MINISTRY OF EDUCATION AND SCIENCE
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Fundamentals of information systems

Textbook

TO THE EXPERTS' ATTENTION

Dear expert,

This textbook has been written in English and issued as a textbook in higher educational institutions. We offer for examination the text of the book. We kindly ask you not to mind figures', tables' and formulas' quality. They are not 100% ready yet. They will be processed by Adobe Illustrator and put in the book in due course of time. We are planning to complete this work before you end examining texts.

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Information systems are an integral part of all business activities and careers. This book is designed to introduce students to contemporary information systems and demonstrate how these systems are used throughout global organizations. The focus of this course will be on the key components of information systems - people, software, hardware, data, and communication technologies, and how these components can be integrated and managed to create competitive advantage. Through the knowledge of how IS provides a competitive advantage students will gain an understanding of how information is used in organizations and how IT enables improvement in quality, speed, and agility. This course also provides an introduction to systems and development concepts, technology acquisition, and various types of application software that have become prevalent or are emerging in modern organizations and society.

The content of the textbook meets the international standard for the specialty IS 2010 developed by ACM and AIS.

CONTENT

Abbreviation

ACS - Automated Commercial System
ATM - Automated Teller Machine
BI - Business Intelligence
CIO - Chief Information Officer
CRM - Customer Relationship Management
DBMS - Database Management Systems
DSS - Decision Support System
EDI - Electronic Data Interchange
ERP - Enterprise Resource Planning
ESS - Executive Support System
EUD - End-User Development
GIS - Geographic Information System
HR - Human Resource
HTML - HyperText Markup Language
IBM - *International Business Machines*
IOS - IPhone Operating System
IP - Internet Protocol
IS - Information System
IT - Information Technology
ITIL - Information Technology Infrastructure Library
KPI - Key Performance Indicator
MIS - Management Information Systems
MRP II - Manufacturing Resource Planning II
OLAP - On-Line Analytical Processing
OLTP – On-Line Transaction Processing
PC - Personal Computers
PDS - Proactive Decision Support
PHP - Hypertext Preprocessor
RAM - Random Access Memory
SAP - Systems, Applications, and Products in Data Processing
SAS - Statistical Analysis System
SCM - Supply Chain Management
SOLAP - Spatial On-Line Analytical Processing
UML - Unified Modeling Language

Introduction

The concept of information systems throughout its existence, has undergone significant changes. Modern information system - a set of information technology to support the life cycle of information, and include three main components of the process: data processing, management, information management and knowledge management. Execution of functions of the information system is impossible without knowledge of it focused on information technology. Information technology – it is a process of working with information, consisting of clearly regulated rules of operations. The main purpose of information technology – the production of the required information to the user.

Modern information systems solve the following basic tasks:

1. Implementation of search, processing and storing information, which is stored for long periods of time, is of great value. Information systems are designed for faster and more reliable process information, so that people do not spend time to avoid random errors inherent in man, to save costs, to make people's lives more comfortable.

2. Data storage of different structures. There developed an information system that works with a single uniform data file. The reasonable requirements of the information system are to allow it to develop. There may be new functions for the implementation of which requires additional data to the new structure. At the same time, all previously stored information should remain intact. The development of such systems to identify individual components in them, which is a kind of database management system.

3. Analysis and forecasting of information flows of various kinds and types of moving in society. We study flows minimize them, standardization and tools for efficient processing on computers, as well as features of the flow of information flowing through various communication channels.

4. Investigation of the presentation and storage of information, creation of special languages for formal description of information of different nature, the development of special methods of compression and encoding information, annotating voluminous documents and abstracting them. Within this framework, develop work on the creation of a large volume of data banks that store information from various fields of knowledge in a form accessible to computers.

5. The construction procedures and technical means for their implementation, with which you can automate the process of extracting information from documents that are not designed for computers, and focused on the perception of the person.

6. Creation of information retrieval systems that can accept requests for information storage, formulated in natural language, as well as special query language for this type of systems.

7. Create storage area networks, processing and transmission of information, which include information databases, terminals, processing centers and communication facilities.

Specific tasks to be addressed by the information system, independent of the application of the area for which the system is designed. Applications of information systems are diverse.

The reasons why Information Technology and Information Systems are crucial to modern organizations is improve production and manufacturing processes. The strength of an information system lies in the ability to apply the knowledge of information systems and technology together to help organizations compete more successfully in the marketplace or to streamline current operations.

