# CORPORATE INFORMATION SYSTEMS

## Concept and creation requirements corporate information system

The corporate information system is the most important component of the modern information infrastructure of a complex organization, because the need for an information system is typical only for organizations that have a high degree of complexity - a significant number of departments and numerous areas of activity. *Corporate Information System (CIS) is a set of software and hardware tools that provide business processes of the organization.* Sometimes, the definition of a corporate information system does not include hardware, the presence of which in an organization in modern conditions is already taken for granted: most CISs can be implemented on computer equipment already in the organization when it meets the CIS hardware requirements. Thus, CIS is, first of all, a complex of specialized programs that correspond to business processes relevant to the organization. Here it should be noted that the need for CIS is not only for commercial organizations, in connection with which it would be more correct to remove the term ―business‖ from the definition. The information system can serve, for example, scientific and technical research of non-profit organizations, but given the widespread use of CIS in the activities of commercial enterprises, most often the existing CIS solutions are focused on solving the most urgent business problems.

In general terms, some basic features of CIS can be given:

* compliance with information and management needs of the enterprise, its business;

* consistency with the adopted management system and organizational culture of the enterprise;

* integration

* openness and scalability.

The first and second signs combine all the functional features of a specific corporate information system of a particular enterprise, because they are strictly individual. More or less common for all enterprises can only be the functions of accounting and, to a lesser extent, wages regulated by law.

The second and third signs are common, but very specific. A corporate information system is not a combination of separate (scattered) programs for automating an enterprise’s business processes (production, resource, customer relationship management), it is an end-to-end integrated automated system in which each individual module responsible for its business process in real time all necessary information is available, developed by other modules (without additional and, even more so, double input of information).

The corporate information system should be open to include other modules and expand the system both in scope and function and in the territories covered.

Based on the foregoing, we clarify the definition of a corporate information system as follows.



*The corporate information system is an open, integrated automated real- time system for automating the business processes of an enterprise, including the processes of developing and making managerial decisions.*

In general, any information system can be called corporate if it covers all the necessary areas of management and business processes of the enterprise. In particular, it is necessary to determine exactly which business processes are subject to automation, and how, this issue can be resolved individually for each enterprise. Because of this, completely ―boxed‖ solutions of corporate information systems cannot exist without the ability to configure and adapt to specific operating conditions.

The evolution of automated systems has generated a number of requirements for the developed CIS.

1. *Complexity and consistency.* CIS should cover all levels of enterprise management as a whole (from a large division to a specific workplace), as well as taking into account its branches, subsidiaries, service centers and representative offices. Indeed, the production and distribution of goods, from the point of view of computer science, is a continuous process of generating, processing, changing, storing and disseminating information. Each workplace is a node that consumes and generates certain information. All such nodes are interconnected by information flows, embodied in the form of documents, messages, orders, actions, etc. Thus, a functioning enterprise can be represented as an information-logical model consisting of nodes and connections between them. Such a model should cover all aspects of the enterprise’s activity, should be logically justified and aimed at identifying mechanisms to achieve the main goal of entrepreneurship in the market - the extraction of income and maximum profit, which implies a systematic requirement.
2. *Modularity of construction.* Information in such an information-logical model is distributed in nature and can be quite strictly structured at each node and in each stream. Nodes and flows, in turn, can be conditionally (or explicitly)

grouped into subsystems. Then the modularity of the construction allows you to parallelize, facilitate and, accordingly, accelerate the process of installation, training of personnel and putting the system into commercial operation.

1. *Openness - this requirement is of particular importance, given that automation is not limited to management, but also covers tasks such as design engineering and maintenance, technological processes, internal and external document management, communication with external information systems (for example, the Internet), systems security etc*.
2. *Adaptability.* Any enterprise does not exist in a confined space, but in a world of ever-changing supply and demand, requiring a flexible response to the market situation, which can sometimes be associated with a significant change in the structure of the enterprise and the range of products or services provided. This means that CIS must be flexibly adjusted in connection with changes in the enterprise itself and in its external environment. It is desirable that, in addition to the configuration tools, the system also has development tools - tools with which programmers and the most qualified users of the enterprise could independently create the components they need that would integrate seamlessly into the existing system.
3. *Reliability.* When CIS is operated in an industrial mode, it becomes an indispensable component of a functioning enterprise, capable of stopping the entire production process and causing enormous losses in the event of an emergency stop. Therefore, one of the most important requirements for such a system is the continuity of its functioning as a whole, even in conditions of partial failure of individual elements due to unforeseen and irresistible reasons.
4. *Security.* This requirement includes several aspects:

* Data loss protection. This aspect is implemented mainly at the organizational, hardware and system levels, i.e. at the level of the operating environment.

