STATE SERVICE FOR SPECIAL COMMUNICATION AND INFORMATION SECURITY OF UKRAINE
ADMINISTRATION OF STATE SERVICE FOR SPECIAL COMMUNICATION AND INFORMATION SECURITY OF UKRAINE

Odessa National Academy of Telecommunications named after O.S. Popov

Chair of Telecommunication Networks

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INFORMATION SYSTEMS IN ECONOMIC AND BUSINESS

Teaching Aid
for training bachelors and masters
in Telecommunication

APPROVED BY
Methodological Council of
Academy of Telecommunications
Protocol number 16
on March 23, 2012

Odessa, 2012

UDC 621.3 831 **Plan TMP 2012**

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Information systems in economic and business: student's guide in training bachelors and masters, teaching aid/ Tsaryov R.Y., Shulakova K.S., Prikhodko K.D. – Odessa: ONAT named after O.S. Popov, 2012. – 112 p.

ACCEPTED
At the Meeting Chair of
«Telecommunication networks»
Protocol number 7
on February 29, 2012

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INTRODUCTION

All medium to large organizations depend on Information technology for their continued survival. An understanding of the effective and responsible use and management of information systems is important for managers and other business knowledge workers in today's global information society. Information systems (IS) and technologies have become a vital component of successful businesses and organizations. Information systems constitute an essential field of study in business administration and management, as they are considered a major functional area in business operations. We can learn a lot about the importance of information technology and information systems from this case. Managerial end users need to know how information systems can be employed successfully in a business environment. The important question for any business end user or manager is: What do you need to know in order to help manage the hardware, software, data, and network resources of your business, so they are used for the strategic success of your company.

Now the informational systems needs for any type of enterprises. Three major roles of the business applications of information systems include:

1. Support Business Processes – involves dealing with information systems that support the business processes and operations in a business.
2. Support Decision Making – help decision makers to make better decisions and attempt to gain a competitive advantage.
3. Support Competitive Advantage – help decision makers to gain a strategic advantage over competitors requires innovative use of information technology.

This book gives the basic information about informational systems in economic and business. There are describes the architecture IS, logical components of the IS, the basic standards of the IS, design methods of the IS, difference classes of the IS.

TOPIC 1 The basic information about the informational systems

Theme 1.1 The main terms and definitions

Informational systems in economics and business are a special case of information systems that by-turn are a special case of the General Systems Theory.

The system is translated from Greek as "a set of interconnected and interacting elements united with a definite purpose".

The system consists of different elements.

An *element* is a simple indivisible underlying object.

Systems including information systems are studied by means of systems analysis and are described in the general systems theory.

The General Systems Theory divides all systems into six classes:

- natural systems;
- artificial systems (the so called anthropogenic systems);
- engineering systems (or the so called technical systems);
- social systems;
- political systems;
- economic systems (the so called business systems)

The information component is presented in artificial systems, social systems, political systems, technical systems and economic systems.

Natural systems don't have an information component in the per se.

The information system is a set of technical, program and organizational support, and also staff that are united for the purpose of support of handling, storage and information provision.

There are various types of information systems, for example: transaction processing systems, office systems, decision support systems, knowledge management systems, database management systems, and office information systems. Critical to most information systems are information technologies, which are typically designed to enable humans to perform tasks handling large amounts of information, performing complex calculations, and controlling many simultaneous processes.

The economic information system is a set of elements intended for handling, storage and provision of the information, united for the purpose of obtaining of the maximum economic effect.

The “classic” view of Information systems found in the books of the 1980s was of a model of pyramid that reflected the hierarchy of the organization, usually Transaction processing systems at the bottom of the pyramid, followed by Management information systems, Decision support systems and ending with Executive information systems at the top. Although the pyramid model remains useful, since it was first formulated a number of new technologies have been developed and new categories of information systems have emerged, some of which no longer fit easily into the original pyramid model.

You can see the model of pyramid at the Figure 1.1.

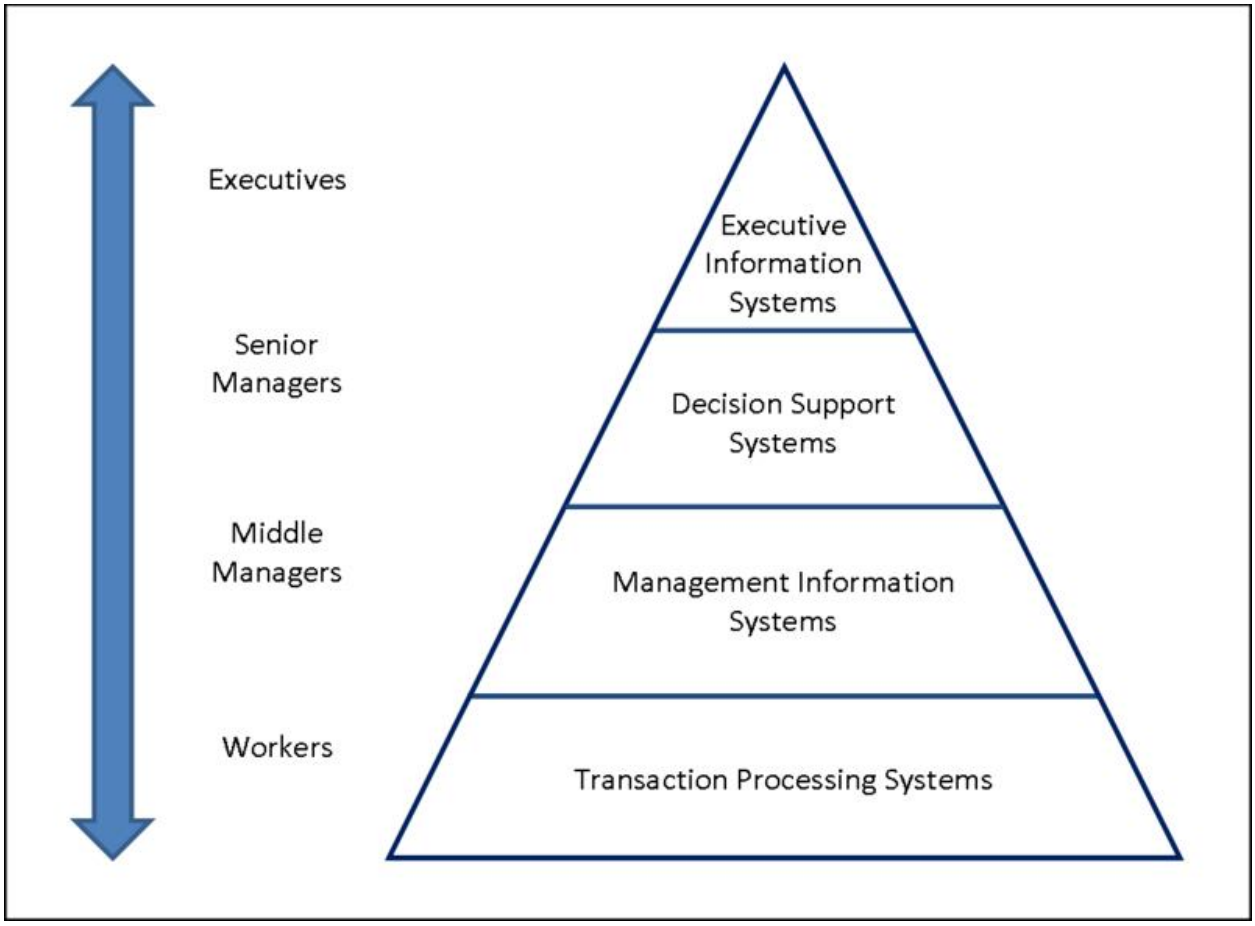

Figure 1.1 – The model of pyramid.

Theme 1.2 Information Systems Classification

Today, there exists relatively large quantity of different information systems, each designed to perform specific tasks. In this connection, you must have a means to separate the multiple systems into any particular groups or classes.

There exist three types of classification:

1. Simplified classification that uses terms of systems theory.
2. Designers' classification.
3. The system integrators' classification.

In accordance with the first type of classification all information systems can be divided into two types – the size of the system and the behavior of the system.

According to the size, the systems are divided into:

1. Simple.
2. Complex.
3. Super complex.

Behavior can be divided into deterministic and probabilistic.

The intersection of these types is possible, so there may exist simple probabilistic systems, complex deterministic system, super complex probabilistic systems, etc. The example of a sophisticated deterministic system is chess, the simplest one – the location of furniture in the room.

Information Systems classification from the perspective of the designers have more classes. Into basis of this classification there have been put the most essential features that define the functionality and design features of modern systems. Figure 1.2 shows the classification of IS from the developer perspective.

By type of data stored IS are divided into factual and documentary. Factual systems are designed for storage and processing of structured data in the form of numbers and texts. Various operations can be performed on such data. In the documentary systems, information is presented in the form of documents, consisting of names, descriptions, abstracts and texts. Search of unstructured data is performed by using semantic features. Selected papers are presented to the user, and data processing in such systems is almost never done.

According to the **degree of automation of information processes** in the system of firm management, information systems can be divided into manual, automated and computerized.

Manual IS are characterized by absence of modern technical means of information processing and all operations are performed by a human.

In automatic IS all the operations of information processing are performed without human intervention.

Computerized IS involves a process of information processing and human and technical means, the main role in the performance of routine data processing operations assigned to your computer. This class of systems corresponds to the modern view of «information system».

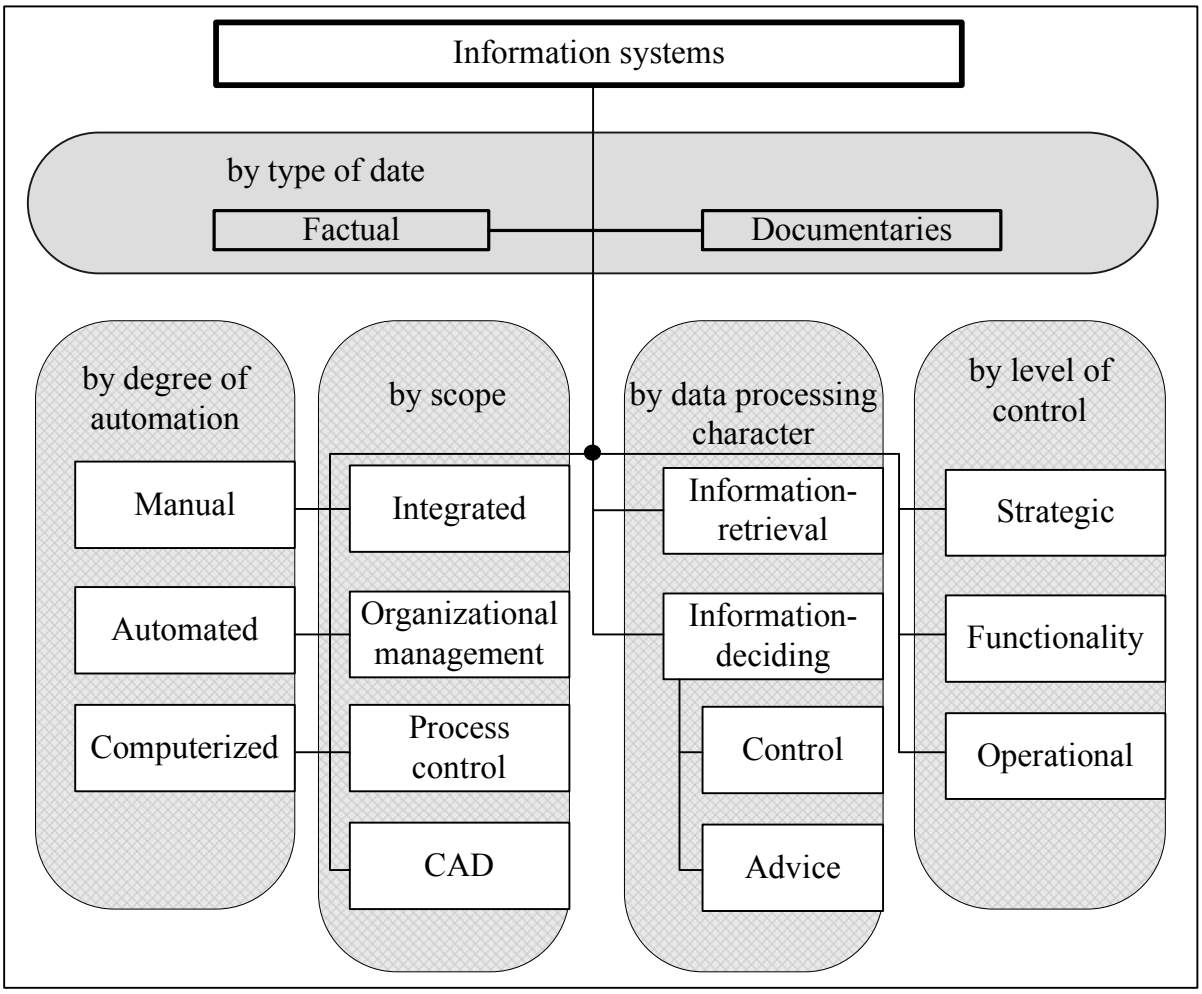

Figure 1.2 – Classification of IS in terms of development

Depending on the data processing character the IS can be divided into information-retrieval and information-deciding.

Information-retrieval systems make entry, ordering, storing, information issuing on the user's request without performing complex transformations on data. (For example, the IS library services, reservations and ticketing for transport, hotel reservations, etc.)

Information-deciding system exercise, in addition, transaction processing information on a specific algorithm.

According to the character of output data use, such systems can be divided into control and advice.

The resulting information management of IS is directly transformed into a decision taken by the human. Such systems usually deal with large data volumes and formulaic tasks (For example, the IS for production or planning of orders, accounting programs).

Advising IS produce information that a person takes into consideration and takes into account when forming management decisions, but this person does not initiate any action. These systems emulate the intellectual processes of knowledge processing rather than data ones. (For instance, systems expert).

Depending on the usage environment there are distinguished the following classes of IS.

Organizational management information systems – are designed to automate the functions of management personnel at industrial enterprises and non-industrial facilities (hotels, banks, shops, etc.).

IS process control (PC) – are used to automate the functions of production personnel to monitor and control production operations. Such systems typically provide developed variables of measurement process (temperature, pressure, chemical composition, etc.), monitoring procedures admissible values and management processes.

IS computerized design (CAD) – are designed to automate the functions of engineering designers, architects and designers to create new techniques or technology. The main functions of such systems are: engineering calculations, creating graphic documentation (drawings, diagrams, and plans), creation of design documents and simulation of the projected objects.

Integrated (corporate) circuits are used to automate all functions of the company and cover the whole cycle of works from planning to marketing. They include a number of modules (subsystems) working in a common information space and performing support functions of related activities.

There is a classification of IS, depending on the **level of control** where the system is used.

Information system operational level – supports artists, processing data on transactions and events (invoices, bills, salaries, loans, the flow of raw materials). Information system operational level is the link between the firm and the external environment.

Functional Information systems– support work with data and knowledge, increase productivity and performance of engineers and designers. The task of such information systems is integration of new information into the organization and

assistance in the processing of paper documents, as well as their use for monitoring, control, decision-making and administration.

The main functions of these information systems are:

- comparison of present performance with past;
- preparation of periodic reports for a certain time, rather than issuing reports on current events, both at the operational level;
- providing access to archival information, etc.

Strategic information system is a computer information system, that provides decision support to implement the strategic long-term goals of the organization.

Classification IS by System Integrator criteria

Every year there is an increase in number of information systems of different orientation and companies introducing or developing these systems. In this case, virtually all of the proposed software solutions are positioned as a full-featured integrated management systems that provide automation of all *main business processes of any enterprise*.

It would not be correct to say that market participants do not use classification systems. Software companies and companies that implement information systems are trying in some way to position their systems primarily using the classification of designers, but this class system does not reach the end user. So both in terms of sales, this classification is not profitable for the company. In this regard, system integrators were forced to develop their own system of classification. In general there exist lots of such systems but the most widespread classification was proposed by I. Karpachov, and then modernized by the corporation Oraclle. In it, all systems are divided into four classes: local (system for small businesses), financial management, integrated middle and large integrated systems. The classification is based on the following principles:

- any information system is designed to solve a specific set of business objectives of the enterprise, so that classification systems should be based primarily on the classification of these business problems (the set of such problems, at least, must be consistent with the strategic and operational objectives of the enterprise);
- classification must give clear definitions and criteria by which management information systems could be attributed to a particular class of systems;

- there must be clearly traceable relationship between the business objectives of the enterprise and functional completeness of systems aimed at addressing them;
- the classification should serve as a working tool for companies with which they could not only generate the initial list of systems that potentially meet their needs, but also to assist in the implementation of choice (focusing the search reduces the cost of the procedure of choose).

That is, in this case, the classification of information systems should be based on the classification of business challenges. Business objectives are closely linked to levels of management. Figure 1.3 shows the levels of the enterprise management.

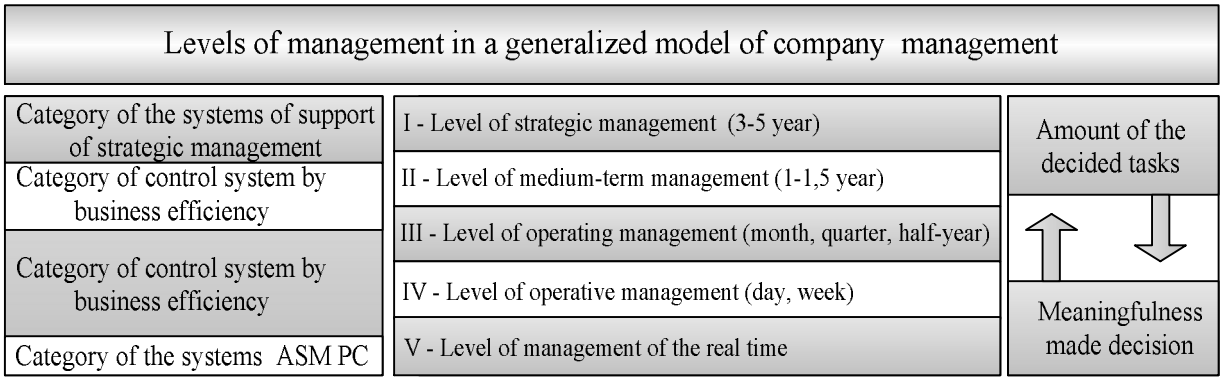

Figure 1.3 – Levels of management in a generalized model of company management

Each of these levels is characterized by its time horizon (the time interval from now until some future date, for which plans are made and their implementation is monitored) and the degree of detail for planning and control. Usually it's called **planning horizon**.

Strategic planning horizon is typically three to five years, divided into separate years (the first year is detailed into quarters). This plan establishes the main objectives of the enterprise and the goals that it wants to achieve in the given period. The degree of detail of the strategic plan is low, but the decisions taken at the strategic level, has an impact on long-term performance of the company because it regards how it can meet the needs of its customers.

Medium-term management (and medium-term planning) covers the horizon of a year and a half by quarter and the nearest quarter - by months. Medium-term plan is actually a detailed strategic plan for the coming period.

Operations management (or managing the underlying operating activities) is management and planning within a calendar month – a quarter – half of a quarter (or less, especially in the production cycle for a long production cycle). At this level, there are primarily produced specific options for the most efficient allocation of material resources and manpower within the constraints identified in previous stages of decision-making.

At this stage there are taken decisions about:

– How many workers will be needed for the production of goods (services)?
– At what point the need in them arises?
– Will we have to work overtime or to introduce a second shift?
– What should be the schedule of materials deliveries?
– Whether to create a finished product inventories.

Operational management – is the present (daily or within a week) management and planning. It provides answers to specific questions, such as "what job should be done today or during the week?», «Who would be responsible for this task?», «What work should be done in the first place?».

Real-time control – the name speaks for itself, it is a management mode of minutes and seconds.

In accordance with the levels of management there could be carried out the initial classification and management of information systems, placing them into the following categories:

– strategic management systems;
– medium-term management system;
– system operation management;
– operational management system;
– control systems in real time.

The second option of the Classification of systems is according to management functions. Management generally consists of the following functions: analysis, planning/decision making, organization of performance, accounting and control. Management cycle is closed (see Figure 1.4), and repetitive. All functions are equally important, the lack of practice of any of them leads to disruption of the management cycle and significantly reducing the effectiveness of the control system.

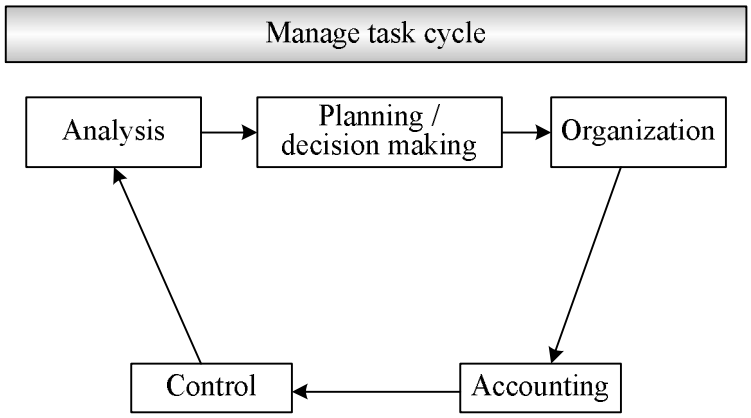

Figure 1.4 – The management cycle

In addition to the hierarchy of management levels, discussed above, the business objectives of the enterprise can be classified according to functional areas of management. These functional areas include marketing management, sales, purchasing, finance, manufacturing, material and human resources, product development/services, service, information resources.

To solve the problem of classifying, the entire field of enterprise management, formed by the functional areas of management, should be divided into the functional management: analysis, planning, organization performance, accounting and control (see Figure 1.5)

The functional of management and the functional areas of management								
Analysis	Management of marketing and sales	Management of a production	Management of purchases	Management of material resources	Management of finances	Management of human capitals	Management of product development / services	Management of support manning	Management of capital assets
Planning								
Organization								
Accounting								
Control								

Figure 1.5 – The functions of management and the functional areas of management

The resulting “matrix» will allow any company to conduct a clear classification systems from the perspective of their business and their own business objectives.

Without contributing anything revolutionary in the familiar idea, proposed to divide the category of operational management systems for several classes:

- accounting;
- managerial accounting;
- planning and enterprise resource planning (ERP-system).

In addition to these base classes can be identified yet into another class – highly specialized systems (examples of MES - manufacturing execution systems or EAM – System asset management company).

«Accounting Systems»

If only the function of financial accounting business is implemented in this information system transactions, it is (regardless of the claims of its developers) is accounting system. Accounting system implements accounting functions in financial management, and partly in the management of material resources, with emphasis on the financial side of economic activity.

«Accounting of Systems Management»

Systems of this class provide the implementation of the accounting functions in other functional areas, and significantly differ from the accounting systems is to consider the facts of economic activity, primarily in physical terms and, where necessary, also in financial services. Appointment of management accounting and its difference from the book were discussed in article

«Systems Planning and Resource Management or ERP-systems»

Support fully all the control functions in all functional areas of management and it is possible only in systems ERP.

The degree of integration of such systems is very high – all management functions integrated into a single management cycle, based on specific business logic. At every workplace artists have access to only those data that define the business logic.

Theme 1.3 Architecture of Information Systems

Any information system, from the general system theory standpoint, is particularly characterized by architecture (static hardware - software components) and information technology (or technology dynamics of information processing). The same is applied to the economic information system (EIS).

EIS architecture includes logical, physical and software components and may look quite differently. Usually it includes active and passive network equipment, as well as operating system and drivers.

Information technology EIS includes a set of technologies of measurement, collection, distribution and processing, storage and visualization of data, combined with the aim of solving economic problems. Information technology EIS is often called the technology of information processing.

Structure of information system in terms of systems theory is shown in Figure 1.6.

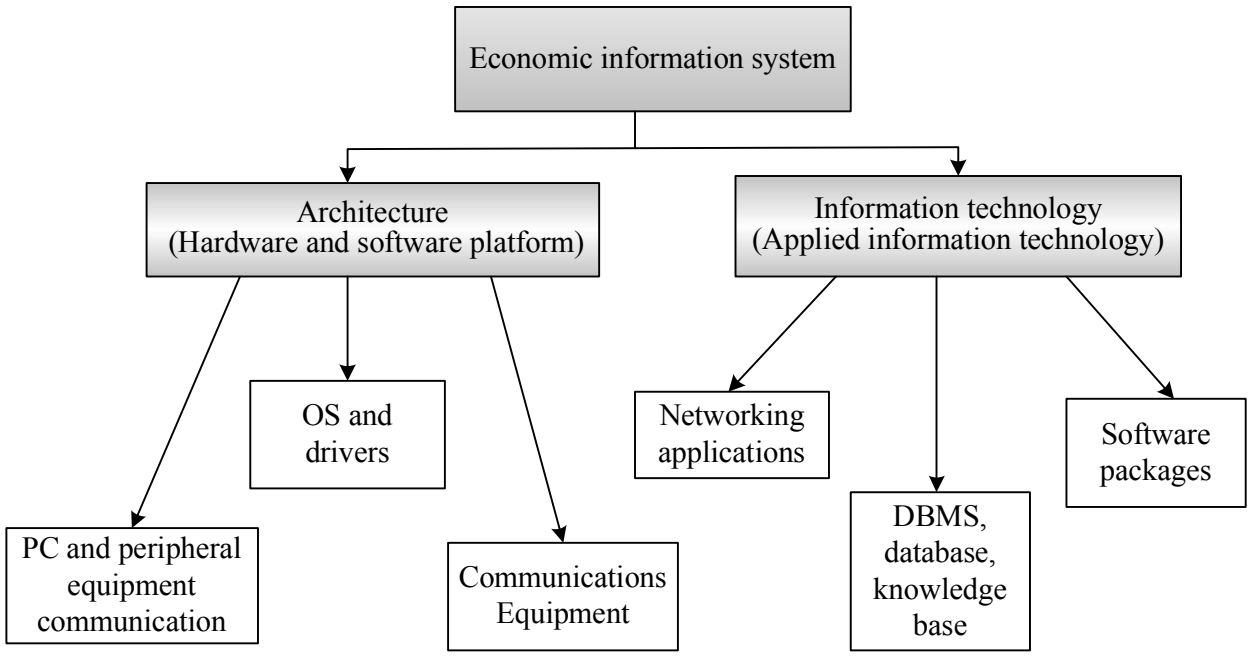

Figure 1.6 – The structure of the IS position in system theory

The hierarchy of the hardware and software components of the EIS give an explanation of each layer.

EIS architecture consists of:

- computers and peripheral equipment;
- communication equipment;
- operating systems and drivers.

The information technology includes:

- networking applications;
- database, databases and knowledge bases;
- software packages.

Information technology as a conceptual model of the interaction of elements EIS can also be represented by different hierarchical layers in a descriptive form or a block - the schematic level.

Network applications (network services), such as network (distributed) databases, mail systems, tools for data archiving, automation of teamwork, etc. It is important to know the possibilities offered by network applications for different areas, as well as to know how they are compatible with other applications and operating systems.

Databases and knowledge bases, as well as automation of work with them, such as database management systems, design of client-server, application server, server resources, etc. This includes the application of measurement, collection, distribution and temporary storage of information, combined with a view to solving metrological problems.

Software packages or applications actually implement the information technology applications in various fields of science and technology. This is the most representative layer of all the components of information technology.

