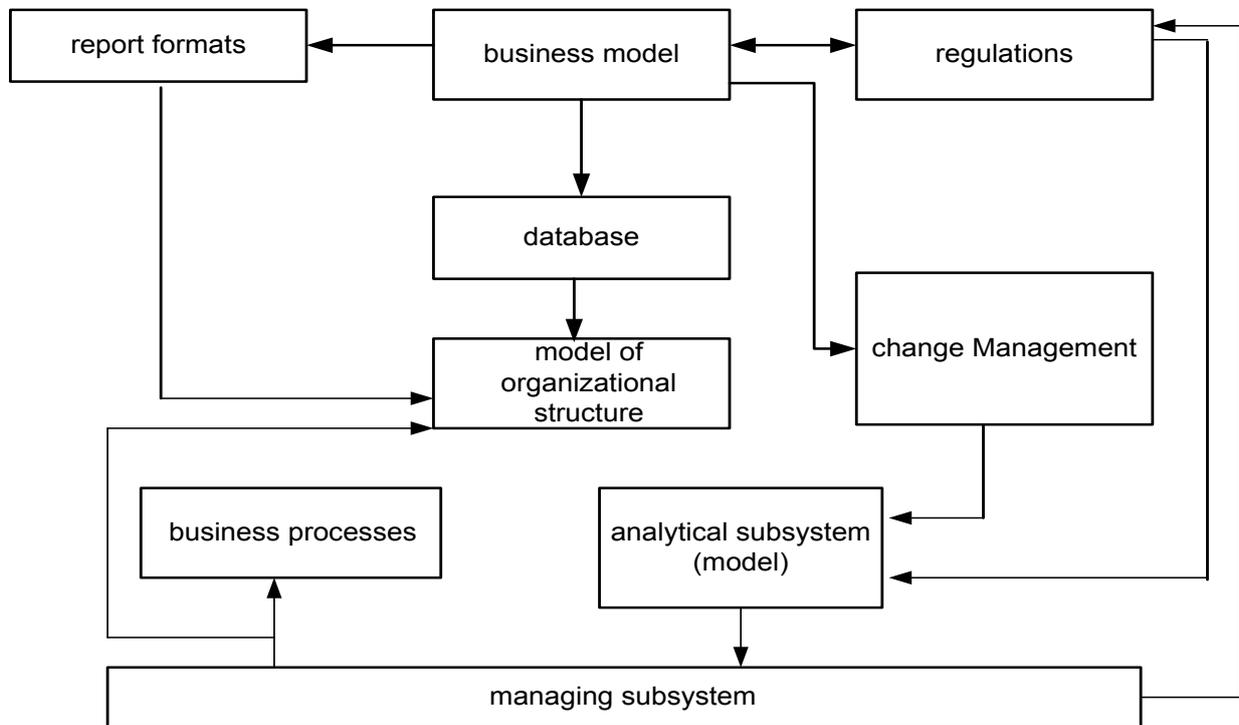


Figure 3. Model Corporation Management

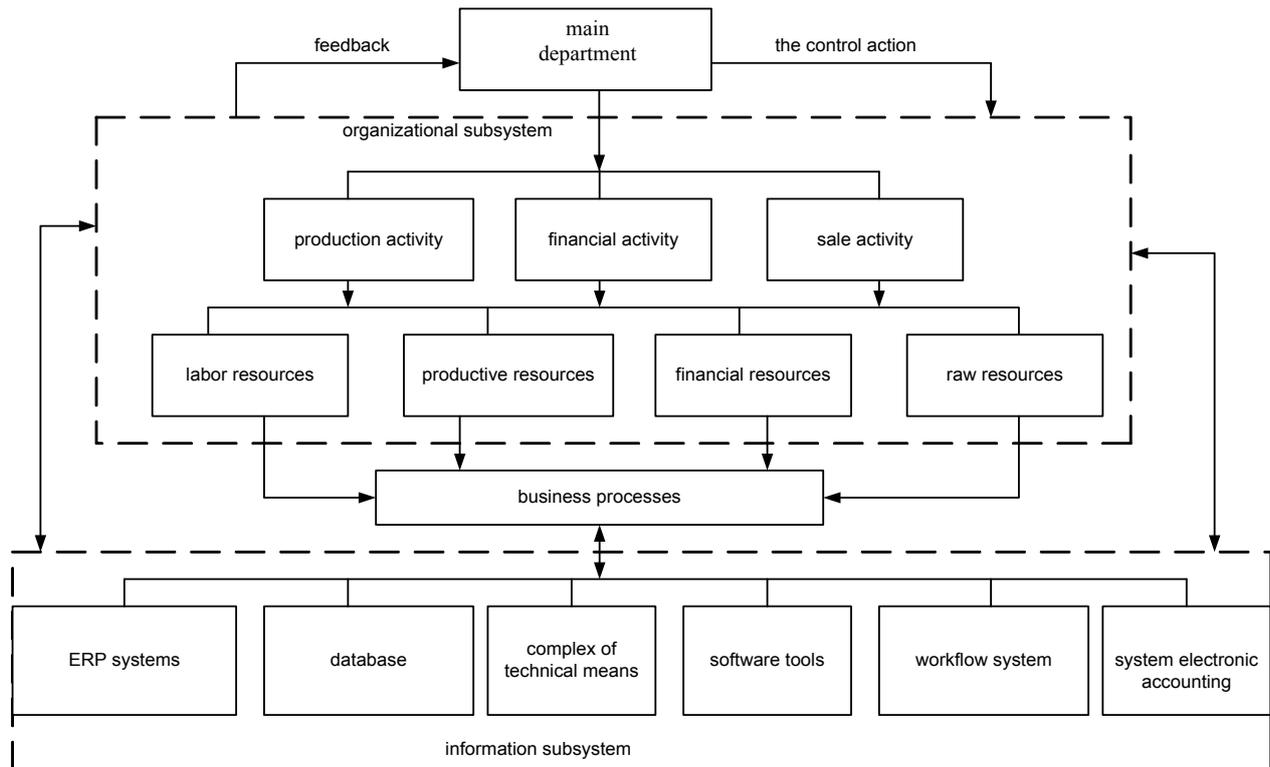


Figure 4. System of structure and information reconciliation

The integrated management system will collect, organize external information and pass it on to end-users through graphical user interfaces that allow you to monitor your progress and improve communication. In organizations, there are several control loops, the amount of which depends upon the number of information subsystems. At the same time there is a need to work with different types of information as each circuit of information is rather specific. Input information is provided to the governing body from the external environment. Primary information comes from facility management and results from direct measurement or calculation. The peculiarity of the initial information is that it often contains the bulk characteristics of the object. These characteristics are the basis for the assessment of the actual state and dynamics of the controlled object. From the point of view of the management process the primary information serves as the feedback received from the managed object and is showing the results achieved, as well as deviations from the standard operation of the facility. External information is divided into two groups: coming from external organizations and from the higher authorities and includes different parameters. If authorities' data affect the functioning of the object, the external data determine the conditions of object's operation. They preferably have a dimensionless value or character. After processing by technical information input means is converted into derivative information. Information methods may be very different from a simple transfer and aggregation to grouping to complex economic calculations and analysis. The derivative information obtained as a result of these calculations reflects a more challenging economic characteristics of the production. For to compare the current

operation with the assignments of authorities the derivative information is expressed in the same figures. However, the derivative information is immeasurably wider in composition and presentation than the input and the output information, because it reflects the diversity of the information used and the complexity of its processing. It depends on the type of econometric models that are used in the organization of control processes. Getting the derivative information is a processing target and determines the selection of appropriate methods.

The introduction of integrated management systems on the basis of this models will help to achieve a fundamentally new quality of information management in the organization, providing such indicators as storing large amounts of information (accumulated knowledge base), structuring and presentation of information. The precise targeting of management reports reflects both tactical and strategic performance, speed and accuracy of complex data transformations, fast and distributed access, the ability to group work with information. The use of these models in the organization significantly increases the information frequency and provides the ability to handle greater amounts of information. Incoming information is analyzed, filtered according to the criteria and assigned to different functional units and governmental levels of the organization. In the control system there the number of processed data is increased per unit of time and it gives more information to make management decisions. The result is the integrated system that implements the standard cycle management: information gathering, analysis, development of solutions, organization, control, regulating. Managers of the company

will receive both the necessary administrative documents (job descriptions and other management regulations), and the necessary operational and strategic reports of the set format which are formed by the software components.

Despite the fact that the developers provide a wide array of information systems there is information overloading on the upper levels of management and absence of tiered accessory information files, underdeveloped scheme transfer of information between levels of government and departments of the company.