* Preservation of data integrity and consistency. The application system should track changes in interdependent documents and provide control over versions and generations of data sets.

* Prevention of unauthorized access to data inside the system. These tasks are solved in a comprehensive manner, both by organizational measures, and at the level of operational and applied systems. In particular, application components should have developed administration tools that allow restricting access to data and system functionality depending on user status, as well as monitor user actions.

* Prevention of unauthorized access to data from outside. The solution to this part of the problem falls mainly on the hardware and operating environment of the CIS operation and requires a number of administrative and organizational measures.

1. *Scalability.* An enterprise that successfully operates and receives sufficient profit tends to grow and form subsidiaries, branches and representative offices, which, during the operation of CIS, may require an increase in the number of workstations and an increase in the amount of information stored and processed.

In addition, for companies such as holdings and large corporations, it should be possible to use the same management technology, both at the level of the parent company, and at the level of any, even a small, company within it.

1. *Mobility.* At a certain stage in the development of an enterprise, an increase in requirements for system performance and resources may require a transition to a more productive software and hardware platform. In order for such a transition not to entail a radical breakdown of the management process and unjustified investments in the acquisition of more powerful applied components, it is necessary that the system be sufficiently mobile.
2. *Simplicity in learning* - this requirement implies not only the use of an intuitive interface of programs, but also the availability of detailed and well- structured documentation, the possibility of training personnel in specialized courses and internships by responsible specialists at related enterprises where this system is already in operation.
3. *Developer support -* includes a number of opportunities, such as obtaining new versions of software free or at a substantial discount, obtaining additional methodological literature, consulting on the hotline, obtaining information about other software products of the developer, the possibility of participating in seminars, scientific and practical conferences users and other events conducted by the developer or user groups, etc. Naturally, the user is able to provide such support and only a serious developer company, steadily working in the software market and having a fairly clear future perspective.
4. *Escort.* During the operation of complex software and hardware systems, situations may arise that require the prompt intervention of qualified personnel of the developer company or its representative on the spot. Support includes a specialist’s visit to the customer’s site to eliminate the consequences of emergencies, technical training at the customer’s site, methodological and practical assistance if necessary to make changes to the system that are not in the nature of a radical restructuring or new development. It also implies the installation of new releases of software received from the developer free of charge by the authorized developer of the accompanying organization or by the developer.

In conclusion, it should be noted that the catfish application system, which is the CIS, puts forward a number of requirements for the environment in which it operates. The environment of functioning of the application system is a network operating system, operating systems at workstations, a database management system and a number of auxiliary subsystems that provide security, archiving, etc. functions that go beyond the attention of information management.

#### Classification of corporate information systems

The initial classification of CIS can be based on the evolution of their development. Therefore, until the 60s of the XX century, the function of information systems was simple: dialog processing of requests, record keeping, accounting and other electronic data processing (electronic data processing – EDP). Later, in connection with the emergence of the concept of management

information systems (MIS), a function was added aimed at providing managers with the necessary reports for making management decisions, compiled on the basis of data collected in the process (information reporting systems).

In the 70s, it became obvious that the well-defined forms of the results of the reporting system did not meet the requirements of the managers. Then the concept of decision support systems (DSS) appeared. These systems should have provided managers with specialized and interactive support for the adoption of unique solutions in a real, fast-paced world.

In the 80's, the development of the power (speed) of microcomputers, application packages and telecommunications networks gave rise to the phenomenon of end user computing. Since then, end users (managers) have been able to independently use computing resources to solve problems related to their professional activities, without depending on the mediation of specialized information services.

With the understanding that most top-level managers do not directly use the results of reporting systems or decision support systems, the concept (executive information systems – EIS) has emerged. These systems must provide top management with vital information, primarily about the outside world, when they need it and in the format, they prefer.