Any Applied Information Technology implements a set of some particular technology. Since the measurement procedure, digitization, collection and temporary storage of information, combined with a view to solving metrological problems of economics, called the measurement technology (MT), and the collection of admission procedures, transfer and sharing of information, combined with the purpose of transmitting information over communications networks, called the network technology (NT). Received through the communication channels the information is placed with the help of information storage technology (IST) in the database. Processes of computer information are called data processing technology (DPT).

The above-mentioned technologies form the specific applications of information technology-specific EIS. Consequently,

$$PIT = MT + NT + IST + DPT.$$

Computers with their operating systems, as well as network and peripheral equipment, together with their drivers and protocols form hardware-software platform (HSP)- a specific EIS, which, together with the totality of PIT form of economic information systems. Consequently,

EIS= HSP + PIT.

Structure of automated information systems

The structure of IS in terms of system integrators and developers is shown in Figure 1.7.

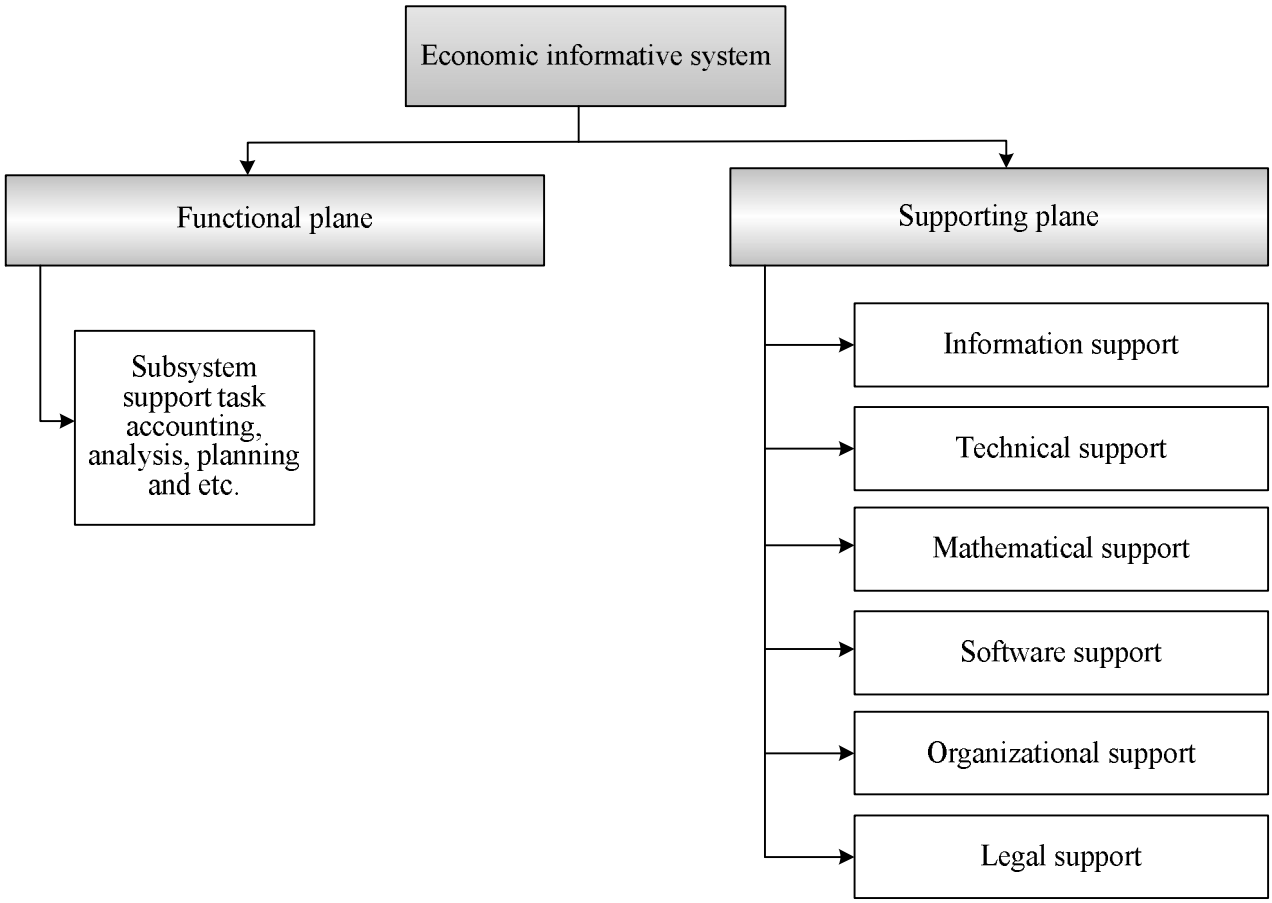

Figure 1.7 – Structure of IS in terms of system integrators and developers

Structure of the EIS is the collection of its separate parts, called planes.

IS consists of two planes: a functional interaction between the plane and providing plane (supporting plane).

Functional plane may include a number of subsystems that cover the solution of specific problems of planning, monitoring, recording, analysis and regulation of managed objects.

Providing plane usually contains a subsystem providing **information, technical, mathematical, software, organizational and legal support.**

Information support (IS) – a set of uniform system of classification and coding of information, standardized systems of documentation, diagrams, information flows, circulating within the organization, as well as the methodology of building databases.

Appointment of sub information provision consists of timely establishment and delivery of reliable information for management decisions.

Scheme of information flows reflect the routes of information flow and its volume, location of primary information and the use of Result information. By analyzing the structure of such schemes one can work out measures to improve the whole system of governance:

- construction of schemes of information flow in order to tap the volume of information and to conduct its detailed analysis provides;
- elimination of duplicative and unused information;
- classification and management of information reporting.

Technical support (TS) – a set of technical means intended for the information system, as well as relevant documentation on these tools and processes.

Complex technical facilities are:

- computers of all models;
- devices for collecting, storage, processing, transmission and display of information;
- unit of data transmission and communication lines;
- office equipment and the automatic data acquisition;
- maintenance of materials, etc.

There are two main forms of technical support (forms of technology): centralized and partially or completely decentralized.

Centralized technical support is based on the use of the information system of powerful servers.

Decentralization of facilities involves the implementation of the functional subsystems on personal computers directly to the workplace.

A promising approach should be considered, apparently, partially decentralized approach – the organization of logistics based on distributed networks of personal computers and one server to store databases that are common to all functional subsystems.

Mathematical and software (MS, SW) is a set of mathematical methods, models, algorithms and programs for achieving the goals and objectives of an information system, as well as the normal functioning of the hardware.

This kind of software includes:

- simulation tools of management processes;
- typical management tasks;
- methods of mathematical programming, mathematical statistics, queuing theory, etc.

The software includes system-wide and special software, and technical documentation.

The general system software includes a set of programs which are user-oriented and designed to solve typical problems of information processing. They serve to extend the functionality of computers, the process of data control.

Special software is a collection of programs designed to create a specific information system. It is composed of packages of applied programs (PAP) that implement the model developed varying degrees of adequacy, reflecting the operation of a real object.

Technical documentation for software development should include a description of tasks, job algorithm, economic and mathematical model of the problem, the test cases.

Organizational support (OS) is a set of methods and means of regulating the interaction of employees with technical means and with each other in the development and operation of an information system.

Organizational support has the following functions:

- analyzing of the existing system of organization management, which will be used by IS, and the identification of tasks to be automated;
- problem training to solve on your computer, including the technical specification for the design of IS and a feasibility study of its effectiveness;
- development of managerial decisions on the composition and structure of the organization, problem solving methodology aimed at improving the management system.

Legal provision (support) (LPro) – a set of legal rules governing the creation, legal status and operation of information systems governing the production, transformation and use of information.

Legal steps to ensure the information system includes:

- information system status;
- the rights, duties and responsibilities of staff;
- legal status of individual species of management process;
- order to create and use information, etc.

Classification by the architecture

1. «File server» architecture. Is historically, the first architecture of information systems. Both executable files and data are placed in separate files of the operating system. Access to data is done by specifying the path and use file operations (open, take it to record). For data storage there is used a dedicated server (single computer), which is the file server. Executable files are stored either on workstations or on a file server. In the latter case, there is a simplified procedure for their administration, but increasing requirements for network reliability.

2. «Client-server» architecture. Client-server – is not only architecture, it is – a new paradigm, replacing the outdated concepts. Its essence is that the client (executable) requests certain services in accordance with certain communication protocols. In this case, unlike the situation with a file server, there is no need to use direct paths of the operating system: the client does not know them he «knows» only data source name and other specific information that is used for client authentication on the server. Server, which physically can be located on the same computer, but can also be located in the other end of the world, handles the client request and makes the appropriate manipulation of the data to the client portion of the requested data.

In the area of client-server, there are two major «dialects»: «thin» and «fat» client.

In systems based on thin client there is used a powerful database server, it is a high performance computer and a library of so-called stored procedures, allowing to perform calculations that implement the basic logic of data processing on the server. A client application, respectively, shows the low hardware requirements workstation. The main advantage of such systems is the relative cheapness of client stations.

System with a thick client, on the contrary, realizes the powerful processing logic on the client and the server is a pure database server, providing execution of only standardized requests for data manipulation (as a rule they are reading, writing, modifying data in a relational database table). In systems of this class of have higher workstation requirements and lower server requirements. The advantage of their architecture is the portability of the server components on the servers from different manufacturers: all industrial database servers relationally support work with the standardized data manipulation language SQL, but the internal built-in language data processing requires implementing of the processing logic on the server for each of your servers.

3. A three-layer architecture. It is Based on the further specialization of a component architecture: the client is only concerned with the organization of user interface, the database server deals only with the standardized data processing. To implement the logic of data processing this type of architecture provides a separate layer – a business logic layer. This layer can be either a dedicated server (application server), or placed in the client as a dynamic link library. This architecture will allow to combine advantages of thin and thick clients: good tolerability merges with the low requirements to the client.

With the development of an intranet-internet technologies there emerged a new kind three-layer architecture based on the use of web-based technologies. In this type of application the server role is played by web-server, as well as a customer uses a standard web-browser. The Advantages consist in lower customer requirements and in light build-on of this architecture into the world information network. The main disadvantage is the well-known limitations on the user interface implemented by web-browsers.

Theme 1.4 Logical Components of IS. Formalization and Modeling of IS

The formalization of any IS, including economic, can be performed using logical, rather than hardware and software components of the IS.

Logical structure of a specific IS is a collection of interconnected and interacting logic elements, combined with a certain purpose. For example one of these logic elements is the IT client-server design.

As a rule, computers and programs that are part of modern information systems are not equal. Some of them are owned and managed resources (file system, printer, database, etc.), others only have access to these resources.

A Computer or a program, which are resource managers, are called a server resource (file server, database server, computer server), and the computer or the program that may only apply to the resource are called clients of the resource. The client and the server of any resource can be located within a single information system, and in various parts of the EIS, an interconnected network.

At present, information technologies, using two-tier client-server design are the main method of data processing in information systems for various purposes. This is also applied to economic information technologies, with their range of application packages for the processing of economic information.

The basic principle of the logical element of client-server is to divide the application of information technology into the following six functions:

- PS is a means of providing customers (entering and displaying data);
- PL is presentation logic interface client – PC;
- BL is Logic Interface Business Process – CW;
- DL is Processing SQL statements of this application;
- DS are processing operators manage resources (file system, database);
- FS are processing file operations using the operating system.

Consequently, in a formal model of EIT, which uses information technology, a client-server defines the corresponding components of Applied Information Technology:

- PS. PL are components of client representation;
- BL. DL are application components (service);
- DS. FS are the components of resource management.

Connection between these components is carried out according to certain rules, which are called interaction protocols. As a protocol for two-tier structure of the client – server there is used a structured query language SQL (structured query language).

In case the information system brings together a sufficiently large amount of various information resources and application servers, there is a question about the optimal management of all its components. In this case, use the three-link design: client – server application – server resources.

Their implementation requires specialized tools such as transaction processing monitors (often referred to simply as «transaction processing monitors»). In this case, the concept of transaction expands over used term in database theory. In this

case, it is not an atomic operation on the database, but any action in the system – giving the message entry in the index file, print reports, etc.

With the development of the Internet technologies, there recently has developed a new information technology, which is called «Internet / intranet technology". Its essence lies in the fact that it successfully combines the ideas of three-tier structure «Client – Server applications – server resources" with Internet access – technology. In this case, the structure of the info application takes the following form: «Browser as an application server – the server resources – server dynamic pages – web-server».

As it can be seen from the above structure, the first three components of this design are the *intranet – components* and the last two – are *the Internet – components*. In this case all changes in the content of the distributed database corporate network, are automatically displayed onto the dynamic pages and on the web – servers corporation. It's clear that in this case we are talking about public information. All confidential information is handled by the same Internet / Intranet – technology, but with the help of coding programs or devices.

Intranet / Internet – technologies include the creation of enterprise portals. That means the establishment of both vertical and horizontal portals.

Portal (portal) – is a web site, organized as a multi-level integration of various resources and services. It gives the user clear information, provides instant access to services such as search engines, e-shopping, free e-mail, trade advertising, instant messaging, web auctions, chat rooms. Portals have the opportunity to attract a large number of users and gather information about their interests. Under this definition there commonly are understood general portals which play the role of the «starting point» for a specific audience of the Internet. Portals are a common type of horizontal organization structure that combines several themes.

A Vertical portal is a site with a narrow thematic focus to provide different services within it. It's the most promising information resource and a tool that has its followers all over the world.

A Horizontal portal is a site of general nature, offering a range of different services, serving a variety of topics.

Modeling IS

Model – Is a mentally represented or materially implemented system, which, displays or reproduces the object of study, has the ability to replace it so that its study provided new information about this object. In the modeling there is used the

analogy between the original object and the target object. Any model is always dual (dual), so it can act as a result of modeling or as a research tool.

The term «simulation» is used very widely and has several meanings. Modeling is Often the process of model building. But sometimes, under the simulation we understand the research process over the system model. That is why we can make a conclusion that if the model does not exist yet, then the modeling is the process of constructing a model. If the model already exists, the simulation is a process of investigation (analysis) of the system (or rather of its model). This process is often called simulation.

There are the following types of models:

- verbal model;
- conceptual models;
- physical model;
- mathematical models;
- design Models and etc.

Modeling consists of two parts – the method and the process. The simulation method involves a modeling language, which is a finite number of symbols and strict rules of operating with these symbols. Finite number of characters is the alphabet of the model, and the strict rules of operating with these symbols are «grammar» and «syntax» of the model. Modeling process is a sequence of actions (operations, functions) that must be done to build the model.

Using the «alphabet», «grammar» and «syntax» of the model allows to form an *abstract mathematical object* (AMO).

Interpretation – the process of converting abstract mathematical object (AMO) in the mathematical model (MM) of a specific object. Mathematical dynamic model is called a *simulation model*.

In general, there is difference between a two-dimensional (scheme) and a three-dimensional (model) model. When designing information systems, there is used a two-dimensional model, because business processes are modeled as diagrams.

Depending on the degree of detailing, there are several approaches to the modeling of IS. If the level of detailing is not high (it means, we construct a general model of the whole system), then we should apply a conceptual approach. The conceptual model represents the semantic structure of the whole system and its components. They allow you to formalize essentially the technological

development of mathematical models with which, then, there are synthesized the basic system elements.

The major components of any system concept first of all include the purpose of its establishment and the achieved or the expected result.

Concept of complex systems is always verbal and is formalized by mathematical or conceptual and mathematical models depending on the modeling method.

If the formalization is carried out only with the help of mathematical models, such an approach is referred to as subjective, and there are used subjective or heuristic modeling techniques.

If in the process of formalization there are used conceptual and mathematical models, such an approach is called objective, there are applied objectively and scientifically sound methods of constructing the mathematical models.

Conceptual models (concepts or formalisms) are always presented as block – designs with a description. Description of conceptual models is performed using the theory of proposals, the theory of relations, or the theory of sets, while the unit which is the schematic representation is represented in the form of functional sub-structure, structure, functions, tables of basic and auxiliary functions, etc. Conceptual models allow us to highlight the most significant functions of the system, to clarify the properties of the interaction and interrelationship of its elements, to highlight the most significant of these and many ideas to determine and set parameters.

If the level of detailing is higher, you have to build models not only for the whole system but also for its separate components. In this case, we use functional or object-oriented approaches.

In a functional approach, the main structure-forming element is a function (action, operation), object-oriented approach – it is the object.

The functional approach focuses on mapping the sequence of functions without an explicit description of the scheme of objects interaction. In this case, we know in advance the sequence of operations within the modeled business process and adding something new is difficult.

Object-oriented approach reflects only the general scheme of interaction of objects, without detailing the sequence of the functions, but with a description of conditions and events in which objects trigger execution of specific functions of the business process.

The process of modeling is an integral part of the design process of IS. The design process has several phases, one of these stages is the stage of preliminary survey of the enterprise. At this stage the designer receives the input data for modeling the system. At the stage the survey is conducted to classify the functions to be performed by the system in terms of importance for this purpose we use the following methodology – MuSCoW.

This abbreviation stands for both: Must have – the necessary functions; Should have – the desired function; Could have – the possible functions; Won't have – the missing function. The functions of the first category are critical to the success of the system capabilities. Realization of functions of the second and third categories depend on time and financial framework. First, we develop what is needed, then, what is possible in order of priority, according to the number of functions of the second and third categories. The latter category is particularly important because it must define clear boundaries of the project and a set of features that are missing in the system.

Model of the organization is created in two ways:

- model «as it is» – reflects the organization business processes;
- model «as it should be» («to-be») – reflects the necessary changes that should be made in business processes, taking into account the introduction of IS.

Features of IS modeling

Modeling is a creative process, and therefore it can not have strict regulation. However, adherence to certain principles allows a use of better developed models. Therefore, using the IS, we recommend the following modeling principles.

Correctness principle. The correctness of the model depends on the correctness of its semantics and syntax. Semantic completeness and correctness of the model are determined by how adequately it meets the structure and behavior of the modeled system. Compliance with these requirements can be confirmed after carrying out simulation experiments with the obtained models.

The relevance principle. Should be modeled only so that statistics and dynamics of the real system correspond to the purpose of the model. The model should not contain more information than it is necessary to achieve the goals of modeling.

The principle of proportionality of costs and benefits. Among the factors that determine the efficiency of simulation are, firstly, the costs required to create

models, and secondly, utility models, and thirdly, the duration of their use. You should seek a way to maximize the usefulness and duration of model use and to minimize the cost of their creation.

Transparency principle. Transparency ensures clarity and convenience for users of the model. IS models are divided into types, the types and levels of representations, which facilitates the understanding of specific aspects of the simulation.

Comparability principle. The models created on the basis of an agreed conceptual infrastructure and unified modeling language are comparable, of course, if the object names correspond to established conventions and if we use identical modeling objects, as well as equivalent levels of detail.

Systematic structure principle. This principle implies the ability to integrate models of different types. This requires unified meta-model, combining different types of performances.

Theme 1.5 Functions of enterprises economic management

Management in socio-technical systems can be represented as a sequence of control functions that make up the workflow management. Under the function of management is understood the ordered set of operations based on the division of labor in the control system.

The founder of a functional approach to management is A. Fayolle. He singled out the five functions of management: planning (foresight), organization, accounting (a governance activity), analysis and control. Simultaneously A. Fayolle identified six processes: manufacturing, finance, security, accounting, administration, safety. At the present time the control functions include:

- data collection;
- formation of the message;
- data transfer via communication channels;
- accounting;
- control;
- analysis;
- forecasting;
- planning;
- operational management;
- organization and coordination;
- reduction solution.

Taking into account the human factor is a separate group of isolated functions of stimulation and motivation.

Data collection – is a function of measuring the characteristics, performed at the facility management manual, automated or automatic.

Formation of messages (query) – this is information which is formed for transmission over communication channels in the control system for further processing.

Data transmission via the communication channels is implemented by various means available. The main requirements for data transmission are: timeliness, accuracy and security of information exchange.

Accounting is a system of functions that provide data storage. Accounting includes input / output operations, registration, form transformation, search and display, reproduction, classification and aggregation, sampling, receipt of aggregate data, insurance of confidentiality and integrity of information (see Figure 1.8).

Control is a system of functions, providing the definition of the object state management and assessment of the degree of deviation of the current status of the required effectiveness criteria. These functions are performed by comparing the required system state.

There are three types of control:

- precheck (preliminary);
- running check;
- final.

Preliminary control is performed prior to the management cycle for resource assessment facility management and external influence.

Running check or operational, control is exercised during the entire management cycle in order to detect deviations from the desired state.

Final control is designed to assess the degree of achievement at the end of the management cycle.

Analysis function in the general case depends on the purpose of analysis. In the general case, this feature is meant to understand explanations of deviations from the desired state of the system.

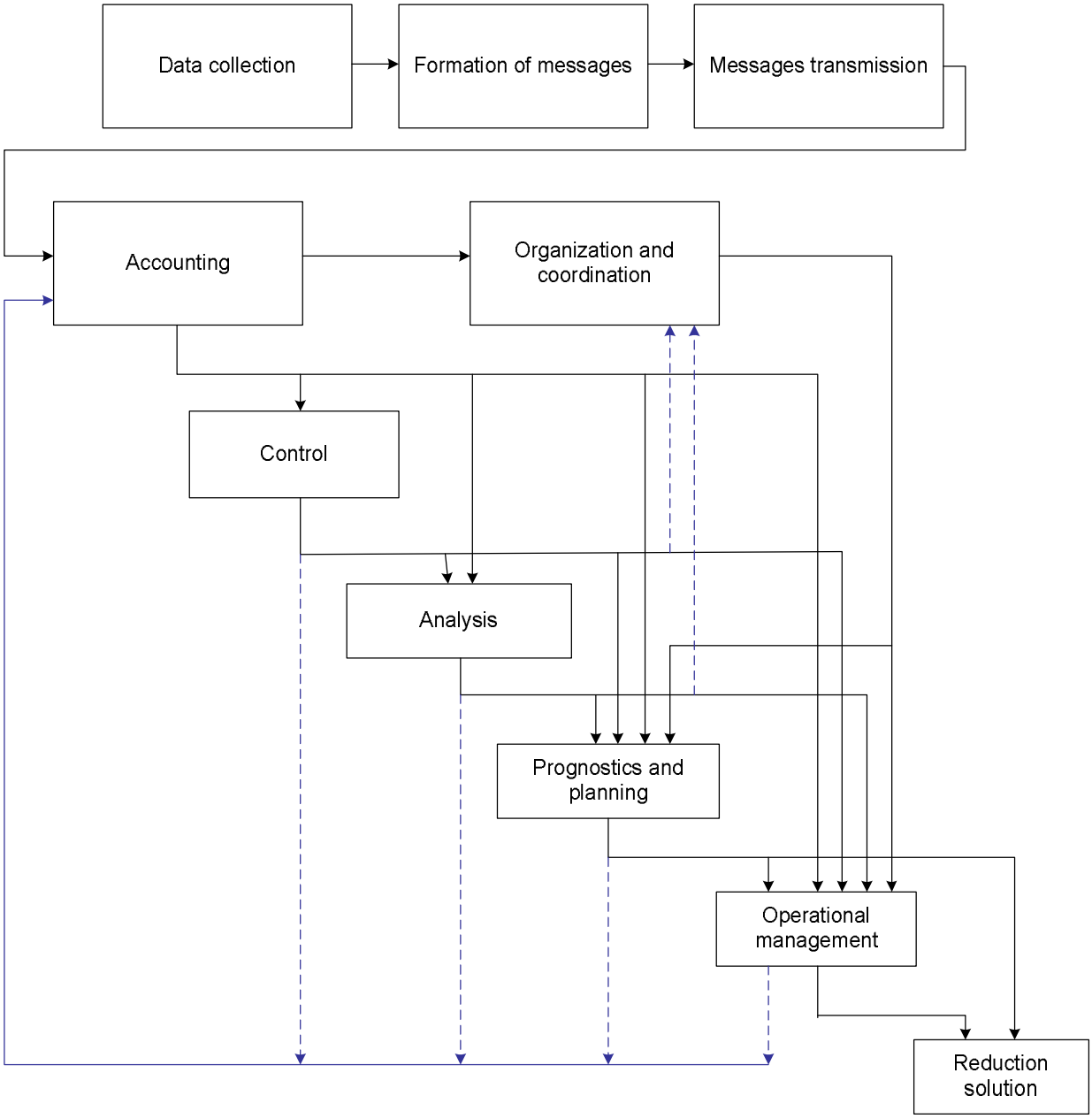

Figure 1.8 – The functional structure of enterprise management

Prediction function is means of taking away the uncertainty regarding the possible structure, properties, or the system law in the future. The current forecast is a set of possible options for the system development. Typical goals of forecasting are:

- slowing the aging process of the decisions preventing adverse situations;
- increase in system performance.

Forecasts can be divided into two groups according to the period of forecasting and prediction methods.

According to the projection period it is the interval of time for which the forecast is being calculated, there are operational (current), short-, medium-and long-term forecasts.

Operative forecast is generally calculated for the time period during which the control object does not change considerably, we determine short-term forecast for the quantitative changes. Medium term covers the period when the quantitative changes take precedence over quality, and long – term qualitative changes in the system.

The planning function consists in the successive removal of uncertainty about the required structure, properties, law of the system or the external environment. It includes the task of deciding upon the goal-setting (TDGS) and the task of deciding upon actions (TDA).

In management terminology TDGS is called strategic or forward planning and TDA means tactical or current planning.

The stage of strategic planning addresses the need and possibility of changing the structure, properties, or the law of the system.

Tactical planning is deciding on the choice of the trajectory to transfer the system into a new state. It identifies the action both of the object of management, and the use of resources, and solves the problem optimization taking into account its expected impact on the environment. Ways and means of achieving the goals, use of resources, procedures and technology are being worked out in details. The system characteristics are defined and treated as constraints.

Exact boundary between strategic and tactical planning is hard to define. Typically, the strategic planning takes several times more time than the tactical one, it has much more long-term consequences, increasing influence on the functioning of the control system as a whole and uses more powerful resources.

Operational management maintains a system under the current plan. It consists in solving the problems of stabilization, tracking and performance of management programs. Sometimes this function includes the optimization task.

Organization function is to establish permanent and temporary relationships between all the elements of the system determining the order and conditions of their operation and to combine components and system resources so as to ensure the effective achievement of goals.

Organization function carries out:

- the grouping of functional elements and resources in the organizational structure;
- allocation of responsibilities.

Coordination function is the coordination of actions of subsystems in accordance with the purposes of system administration and maintenance of this agreement for the management cycle. The presence of multiple objects and management subsystems leads to a contradiction between their private purposes. This, in turn, leads to fragmentation of action. Resolving these contradictions is the main task of coordination.

Key questions

1.1 What is an informational system?
1.2 What is the architecture of IS?
1.3 Named the classification of the IS.
1.4 Described the structure of the IS in terms of the system integrators and developers.
1.5 What is the logical structure of IS?
1.6 What is the model of the IS?
1.7 Name the main types of models.
1.8 What is management cycle?
1.9 Name the functions of enterprises economic management.
1.10 What is the methodology MuSCoW?
1.11 Describe the control function.
1.12 Describe the planning function.

TOPIC 2 The design of the informational systems

Theme 2.1 Information Management System (MIS) of enterprise, life cycle of MIS

Information Management System – is a set of interacting elements for the collection, processing, storing and providing information on the activities of the company (which is used in the management process), as well as their relationships.