The information system should match the characteristics of the organizational structure of the corporation. To change the situation it is necessary to create the interrelated model of organizational structure and information system.

Information management system of corporation should cover all levels of management including branches, subsidiaries, representative offices, the specific workplace and the employee. We consider information management as a continuous process of change, storage and dissemination of information.. Each workplace is the node that consumes and generates certain information. All of these nodes are interconnected streams of information presented in the form of documents, reports, orders. From this viewpoint, a corporation can be represented as institutional information system comprising nodes and links between them (Figure 4).

Such a model should encompass all aspects of the enterprise, must be logically justified and is aimed at identifying the mechanisms to achieve the main objectives of the corporation.

This model allows us to determine required set of technical and information resources necessary for the functioning of all the business processes of the company in view of the functional elements of the organizational structure and information flow features This model allows us to determine required set of technical and information resources necessary for the functioning of all the business processes of the company in view of the functional elements of the organizational structure and information flow features..

3. The Conclusions

The corporate management system should combine elements of organizational structure and information streams. Business units should solve their specific problems themselves. Functions of management in information systems include the determination of the organization's goals, analysis of its performance, and a set of solutions to achieve the strategic goal. This approach is the most appropriate one for the construction of a corporate information system.

Its advantage is that there is a rapid correction of the functional structure of corporate management for as conditions change or insufficiency of good performance of its functions in some business units. The presented models allow realizing the multilevel and multifunctional approach to the implementation of corporate information management

tools taking into account its features.

Necessary condition for effective acceptance of administrative decisions is installation levels of access of certain number of users to various types of information. The information is distributed on groups of users according to importance of decision-making and definition of credentials in the company. Level 1 requires information to make strategic management decisions. Such decisions are accepted by the supreme governing body. They are owners or board of directors, as well as salaried managers. At this level there is full access to all information.

Level 2 - is the more low level of management. There is the information necessary for acceptance of tactical decisions. Such information is not complete, access to it is limited by the necessity of tactical decisions. The decision makers at this level are the heads of business units in accordance with the organizational structure of the enterprise. Operational decisions are made by those responsible for the implementation of projects with working groups on the basis of using the definite information. Thus, there is a limited access to the information, based on importance of the solutions and certain levels of management.

The decision making process exists in every organization that has its own specific characteristics. Therefore the information streams control should be unique in each organization. The proposed models allow combining business units and information streams to create a unique control system.

Operating the company on the basis of the proposed models managers will be able to receive timely information in the form of reports, guidelines, regulations and other documents, as well as to disseminate information streams in the right direction. The application of these approaches to manage the flow of information is justified by the fact that it allows creating a sustainable business and increase the competitiveness of the corporation.

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