A major achievement was the creation and application of systems and methods of artificial intelligence (artificial intelligence – AI) in information systems. Expert systems (ES) and knowledge - based systems have defined a new role for information systems. Today they can provide managers with quality recommendations in specialized areas.

The concept of the strategic role of information systems, sometimes called strategic information systems (SIS), appeared in 1980 and continued to develop in the 90's. According to this concept, information systems are no longer just a tool that provides information processing for end users within the enterprise. Now they are becoming a generator based on information, new products and services that should give it a competitive advantage in the market.

Production information systems include the transaction processing systems (TPS) category. Transaction processing systems register data about the process. Typical example-information systems, sales registering which, when purchasing, do not change the state. The results of such a registration are used to update the database on the client, inventory, and other organized databases of data. Transaction processing systems also produce information for internal or external use. For example, they prepare customer requests, payroll statements, sales receipts, and tax and financial reports. Transaction processing systems process data in two main ways. About batch processing, data about operations is accumulated over a period of time and is processed periodically. In real-time (or interactive) mode, the data are processed immediately after the operation occurs. For example, a point of sale (POS) used for retail sales can use electronic terminals that capture and transmit commercial data to regional computer centers in real time or in batches.

**Process control systems** make the simplest decisions necessary to manage production processes. These include a category of information systems called process control systems (PCS), which automatically make decisions that regulate the physical process of production. For example, oil refineries and automated Assembly lines use such systems. They monitor physical processes, process data collected by sensors, and perform real-time process control.

Another function of production information systems is the conversion of traditional manual methods of office work and paper workflow. Office automation systems (OAS) collect, process, store and transmit information in the form of electronic documents. These automated systems use special methods of text processing, data transmission and other information technologies to improve the efficiency of the office. For example, it is possible to use text processors for processing correspondence, e-mail, for exchanging electronic messages, desktop publishing systems are used for the production of company newsletters, and teleconferencing capabilities are used for electronic meetings.

Information systems designed to provide managers with information to support effective decision – making are called management information systems (MIS). The most important for us are three main types of management information systems: report generation systems, decision support systems, and strategic decision support systems.

**Information reporting systems (IRS)** are the most common form of management information systems. They provide managers with the information they need to meet their daily decision-making needs. They produce and execute various types of reports, the information content of which is determined in advance by the managers themselves so that they have only the necessary information for them. Report generation systems select the necessary information about processes within the enterprise from databases prepared by production information systems, and information about the environment from external sources. The results of the report generation systems can be provided to the Manager on demand, periodically or in connection with any event.

**Decision support systems (DSS)** are a natural development of report generation systems and transaction processing systems. Decision support systems are interactive computer information systems that use decision models and specialized databases to help managers make management decisions. In this way, they are different from transaction processing systems that are designed to collect raw data. They also differ from report generation systems that focus on providing managers with specific information. Instead, decision support systems provide managers with information online and only on demand. DSS provides them with analytical modeling capabilities, flexible tools for finding the necessary data, a wealth of forms of diverse information representation. Managers deal with the information needed to make less structured decisions online. For example, spreadsheets or other types of decision support software allow a Manager to ask a series of "what if?"and get interactive answers to them. Thus, the information obtained using DSS differs from the pre-formulated report forms obtained from the

report generation systems. When using DSS, managers explore possible alternatives and get trial information based on sets of alternative assumptions. Therefore, managers do not need to define their information needs in advance. In return, DSS interactively helps them find the information they need.

**Executive information systems (EIS)** are management information systems adapted to the strategic information needs of senior management. Top management gets the information it needs from many sources, including letters, records, periodicals, and reports prepared by hand and computer systems. Other sources of strategic information include meetings, phone calls, social activities, and so on. Thus, most of the information comes from non-computer sources.

The purpose of computer systems for strategic decision support is to provide top management with direct and free access to information about key factors that are critical in the implementation of strategic goals of the enterprise. Therefore, EIS should be easy to operate and understand. They provide access to a variety of internal and external databases, actively using a graphical representation of the data.