Every enterprise, regardless of its level of automation has the MIS. The efficiency of the entire enterprise often depends on the efficiency of the MIS.

Nowadays in Ukraine and CIS countries there are no modern standards in this area. Therefore, the establishment and operation of the MIS should be guided according to the standards and recommendations of the International Committee for Standardization ISO / IEC – ISO/IEC12207: 1995 (standard edition 1995). And the new standard ISO / IEC 15288:2004, which reviews and regulates all processes of life cycle (LC) of information system, including hardware and software, personnel and business processes.

Under this standard, IMS has the following aspects:

1. MIS consists of hardware and software, as well as of organizational support and human resources;
2. MIS covers varying degrees, all business processes of an enterprise;
3. Most of the problems encountered when creating the MIS are not technical but of organizational and managerial nature;
4. Every enterprise is unique and has its own structure, capabilities and limitations which are different from other companies;
5. Existing standards describe the main stages and processes of the life cycle of the MIS, but do not define the implementation details of activities and assignments.

The main components that make the MIS up are: software, information management, facilities, staff. Hence the creation of IMS is a complicated and complex process that involves directly the activities of the enterprise and affecting its performance.

The standard focuses special attention on two concepts: MIS architecture and life cycle of MIS. Standard ISO / IEC – ISO/IEC12207: 1995 gives the following definition of architecture:

Architecture – a set of key decisions, constant changing business technology in the business vision.

Figure 2.1 shows the main components of the IMS architecture.

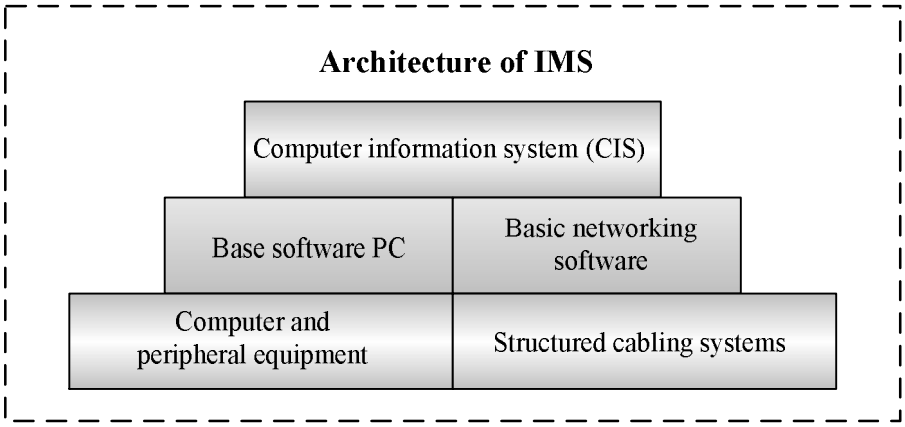

Figure 2.1 – Architecture of IMS in accordance with standard ISO/IEC12207: 1995

In other words, software is a basic component for the efficient operation of MIS. However, without well-functioning elements of the first and second levels of architecture of the MIS (Fig. 1) it is not possible to work out the right software.

Life cycle (LC) is a continuous process that begins with the decision upon the need for MIS and ends at the time of its complete removal from service.

The life cycle of IMS is defined by three types of processes described in the standard, these include:

1. Basic processes such as acquisition (order), delivery, development, operation and maintenance.

2. Subsidiary (supporting) processes (enforce basic processes) – documentation, configuration management, quality assurance, verification, validation (certification), assessment (joint show), audits, problem solving.

3. Organizational processes – management, creation and maintenance of infrastructure, improvement, and training.

Most processes are cyclic and implemented throughout the life cycle MIS.

Among the *basic processes* of MIS life cycle the greatest attention is paid to the *development process*. However, this process does not always get the best, sometimes it merges with the *process of maintenance*. To the *operation Process* practically no attention was paid, resulting in the process that did not bring any tangible results. This approach is wrong because the processes of *operation and maintenance* are the long life cycle processes, MIS, and hence on the quality of their implementation depends not only on the efficiency but also on the total cost of MIS ownership. Following the acquisition and commissioning of the MIS major impact on the level of costs on the content of the MIS we have the processes of *operation and maintenance*.

With the modern development of the MIS market, the development process is gradually reduced to the *acquisition and delivery*, the main role in these processes is the development of requirements for the ISU, the definition of criteria for selecting, organizing and conducting tenders.

Most of the problems with the use and operation of the MIS are due to the neglect of the subsidiary and the organizational processes of life cycle. If the key management processes involved are more or less involved, then a subsidiary, and organizational processes, the system faces only when problems occur during the operation of MIS.

Managers of enterprises often overlook the fact that the company is constantly evolving and, consequently, changing the requirements for the MIS. All support processes are oriented precisely on identifying, studying and documenting of these changes, but the basic processes run for their implementation. Considering this factor, we can conclude that the competent implementation of life cycle subsidiary processes is also an urgent task.

Let's consider subsidiary (supporting) processes in detail. Subsidiary processes include:

1. Documentation which is the process of fixing the information that is created within the life cycle. The importance of the availability of documentation can be illustrated as follows-software vendors, system integrators, consulting companies to configure the project and its cost by paying special attention to the availability of relevant and complete documentation, if there is no cost and duration of the project increased by 15-20%. Another example of the importance of documentation is when the company is developing its own

MIS. The ideology of MIS, processes of development and etc., have been assigned to several people. If you need to solve many issues and problems associated with the creation of MIS for record-keeping there is not enough time. This situation suits the developers and (guarantee immunity) and management (saving on the salary of 2-3 people). The duration of the project was 1.5 years. There was a conflict in the leadership of the developers, the company was deprived of all the developments and had to start over. From this we can draw the following conclusions: · For the enterprise it is not profitable to use expensive third-party services to address their own shortcomings; the cost of documentation exceeds considerably the money spent on its creation and maintenance.

2. Configuration management is the process of application throughout the life cycle of ISU administrative and technical procedures for managing a modification of the elements of MIS, fixing the state of elements, reporting and registering the requests for modification to ensure the integration of the MIS.

3. Quality providing is a process to ensure adequate assessment of MIS compliance and its elements with the established requirements.

4. Verification (confirmation of fulfillment of specified requirements) is the process of determining how much the initial requirements modifications match the MIS. It is advisable to combine this process with the processes of delivery, development, operation or MIS maintenance. Separate the verification of contracts, requirements and projects.

   Verification of contracts is made to establish that:
   - the supplier and the customer have the opportunity to meet the requirements of the contract;
   - the requirements are consistent and comply with the requirements of the customer;
   - there is a procedure for amending the requirements;
   - there is Identification of forms of interaction between the parties;
   - the procedure is identified for accepting the results and there are criteria for their evaluation.

Verification of the requirements is made to establish that:

- the requirements match the strategy of MIS;
- the requirements reflect the needs of the customer;
- the requirements are consistent, feasible and suitable for testing;
- there are used appropriate methods and means of building requirements.

Verification of the project is made to establish that:

- the project is correct and consistent;
- the structure is adequate to the objectives of the project works;
- the organizational structure is adequate to the objectives of the project;
- the results meet the requirements;
- the criteria and procedures are the right ones for evaluating the results of the project;
- risks can be counted.

5. Validation (confirmation that the requirements for the expected use of the system are performed) is the process of determining compliance with elements of MIS goal. This process can be an integral part of action to adopt elements of the MIS and consists of the following tasks:
   - preparation of a test case, the specification tests for the analysis of test results;
   - providing maps in the testing requirements for its intended use;
   - testing;
   - identifying opportunities of a separate user to perform tasks.

6. Evaluation is the process of estimating the state of activities and products resulting from implementation of project activities, in other words, it's the evaluation of the effectiveness of the company after the MIS implementation.

7. Audit is the process of determining consistency with the requirements, plans and contracts. It consists in the evaluation of:
   - quality of the product of the project;
   - procedures for adoption of the draft;
   - testing procedures;
   - documentation;
   - action for the production of the project product;
   - costs and time frames.

8. Solving problems is the process of analyzing and solving problems that arise during the development, operation and maintenance of MIS.

Life cycle model MIS

LC model is the structure that determines the execution sequence and interaction of processes, activities and tasks throughout the life cycle.

The standard regulates the process of creating MIS and divides it into six stages:

1. The idea and concept (analysis) which is the analysis of needs, concept identification and solution development.

2. Design and development which is the development (choice) of products, which will be the structural components of the MIS.

3. Realization – it's the realization of the structural MIS components.

4. Implementation and operation are the operation and use of structural MIS components.

5. Maintenance is support and maintenance of the structural components of the MIS.

6. Decommissioning – it's decommissioning, disposal and recycling.

Nowadays, there are two models of life cycle:

- a cascade model;
- a spiral model.

A cascade model is the partition of the whole process of IMS developing into stages, and the transition from one stage to the next takes place only after a fully completed work on the previous one. The cascade model is shown in the Figure 2.2.

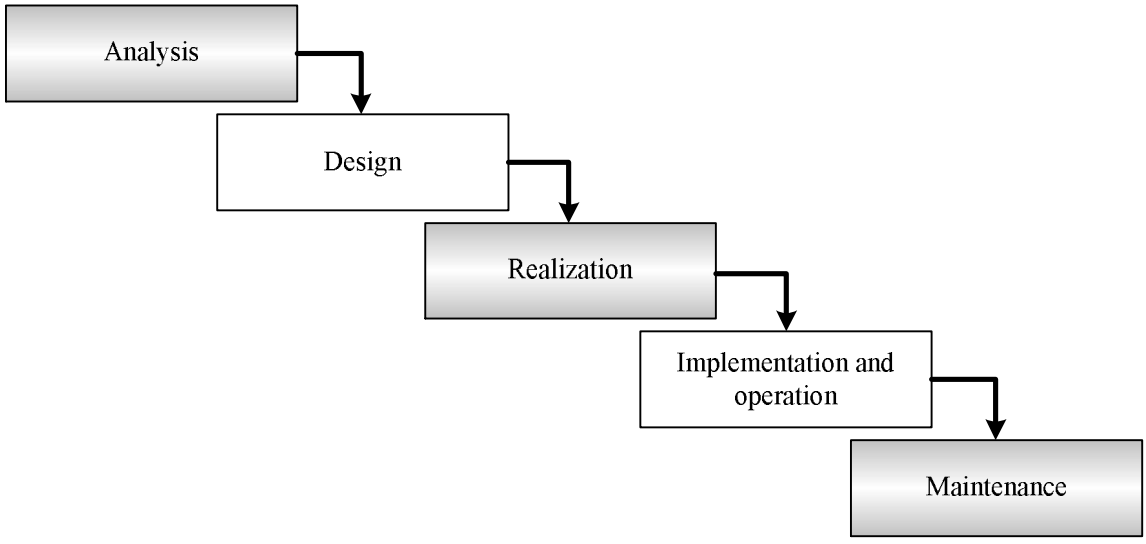

Figure 2.2 – A cascade model for the development of MIS

The cascade approach (model) is well established in the construction of IS, for which all the requirements are perhaps the most accurately and fully articulated.

However, in reality in the creation of the MIS there is a constant need to return to the previous steps, to clarify or reconsider the earlier decisions. The actual process of IS creating takes the form shown in the Figure 2.3, this type of the cascade model is called the waterfall model.

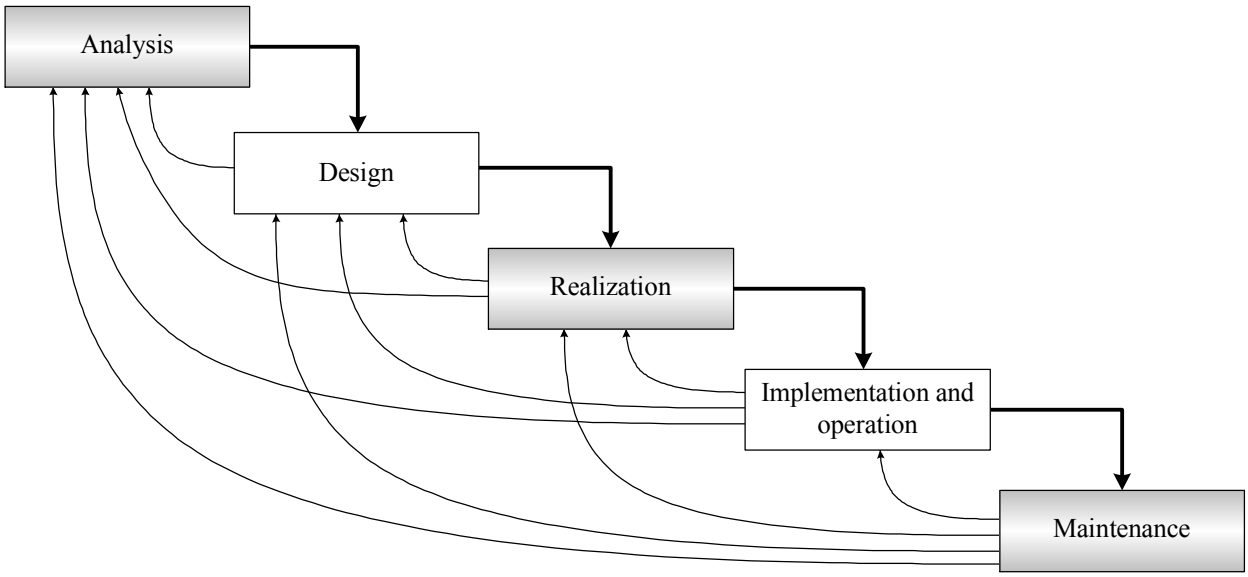

Figure 2.3 – Option cascade model of a MIS – waterfall model

The advantages of the cascade model of MIS planning include:

1. Formation of a full package of project documentation, meeting all criteria and requirements for each stage.

2. Thanks to the logical sequence of execution of works, the cascade model allows us to define a clear date for the completion of all work and assess the associated costs.

The main disadvantage of the cascade approach is more long-term results receiving. The models (both functional and informational) of the proceeded object may become obsolete at the time when they are approved.

In the **spiral model of life cycle** (see Figure 2.4), there are focuses on the initial stages of life cycle: analysis and design. Marketability of technical solutions is verified by creating intermediate versions of the system (prototype).

Each turn of the helix corresponds to the creation of a new version of IMS, it clarifies the purpose and characteristics of the project, determines its quality and plan of the next turn of the spiral. One helix turn at the same time is a complete project cycle for the type of cascade scheme. This approach is also called «continuing the design».

This method makes it possible to obtain a preliminary working version of the MIS in a relatively short period of time. The disadvantage of this method is reducing the controllability of the overall project and connectivity of different fragments of the MIS. The main problem of the spiral model is the correct definition of the moment to the next stage. The transition is carried out in accordance with the plan, even if not all the planned work is completed. The Plan is based on statistical data from the previous projects, and personal experiences of the developers.

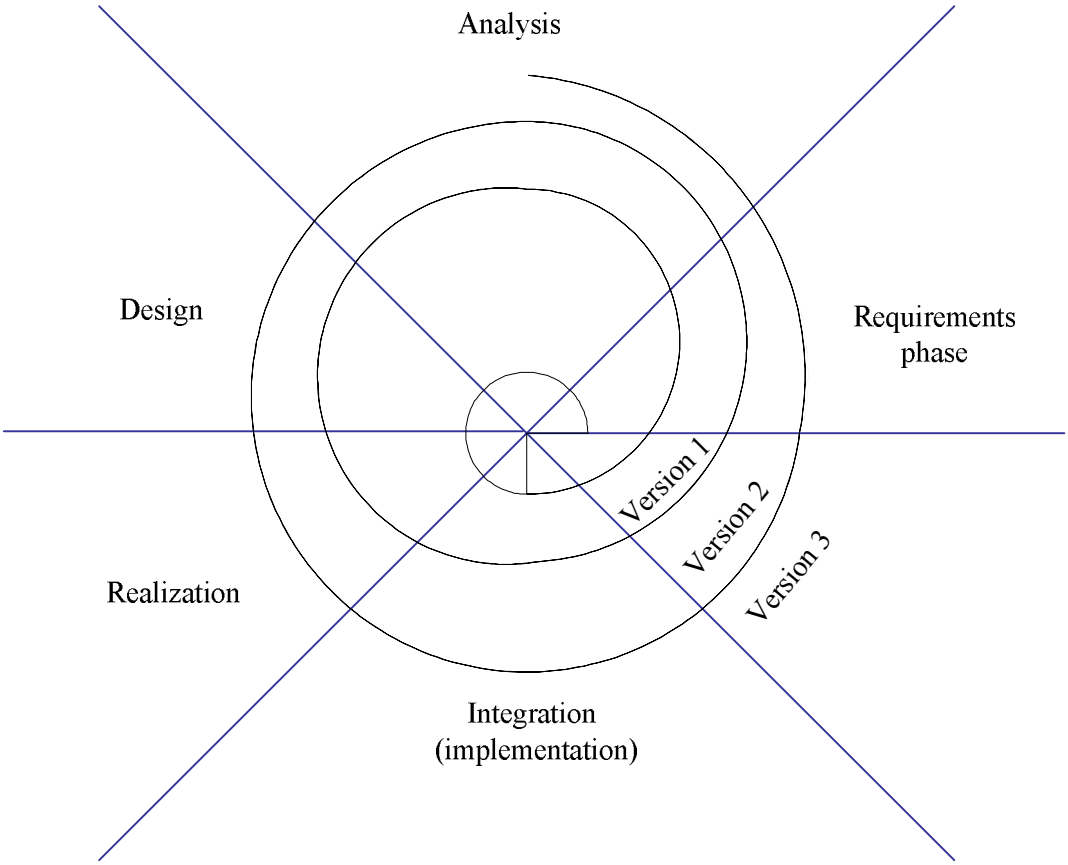

Figure 2.4 – The spiral development of the MIS model

Theme 2.2 A conceptual Model of the Enterprise

The aim of mathematical modeling of the MIS is to use mathematical methods to meet most effectively the challenges arising in the field of enterprise management. There are heuristic (subjective) and scientific (objective) approaches to solving such problems. When we use the subjective approach the mathematical formulation is intuitive. In the objective approach, the process of solving economic problems goes in several steps. Usually there are singled out:

1. Step of meaningful problem definition – at this stage we should state the problem clearly as well as select the objects that relate to the task. In this case, complex objects can be divided into parts (elements). The result of the formulation of the problem is the concept of automation in business economics.
2. Step of System Analysis – at this stage of the control the object is represented as an object description and management systems are determined by its structure and functionality. The result of this is usually a conceptual model of objects and systems of company management (see Figure 2.5).
3. Step of System Synthesis – at this stage, we make mathematical formulation of objectives, to create a simulation mathematical model of the enterprise and identify methods and algorithms for solving tasks of the enterprise management. The results obtained at this stage could lead to the following. The previously conducted systematic analysis has led to such a set of elements, attributes and relationships, for which there is no acceptable method for solving the problem. Then you have to go back to the stage of system analysis.
4. The fourth step is to develop a program to deal with the problem on a PC. Large enterprises, consisting of a large number of elements having a large number of properties may require personal database development, database management tools, means of extracting the data needed for calculations. For standard tasks there is not carried out the development but the selection of an appropriate package of applied programs (PAP) and the database management system (DMS).
5. At the final stage, the mathematical calculation results are made using a PC.

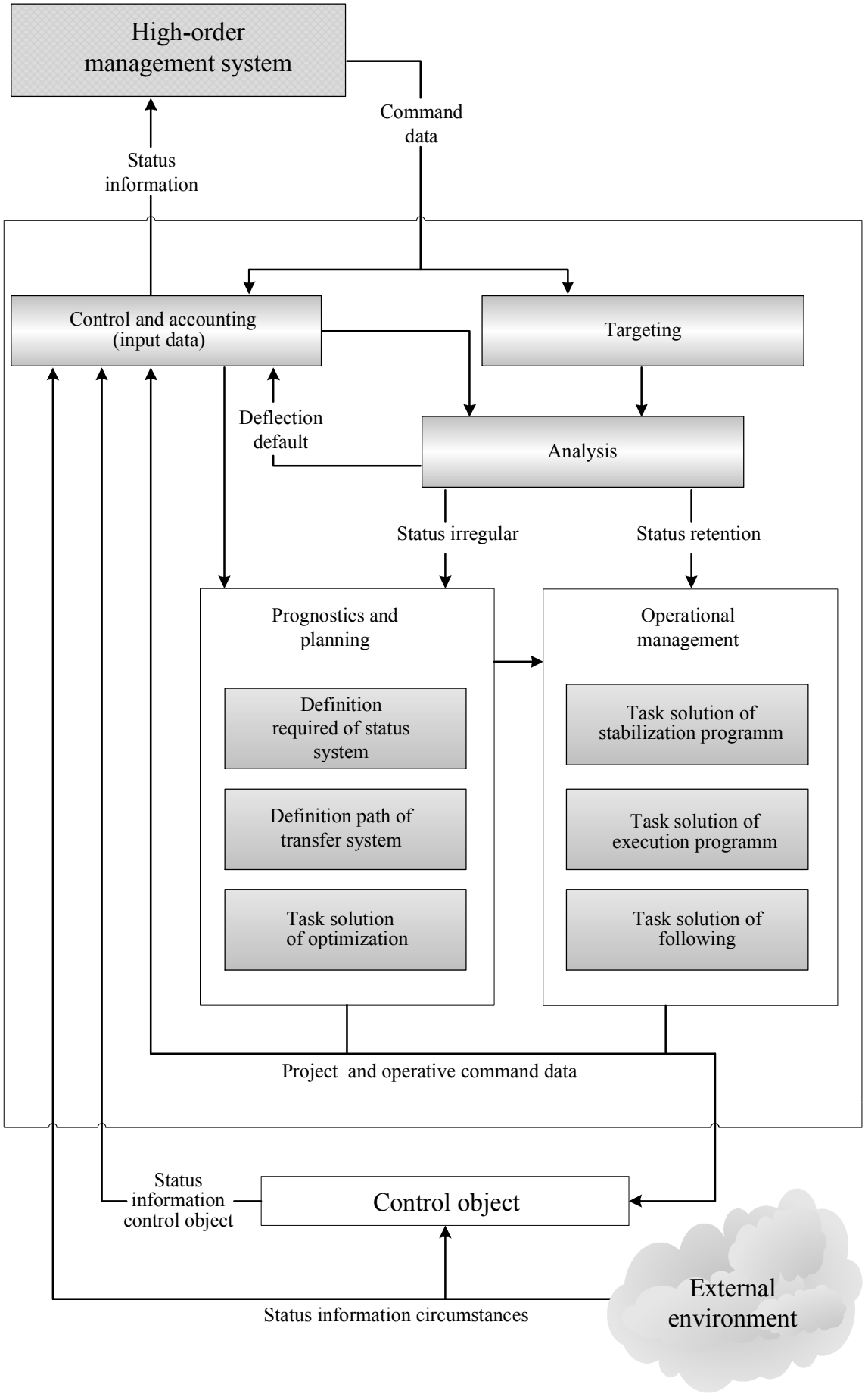

Figure 2.5 – The conceptual model of company

This method is quite effective and, therefore, we can say that task solution of constructing the company MIS consists of five steps:

- creation of concepts (content tasking);
- system analysis (building of conceptual information models);
- system synthesis (mathematical modeling);
- developing or selecting the software;
- solving problems on computers.

Complete business model

The company is regarded as a target, open, social and economic system belonging to a hierarchical set of open external super-systems (market, state. Institution, etc.) and internal subsystems (departments, workshops, etc.). The company's capabilities are determined by the characteristics of its structural units and the organization of their interaction. Figure 2.6 presents a generalized scheme of the organizational business model. Building a business model begins with a description of the model interaction with an environment that is, with the mission statement of the company.

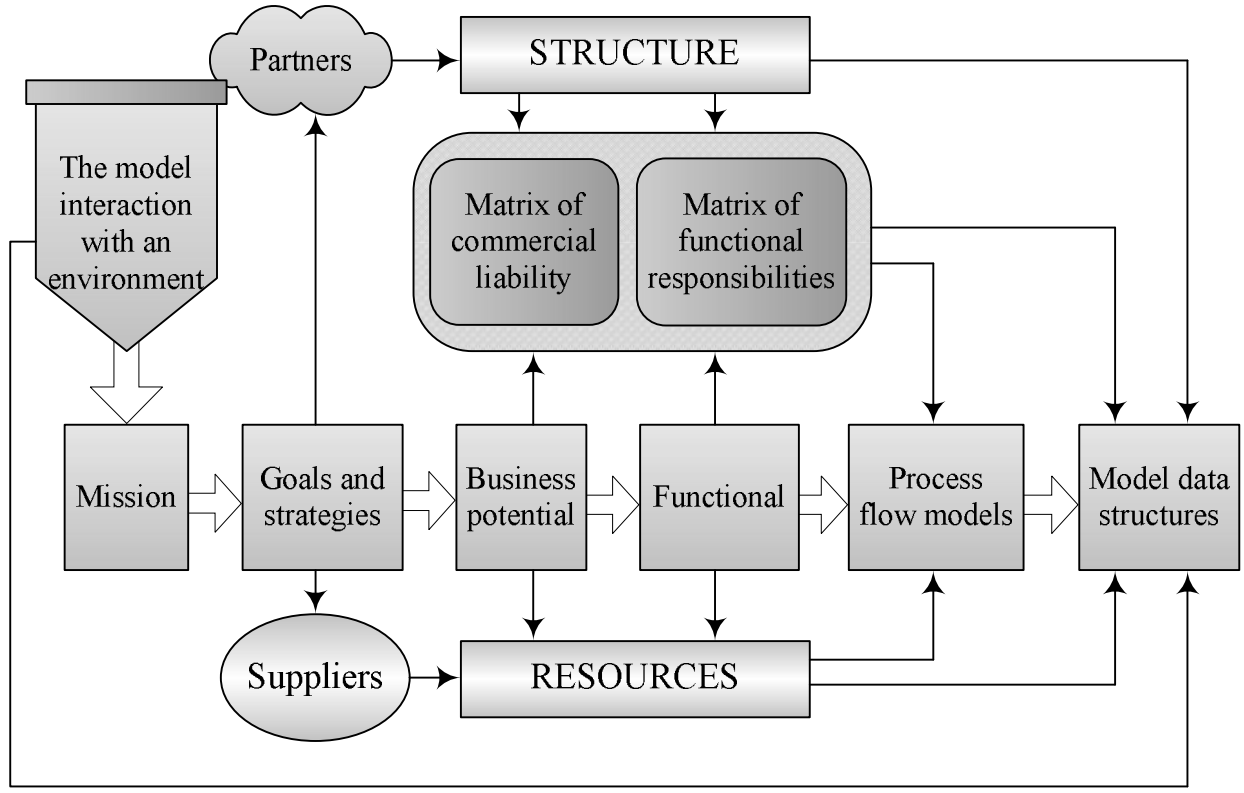

Figure 2.6 – General scheme of organizational business model

Mission in accordance with [ISO-15704] is:

1. Activities carry out by the company to meet the goal which is the production of a product or service.
2. The mechanism by which the company implements its goals and tasks.

Defining the mission allows to generate a tree of company goals – hierarchical lists of specify and detail mission.

Tree of goals creates a tree of strategies – hierarchical lists of refinement and detail ways to achieve the goals. In this case, at the corporate level there are developed the growth strategy, integration, and business investment. Block of business strategy defines the productive and competitive strategies, as well as the segmentation strategy and promotion.

Resource strategy is a strategy involving physical, financial, human and information resources.

Functional strategies are strategies in the organization of the management components and stages of product life cycle. This makes it possible to form a business potential of the company – a set of business activities aimed at meeting the needs of specific market segments.

Business potential, in its turn, defines company's functionality – a list of business functions, management functions and support functions required for the organization of the chosen types of commercial activities. In addition, it specify the required resources (material, human, information) and the structure of the company.

Creating the business capacity and company's functionality allows using a matrix of projections to define areas of administrational responsibility.

Matrix of commercial liability establishes responsibility for the structural units of generating revenue from the sale of commercial activity.

Matrix of functional responsibilities establishes the responsibility of structural units (or individuals) for the execution of business functions in the implementation of business processes (purchasing, production, marketing, etc.), as well as the management functions associated with managing these processes (planning, accounting, control marketing, finance, personnel management, etc.).

Process flow models – are models describing the process of successive time-conversion material and information flows of the company during the implementation of any business process. The first (upper) level describes the logic

of interaction between the process participants, and then (on the lower level) it gives the technology of individual professionals in their workplaces.

Business organization is completed by the development modeling of the model data structures, which define the list of formats and documents accompanying processes in the company, and it also sets the format description of environmental objects, components, and regulations of the company (see Figure 2.7). This creates a system of reference which gives the necessary documents and reports.

After that there is a process-target description of the company, which allows obtaining answers to the following interrelated questions: why-what-where-who-how-when-whom-how much-in what form.

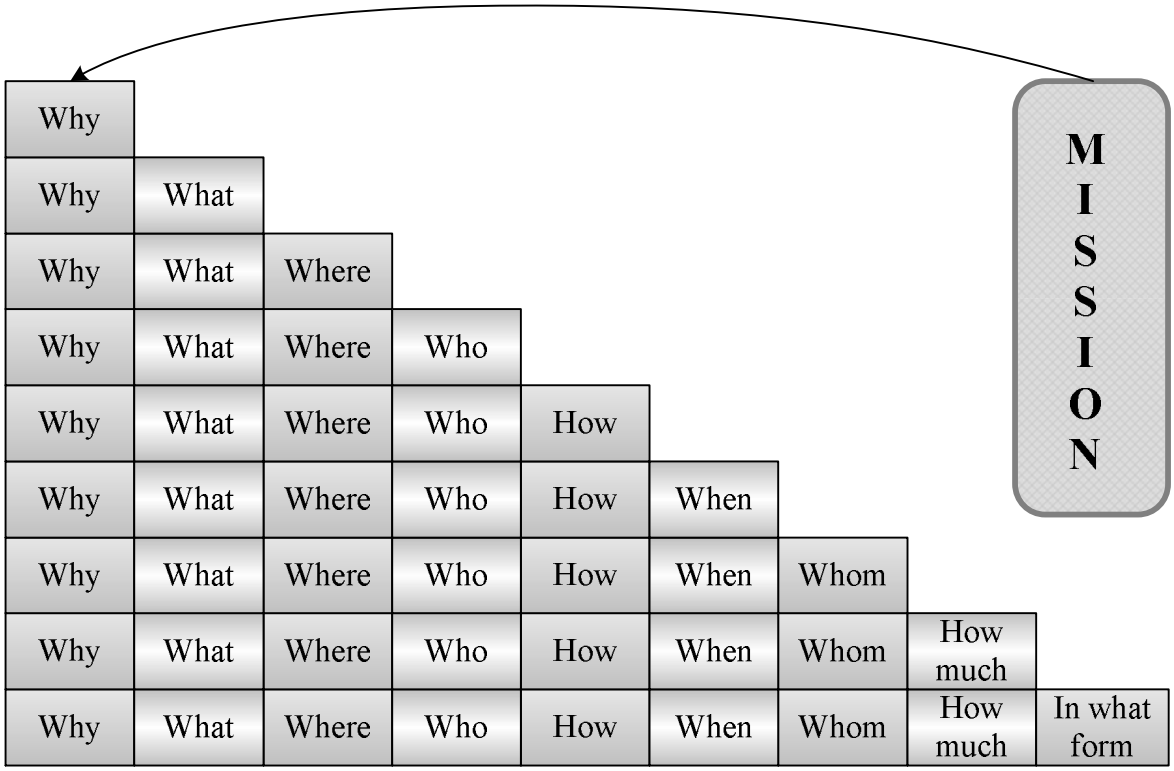

Figure 2.7 – The main stages of process-oriented description of the company

Hence the full business model is a set of functionally-oriented information model that provides answers to the following interrelated questions: «why» – «what» – «where» – «who» – «how much» – «how» – «when» – «whom» (see Figure 2.8).

Thus, organizational analysis involves the construction of complex information model of the company, which includes:

- **strategic model of goal-setting** (which answers questions: why the company is in this business, why it tends to be competitive, what goals and strategies for this you have to implement);
- **organizational and functional model** (answers the question about the functions of the employees in the company and their responsibilities);
- **functional-technological model** (answers the question what is produced and how it is done);
- **process-role model** (who answers the questions what-how-to whom);
- **a quantitative model** (answers the question about the necessary resources);
- **model data structure** (answers the question in what form the regulations of the company exist and describes the objects of the external environment).

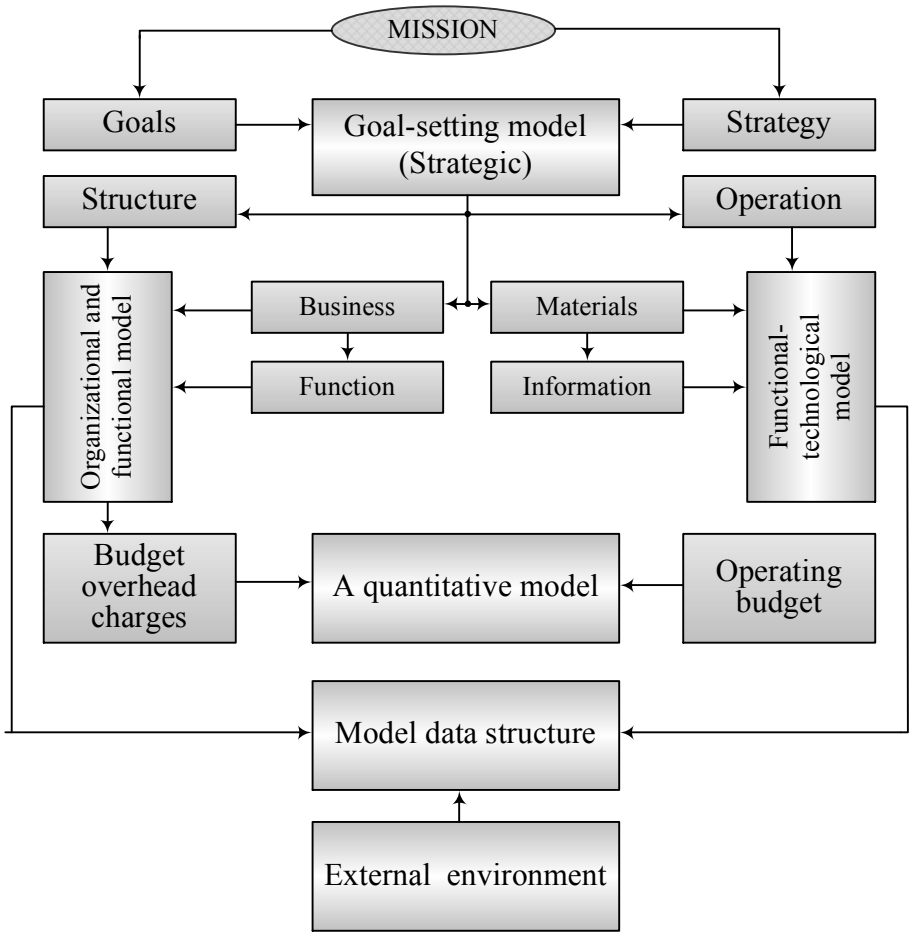

Figure 2.8 – Complete business model

The presented set of models provides the necessary completeness and accuracy of the description of the company and allows you to develop clear requirements for the designed information system.

Maturity levels of the company

In its development, every company goes through certain stages which are characterized by a number of parameters. Each such stage has its own governance principles, and consequently their approaches and strategies of MIS. Software Engineering Institute SEI proposes to classify all the companies according to the following levels of development (maturity):

1. Initial level – is characterized by indecent bonds and chaos.
2. The level of repetition – is characterized by the presence of basic processes and repetitive tasks.
3. The level of regulation – is characterized by the presence of procedures, standardization of processes and integration.
4. The control level is characterized by the presence of quality control and the use of feedback.
5. Optimization level – is characterized by constant development and self-adaptive system.

The initial level is inherent in the main start-up and small businesses. The chaotic nature of managerial decisions is directly connected with struggle for existence. The company has no long-term development strategy. Information links are spontaneous in nature and used by management only as a reference.

Level of repetition allows to implement projects extended over time successfully, due to the introduction of authoritarian governance, operational planning and control. The main processes are repeatable and manageable. The company starts looking for ways to reduce costs, primarily due to efforts to optimize repetitive processes. For the given level automation is characterized by a number of basic operations such as personnel records, bookkeeping, payroll, but the information flows remain formalized and piecemeal.

The level of the regulation denotes that the processes of management and production have become formalized and repeatable so that they can be described and documented. At this level there are job descriptions of employees. All processes are united into the overall flow of information, it is possible to analyze

information on all aspects of management. However, at this level, there is still no process of setting long term goals (e.g. 2 or 3 years in advance).

Control level. At this level, the priority is to improve the quality of products or services provided, and to increase the market share of the company. The company is formed according to intra-quality standards and receives regular customers. The presence of loyal customers allows you to organize long-term planning. Decisions are made being based on the analysis of previous experience, forecasts, just for making active use of feedback such as marketing solutions, customer reviews and etc. All processes of the enterprise are fully automated.

Optimization level. Only several companies go to this level. For this level is characterized not only by long-term strategic plans, but also by the optimization of ways to achieve them. The company's strategy aims to achieve organizational, financial and technological superiority over its competitors.

The Figure 2.9 shows the options for MIS development.

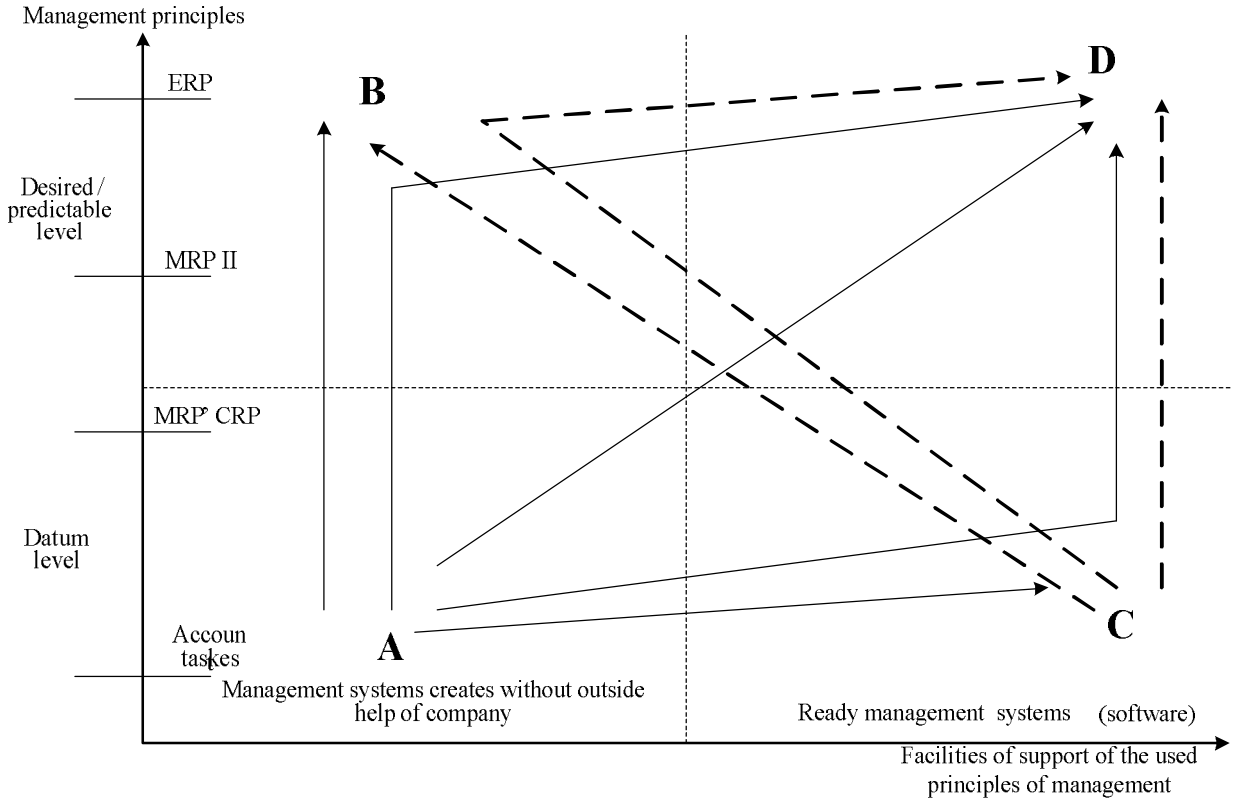

Figure 2.9 – options for MIS development

——— For companies oriented to their own decisions

– – – – For companies oriented to the prepared decisions

Theme 2.3 The basic approaches to designing MIS. CASE-means

The basic approaches to designing MIS

One of factors defining success of the company in the market is ability of a management to predict the market and to be guided in it. For successful activity the company should solve two problems – management of internal resources and management of external factors and influences.

Management of internal resources is a control of technological processes, procedures of document circulation, organizational-staff structure. Management of external factors and influences is an adaptation to surrounding conditions, requirements of the market, management of suppliers and customers.

Now the tendency of transition from detailed management of internal activity to management of customers and suppliers is shown. Competitiveness of the company depends on its ability to create and strengthen mutual relationship with other companies (partners, competitors, customers or suppliers) more and more. The reasons are:

- expansion of economic space on which the enterprises functions;
- occurrence of a new strategic resource – information;
- necessity to consider time factor.

To regard the problems set forth above it is necessary to have the effective management system of the enterprise including system of quality management, and information system of its support.

Two methods of the MIS design

Today, there are two methods to design the management information system (MIS):

1. Structural approach.
2. Process approach.

The structural approach is based on the use of the staff structure of the enterprise. In this case the system design is divided into organization departments. Technologies of activity of the enterprise (those processes) are described through work techniques of organization departments, and interaction of organization departments are described through the top level model. The main lack of the

structural approach is the binding to the staff structure of the enterprise which changes very quickly, therefore in the project of IS and as in IS itself it is necessary to make changes very often, and it is very difficult and it takes a lot of time.

The process approach isn't focused on the staff structure, it uses the business processes of the enterprise. Today this approach is the most perspective. Business processes, unlike the staff structure of the enterprise, change very seldom. As a rule, the enterprise has several basic business processes, usually not more than ten. Today as a rule there is applied the process approach.

The basic lines of such reorganization are:

- wide delegation of powers and responsibility to executors;
- reduction of quantity of levels of decision-making;
- a combination of a principle of a goals management to the group organization of work;
- special attention to questions of maintenance of product quality or services, and also enterprise works as a whole;
- automation of technologies of business process performance.

CASE-means

Computer-aided software engineering (CASE) is the scientific application of a set of tools and methods to a software system which is meant to result in high-quality, defect-free, and maintainable software products. It also refers to methods for the development of information systems together with automated tools that can be used in the software development process.

CASE-means are means of the computer analysis, design, redesign, control over observance of conformity to those which have already been designed etc.

The term «computer-aided software engineering» (CASE) can refer to the software used for the automated development of systems software, i.e., computer code. The CASE functions include analysis, design, and programming. CASE tools are automated methods for designing, documenting, and producing structured computer code in the desired programming language.

CASE software supports the software process activities such as requirement engineering, design, program development and testing. Therefore, CASE tools include design editors, data dictionaries, compilers, debuggers, system building tools, etc.

CASE also refers to the methods dedicated to engineering discipline for the development of information system using automated tools.

CASE is mainly used for the development of quality software which will perform effectively.

The term CASE was originally coined by software company Nastec Corporation of Southfield, Michigan in 1982 with their original integrated graphics and text editor GraphiText, which also was the first microcomputer-based system to use hyperlinks to cross-reference text strings in documents – an early forerunner of today's web page link. GraphiText's successor product, DesignAid, was the first microprocessor-based tool to logically and semantically evaluate software and system design diagrams and build a data dictionary.

Today the CASE can be classified into 3 categories:

1. *Tasks* support only specific tasks in the software process.
2. *Workbenches* support only one or a few activities.
3. *Environments* support (a large part of) the software process.

Workbenches and environments are generally built as collections of tools. Tools can therefore be either standalone products or components of workbenches and environments.

Tools

CASE tools are a class of software that automate many of the activities involved in various life cycle phases. For example, when establishing the functional requirements of a proposed application, prototyping tools can be used to develop graphic models of application screens to assist end users to visualize how an application will look after development. Subsequently, system designers can use automated design tools to transform the prototyped functional requirements into detailed design documents. Programmers can then use automated code generators to convert the design documents into code. Automated tools can be used collectively, as mentioned, or individually. For example, prototyping tools could be used to define application requirements that get passed to design technicians who convert the requirements into detailed designs in a traditional manner using flowcharts and narrative documents, without the assistance of automated design software.

Existing CASE tools can be classified along 4 different dimensions:

1. Life-cycle support.
2. Integration dimension.

3. Construction dimension.
4. Knowledge-based CASE dimension.

Let us take the meaning of these dimensions along with their examples one by one:

Life-Cycle Based CASE Tools

This dimension classifies CASE Tools on the basis of the activities they support in the information systems life cycle. They can be classified as Upper or Lower CASE tools.

1. Upper CASE Tools support strategic planning and construction of concept-level products and ignore the design aspect. They support traditional diagrammatic languages such as ER diagrams, Data flow diagram, Structure charts, Decision Trees, Decision tables, etc.
2. Lower CASE Tools concentrate on the back end activities of the software life cycle, such as physical design, debugging, construction, testing, component integration, maintenance, reengineering and reverse engineering.

Integration dimension

Three main CASE Integration dimensions have been proposed:

1. CASE Framework.
2. ICASE Tools.
3. Integrated Project Support Environment (IPSE).

Workbenches

Workbenches integrate several CASE tools into one application to support specific software-process activities. Hence they achieve:

- a homogeneous and consistent interface (presentation integration);
- easy invocation of tools and tool chains (control integration);
- access to a common data set managed in a centralized way (data integration).

CASE workbenches can be classified into following 8 classes:

1. Business planning and modeling.
2. Analysis and design.
3. User-interface development.

4. Programming.
5. Verification and validation.
6. Maintenance and reverse engineering.
7. Configuration management.
8. Project management.

Environments

An environment is a collection of CASE tools and workbenches that supports the software process. CASE environments are classified based on the focus/basis of integration:

1. Toolkits.
2. Language-centered.
3. Integrated.
4. Fourth generation.
5. Process-centered.

Toolkits

Toolkits are loosely integrated collections of products easily extended by aggregating different tools and workbenches. Typically, the support provided by a toolkit is limited to programming, configuration management and project management. And the toolkit itself is environments extended from basic sets of operating system tools, for example, the Unix Programmer's Work Bench and the VMS VAX Set.

Language-centered

The environment itself is written in the programming language for which it was developed, thus enabling users to reuse, customize and extend the environment. Integration of code in different languages is a major issue for language-centered environments. Lack of process and data integration is also a problem. The strengths of these environments include good level of presentation and control integration. Interlisp, Smalltalk, Rational, and KEE are examples of language-centered environments.

Integrated

These environments achieve presentation integration by providing uniform, consistent, and coherent tool and workbench interfaces. Data integration is achieved through the *repository* concept: they have a specialized database

managing all information produced and accessed in the environment. Examples of integrated environment are IBM AD/Cycle and DEC Cohesion.

Fourth-generation

Fourth-generation environments were the first integrated environments. They are sets of tools and workbenches supporting the development of a specific class of program: electronic data processing and business-oriented applications. In general, they include programming tools, simple configuration management tools, document handling facilities and, sometimes, a code generator to produce code in lower level languages. Informix 4GL, and Focus fall into this category.

Process-centered

Environments in this category focus on process integration with other integration dimensions as starting points. A process-centered environment operates by interpreting a process model created by specialized tools. They usually consist of tools handling two functions:

- process-model execution;
- process-model production.

Examples are East, Enterprise II, Process Wise, Process Weaver, and Arcadia.

All CASE-means possess following basic prominent features:

- powerful graphic means for the description and documenting IS, providing the convenient interface to developers;
- the integration of CASE-means separate a component providing controllability by process of working out IS;
- use of in special way organized storehouse of the design metadata – a repository.

Estimation and choice of CASE-means

Estimation and choice process can pursue some goals, including one or more of the following:

- estimation of several CASE-means and a choice of one of them;
- estimation of one or more CASE-means and saving results for the following use;
- choice of one or more CASE-means with helps of results of the previous estimations.

The model of process of estimation and the choice is showed in Figure 2.10.

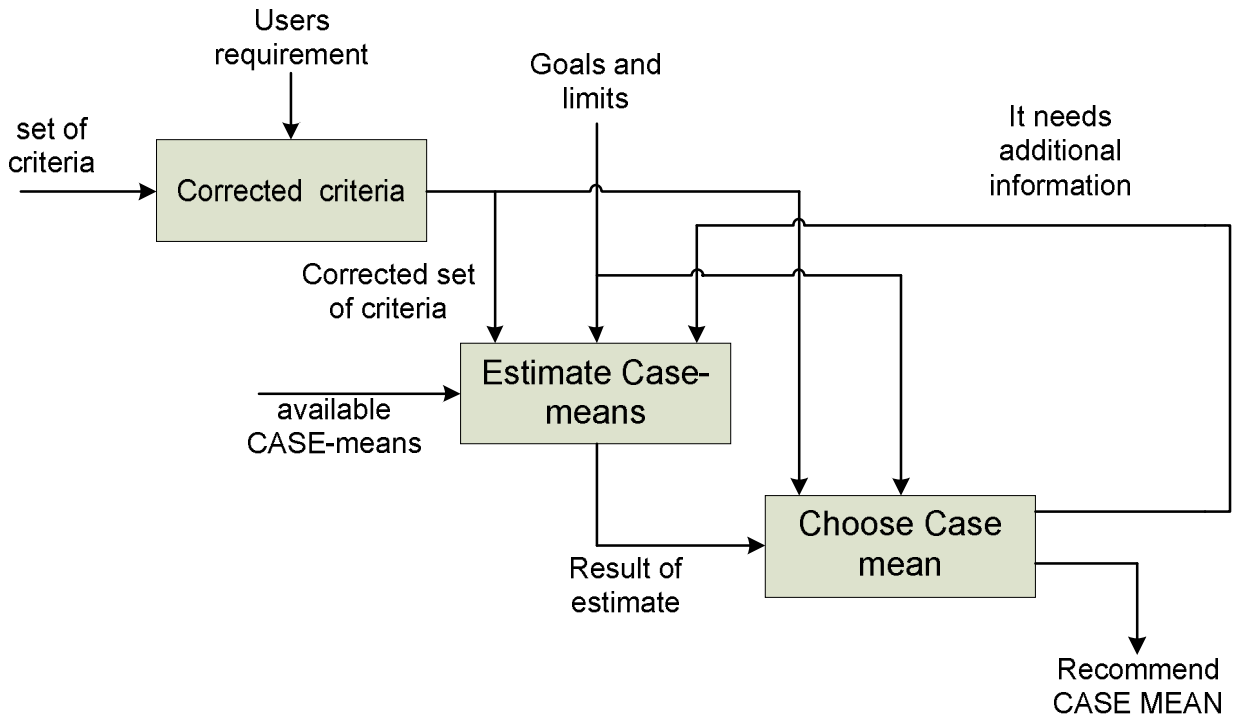

Figure 2.10 – The estimate and choice of the Case-means

Criteria of estimation and choice

Criteria form basis for estimation and choice processes and can accept various forms (see Figure 2.11), including:

- numerical measures in a wide range of values, for example, volume of demanded memory;
- numerical measures in the limited range of values, for example, the simplicity of development expressed in points from 1 to 5;
- binary measures (true/false, yes/is not present), for example, ability of generation of the documentation in Postscript format.

Measures which can accept one or more of final sets of values, for example, platforms for which CASE-means is supported.

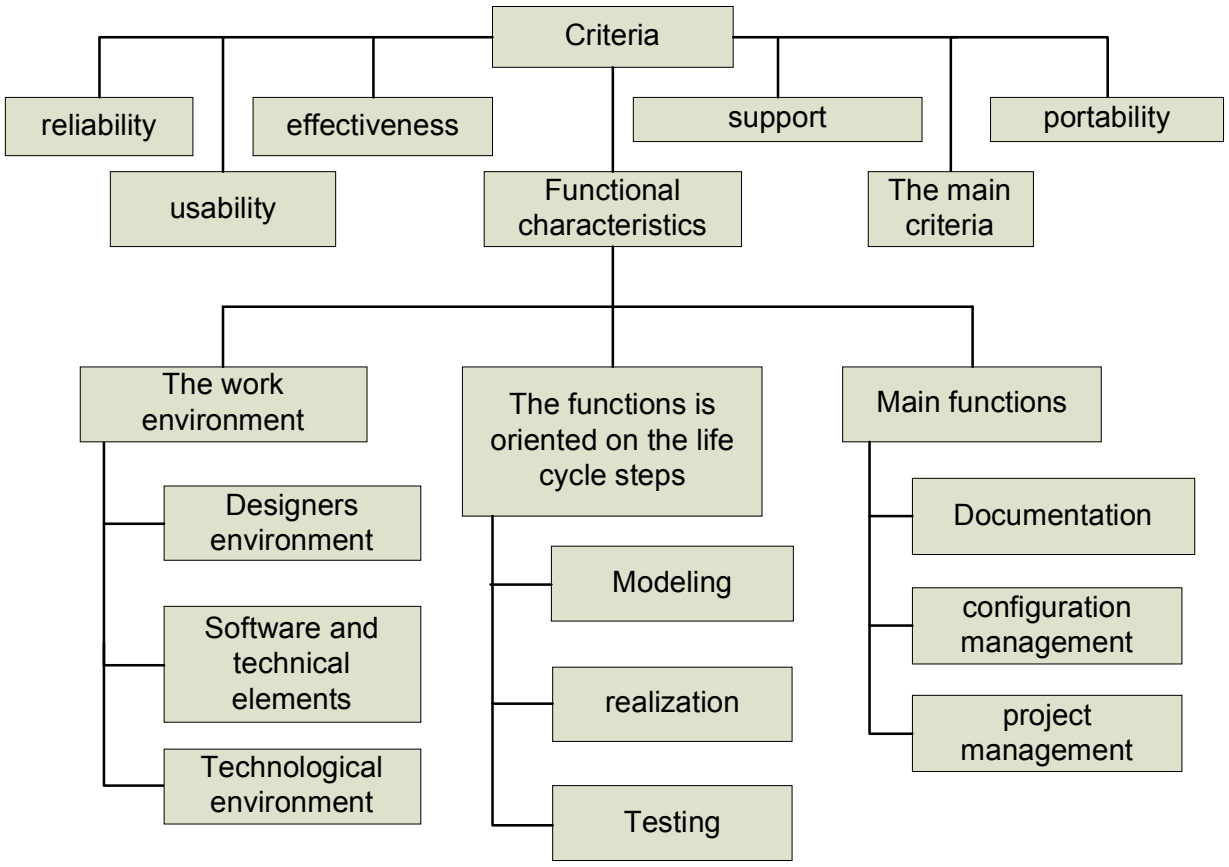

Figure 2.11 – The set of criteria

Theme 2.4 The process of the software selection for automation of the enterprise

The selection software for the complex automation is difficult process. The software for complex automation has a high cost (price) so the process of choice has to be as objective as possible and proved from all possible points of view. The process of choice is divided into three stages for maximum effect:

1. The stage of choice planning.
2. The stage of choice preparation.
3. The stage of choice realization.

At the first stage there is carried out full planning of all resources, there is formed the introduction group, there is made distribution of responsibilities.