At the forefront of the development of information systems are achievements in the field of artificial intelligence (artificial intelligence – AI). Artificial intelligence is a field of computer science whose goal is to develop systems that can think, as well as see, hear, talk, and feel. For example, AI projects involving the development of natural computer interfaces have accelerated the development of industrial robots and intelligent software. The main impetus for this is the development of computer functions, usually associated with human intelligence, such as reasoning, learning and problem solving.

One of the most practical applications: AI-development of expert systems (ES). An expert system is a knowledge-based information system; that is, it uses knowledge in a specific area to act as an experienced consultant. Components of the expert system are knowledge bases and software modules that perform logical conclusions based on existing knowledge and offer answers to users ' questions. Expert systems are used in many fields, including medicine, engineering, physical Sciences, and business. For example, expert systems now help diagnose diseases, search for minerals, analyze compounds, recommend repairs, and make financial planning

End user computer systems are computer information systems that directly support both operational and managerial functions of end users who directly use information resources instead of using them indirectly, using the professional resources of the organization's information services Department. End users of information systems typically use automated workstations and application packages to support their daily activities, such as information retrieval, decision support, and application development.

Other methods of classifying information systems provide a narrower or wider classification than those described above. It is only important to understand that information systems directly support almost all aspects of management

activity in such functional areas as accounting, finance, human resources management, and marketing and production management

Another way to classify CIS is to distinguish them by a number of essential features.

An important feature that differentiates information systems is the ability to configure," individualize" the CIS. In accordance with this feature is allocated: * systems that are universal enough that their implementation does not require special modification for the needs of a particular enterprise. Otherwise, they are called "packaged" or "boxed", because they can be delivered as regular software disks. Widely distributed and are the cheapest;

* systems consisting of detailed differentiated modules that allow you to "assemble" the desired configuration of the CIS. Such systems are called constructors and their implementation is usually quite time-consuming, and also requires the involvement of highly qualified consultants;

* systems developed in accordance with the unique needs of a particular enterprise are the most expensive and complex CMS, but allow you to provide the most time-consuming procedures for the implementation of business processes.

In accordance with the sign of "size" or "volume", which means that the system can cover both business processes and employees using this CIS, allocate:

* local systems that serve a small company or one of the work sites, most often accounting. By means of such systems, individual procedures are automated. Their main purpose is to provide the most time consuming and routine actions; * mid-level systems that meet the needs of the enterprise in the complex, or branch structure;

* integrated multi-disciplinary systems. The need for them arises, as a rule, from the largest enterprises with many activities and a large (up to several thousand people) staff

In accordance with the sign of "locality", i.e. the possibility of using remote access networks, allocate:

* Autonomous systems that do not even require the use of the internal local network of the enterprise for their operation;

* systems designed to use the resources of the local network of the enterprise (this type is the most common);

* systems that provide for the use of the Internet in a controlled access mode (this type of system is most effective in the branch structure of the enterprise, as well as in the territorial remoteness of divisions)

In accordance with the sign of modifiability of the algorithmic foundations of the system, allocate:

* closed systems that are not designed for rapid replacement of a particular software element or type of DBMS, changing the architecture (these systems are the most simple and cheap);

* multi-platform solutions that incorporate a variety of software modifications;

* open systems that allow for operational improvement, which, with objective advantages, is nevertheless very time-consuming.

In accordance with the quantitative level of integration of CIS, there are also types of *information system architecture*-virtually *non-integrated (distributed), little integrated, and highly integrated*. These types of CIS architecture should be considered in detail.

The first type of architecture (distributed) is the most adaptive, because it is a set of software applications (possibly from different manufacturers) that have the ability to exchange data. Given the sufficiency of the current level of unification and standardization of data types and files processed by automated systems, special integration between programs-applications is simply not required, and such a CIS exists in a distributed form, representing a set of programs at the user's workplace. In the presence of an internal local network, data exchange within this type of CIS is almost identical to data exchange in more tightly integrated types. The distribution of the functioning of this type of CIS determines the multiple duplication of data, which, perhaps, should not be considered a disadvantage, on the contrary-it contributes to the preservation of data in the event of problems with the hardware.