At the second stage there are formed the purposes of the project and the requirements to software. Also there are formed the list of criteria and there is defined the class of software.

On the third stage there is a formation of requirements to suppliers' software, presentations of software and formation of inquiry on commercial offers and the analysis of the arrived offers are organized.

The stage of choice planning

The stage of software choice planning consists of three phases. The first phase is the definition of the size budget allocated for the project. The size of the budget depends on:

- the Financial condition of the enterprise;
- the automation goals;
- expected effect from the project;
- understanding by the managers of the project purposes.

After the budget of the project is defined and the preliminary schedule of payments is generated, it is necessary to generate and to confirm initiative (design) group which will coordinate and carry out the entire project. At this phase first of all it is necessary to decide special moments which will allow to avoid problems at the final decision acceptance for software choice. For this is we need:

1. To confirm, who will prepare a decision and who will take this decision (the director, council of shareholder, the project head).
2. For decision-making it's necessary to define the format of the information. Those can be recommendations of the project head (in verbal form or in form of an office memo) or a developed report with detailed comparative software characteristic.
3. It's necessary to issue the order at the enterprise which names the employees taking part in design group and specifies their rights and a duties.

The last phase of this stage is planning of time frameworks of the project. At this phase it is necessary to plan time limit of choice, decision-making and the beginning of introduction of the project. Thus it is necessary to consider, the fact that people, engaged in the project (especially heads of departments, sectors of groups) spend most of the time to perform their principal duties. Therefore planning the terms of the project it is always necessary to provide some time reserve, and to consider that fact that the increase in terms of the project conducts to decrease in efficiency of the enclosed means.

The stage of choice preparation

This stage of software choice process includes 6 phases. All works at this stage are carried out by the project command.

The first phase forms the purposes of the project. If you have had a successful automation project of the enterprise it is necessary to have readable goals of the project and understand which result you should get. As a rule, the project goals agree with the purposes of the company business. The basic requirement to this phase is – if there are a several goals they shouldn't contradict each other.

At the second phase there are formed criteria of increase of effectiveness. It means that you have to define how the expenses for the project will pay off. Criteria can be both qualitative and quantitative. For example, the following criteria can be used for the introduction of ERP-systems:

- cost decrease for transportation on 60 %;
- decrease of production cycle on 30 % for the base products;
- decrease of delays with shipments of finished goods on 45 %;
- decrease of safety stock (level of not reduced rests in warehouses) on 40 %;
- decrease of spoilage in production on 35 %;
- growth of numbers of deliveries in time – to 80 %.

The last two criteria are qualitative criteria, other criteria are quantitative ones.

The next phase forms the functional requirements to the system. On this phase it is decided what the system (software) has to (should) do and how the system has to do it. At first, it is necessary to make detailed inspection of the enterprise, i.e. to define what departments carry out what operations, and then it is necessary to allocate problems and decide which problems can be solved by automation.

After that it is necessary to plan expected changes, and to generate automation model. There can be several problems while forming the model of automation. The main of them are:

- the problems connected with insufficient preparation of the personnel;
- the problems connected with getting information from department employees;
- the problems connected with display of the received information.

The following phase forms the technical requirements to the system, first of all, the requirements to the operation system, servers and workstations, authorization of access, data security, SMDB, and there are formed the rules of integration with the already existing software that is used at the enterprise.

On the fifth phase there are formed comparison criteria. At this phase there are formed criteria which will be used to choose the system which has the maximum equivalence to all the requirements. For each criterion it is necessary to appoint a certain weight factor which defines the importance of this or that criterion. The most popular comparison criteria are:

1. Scalability of the system – that is its possibility if necessary to get or to activate additional modules which aren't required at the initial stage automation.

2. Manufacturability is the indicator of integrability with the existing systems of the account (or automation) and the indicator of the system openness, it means possibility of functional modernization of the system modules.

3. Invariance to business, it is possibility to apply the system in different types of business (it is actual for the holding companies).

4. Development prospects are plans of developers on the further support and development of the system.

5. Functional completeness means how much full system allows to automate activity of all the enterprise.

6. Total Cost of Ownership includes the cost of the system plus the cost of system introduction plus the cost of system support and plus the cost of users training.

The last phase on this stage is to form the additional requirements to the system. For example, presence of certificates, ergonomic requirements (presence of intuitively clear interface of the user), presence of demonstration and training materials.

The stage of choice realization

After finishing all the phases at the first two stages it is possible to start the third stage – the stage of choice realization. This stage is divided into three or four phases.

At the first phase there is made the definition the system class with the help of systems of classification software. After the class of system is defined we can receive the tentative list of systems that meet our requirements and criteria.

The second phase is the choice of the system supplier. In most cases the same software can be sold to two or three dealer companies. We have to choose the supplier that has the greatest knowledge in given subject domain. In general the supplier should provide the following facilities:

1. Carrying out trainings for studied ideology and principles of work in the introduced system.

2. The supplier has to understand in your business area (that is advisers of the supplier should understand adequately subtleties and specificity of your activity).

3. The supplier should be able to organize the project on system introduction and operate it (the preference is given basically to those suppliers who have the greatest quantity of successfully realized projects of introduction).

4. The supplier has to provide qualitative technical support and project support.

5. Reasonable system of payment. Today there are two systems of payment – time rate and budgetary. The time rate payment system assumes that after a defined time interval you have to pay the bill for work of advisers. The main lack of the method - cost of the entire project is unknown. Budgetary system means that at the beginning of the project it is necessary to define possible input cost and time cost and financial frameworks of the project. In it you know precisely how much you have to pay, when and for what the payment is carried out, how much work there is at each stage and in how much money you'll spend on this project.

The third phase is forming of the inquiry about the offer. At this phase there is formed the offer in which you inform that your company plans to start the project of automation and shortly describe the project conditions. This letter is dispatched to prospective suppliers of systems. Such letter is called inquiry about the offer. Then from the answered suppliers on the basis of general criteria there are chosen 2-3 most probable candidates who you invite to take part in the tender (competition) on carrying out of the automation project.

At last stage for each of the chosen suppliers will organize carrying out of presentation of their system (at the presentation there should necessarily be bosses of the company). After carrying out the presentation you form the report for the system choice on the basis of offers of suppliers which you later give to the managers. On the basis of the given report and held presentations the company management carries out a choice of concrete system of automation and the

concrete supplier of system then sign the contract with the supplier on the project to organize the system introduction.

Key questions

2.1 What is a life cycle (LC) of IS?
2.2 What types of processes included the LC?
2.3 Describe the basic processes of LC.
2.4 Describe the subsidiary (supporting) processes of LC.
2.5 Describe the model of Life cycle MIS.
2.6 What is the mission?
2.7 Describe the complete business model.
2.8 Name the maturity levels of the company.
2.9 Describe the structural approach of the MIS design.
2.10 Describe the process approach of the MIS design.
2.11 What are the CASE-means?
2.12 Describe classification of the CASE-means.
2.13 Describe process of estimation and choice of the CASE-means.
2.14 Describe the process of the software selection for automation of the enterprise.
2.15 Name the stages process of the software selection for automation of the enterprise.

TOPIC 3 The informational system in economic and business

Theme 3.1 Electronic Document Management systems

Electronic Document Management (EDM) is a system that is used to store documents in the electronic format and this system provides opportunities to work with these documents (document search, document creation, document change).

Document

The main element of any EDM system is a document.

A *Document* is the main information unit and all the life cycle of an EDM system is devoted to storing documents, their attributes and properties.

A Document is a logical unit. The method of document storage depends on the types of work with it. The document can be made up of texts, tables, pictures, drawings. The COM mechanism gives an opportunity to make into document something like a file system that includes files and folders. But it is inconvenient, the simplest method it to store all parts of the document into different files which are edited by different programs. The document consists of a file set in most EDM systems.

A Life cycle of a document

The life cycle of a document consists of four stages:

1. Birth.
2. Making.
3. Publication.
4. Archiving.

Birth

At any moment we can create a new document. The moment of creation of a document is fixed and saved in modern EDM systems. The file history is easily lost in usual file systems. If you write a new file with the same name into the same place you will lose the previous file. You can't create a document into an EDM system if it hasn't a "passport" (a registration card). You can't delete a document, change a document or rename a document without these actions being recorded by The EDM system of a computer. All the actions are fixed. The EDM system saves all versions of the document if it is necessary.

Making

Any document undergoes a stage which is called a «draft copy». At this stage a document passes through many hands, it is changed and remade. The Quality of the resultant document depends on the quality of works at the «draft copy» stage. The technology of locking the edited documents («check-out, check-in») is used to organize a collective operation over the document in the EDM system. The system gives opportunity to only one person to edit the document at any moment. Other people cannot edit this very document if somebody is working with it. If a system uses this technology you can be sure than only one person can edit a document. When in the EDMS one of the employees takes away the document for editing, another worker will see it but can't change the document until the first hasn't returned it. The returned document gets a new number of version which is automatically assigned. The previous version of the document is saved and it can be opened, looked and edited. All the actions of all participants of the process are documented, therefore no confusion will arise.

Publication

The document was created and edited for the sake of publication. Publication is a moment after which the document "dies". Thanks to the presence of the publication mechanism you can be sure that you will always have in electronic format the very same document that was, for example, signed, or sent in the press, or sent to the partner. And if it is necessary to change something in the document after the publication? For this purpose on the basis of the published version there is a new variant of the document and a new life cycle begins.

Archiving

After the publication the document goes to the electronic archive where it should stay as long time, as is provided by the company charter. There are documents which are stored eternally. There are documents which it is necessary to store for some days. Archive creation is the non-simple task. It depends on the organization needs. For example, if documents are used very often they will have to be stored on fast carriers, or if documents are used rarely, it can be possible to use less expensive, but slow carriers. For these tasks there are used technologies of control by hierarchical storage HSM (Hierarchical Storage Management). These technologies create «virtual file system» of as much a big size from different storage devices, and are controlling transfer of the information from one carrier to another.

An electronic document is any electronic media content (other than computer programs or system files) that are intended to be used in either an electronic form or as a printed output.

The main tasks which are solved by electronic document systems:

The EDM systems are used for the following tasks:

- to carry out a more effective control over the expense of automatic control of performance and transparency of activity of all organization at all levels;
- support the quality control system that corresponds to international norms;
- it is conducted to organize activity protocols;
- optimization of business processes and automation mechanism of performance and control;
- deleting or the maximum possible reduction of paper documents turn at the enterprise. Saving resources at the expense of cuts in expenditure on control of workflows of documents;
- exception or the maximum possible simplification and reduction of the costs of storage of paper documents at the expense of presence of electronic archive.

The main factors which have influence on decision of system selection

1. The requirements to the storages volume. If you have a lot of documents (on storage volume), it will be necessary to select the system supporting hierarchical storage (HSM - Hierarchal Storage Management).
2. There are formalized procedures which are needed to support and control (preparation of special types of documents or carrying out standard functions of organization).
3. Need of automation of managerial control by the organization. A level of complexity of an organization structure.
4. There are geographically-distributed departments. This factor needs special requirements to the remote access.
5. There are paper archives of big size.
6. There are needed a well-developed routing system and workflow control.
7. There are requirements to the keeping time of documents.

8. There are requirements to the extensibility of the system. There is a possibility to integrate this system into real information systems and equipment.
9. There is need to save images of the documents. There are special formats of document storage.
10. There is need of comprehensive facilities to search.
11. There are requirements to the security (encryption, encoding).
12. There are requirements according to defined standards (national standards, state standards, industry standards).

The problems of introducing EDM systems

There are several problems for any types of companies. These problems have to be decided simultaneously with the introduction of EDM systems. There exist the following problems:

1. Conservatism of the staff.
2. Low level of scholarship.
3. There is factor of a "soviet type" director. He disinclines working with computers and electronic documents.
4. There are constant changes into organization and weak formalization of the business processes.
5. There is need to provide legal effect of the documents (if there is a law about digital signature this factor will not be significant).
6. There is need to interact with outward "paper world".

The classification of the EDM systems (EDMS)

The modern enterprises demand EDMS for a distributed architecture management of documents. This one has to meet the following requirements:

- scalability, reliability (safety), manageability for economical expand system;
- automatic support of distributed control by various information materials throughout all their life cycle, from creation before reviewing, the statement, propagation and archiving;
- management flexibility access to all types of documents;
- possibility of authorization of documents from Web-browsers;
- EDMS has to have an open expandable architecture;
- availability is a broad spectrum of additional technologies to increase the level of reset investments.

Here is the classification of the EDMS:

- business-process oriented EDMS are BP EDMS (Documentum, FileNet (Panagon и Watermark), Hummingbird (PC DOCS));
- enterprise-centric EDMS are Lotus (Domino.Doc),Oracle (Context);
- content management EDMS are Adobe, Excalibur;
- EDMS information management portals are Excalibur, Oracle Context;
- EDMS for management of images is Imaging;
- EDMS for workflow management are Lotus (Domino/Notes and Domino Worflow), Jetform, FileNet, Action Technologies, Staffware.

Standards of the EDMS

Today there are several standards of the EDMS:

1. ISO 2709 Information and documentation – Format for information exchange.
2. ISO 15836:2009 which replaces ISO 15836:2003 Information and documentation – The Dublin Core metadata element set.
3. ISO 15489: 2001 Information and documentation -- Records management
4. ISO 21127:2006 Information and documentation – A reference ontology for the interchange of cultural heritage information.
5. ISO 23950 Information and documentation – Information retrieval (Z39.50) – Application service definition and protocol specification.
6. ISO/CD 10244 Document management – Business process/workflow baselining and analysis associated with EDMS technologies.

The logical components and process of the EDMS

The EDMS may have next logical components:

1. **Metadata –** is typically stored for each document. Metadata may, for example, include the date the document was stored and the identity of the user storing it, date the document was created who created document and so on.
2. **Integration –** Many document management systems attempt to integrate document management directly into other applications, so that users may retrieve existing documents directly from the document management system repository, make changes, and save the changed document back to the repository as a new version, all without leaving the application.

3. **Capture (input systems) –** Capture primarily involves accepting and processing images of paper documents from scanners or multifunction printers.
4. **Indexing –** Track electronic documents. Indexing may be as simple as keeping track of unique document identifiers; but often it takes a more complex form, providing classification through the documents' metadata.
5. **Storage –** Store electronic documents. Storage of the documents often includes management of those same documents; where they are stored, for how long, migration of the documents from one storage media to another (hierarchical storage management) and eventual document destruction.
6. **Retrieval –** Retrieve the electronic documents from the storage. Simple retrieval of individual documents can be supported by allowing the user to specify the unique document identifier, and having the system use the basic index (or a non-indexed query on its data store) to retrieve the document. More flexible retrieval allows the user to specify partial search terms involving the document identifier and/or parts of the expected metadata.
7. **Security –** Document security is vital in many document management applications. Compliance requirements for certain documents can be quite complex depending on the type of documents. Some document management systems have a rights management module that allows an administrator to give access to documents based on type to only certain people or groups of people.
8. **Workflow (routing) –** Workflow is a complex problem and some document management systems have a built-in workflow module. There are different types of workflow. Usage depends on the environment the electronic document management system (EDMS) is applied to. Manual workflow requires a user to view the document and decide who to send it to. Rules-based workflow allows an administrator to create a rule that dictates the flow of the document through an organization: for instance, an invoice passes through an approval process and then is routed to the accounts-payable department. Dynamic rules allow for branches to be created in a workflow process.
9. **Collaboration –** Collaboration should be inherent in an EDMS. In its basic form, a collaborative EDMS should allow documents to be retrieved and worked on by an authorized user. Access should be blocked to other users while work is being performed on the document. Other advanced forms of collaboration allow multiple users to view and modify (or markup) a

document at the same time in a collaboration session. The resulting document should be viewable in its final shape, while also storing the markups done by each individual user during the collaboration session

10. **Versioning –** Versioning is a process by which documents are checked in or out of the document management system, allowing users to retrieve previous versions and to continue work from a selected point. Versioning is useful for documents that change over time and require updating, but it may be necessary to go back to or reference a previous copy
11. **Searching –** Finds documents and folders using template attributes or full text search. Documents can be searched using various attributes and document content.
12. **Publishing –** Publishing a document is the procedures of proofreading, peer or public reviewing, authorizing, printing and approving etc. Those steps ensure prudence and logic thinking.

Theme 3.2 The structure of EDMS

As you know the EDMS may have 12 logical components and processes. These logical components are realized by physicals elements. There are the following physicals elements in EDMS:

1. The storage of the document attributes.
2. The storage of the documents.
3. Business logics.

The storage of document attributes (repository)

The repository is used to save the document attributes (the card (passport) of the document).

In EDMS there is often used a term “the type of document” (for example, a contract, a specification, a letter etc.) and for each type of the document there exists its own card. Cards of different types have obligatory or common fields, the same for all types of documents, and special fields that are unique for each type of documents. For example, the unique number of the document, the name, the author, the date of creation can be common fields. Thus documents of type «contract» can have such fields as the date of signing, period of validity, and the sum of contract. Types of documents can have subtypes which have the same fields as the basic type of document, and additional fields, unique for this subtype.

Except the term “the type of document”, there is possible to give the documents categories and one document can belong at the same time to several categories. Categories can be built into a tree of categories. For example, it is possible to have a category «Legal documents» with subcategories «Laws», «Contracts», «Orders» etc. Thus it is possible to have parallel structures of departments, for example, a category «sales department Documents», and in it a subcategory «Contracts on sale», «Accounts» etc. “The Contract on sale” can be simultaneously related to subcategories «Contracts» and «Contracts on sale», concerning different branches in hierarchy of categories. Thus, there is a possibility of document search in such tree in the basis of its classification, and the same physical document can be met any number of times in different knots of this hierarchy.

The storage of documents

The storage is used to save documents. Today there are two methods to create document storage:

1. The use of special storage.
2. The use of file system of the server (or of the workstation).

Storage in file system lowers degree of safety at access. Different file systems cannot support that model of safety which is realized in most EDMSes. Therefore it is necessary to allocate an EDMS with the access rights so that the files were kept by it, it will be inaccessible to other user directories. And EDMS will support the system of the list of users with access rights, organizing access to files according to these rights. The access system thus becomes difficult to rule the access but still it’s not quite irreproachable from the point of view of information security. For maintenance of additional reliability, enciphering of files in the storage is often used. Besides, practically all EDMSes use casual file names, which strongly complicates the search of necessary file at attempt of access to system detour. It is necessary to tell that majority of EDMSes carry out storage of files in the file system.

The systems having their own storehouse of files can guarantee more efficient control of access to documents and more reliable solution of the problem of differentiation of this access. But thus there are questions connected with the integrity of data, presence of effective remedies of reserve copying and integration with means of archival storage for slow carriers. In the majority of systems they are anyhow solved, however it is possible to use only the tools accessible in the system while in case of file storage you always have a choice.

Business logics

Business logic is a rule set which determines the principles of operating an EDMS. Every EDMS has its own rule set. But all of them have several standard functions:

- documents management;
- routing and control;
- document imaging;
- workflow management.

Document imaging

It is used for entering, storage and managing of electronic images of paper documents that have been previously scanned, faxed or e-mailed.

Document management

It comprises technological solutions that enable:

- search – consists of search in attributes, visual search in various trees in which documents are searched by the full text, by semantic search etc.;
- access;
- protection;
- management of documents includes procedures of addition and withdrawal of documents, preservations of versions, transfers to storage in archive, archive maintenance etc.

Documents are entered into the system by scanning paper documents or importing electronic documents created with applications for electronic tables editing or text editing, images, audio/video clips creation and editing, etc.

Workflow management

It automates the flow of documents and information in the work process whereby we can precisely define working methods with regard to employees and their tasks, their input and output values.

At the same time the automated process enables the company to create business policies and strategies for the management of workflow, control and communication in the completion of work tasks.

Routing and control

This function provides delivery of documents within the scope of business processes in the organization. Routes of documents can be *flexible* and *rigid*.

In case of *flexible routing* the following addressee of the document is defined by the employee who is conducting the document at present.

In case of *rigid routing* the way of passage of documents is defined in advance on the basis of some logic.

In real life there is used a «mix» from these two approaches is applied: for certain documents and structures in the organization there is rigid routing, for others the flexible is more pertinent. Routing function is not present in all EDMSes. Usually, a system which doesn't have the routing elements is called the electronic archive.

Execution control is an integral part of routing. If the document has a step-by-step control it means the user is aware of where it goes and where it is now. Actually, the route is defined by terms of passage way and time intervals in performance of a document by each of participants of passage process. Performance of the action connected with the document by each participant means performance of a document within the limits of its powers of office. Better to say, someone can simply read it, but there should be someone who has to introduce certain changes into it.

On the Figure 3.1 you can see the structure of an EDMS.

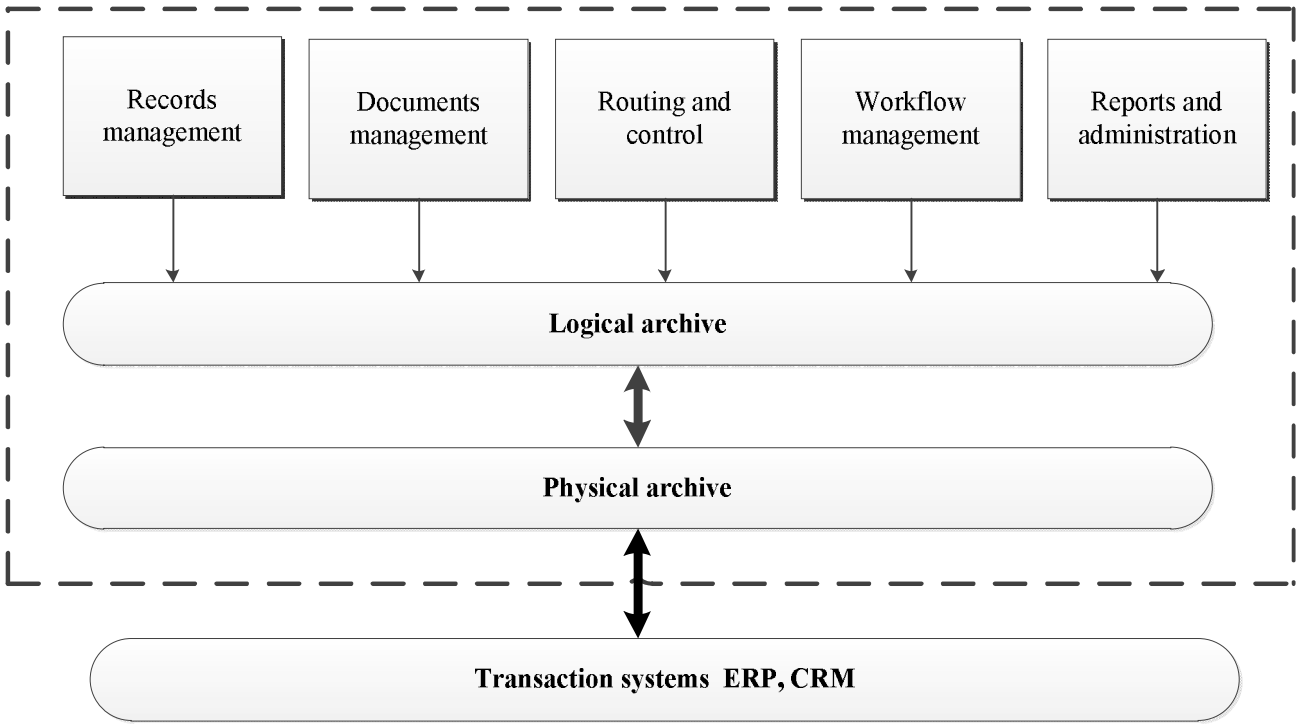

Figure 3.1 – The structure of the EDMS

The structure of an EDMS can also have a special element *output management* (COLD – Computer Output to Laser Disk / ERM – Enterprise Report Management).

Logical archive and physical archive are used for documents and information storage; a physical archive stores actual documents, while the logical archive stores their meta-data (attributes). The physical archive also ensures that these documents can be accessed and protected.

Reports. These serve as analog of office log-books of documents. Using various reports, it is possible to look, for example, at the general time spent by employees for work on the concrete document, speed of passage of documents on divisions etc. Reports are excellent materials for acceptance of administrative decisions.

Administration. It supports works of the system, adjustment of its parameters, etc.

Theme 3.3 The systems of reference data (RD)

To define reference information in the automated management systems in enterprises there are used terms Master Data and those defining tasks of control of the given information are Master Data Management (MDM) systems. In Ukraine the term “reference data” is used more often.

The reference data is a conditional-permanent part of the corporate information, unlike the current information that has been formed immediately in the process of work.

The reference data includes the dictionaries, handbooks, classifiers (for example terms, units of measure, contractors) that are used to form work documents.

At formation of the invoice the name of materials, units of measure, the name of the enterprise-receiver are selected from the reference handbooks which have been built in system, instead of being entered manually.

The main oil companies have handbooks that content more than 250 000 records. The questions of creation and support of the reference data in an actual state is a special task that is regarded in a special department.

According to the experts the cost of handling one record of the reference data is around 10-20$. The cost of one project of the reference data creation for a large enterprise can be estimated in $400,000-900,000.

The creation of the enterprise reference data system consists in no simple decision. The simplest method is to use a ready dial-up of reference handbooks. However any specific enterprise can't use such reference handbooks without problems – they are too superfluous and don't consider the specificity of the enterprise.

The decision of the task of reference data control is possible only in the form of creating a specialized system of reference data application using appropriate standards, techniques and software.

The systems of reference data are reasonably used in the following cases:

- necessity of the units information systems at the level of reference information that will allow to sort and cut down expenses on process of guiding reference data;
- desire to use the uniform codes of the reference information for automation of collection and the analysis of the corporate reporting;
- possibility to raise quality and reliability of the reference data at the expense of avoiding duplication of reference information, optimization of methods of its guiding

There are several preferences if you have a system of reference data management:

1. Real financial advantage:
   - cutting the costs that are spent to quality assurance of the reference data (actuality, consistency, fullness);
   - lowering of expenses for guiding corporate reference data by organizing a uniform access point to control the reference information that will be used by all systems of the company;
   - lowering of expenses for realization of information data exchange.
2. Indirect financial advantage:
   - preventing losses of the company for using the poor-quality reference information (non-actuality, inconsistency, non-fullness);
   - preventing losses resulting from the errors in consolidated reporting, connected with non-actuality or inconsistency of the reference information that was used.
3. Advantages of the reference data:
   - growth of level of actuality of the reference data;
   - availability of the reference data to any workers of the company in real time independent of their location;

– full discrimination of responsibility for managing the concrete reference handbooks.

The main steps of the creation system of reference data

There is used a special step-by-step technique to create the reference data system which is characterized by a row of principles:

– the system has evolutionary development, there is used the following algorithm – old system – old system and new system – new system;
– the system has to adapt easily for specificity of real information systems of the enterprise and of different systems of classification and information coding;
– the system has to take into account the human factor and to give opportunity of working in system for different user categories, with different skills in the information technologies, «friendliness» of system interfaces.

The process of creation of the reference data system can be seen in the Figure 3.2.

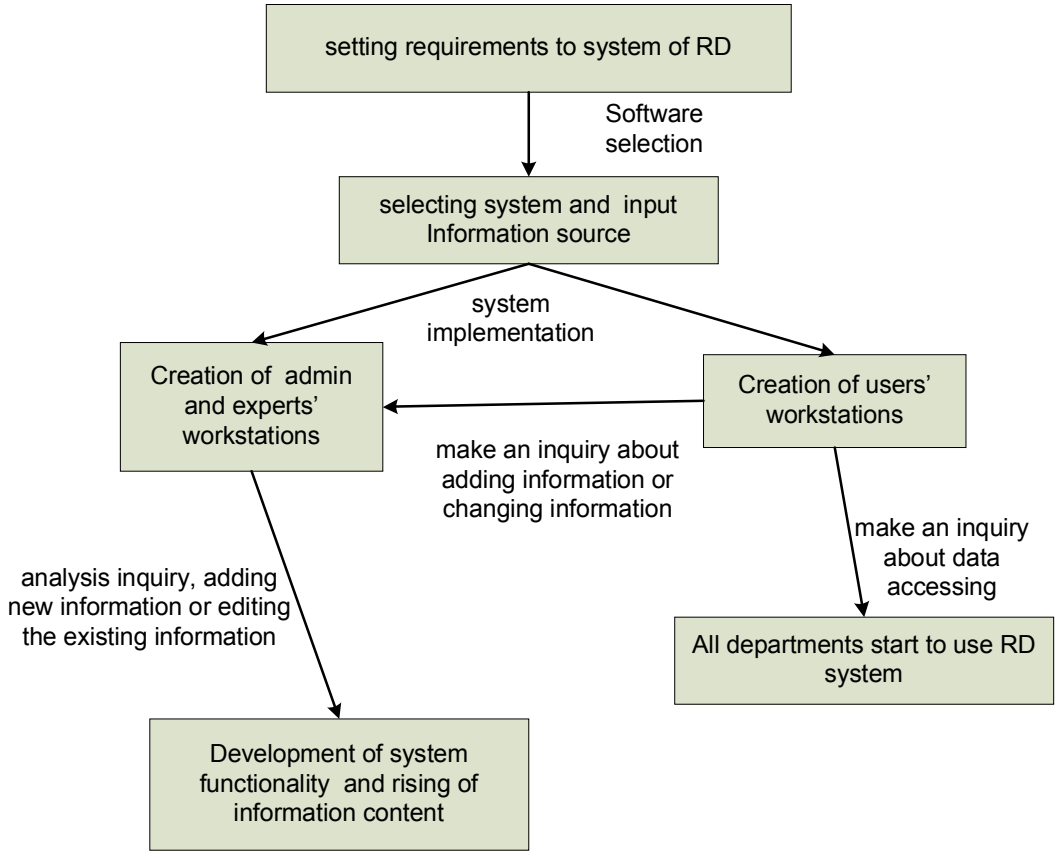

Figure 3.2 – The process of creation of the reference data system

The reference data system has to have the following groups of users:

- users – those are workers of the company that use different types of reference data to create working documents;
- experts are specialists who update or change the reference data;
- main specialists who are the leading staff of the company departments and deal with different types of reference data that is in their competence. They take part in agreement processes of changing and updating the reference data;
- technical support staff who are the workers of IT department providing service hardware and software complex of the system.

The structure of the reference data system

The main functional structure of the reference data system is showed in the Figure 3.3.

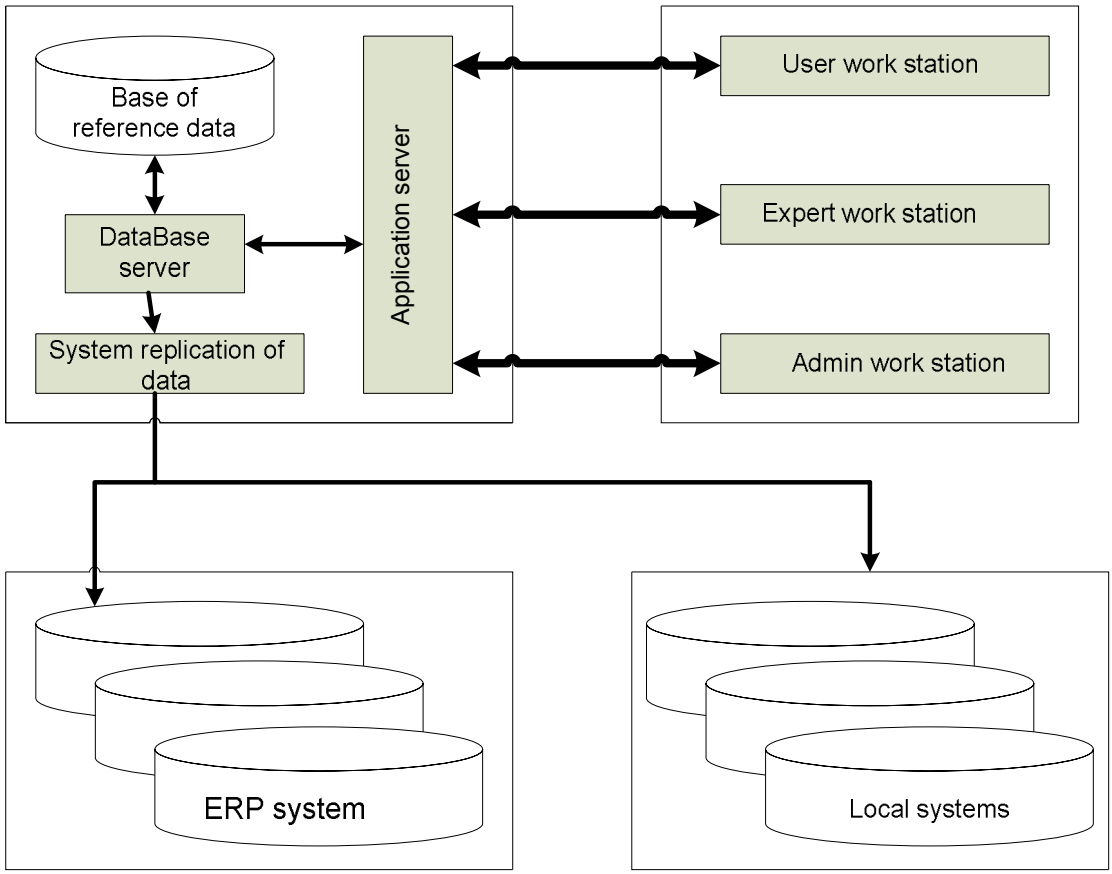

Figure 3.3 – The main functional structure of the reference data system

In general case the reference data are:

- handbook of fixed assets of the company;
- handbook of inventory holdings;
- handbook of services;
- handbook of accounts;
- handbook of the expense items;
- handbook of tariffs;
- handbook of contractors;
- handbook of coefficients.

Today there are three types of reference data systems creation. They differ according to the data storage method:

1. The reference data systems with centralized data storage method.
2. The reference data systems with decentralized data storage method.
3. Hybrid reference data systems.

Centralized data storage method

In this case the reference information is retrieved from different systems. It is sorted out, specified, added and written into the etalon storage. If reference data is changed the system has to inform all users who use this reference information. The Figure 3.4 shows the structure of centralized data storage method.

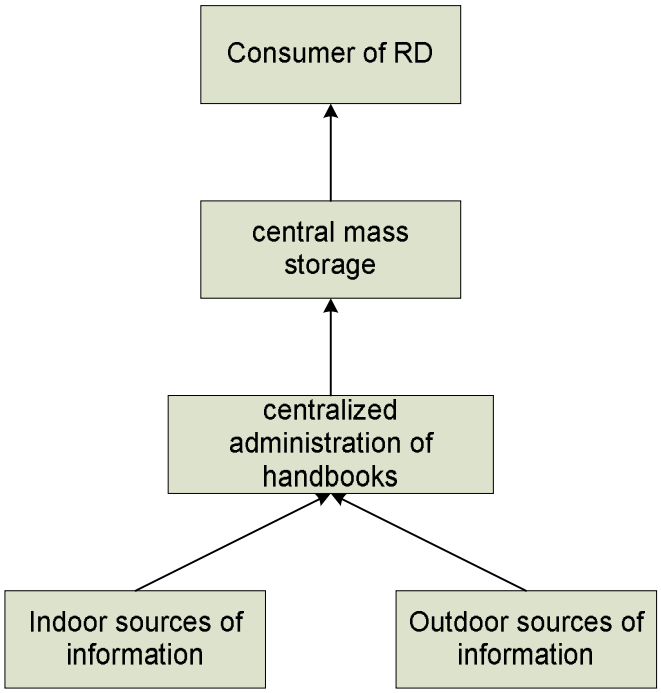

Figure 3.4 – System of centralized data storage method

Decentralized data storage method (virtual storage)

In this case there is a virtual storage (or a database). When the user requests reference data from this base he gets data like those from data base. But really the reference information is stored in different systems. The Figure 3.5 shows the structure of decentralized method of data storage.

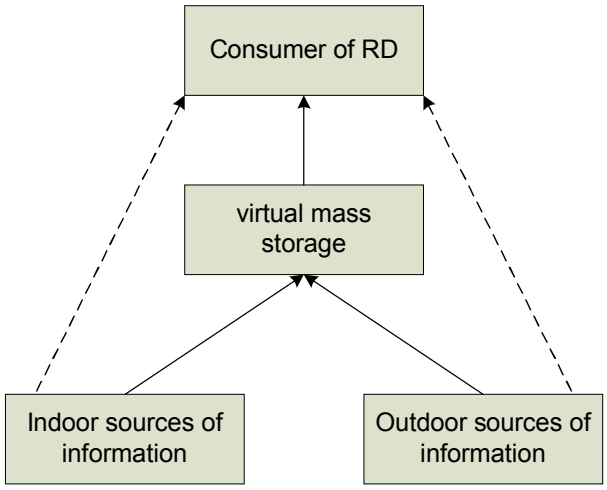

Figure 3.5 – System of Decentralized data storage method

Hybrid reference data systems

These systems realize both methods at the same time. This is a system with an adaptable model of data storage. The main information (identifiers, keys of tables) is stored into etalon database. The other information is downloaded from indoor and outdoor sources.

Theme 3.4 The Base standards of information systems in economy

Today the process operation of business can be considered with the several points of view. There are three basic points of view:

- the financial;
- the logistical;
- the industrial (technological).

As the financial point of view understand the description of the enterprise from the point of view of movement of cash flows.

Under logistical point of view understand the description of the enterprise from the point of view of movement of material flows.

Under industrial point of view understand the functional description of business that is the description from the point of view of sequence and rules of realization of production functions.

Each of the points of view represents some «cutoff» from the real processes occurring inside and around enterprise. The technological point of view is the most difficult.

Each point of view has under itself a serious theoretical platform and defines an essential part of activity of the company. Depending on business type (character of activity of the company) one of three points of view can have dominating value. For example the distributor first of all interests the logistical point of view, the investment company first of all interests the finance.

However the real enterprise three points of view either simultaneously interest at once, or is consecutive. If not pay attention to one of the points of view it can to lead to problems in the future. Take to attention this fact there were created several base standards for operation of business. The first of all were created the follows standards:

- MPS;
- SIC;
- BOM;
- Kanban.

MPS - master production schedule

A **master production schedule** (MPS) is a plan for production, staffing, inventory, etc. The idea was simple – we form the plan of sales («volume»), with breakdown on the calendar periods – from here – volume-calendar, on it we form the plan of replenishment of stocks and is estimated financial results on the periods.

It is usually linked to manufacturing where the plan indicates when and how much of each product will be demanded. This plan quantifies significant processes, parts, and other resources in order to optimize production, to identify bottlenecks, and to anticipate needs and completed goods. Since an MPS drives much factory activity, its accuracy and viability dramatically affect profitability. Typical MPS's are created by software with user tweaking.

Due to software limitations, but especially the intense work required by the «master production schedulers», schedules do not include every aspect of production, but only key elements that have proven their control effectivity, such as forecast demand, production costs, inventory costs, lead time, working hours,

capacity, inventory levels, available storage, and parts supply. The choice of what to model varies among companies and factories. The MPS is a statement of what the company expects to produce and purchase (i.e. quantity to be produced, staffing levels, dates, available to promise, projected balance).

The MPS translates the business plan, including forecast demand, into a production plan using planned orders in a true multi-level optional component scheduling environment. Using MPS helps avoid shortages, costly expediting, last minute scheduling, and inefficient allocation of resources. Working with MPS allows businesses to consolidate planned parts, produce master schedules and forecasts for any level of the Bill of Material (BOM) for any type of part.

An effective MPS ultimately will:

- give production, planning, purchasing, and management the information to plan and control manufacturing;
- the overall business planning and forecasting to detail operations;
- enable marketing to make legitimate delivery commitments to warehouses and customers;
- increase the efficiency and accuracy of a company's manufacturing.

MPS issues:

- width of the time bucket;
- planning horizon;
- rolling plan;
- time fencing;
- schedule freezing.

The standard MPS has well proved for simple and small manufactures of manufactures, with growth and complication of manufactures problems began to arise. The first problems have begun with logistics, namely with forecasting of necessary volume and time of delivery. The ordered goods aren't delivered instantly, hence it is necessary to predict demand for long time forward, to consider duration of manufacture and requirement for the warehouse areas. Absence on sale of «day-to-day goods» as it can lead to leaving of the client to competitors is besides inadmissible. As a result there is a concept «**Safety stock**».

Safety stock

The **Safety stock** is a certain not reduced stock of the goods (a material, a product, a component) necessary on purpose to provide continuous production in

case of faults with deliveries. Also it can be used for maintenance of requirements of replacement failed and the equipment shown to guarantee repair.

Safety stock (also called **buffer stock**) is a term used by logisticians to describe a level of extra stock that is maintained to mitigate risk of stockouts (shortfall in raw material or packaging) due to uncertainties in supply and demand. Adequate safety stock levels permit business operations to proceed according to their plans. Safety stock is held when there is uncertainty in the demand level or lead time for the product; it serves as an insurance against stockouts.

The amount of safety stock an organization chooses to keep on hand can dramatically affect their business. Too much safety stock can result in high holding costs of inventory. In addition, products which are stored for too long a time can spoil, expire, or break during the warehousing process. Too little safety stock can result in lost sales and, thus, a higher rate of customer turnover. As a result, finding the right balance between too much and too little safety stock is essential.

For this situation was developed one more standard - SIC «statistical inventory control». There are two new terms (in the SIC standard):

- recorder point – defines level of warehouse stocks, at decrease in quantity of existing stocks below which it is necessary to make to (plan) the order to the supplier;
- replenishment level - is a quantity of the goods above which it is not recommended to raise level of a warehouse stock of the concrete goods.

These terms have dynamic character and their values can be change depending on those or other factors. For example, the safety stock of extensive assortment of soft drinks is rather essential in the summer, and here in the winter absence of full assortment hardly will lead to appreciable troubles, except can be the most popular grades. Besides, holiday trade demands an establishment of higher levels of «an order point», than during the usual periods. Definition and fixing of similar fluctuations - sometimes a subject of serious statistical researches.

These terms is showed on the Figure 3.6.

Safety stocks enable organizations to satisfy customer demand in the event of these possibilities:

- supplier may deliver their product late or not at all;
- the warehouse may be on strike;
- a number of items at the warehouse may be of poor quality and replacements are still on order;

- a competitor may be sold out on a product, which is increasing the demand for your products;
- random demand (in reality, random events occur);
- machinery breakdown;
- unexpected increase in demand.

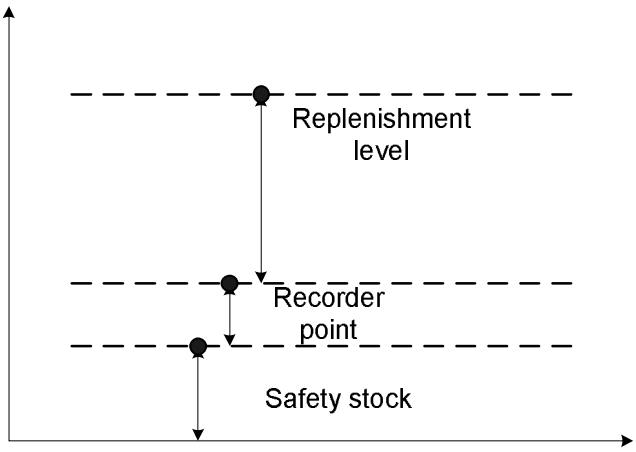

Figure 3.6 – The levels of the statistical inventory control

Safety stock is used as a buffer to protect organizations from stockouts caused by inaccurate planning or poor schedule adherence by suppliers. As such, its cost (in both material and management) is often seen as a drain on financial resources which results in reduction initiatives.

Bill of material or BOM

Even more serious problems began to arise at complication of manufacture and occurrence of difficult compound products which assemblage is made on several assembly conveyors. The products made during such manufacture, are represented in the form of the trees which have received generalizing name BOM (bill of material - «product structure» or «the assembly specification»).

A **bill of materials** (sometimes **bill of material** or **BOM**) is a list of the raw materials, sub-assemblies, intermediate assemblies, sub-components, components, parts and the quantities of each needed to manufacture an end product. No physical dimension is described in BOM.

A BOM can define products as they are designed (engineering bill of materials), as they are ordered (sales bill of materials), as they are built (manufacturing bill of materials), or as they are maintained (service bill of

materials). The different types of BOMs depend on the business need and use for which they are intended. In process industries, the BOM is also known as the *formula*, *recipe*, or *ingredients list*. In electronics, the BOM represents the list of components used on the printed wiring board or printed circuit board.

BOMs are hierarchical in nature with the top level representing the finished product which may be a sub-assembly or a completed item. BOMs that describe the sub-assemblies are referred to as modular BOMs.

The first hierarchical databases were developed for automating bills of materials for manufacturing organizations in the early 1960s.

A BOM can be displayed in the following formats:

- a **single-level BOM** that displays the assembly or sub-assembly with only one level of children. Thus it displays the components directly needed to make the assembly or sub-assembly;
- an **indented BOM** that displays the highest-level item closest to the left margin and the components used in that item indented more to the right;
- **modular (planning) BOM -** s type of bill of materials (BOM) and a critical element in defining the product structure of an end-item.

Modular BOMs define the component materials, documents, parts and engineering drawings needed to complete a sub-assembly. While the terms BOM and modular BOM are most commonly used in association with physical products, the concept can be used in a variety of industries (e.g. software, medical records). Modular BOMs are used by modern information systems to serve a variety of purposes, such as defining the components needed to produce a sub-assembly, and providing cost information for each component and «rolled-up» cost information for the overall sub-assembly.

For option-based, configurable products (e.g. automobiles, PCs) companies needed to plan every combination and permutation of options to ensure they could fulfill customer demands. With a modular BOM structure, companies can plan the demand for each module independent of the end-item demand by estimating the popularity of the module sub-assembly.

A BOM can also be visually represented by a product structure tree, although they are rarely used in the workplace (see Figure 3.7 and Figure 3.8).

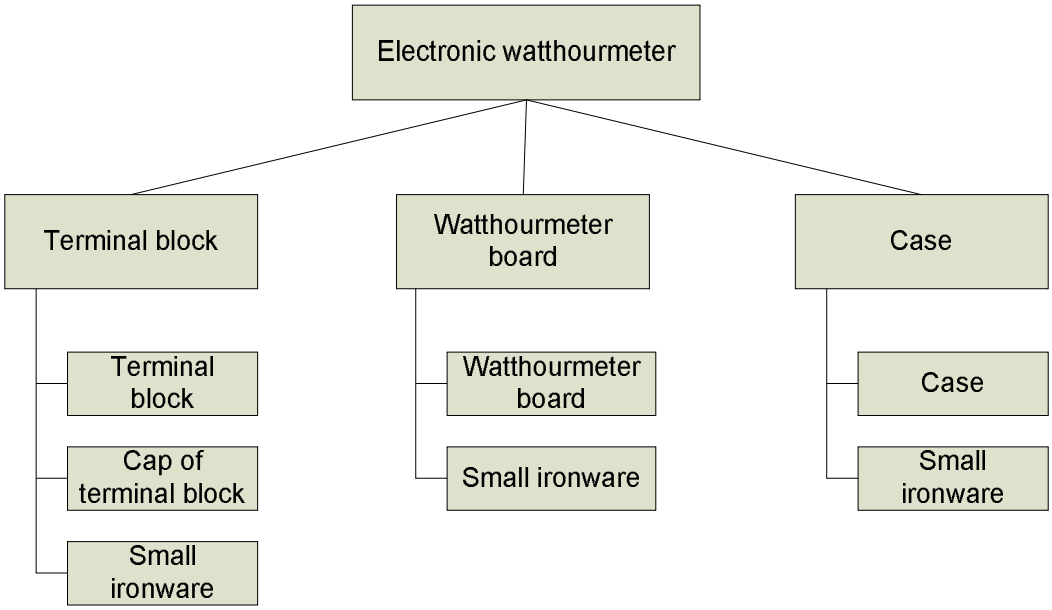

Figure 3.7 – The structure tree BOM for electricity supply meter

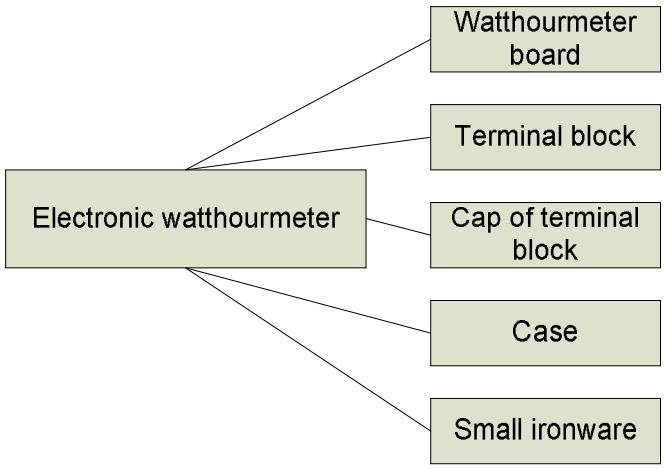

Figure 3.8 – The dense list of BOM for purchase of elements

Theme 3.5 The MRP standard

Material requirements planning (MRP) is a production planning and inventory control system used to manage manufacturing processes. Most MRP systems are software-based, while it is possible to conduct MRP by hand as well. An MRP system is intended to simultaneously meet three objectives:

- ensure materials are available for production and products are available for delivery to customers;
- maintain the lowest possible level of inventory;

- plan manufacturing activities, delivery schedules and purchasing activities.

History

In the 1960s, Joseph Orlicky studied the TOYOTA Manufacturing Program and developed Material Requirements Planning (MRP), and Oliver Wight and George Plossl then developed MRP into manufacturing resource planning (MRP II).. Orlicky's book is entitled *The New Way of Life in Production and Inventory Management* (1975). By 1975, MRP was implemented in 150 companies. This number had grown to about 8,000 by 1980.

The basic function of MRP system includes inventory control, bill of material processing and elementary scheduling. MRP helps organizations to maintain low inventory levels. It is used to plan manufacturing, purchasing and delivering activities.

«Manufacturing organizations, whatever their products, face the same daily practical problem - that customers want products to be available in a shorter time than it takes to make them. This means that some level of planning is required».

Companies need to control the types and quantities of materials they purchase, plan which products are to be produced and in what quantities and ensure that they are able to meet current and future customer demand, all at the lowest possible cost. Making a bad decision in any of these areas will make the company lose money. A few examples are given below:

- if a company purchases insufficient quantities of an item used in manufacturing (or the wrong item) it may be unable to meet contract obligations to supply products on time;
- if a company purchases excessive quantities of an item, money is wasted - the excess quantity ties up cash while it remains as stock and may never even be used at all;
- beginning production of an order at the wrong time can cause customer deadlines to be missed.

MRP is a tool to deal with these problems. It provides answers for several questions:

- *What* items are required?
- *How many* are required?
- *When* are they required?

MRP can be applied both to items that are purchased from outside suppliers and to sub-assemblies, produced internally, that are components of more complex items.

The data that must be considered include:

1. The *end item* (or items) being created. This is sometimes called Independent Demand, or Level «0» on BOM (Bill of materials).
2. How much is required at a time?
3. When the quantities are required to meet demand?
4. Shelf life of stored materials.
5. Inventory status records. Records of *net* materials *available* for use already in stock (on hand) and materials on order from suppliers.
6. Bills of materials. Details of the materials, components and sub-assemblies required to make each product.
7. Planning Data. This includes all the restraints and directions to produce the end items. This includes such items as: Routings, Labor and Machine Standards, Quality and Testing Standards, Pull/Work Cell and Push commands, Lot sizing techniques (i.e. Fixed Lot Size, Lot-For-Lot, Economic Order Quantity), Scrap Percentages, and other inputs.

Outputs

There are two outputs and a variety of messages/reports:

1. Output 1 is the «Recommended Production Schedule» which lays out a detailed schedule of the required minimum start and completion dates, with quantities, for each step of the Routing and Bill Of Material required to satisfy the demand from the Master Production Schedule (MPS).
2. Output 2 is the «Recommended Purchasing Schedule». This lays out both the dates that the purchased items should be received into the facility AND the dates that the Purchase orders, or Blanket Order Release should occur to match the production schedules.

Messages and Reports:

1. Purchase orders. An order to a supplier to provide materials.
2. Reschedule notices. These *recommend* cancelling, increasing, delaying or speeding up existing orders.

The structure of MRP system

MRP systems are based on planning of materials for the optimum organization of manufacture (MRP) both functionality under the description and planning of loading of capacities CRP (Capacity Resources Planning) and have the purpose creation of optimum conditions for realization of the production plan of output.

The main idea MRP system consists that any registration unit of materials or the accessories necessary for manufacture of a product, should be available in due time and in the necessary quantity.

In really MRP system is application software. The structure of the MRP system is showed on Figure 3.9.