When using a distributed type of CIS, the operation of the system itself is significantly cheaper. The company buys only licensed software applications, and, what is worth noting specifically, in modern Russian conditions of mass violation of the rights of software manufacturers through the acquisition of unlicensed copies, the operation of this kind of CIS becomes almost free, which, of course, should not be considered a virtue in any way. The selection of individual business applications in accordance with the specific needs of the enterprise leaves the maximum freedom to modify the CIS, which makes this type of architecture the most versatile and frequently used. In the conditions of market instability, at the stage of its intensive and extensive growth, with the unpredictability of further changes in business processes, this type of architecture is extremely functional and ergonomic.

The second type of architecture-poorly integrated, allows you to divide the functions of the system into Autonomous services, focused on the variety of different types of data. Such an information system is an operating environment that provides many opportunities for independent work of individual users who are not associated with mandatory algorithms of actions with data. In the conditions of dynamic development of business processes, business restructuring, in the presence of highly qualified users, weak integration gives many opportunities to intensify business processes, providing them with variable models, rather than ready-made rigid solutions. Users ' actions are limited by their data access rights, data modification rights, and data processing models (classifiers, description rules, and so on). In a weakly integrated type of GIS, data processing models largely replace the usual form of a separate application, and therefore working with this type of GIS requires special training.

A highly integrated architecture, as in the case of a distributed type, is a set of applications, but it differs in the unity of the interface, the unity of the data presentation formats, and the tight connection between individual applications. The relationship between the applications must exactly match the business processes that are simply "written" in the structure of the CIS, which greatly facilitates the work with it for untrained users. Data in this type of CIS is practically not duplicated, and can be presented in all the variety of their relationships, which is extremely important in the implementation of analytical activities and end-to-end management control. The use of this type of CIS is typical for stable large enterprises, even high turnover. Highly integrated CIS provide transparency of all operations, control over the actions of all users, strictly regulate access to data. As a rule, in the structure of such CIS fixed and features of the management structure of the enterprise. The disadvantage of this type of CIS is the complexity of making changes to its structure, and therefore, even if minor changes are necessary, the process of restructuring the system affects many of its elements, for a long time bringing the system out of operation.

In accordance with the nomenclature and typology of business processes of the organization, it is customary to consider the functional-component structure of the CIS, which determines the specialized modules included in the CIS (for example, "Accounting", "Sales", etc.). On this basis, we can distinguish the following aspects of the functioning of the CIS, which determine their typology: * formation of accounting documentation;

* financial planning and budgeting; * human resource management; * materials management;

* managing customer interaction; * production management; * logistics;

* formation of databases for any purpose, etc.

In accordance with the given nomenclature of business processes implemented in the CIS, the typology of the CIS itself is built, which can have a functional specialization, and combine all or many business processes in a universal structure. The most commonly used English abbreviations of the types of CIS, quite accurately reflecting their functional specialization. Here are the most common types of CIS:

* **CRP** (Capacity Requirements Planning) - systems that implement the main functions of production management.

* **FRP** (Finance Requirements Planning) - systems that implement only planning and budgeting technologies.

* **MRP** (Material Requirements Planning) – systems specially developed for the needs of material resources management, primarily – supply.

* **MRP-II** (Manufacturing Resources Planning) - integrated financial planning and production management systems.

* **MPS** (Master Planning Schedule) - systems focused on most types of planning, not only financial, but also production, sales planning, etc.

* **CRM** (Customer Relationship Management) – systems focused not only on customer service in connection with the product, but also on any type of customer service.

* **SCM** (Supply Chain Management) - logistics systems.

* **ERP** (Enterprise Resources Planning)-complex systems that implement most business processes without a pronounced dominant of any direction, but with the ability to "fine-tune" to the needs of a particular enterprise. As a rule, they take into account the possibility of both end-to-end and operational control, which makes them extremely convenient for use by top management. Currently – it is the most common and popular type of CIS.

* **reference and legal information systems**. This type of system is usually considered separately from the CIS, but the frequency of use of such systems in the context of business process Informatization allows us to refer them to the actual additions to the CIS.

Note that information systems in the real world are usually combinations of several types of information systems, because conceptual classifications of information systems are designed to emphasize their different roles. In practice, these roles are integrated into complex or interconnected information systems that provide a number of functions. Thus, most information systems are designed to provide information and support decision-making at different levels of management and in different functional areas. Let's look at the features of some of the above types of CIS in more detail.