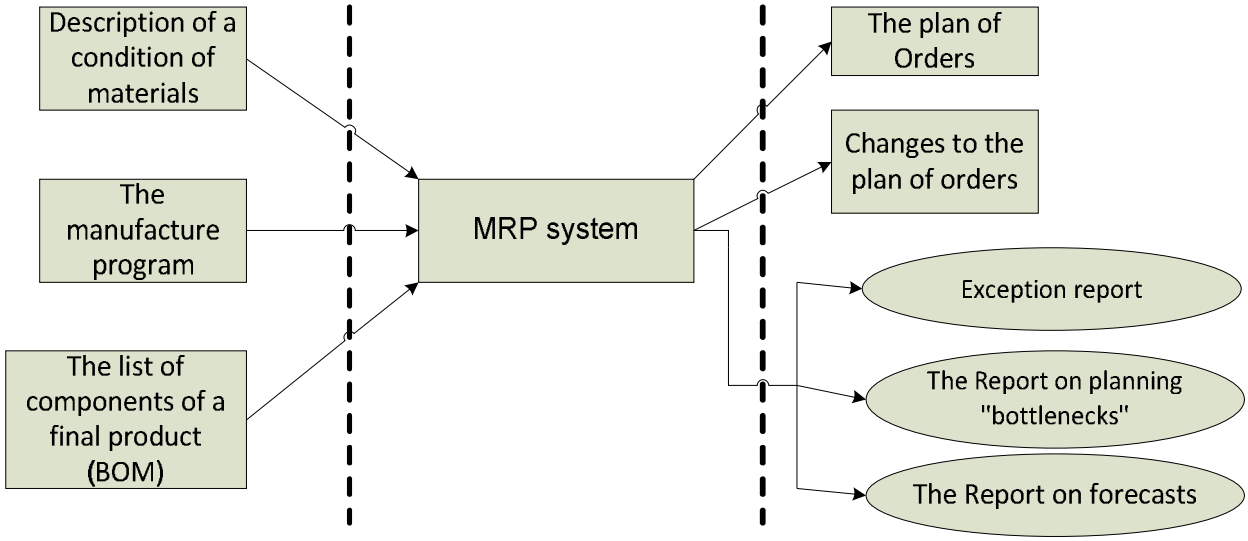

Figure 3.9 – The structure of the MRP system

1. The description of a condition of materials (Inventory Status File) – is the basic entrance element of MRP-system. In it as much as possible full information on all components necessary for manufacture of a final product should be reflected. In this element the status of each component defining should be specified, whether there is it in divisions, in a warehouse, in current orders or its order only is planned, and also descriptions, its stocks, an arrangement, the price, possible delays in delivery, requisites of suppliers. The information on all positions set forth above should be put separately on each component participating in production.

2. The manufacture program (Master Production Schedule) – represents the optimized schedule of distribution of time for manufacture of necessary party of finished goods for the planned period or a range of the periods. At first the trial program of manufacture subsequently tested for feasibility with the help CRP-

system (Capacity Requirements Planning) which defines is created, whether there are enough capacities for its realization. If the production program is recognized by feasible it is automatically formed in the basic. In case of inaccessibility of some components, or impossibility to pursue the scheme the orders, necessary for maintenance realized from the point of view of CPR the production program, the MRP-system in turn specifies about necessity to bring in it updatings.

3. The list of components of a final product (Bills of Material File) is a list of materials and their quantity demanded for manufacture an end-product. Thus, each end-product has the list of components. Besides, the description of structure of an end-product here contains, i.e. it comprises the full information on technology of its assemblage.

The turnaround of the MRP system consists following steps:

1. MRP-system, analyzing the accepted program of manufacture, defines the optimum schedule of manufacture for the planned period.
2. The materials which have been not included in the production program, but present at current orders, join in planning as separate point.
3. For each component is calculated the full requirement, according to the list of components of an end-product.
4. If the pure requirement for a material is more than zero the system automatically creates the order for a material.
5. All orders created before the current period of planning, are considered, and, in need of them changes are made to prevent premature deliveries and delays in delivery from suppliers.

The main results of MRP-system are:

1. The plan of Orders (Planned Order Schedule) - defines, what quantity of each material should be ordered during each considered period of time during planning term.
2. Changes to the plan of orders (Changes in planned orders) – are updatings to earlier planned orders. A number of orders can be cancelled, changed or detained, and also are transferred for other period.

There are having several secondary results:

1. The Report on planning «bottlenecks» – is intended beforehand to inform the user on time intervals during term of planning which demand special attention and in which there can be a necessity of external administrative

intervention. By typical examples of situations which can be – it is unforeseen the late orders for accessories, surpluses of accessories in warehouses, etc.

2. The Executive report – is the base indicator of correctness of work of MRP-system and has for an object to notify the user on the arisen critical situations in the course of planning, such as, for example, full expense insurance stocks on separate accessories, and also about all arising system errors in the course of MRP-program work.
3. The Report on forecasts – represents the information used for drawing up of forecasts about possible future change of volumes and characteristics of let out production, received as a result of the analysis of current production and reports on sales. Also the report on forecasts can be used for long-term planning of requirements for materials.

So, use of MRP-system for planning of industrial requirements allows optimizing time of receipt of each material, thereby considerably reducing warehouse costs and facilitating conducting the industrial account.

Problems of the MRP system

The major problem with MRP systems is the integrity of the data. If there are any errors in the inventory data, the bill of materials data, or the master production schedule, then the outputted data will also be incorrect. Data integrity is also effected by inaccurate cycle count adjustments, mistakes in receiving input and shipping output, scrap not reported, waste, damage, box count errors, supplier container count errors, production reporting errors, and system issues.

Another major problem with MRP systems is the requirement that the user specify how long it will take a factory to make a product from its component parts (assuming they are all available). Additionally, the system design also assumes that this «lead time» in manufacturing will be the same each time the item is made, without regard to quantity being made, or other items being made simultaneously in the factory.

Theme 3.6 The MRP II systems

Manufacturing resource planning (**MRP II**) is defined as a method for the effective planning of all resources of a manufacturing company. Ideally, it addresses operational planning in units and has a simulation capability to answer «what-if» questions and extension of closed-loop MRP.

MRP II is not a proprietary software system and can thus take many forms. It is almost impossible to visualize an MRP II system that does not use a computer, but an MRP II system can be based on either purchased–licensed or in-house software.

There are following basic modules in an MRP II system:

1. Master production schedule (MPS).
2. Item master data (technical data).
3. Bill of materials (BOM) (technical data).
4. Production resources data (manufacturing technical data).
5. Inventories and orders (inventory control).
6. Purchasing management.
7. Material requirements planning (MRP).
8. Shop floor control (SFC).
9. Capacity planning or capacity requirements planning (CRP).
10. Standard costing (cost control).
11. Cost reporting / management (cost control).

And there are following auxiliary modules in an MRP II system:

1. Business planning.
2. Lot traceability.
3. Contract management.
4. Tool management.
5. Engineering change control.
6. Configuration management.
7. Shop floor data collection.
8. Sales analysis and forecasting.
9. Finite capacity scheduling (FCS).

The MRP II system integrates these modules together so that they use common data and freely exchange information, in a model of how a manufacturing enterprise should and can operate.

MRP II (Manufacturing Resource Planning) is a methodology of planning of industrial resources which unlike MRP, allows to carry out planning not only in material resources, but also financial.

History

Material requirements planning (MRP) and manufacturing resource planning (MRPII) are predecessors of enterprise resource planning (ERP), a business information integration system. The development of these manufacturing

coordination and integration methods and tools made today's ERP systems possible.

The vision for MRP and MRPII was to centralize and integrate business information in a way that would facilitate decision making for production line managers and increase the efficiency of the production line overall. In the 1980s, manufacturers developed systems for calculating the resource requirements of a production run based on sales forecasts. In order to calculate the raw materials needed to produce products and to schedule the purchase of those materials along with the machine and labor time needed, production managers recognized that they would need to use computer and software technology to manage the information.

MRPII was concerned with the integration of all aspects of the manufacturing process, including materials, finance and human relations.

MRP II is a set of principles, models and procedures of management and the control, indicators of economic activities of the enterprise serving to increase. In basis MRP II system it is put two known principles – JiT (Just in time) and KanBan.

Just-in-time (JIT)

Just-in-time (**JIT**) is an inventory strategy that strives to improve a business's return on investment by reducing in-process inventory and associated carrying costs. Just In Time production method is also called the Toyota Production System. To meet JIT objectives, the process relies on signals or *Kanban* between different points in the process, which tell production when to make the next part. Kanban are usually 'tickets' but can be simple visual signals, such as the presence or absence of a part on a shelf. Implemented correctly, JIT focuses on continuous improvement and can improve a manufacturing organization's return on investment, quality, and efficiency. To achieve continuous improvement key areas of focus could be flow, employee involvement and quality.

Quick notice that stock depletion requires personnel to order new stock is critical to the inventory reduction at the center of JIT. This saves warehouse space and costs.

Kanban

Kanban also spelled *kamban* and literally meaning «signboard« or «billboard«, is a concept related to lean and just-in-time (JIT) production. Kanban is not an inventory control system. Rather, it is a scheduling system that tells you what to produce, when to produce it, and how much to produce.

The need to maintain a high rate of improvements led Toyota to devise the kanban system. Kanban became an effective tool to support the running of the production system as a whole. In addition, it proved to be an excellent way for promoting improvements because reducing the number of kanban in circulation highlighted problem areas.

Toyota's six rules Kanban

- do not send defective products to the subsequent process;
- the subsequent process comes to withdraw only what is needed;
- produce only the exact quantity withdrawn by the subsequent process;
- level the production;
- Kanban is a means to fine tuning;
- stabilize and rationalize the process.

MRP is concerned primarily with manufacturing materials while MRPII is concerned with the coordination of the entire manufacturing production, including materials, finance, and human relations. The goal of MRPII is to provide consistent data to all players in the manufacturing process as the product moves through the production line.

MRPII systems begin with MRP, material requirements planning. MRP allows for the input of sales forecasts from sales and marketing. These forecasts determine the raw materials demand. MRP and MRPII systems draw on a master production schedule, the breakdown of specific plans for each product on a line. While MRP allows for the coordination of raw materials purchasing, MRPII facilitates the development of a detailed production schedule that accounts for machine and labor capacity, scheduling the production runs according to the arrival of materials. An MRPII output is a final labor and machine schedule. Data about the cost of production, including machine time, labor time and materials used, as well as final production numbers, is provided from the MRPII system to accounting and finance.

MRP II systems can provide:

- better control of inventories;
- improved scheduling;
- productive relationships with suppliers.

For design / engineering:

- improved design control;
- better quality and quality control.

For financial and costing:

- reduced working capital for inventory;
- improved cash flow through quicker deliveries;
- accurate inventory records.

It you use MRP II you can have following results:

- reception of the operative information on current results of activity of the enterprise as a whole, and with full detailed elaboration under separate orders, kinds of resources, performance of plans;
- long-term, operative and detailed planning of activity of the enterprise with possibility of updating of the planned data on the basis of the operative information;
- the decision of problems of optimization of industrial and material flows;
- real reduction of material resources in warehouses;
- planning and control on all cycle of manufacture with possibility of influence on it, with a view of optimum efficiency achievement in use of the capacities, all kinds of resources and satisfactions of requirements of customers;
- financial reflection of activity of the enterprise as a whole;
- considerable reduction of non-productive expenses.

The hierarchy of plans is put in basis MRP II. Plans of the bottom levels depend on plans of higher levels, the highest level plan gives the entrance data, planned indicators and-or any restrictive frameworks for plans of the lowest level.

The hierarchy of plans of the MRP II system is showed on the Figure 3.10.

If results of the plan unreal this plan (or highest level plans) should be reconsidered. It is possible to spend coordination of supply and demand of resources at certain level of planning and resources at the planning highest levels

Strategic planning is a long-term planning. It is usually made for the term from one till five years. It is based on macroeconomic indicators, such as tendencies of development of economy, change of technologies and a market and competition condition.

The business plan is usually the plan for year. It could reconsider in a current of year. As a rule it grows out of meeting of administrative structure on which plans of sales, investments, development of the basic means and requirement of the capital. This information moves in money terms. The business plan defines

planned targets on sales volumes and manufactures, and also other plans of the lowest level.

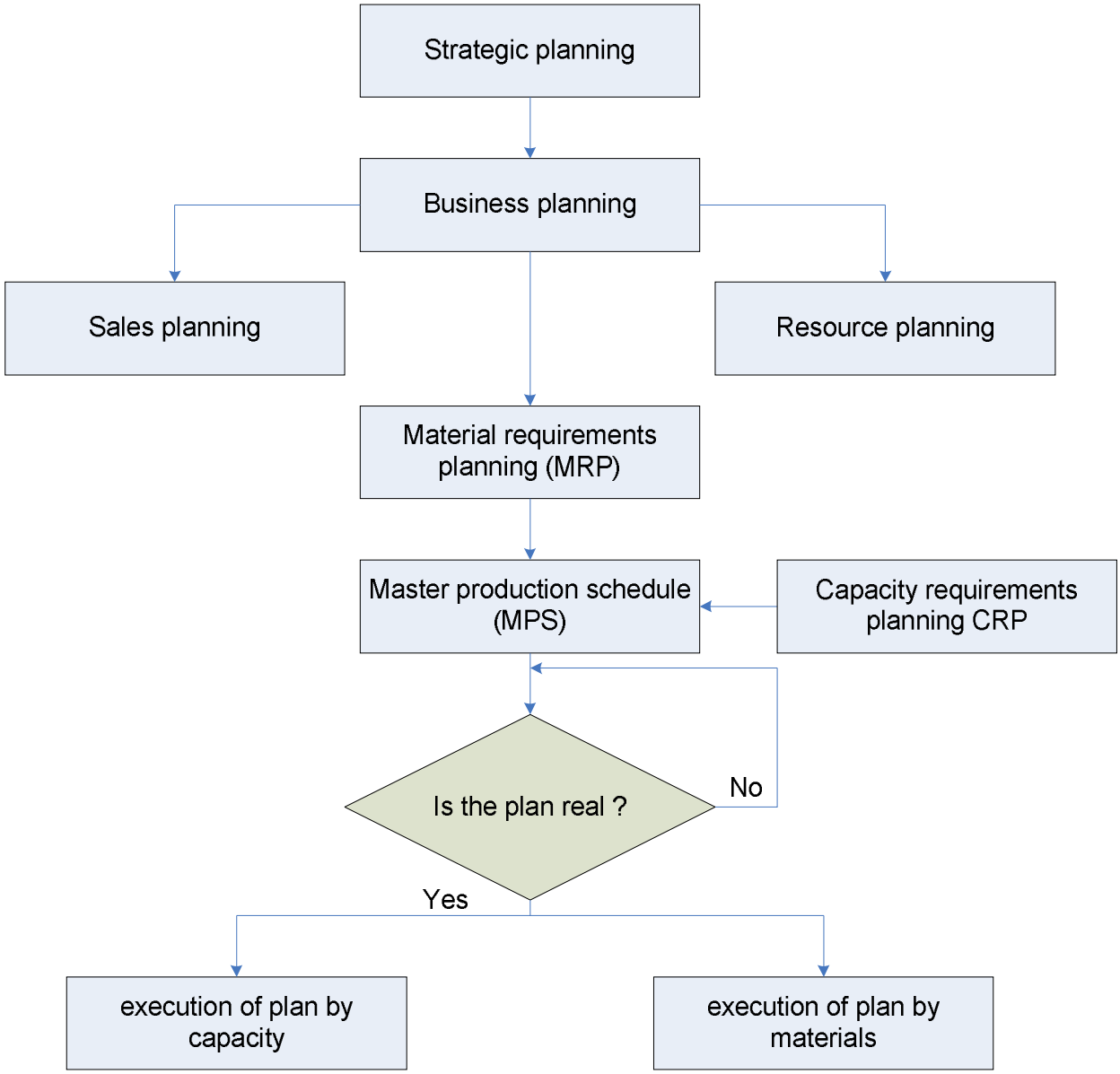

Figure 3.10 – The hierarchy of plans of the MRP II system

If the business plan gives a total on sales volumes by the month (in money terms) the *plan of sales volumes and manufacture* breaks this information on range of groups.

There are following elements into a plan of sales and manufacture:

- sales volume;
- manufacture;
- stocks;
- shipment.

The manufacture plan will be unreal, if it isn't provide presence of necessary volume of resources. *Planning of resources* is a long-term planning which allows estimating necessary (for performance of the plan of manufacture) and cash volume of key resources, such as people, the equipment, buildings and constructions. If there will be a requirement available necessary volume of additional resources, that, probably, it is required to reconsider the business plan.

Planning of resources mentions only key resources and is made on plan period of validity on manufacture (usually one year). The resource can be considered key if its cost is great enough or if term of its delivery it is great enough or if other resources depend on it. Resources can be both external (possibilities of suppliers), and internal (the equipment, the warehouse areas, money).

CRP (Capacity requirements planning) is a planning which uses the data of orders for manufacture for definition of necessary volume of working hours (both on manpower, and on technical resources). CRP defines loading of workplaces. Loading of workplaces pays off on the basis of a technological route of manufacturing of a product which defines which image makes the given kind of a product. The technological route is similar to the instruction to application – a set of steps (or technical operations) which are necessary for making for manufacturing something. Each technical operation is made on any workplace which can consist of one or several persons and-or the equipment.

Theme 3.7 The ERP system

In the customary terminology APICS (American Production and Inventory Control Society), the term «ERP-system» (Enterprise Resource Planning – enterprise Resource management) can be used in two values.

First, ERP is an information system for identification and planning of all resources of the enterprise which are necessary for realization of sales, manufacture, purchases and the account in the course of performing the client orders.

Secondly (in the more general context), ERP is a methodology of effective planning and management of all resources of the enterprise which are necessary for realization of sales, manufacture, purchases and the account at execution of clients' orders in the spheres of manufacture and service rendering.

The **enterprise resource planning** (**ERP**) system is an integrated computer-based application used to manage internal and external resources, including tangible assets, financial resources, materials, and human resources. Its purpose is

to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders. Built on a centralized database and normally utilizing a common computing platform, ERP systems consolidate all business operations into a uniform and enterprise-wide system environment.

In 1990 Gartner Group first employed the term ERP. The term «enterprise resource planning» originally derived from manufacturing resource planning (MRP II), which followed material requirements planning (MRP). MRP evolved into ERP when «routings» became a major part of the software architecture and a company's capacity planning activity also became a part of the standard software activity. ERP systems typically handle the manufacturing, logistics, distribution, inventory, shipping, invoicing, and accounting for a company. ERP software can aid in the control of many business activities, including sales, marketing, delivery, billing, production, inventory management, quality management, and human resource management.

The main advantages of the ERP

Today there are the five main advantages of the ERP:

1. If you want integrate all financial information of the enterprise it is necessary to use ERP.
2. If you want integrate all information about sales it is necessary to use ERP.
3. If you want to standardize and speed up the production process it is necessary to use ERP.
4. If you want to cut down the storage size it is necessary to use ERP.
5. If you want to standardize the human resources it is necessary to use ERP.

The main function of the ERP

Enterprise resource planning systems or ERP systems integrate all departments and functions across a company onto a single computer system that can serve all departments' particular needs. ERP ensures seamless integration of all the information flowing through the company – financial, accounting, human resources, sales, manufacturing, distribution, project and inventory management, planning and maintenance, customer information and e-business. In addition business specific optimization modules can be integrated, analyzing the

information flow as a whole and proposing effective optimization steps, leading to more efficient business and manufacturing process.

The most part of modern ERP-systems are constructed by a modular principle that gives the chance of choice to the customer and gives the opportunity of introducing only those modules which are really necessary for him. Modules of different ERP-systems can differ both in their names, and in the maintenance. Nevertheless, there is some set of functions which can be considered typical for software products of the ERP class (see Figure 3.11).

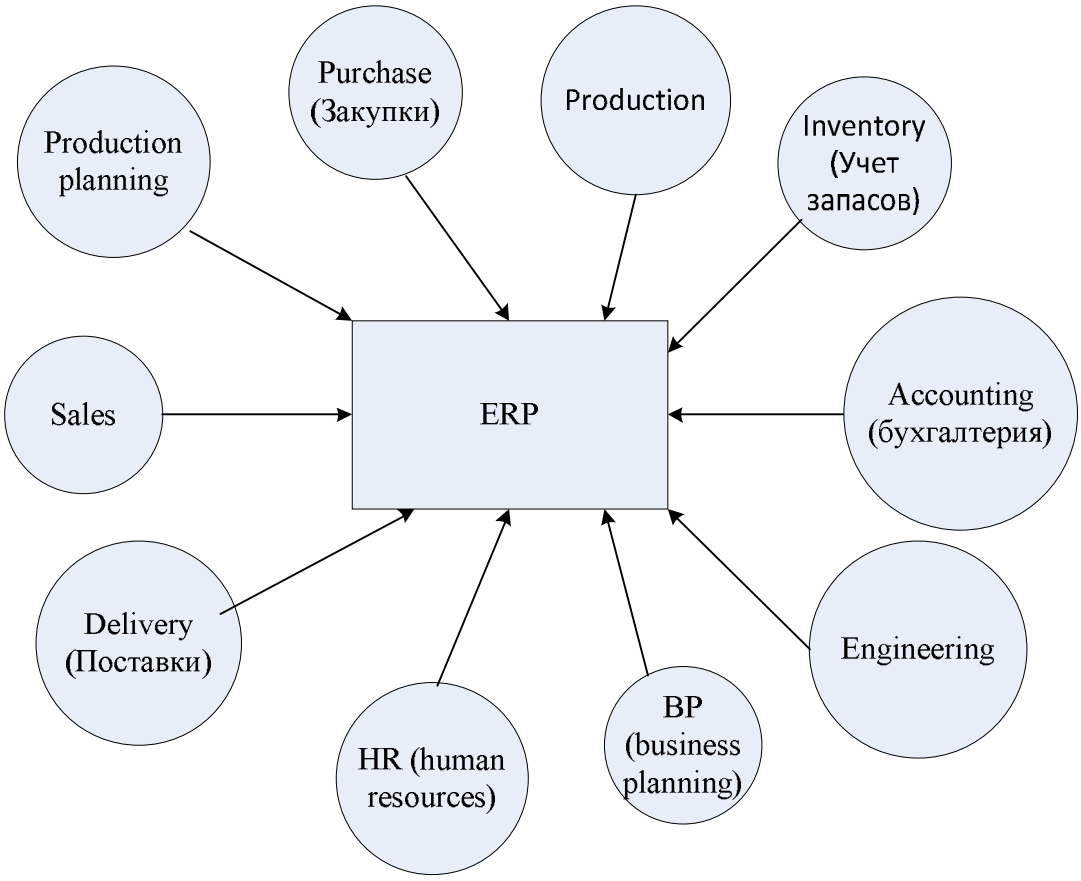

Figure 3.11 – The modules of the ERP

Such typical functions are:

1. Conducting design and technological specifications (engineering) – such specifications define structure of a final product, and also material resources and the operations which is necessary for its manufacturing (including routing).

2. Demand management and formation of plans of sales and manufacture (Sales and BP) – these functions are intended for the forecast of demand and output planning.
3. Materials requirement planning (Production) – allow to define volumes of various kinds of material resources (raw materials, the materials completing), necessary for production plan performance, and also terms of deliveries, the sizes of parties etc.
4. Inventory management and purchasing activity (Inventory and Purchase) – allow to organize conducting contracts, to realize the scheme of the centralized purchases, to provide the account and optimization of warehouse stocks etc.
5. Planning of capacities (Production) – this function allows to supervise presence of accessible capacities and to plan their loading. Includes the integrated planning of capacities (for an estimation of realness of production plans) and more detailed planning, up to the separate working centers.
6. Financial functions (Accounting) – are included into this group of function of the financial account, the administrative account, and also an operational administration the finance.
7. Functions of management by projects – provide planning of problems of the project and the resources necessary for their realization.

The ERP system the same as the MRP II system, but the ERP has more functions. The main differences between the ERP and MRP II are:

1. The ERP system can manage more types of enterprises than the MRP II.
2. There are more financial functions.
3. There are possibilities to integrate into other systems.
4. There is more attention to the information infrastructure of the enterprise.
5. There exist more efficient tools of setup and configuration system.

The ERP system gives the following advantages for your business:

1. Full integration of all corporative information.
2. The cut down of capital production cost.
3. There is a chance to take an investment for the development of your enterprise.

Theme 3.8 The structure of ERP systems. Classification ERP

The **enterprise resource planning** (**ERP**) system is an integrated computer-based application used to manage internal and external resources, including tangible assets, financial resources, materials, and human resources. Its purpose is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders. Built on a centralized database and normally utilizing a common computing platform, ERP systems consolidate all business operations into a uniform and enterprise-wide system environment.

Enterprise resource planning systems or ERP systems integrate all departments and functions across a company onto a single computer system that can serve all departments' particular needs. ERP ensures seamless integration of all the information flowing through the company – financial, accounting, human resources, sales, manufacturing, distribution, project and inventory management, planning and maintenance, customer information and e-business. In addition business specific optimization modules can be integrated, analyzing the information flow as a whole and proposing effective optimization steps, leading to more efficient business and manufacturing process.

On the Figure 3.12 you can see the base concept of the ERP system.

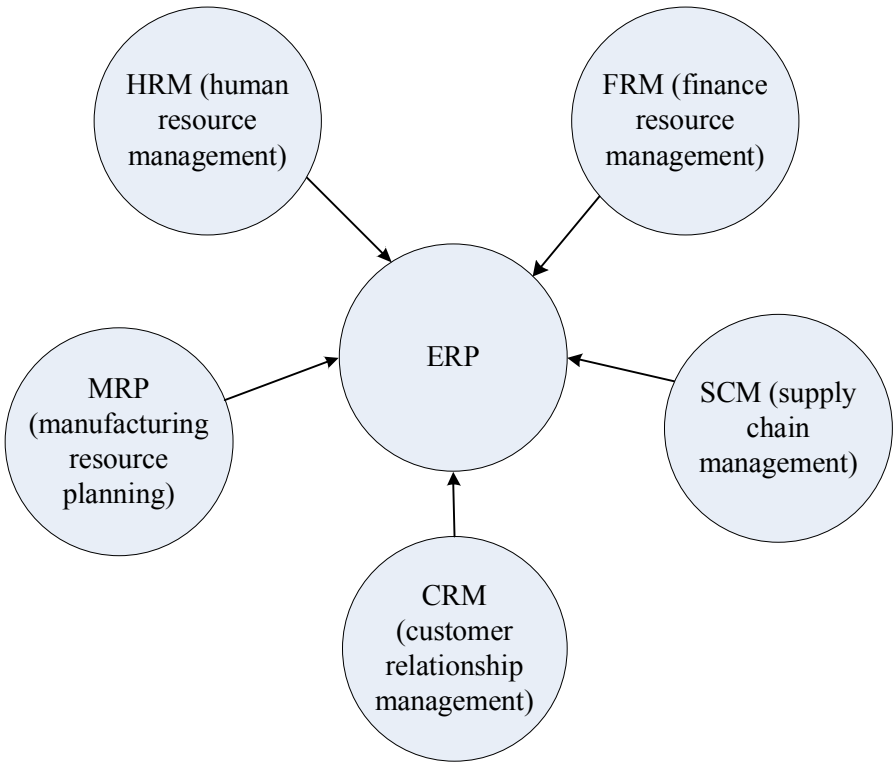

Figure 3.12 – The base concept of the ERP system

On the Figure 3.13 you can see the work diagram of the ERP system.

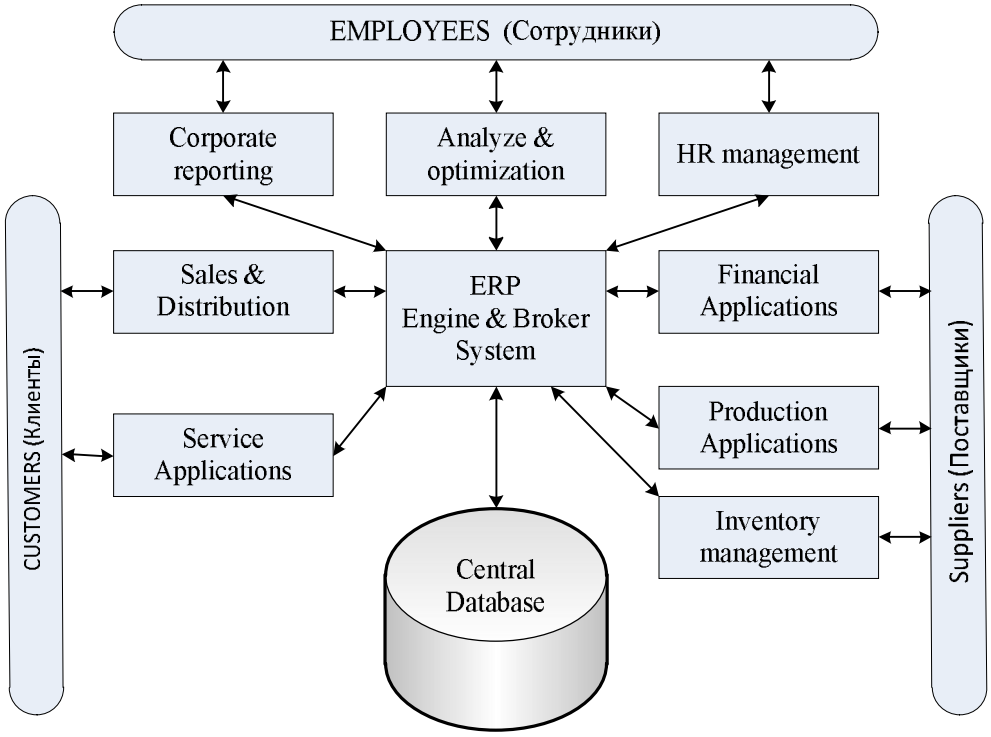

Figure 3.13 – The work diagram of the ERP system

The adoption of e-commerce and e-business solutions (especially business-to-business (B2B) solutions) within a traditional ERP system enables effectively reaching global customers and remote process control. The Web-based Internet accessible user interface is integrated with the back-office ERP application. The concept of the Internet-enabled extended ERP system is shown in the Figure 3.14.

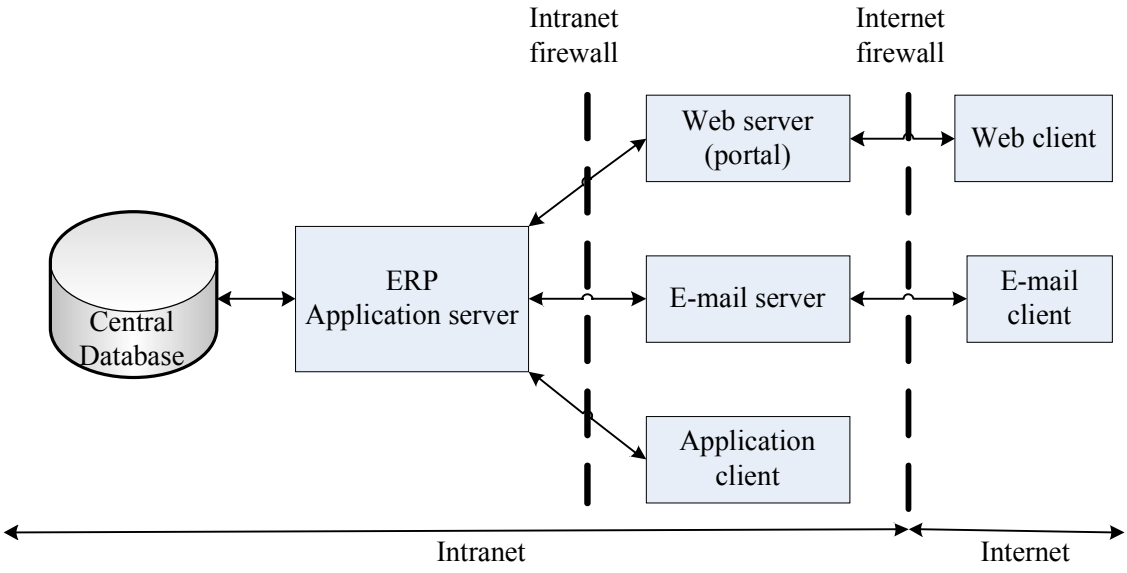

Figure 3.14 – The concept of the Internet-enabled extended ERP system

Classification of the ERP systems

Today there is used the following classification for ERP systems. The ERP systems have the type of classification like the one for the enterprises.

All enterprises can be divided conditionally into the following basic categories (according to the number of employees):

- big corporations (more than 10 thousand employees);
- averages corporations – from 1000 to 10 thousand persons;
- averages enterprises (from 100 to 1000)
- small enterprises (to 100 employees).

So the ERP systems can be classified into the following classes:

- Light ERP systems.
- Average ERP systems.
- Heavy ERP systems.

Class definition of an ERP-system is based on the system's following aspects: *functionality* and *scalability of a technological platform*.

Functionality

One of the conventional approaches to comparison of ERP-systems based on functionality has been developed by the analytical company Arlington Software Corporation within the limits of the project ERP Evaluation Center. According to this approach for the system functionality estimation the tree of criteria containing more of 3600 private criteria is used. Criteria of the bottom level are included into criteria of higher level with the weighty factors.

Estimation of system functionality of different classes is received by means of these means settled down in different intervals and these parameters don't coincide. So, functionality estimations of heavy systems lie above the mark of 0,9, for average systems they settle down in the range of 0,6-0,7, and estimations of easy systems are below the point of 0,5. It is natural, as big corporations have been paying for the development of heavy ERP-systems for a long time. Besides, their business processes, as a rule, are much more complicated, and consequently, the functionality of heavy systems is more refined and considers a bigger number of nuances.

Scalability of a technological platform

Modern ERP-systems have two and three-level architecture (see Figure 3.16) or a multilevel architecture.

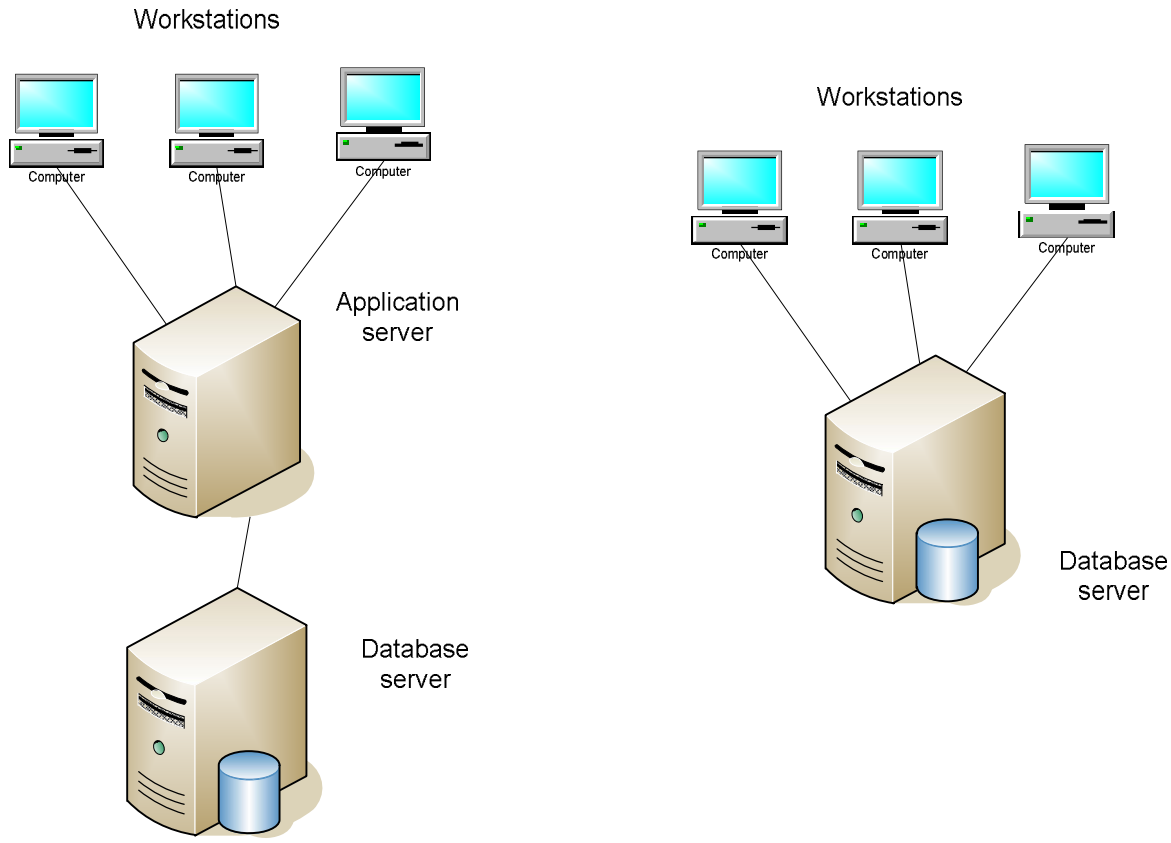

Figure 3.16 – Two and three-level architecture f the ERP

Systems which have two-level architecture have been named the ERP systems of the first generation. Such systems gradually give way to the systems of the second generation which have three-level architecture. It was caused by the fact that the scalability of the systems of the previous generation which have a two-level architecture, is limited by throughput of the local networks which do not provide simultaneous work with databases of a great number of users. And finally, the ERP-systems of the next generation, having service-focused architecture (SOA) and at the expense of it allowing distributing on the network of the data and appendices haven't been presented in the market yet.

The number of users which can work simultaneously in an ERP-system depends on the hardware-software platform: configurations of servers, the general configuration of the network, the used OS, MDBS, etc. All these external factors

which lie out of an ERP-system and can change during its installation and work. The sizes of the database and the feature of business processes of the enterprise will be internal factors defining the maximum number of simultaneously working users. But the basic characteristic of ERP-system defining the maximum number of simultaneously working users, is its technological architecture.

It is possible to consider the maximum number of simultaneously working users as the most rigid restriction of applicability of this or that system at the concrete enterprise. Missing functionality can be added, it is possible to apply a specialized branch decision and if it isn't present, it can be developed; but if the system supports work of not more than of a hundred of users, and it is necessary, that one thousand of users worked simultaneously, no increase in capacity of servers will help. It is necessary to refuse this system.

Characteristics of technological architecture are measurable and stable (in the concrete version the technological architecture is fixed and doesn't change). Therefore we will consider the definition of classes of ERP-systems through the properties of technological architecture.

Theme 3.9 The CRM systems

Nowadays within the limits of business operation it is possible to rely on four concepts of orientation of the enterprise in the market. The first two concepts are industrial-focused and product-focused. These concepts assume that the enterprise will be a success in the market if its goods (service) possess the highest quality and the least price. That is these concepts are focused on production improvement. To realize the principles and methods of these concepts there are applied ERP systems.

Other two concepts are oriented on sales and the marketing concept. They assert that the enterprise should conduct an aggressive policy of sales, it should be in constant study the requirements of the target markets and satisfy them at a higher level, than its competitors.

In connection with these two concepts there appeared such concept as customization.

Customization consists in the definition of needs of each client separately and the offer to him of a unique product.

As the client is considered as «an external world element» that means that his factor is not considered in ERP systems. To make it possible to consider the defining influence of clients there have been developed CRM systems.

CRM-system (Customer Relationship Management System,) is a control system of interaction with clients. It's a corporate information system intended for the improvement of servicing by preservation of the information on clients, stories of mutual relations with clients, establishments and improvements of business procedures on the basis of the kept information and the subsequent estimation of their efficiency.

CRM-system appointment

The CRM-system is a software which is intended for gathering, storage and processing of the information on clients of the enterprise and allowing to make certain conclusions on the basis of available information. It also allows to export the information to other systems or to present it in a convenient form.

Collection of information.

The system gives the employees of the company a convenient way to enter the information into the database. All information which is entered into the system is accessible to the client. But first of all it's the information on interaction between the client and the company (goods type bought by the client, the way of reception of the information about the company, the purchase purpose, the form of payment) as the personal information on the client is brought into the system (age, marital status, income, contacts and etc.).

Storage and information processing.

It's a possibility to keep the received information and to range it according to the set criteria and to analyze the received information for the purpose of its further use.

Export of information.

The information in the system is used by various departments of the company which can request it from the system in different kinds of display.

CRM systems use the following principles in its work:

1. There is only one storage of information, all data on all cases of interaction with clients whence are at any moment accessible.
2. Management synchronization using plural channels of interaction (that is there are organizational procedures which regulate the use of this system and the information on each department of the company).

3. Constant analysis of collected information on clients and acceptance of corresponding organizational decisions – for example, segmentation of clients on the basis of their importance for the company.

The three phases in which CRM support the relationship between a business and its customers are to:

- acquire: CRM can help a business acquire new customers through contact management, selling, and fulfillment;
- enhance: web-enabled CRM combined with customer service tools offers customers service from a team of sales and service specialists, which offers customers the convenience of one-stop shopping;
- retain: CRM software and databases enable a business to identify and reward its loyal customers and further develop its targeted marketing and relationship marketing initiatives.

The use of a CRM system will confer several advantages to a company:

- quality and efficiency;
- decreased costs;
- decision support;
- enterprise agility.

CRM-systems allow to raise efficiency or to organize:

- functionality of sales – at the expense of management of contacts (contact management) – all kinds of contacts and history of contacts and automation of work with clients – input of orders from clients, creation of offers;
- functionality of management of sales – the analysis of «a pipe of sales» (pipeline analysis) – forecasting and the analysis of a cycle of sales, the regional analysis, planned and any reporting;
- functionality for sales by phone (telemarketing/telesales) – creation and distribution of the list of potential clients, an automatic set of number, registration of calls, booking;
- management of time – a calendar/planning as individual, and for group, e-mail;
- functionality of support and servicing – registration of references, readdressing of references, movement of demands from the client in the

company, the reporting, management of the decision of problems, the information under orders, management of warranty service / contract;

- functionality of marketing – management of marketing campaigns, management of potential transactions (opportunity management), the marketing encyclopedia (the full information on products and company services) integrated about the Internet, production configurator, segmentation of client base, creation and management of the list of potential clients;
- functionality of integration with ERP;
- functionality of electronic commerce.

Classification of the CRM systems

Nowadays CRM systems are classified according to functional capabilities and types of information processing.

CRM is divided into the following classes by types of the information processing:

Sales force automation – Sales force automation (SFA) involves using software to streamline all phases of the sales process, minimizing the time that sales representatives need to spend on each phase. This allows sales representatives to pursue more clients in a shorter amount of time than would otherwise be possible. At the heart of SFA is a contact management system for tracking and recording every stage in the sales process for each prospective client, from initial contact to final disposition. Many SFA applications also include insights into opportunities, territories, sales forecasts and workflow automation, quote generation, and product knowledge. Modules for Web 2.0 e-commerce and pricing are new, emerging interests in SFA.

Marketing – CRM systems for marketing help the enterprise identify and target potential clients and generate leads for the sales team. A key marketing capability is tracking and measuring multichannel campaigns, including email, search, social media, telephone and direct mail. Metrics monitored include clicks, responses, leads, deals, and revenue. This has been superseded by marketing automation and Prospect Relationship Management (PRM) solutions which track customer behaviour and nurture them from first contact to sale, often cutting out the active sales process altogether.

Customer service and support (Call centers) – Recognizing that service is an important factor in attracting and retaining customers, organizations are increasingly turning to technology to help them improve their clients' experience

while aiming to increase efficiency and minimize costs. Even so, a 2009 study revealed that only 39% of corporate executives believe their employees have the right tools and authority to solve client problems.“

eCRM-systems – eCRM-systems – CRM-systems for use only in electronic commerce, feature of such systems is that they are integrated with a company site. All information which gets on a company site automatically is brought in eCRM-system.

CRM is divided into the following classes by functional capabilities:

Analytics – Relevant analytics capabilities are often interwoven into applications for sales, marketing, and service. These features can be complemented and augmented with links to separate, purpose-built applications for analytics and business intelligence. Sales analytics let companies monitor and understand client actions and preferences, through sales forecasting and data quality. Marketing applications generally come with predictive analytics to improve segmentation and targeting, and features for measuring the effectiveness of online, offline, and search marketing campaign. Web analytics have evolved significantly from their starting point of merely tracking mouse clicks on Web sites. By evaluating “buy signals,” marketers can see which prospects are most likely to transact and also identify those who are bogged down in a sales process and need assistance. Marketing and finance personnel also use analytics to assess the value of multi-faceted programs as a whole. These types of analytics are increasing in popularity as companies demand greater visibility into the performance of call centers and other service and support channels, in order to correct problems before they affect satisfaction levels. Support-focused applications typically include dashboards similar to those for sales, plus capabilities to measure and analyze response times, service quality, agent performance, and the frequency of various issues.

Integrated/Collaborative – Departments within enterprises – especially large enterprises – tend to function with little collaboration. More recently, the development and adoption of these tools and services have fostered greater fluidity and cooperation among sales, service, and marketing. This finds expression in the concept of collaborative systems which uses technology to build bridges between departments. For example, feedback from a technical support center can enlighten marketers about specific services and product features clients are asking for. Reps, in their turn, want to be able to pursue these opportunities without the burden of re-entering records and contact data into a separate SFA system.

Operative CRM-systems – the system is intended for use by employees of the company for reception of operative access to the information on the concrete client during direct mutual relation with the client – sale and service processes. The basic component of such system is the program module giving to the employee the saved up information on the client. The given type of CRM-systems is characteristic for traditional business.

Non-profit and membership-based – Systems for non-profit and membership-based organizations help track constituents and their involvement in the organization. Capabilities typically include tracking the following: fund-raising, demographics, membership levels, membership directories, volunteering and communications with individuals. Many include tools for identifying potential donors based on previous donations and participation. In light of the growth of social networking tools, there may be some overlap between social/community driven tools and non-profit/membership tools.

Theme 3.10 The CRM systems like as Call center (Contac-center)

One of the types of the CRM system is the center of call service or as it also named Call-center. Such systems as Call-centers have passed some stages in their development. The creation of Call-centers which provided service of clients' calls which arrived only by channels of the general telephone system became the first stage of development of service call centers. The following stage of development is the creation of contact-centers which allow serving references of clients not only through the telephone system, but also the references arriving through the Internet network.

The main difference between a Call-center and a Contact-center is multimedia. The Contact-center can service requests from different telecommunication networks:

- telephone network;
- voice over IP network;
- e-mail;
- fax;
- text chat;
- video calls.

While creating a Call-center or a contact-center it is necessary to define the problems which it should solve. In its turn that will define what configuration of

the equipment is required. Generally a Call-center or a contact-center should provide:

1. A single contact point for the clients – it will allow to achieve accurate performance of general rules of work with references of clients through all channels of interaction.
2. An intellectual routing interaction with clients – this provides time management and distribution of interactions with clients, based on routing rules.
3. Constant control over current indicators of work – the Corresponding software should give possibility to trace current condition of operators and turns for which they bear responsibility to heads of departments.
4. Formation of the reporting for the analysis of work of the center. There are intellectual tools of formation of the reporting focused on estimation of business indicators of work, a contact-center should provide carrying out of the all-round analysis of the information.
5. A single history of contacts to the client – there should be provided preservation of the information on all contacts to the client for all history of interaction with it irrespective of the fact through what channels these contacts were carried out.
6. The user's interface for the operator.
7. The user's interface for the client.
8. Security transactions.

The architecture of a Contact-center

The base architecture of the Contact-center is showed in the Figure 3.17.

The contact-center has to have the following types of communications with the client:

1. Web communications (Web Collaboration).
2. Voice communications (VoIP).
3. E-mail communications.
4. Chat communications.
5. Phone and IVR communications.
6. Fax communications.
7. Mobile communications.

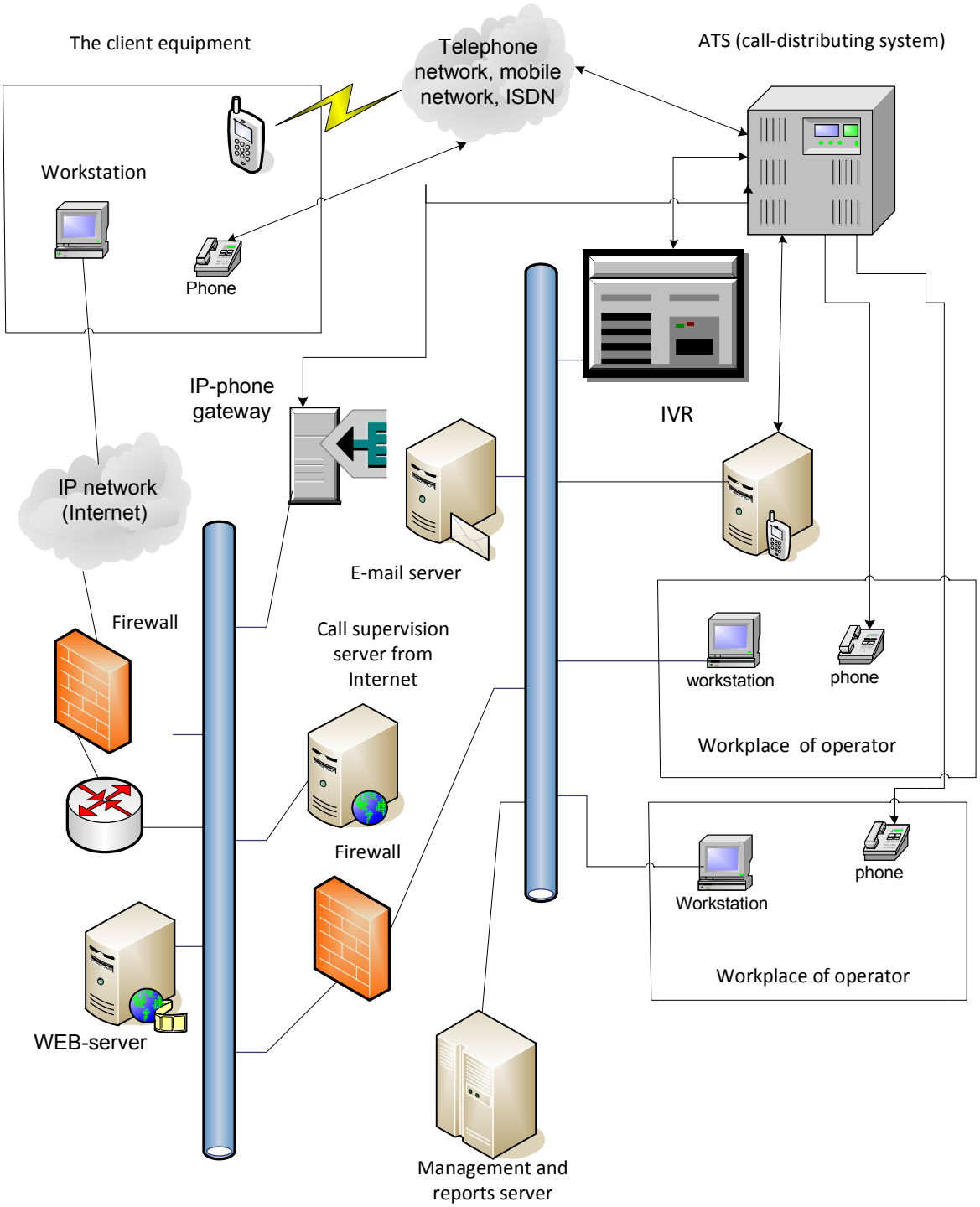

Figure 3.17 – The architecture of the Contact-center

There are the following contact-center elements:

IP-phone gateway which provides interaction between a network with packet switching (IP) and a telephone network with channel switching.

Application server – provides the realization of logic services. It contains *Interactive Voice Response* and call distribution.

Server IVR functions is connected to the organization of computer dialogue with the subscriber which has addressed to the contact-center. It also is transfer to the subscriber of speech helps-invitations, and reception from the subscriber of additional information in the mode of a multifrequent set of Figures, and transfer to the subscriber of automatic mode of help and service information.

Call distribution server is the main element of a Contact-center. It dynamically interacts with databases in the service process of calls, it provides support of system queuing and functions of routing the calls arriving into the contact-center.

Databases save all the information about system configuration. It also saves user data, reports, etc.

The management server provides functions of configuration and system diagnostics, control of condition interfaces and voice channels, collected operative and statistical information on the work of the system and about the call service, and also generation of reports and archiving.

The workplaces of operators are to have special software.

The ways of organization of a Call-center or a Contact-center

Today there are two ways of organization of a Contact-center - to create the company's own contact-center or using the outsourcing.

Outsourcing is the organization of a Call-center or a contact-center by means of a third-party company.

The choice of this or that variant is in many aspects caused by problems which the company faces. If the call-center is needed for carrying out of a single action (for example an advertising campaign or a marketing research) it makes sense to use outsourcing services. For long-term use the organization of own call-center is more expedient.

Both variants have advantages and disadvantages. Using third-party operators the company also transfers its own competence center on interaction with the clients, and this knowledge ceases to collect outside the company itself. On the other hand, the quality of management in its own call-center reaches the level, corresponding to the same outsourcing service, only after a long enough period of operation.

The company's call-center should be created when it is a part of the basic profile of the organization or is necessary for performance of its key functions. Creation of the inside call-center becomes inevitable if the organization needs specially trained personnel or highly protection of its information (banks; security, defence and law enforcement agencies, etc.).

For advertising campaigns, services of virtual office or service of the «general» information it is more effective and more favorable to use outsourcing. Outsourcing can help coping with additional services, regional divisions or

processing of «superfluous» references at peak loadings. There is also a mixed variant – insourcing when the inside call-center copes and the use of an external, profile company when necessary.

The basic criterion in this case is the quantity of client references in the company. The threshold size is 2,5 thousand references a day. If the quantity of calls exceeds this size, it makes sense for the company management to reflect on creation of its own intracorporate call-center. At a smaller quantity of references it is cheaper to use outsourcing companies.

Key questions

3.1 What is a document?
3.2 Describe the Life cycle of a document.
3.3 What is the EDMS?
3.4 Name the main standards of the EDMS.
3.5 Describe the logical components and process of the EDMS.
3.6 Describe the structure of EDMS.
3.7 What is the routing of documents?
3.8 Describe the classification of the EDMS.
3.9 What is the system of reference data?
3.10 Describe the structure of the reference data system
3.11 What is the point of view?
3.12 Name the basic points of view.
3.13 What is the MPS?
3.14 What is the Safety stock and SIC?
3.15 What is the BOM?
3.16 What is the MRP standard?
3.17 Describe the structure of MRP system
3.18 What is the MRP II system?
3.19 What is the JIT strategy?
3.20 What is the KanBan?
3.21 What is the ERP?
3.22 Describe the structure of the ERP system.
3.23 Describe classification of the ERP system.
3.24 What is the CRM system?
3.25 Describe the structure of the CRM system.
3.26 Describe classification of the CRM system
3.27 Describe the call-center.
3.28 Name the main functions of the call-center.

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Educational publication

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INFORMATION SYSTEMS IN ECONOMIC AND BUSINESS

Teaching Aid
for training bachelors and masters
in of Telecommunications

Editor – Кодрул Л. А.
Computer make-up – Корнейчук Е. С.

Сдано в набор 27.06.2012 Подписано к печати 10.07.2012
Формат 60/88/16 Зак. № 4911
Тираж 100 экз. Объем: 7,0 п.л.
Отпечатано на издательском оборудовании фирмы RISO
в типографии редакционно-издательского центра ОНАС им. А.С. Попова
ОНАС, 2012