The textbook discusses the basic components of information systems - people, software, hardware, data and how these components can be integrated, databases, which are at the heart of modern commercial application development and communication technologies that create competitive advantage. The textbook disclosed other topics such as globalization, valuing information systems and information visualization. All businesses use telecommunications and the internet as a matter of course these days that has become the norm and a must for business operations and so in textbook also discusses overview of business telecommunications and networks, electronic commerce and intranets, extranets and electronic collaboration. Information and data storage are crucial to any business operation and so the textbook discusses business intelligence and also application systems such as information systems for business operations, management information and decision support systems and intelligent systems. The textbook discusses the questions development and acquisition of information systems and their security. Also, enterprise-wide information systems such as enterprise resource planning, supply chain management and customer relationship management. An information system is a powerful tool, which are used in organizational goals, support sustainable development and therefore crime, identity theft, employee surveillance, privacy, compliance, social networking, and the ethics of information technology corporations is important. So the textbook include next issues surrounding security and control issues in information systems and ethical and societal challenges of information technology.

Thus this textbook provides an overview of information systems, technical and organizational foundations of information systems, building information systems, managing information system resources and their use in business and other organizations. This textbook is designed for students majoring in "Industrial Information Systems". Also it is relevant not only for Information Systems majors, but to students from such areas group of fields of study, such as management, business, and social science. This textbook can equip students to function more effectively as an employee, manager, or decision maker in business today. Through the knowledge of how information systems provide a competitive advantage students will gain an understanding of how information is used in organizations and how information technology enables improvement in quality, speed, and agility. Students can see, how information systems can increase profits and reduce costs as they review the latest on e-commerce and enterprise systems, artificial intelligence, virtual reality, and social media.

Chapter 1. Characteristics of the Digital World

The modern period of development of society characterized by the process of informatization.

Informatization of society - it is a global process, a feature of which is that the dominant activity in the sphere of social production is the collection, storage, creation, processing, storage, transmission and use of information, carried out by means of a microprocessor and computer technology, as well as on the basis of means of information exchange.

Informatization of the society provides:

- active use of the ever-expanding intellectual potential of society, concentrated in printed fund, and scientific, industrial and other activities of its members;
- integration of information systems in research and production activities, initiating the development of all spheres of production, the intellectualization of work;
- a high level of information services, the availability of any member of the society to the sources of reliable information, the visualization of the information, the materiality of the data used.

The use of open information systems designed to use the entire array of information available at the moment is a society in a particular field it allows to improve the mechanisms of public control device, promotes the humanization and democratization of the society, increases the welfare of its members. The processes taking place in connection with the implementation of information systems that contribute not only to accelerate scientific and technological progress, the intellectualization of all human activities, but also the creation of new information society environment qualitatively ensures the development of the creative potential of the individual.

The process of informatization also affected the economic sector. Their radical improvement and adaptation to modern conditions was made it possible due to the massive use of the latest computer and telecommunication equipment, the formation on its basis of high-performance information management technologies. Tools and methods of applied Informatics were used in management and marketing. New information systems based on computer technology, require radical changes of organizational structures of management, its regulations, human resource capacity, system documentation, recording and transmission of information.

The new information system will greatly enhance the possibility of the use of information resources in various industries, as well as in education.

Information systems - is the result of interrelated, scientific, technological and engineering disciplines studying methods of efficient organization of the working people, is busy processing and storage of information; computer technology and methods of organization and interaction with people and production equipment, and their practical application, as well as associated with all this social, economic and cultural problems. Sami information systems require

complex preparation, large initial costs and high technology equipment. Their introduction should begin with the creation of software, the formation of information flows.

There are several points of view on the development of information systems with the use of computers, which are determined by a variety of signs of division.

Common to all of the following approaches due to the advent of the PC began a new stage in the development of information systems. The main purpose of getting personal satisfaction of information is the needs of the person as for professional and for home.

The main features of the division of information systems:

By referring the information processing tasks and processes:

- Stage 1 (60 - 70-ies.) - Data processing in computer centers in shared mode. The main direction of development of information systems is to automate routine actions of man.
- Stage 2 (with 80-ies.) - The creation of information systems aimed at solving strategic tasks.

According to the problems standing in the way of information society:

- 1st stage (before the end of the 60-ies.) - characterized by the problem of processing large amounts of data with limited hardware capabilities.
- 2nd stage (before the end of the 70-ies.) - associated with the spread of IBM / 360 series computers. The problem of this phase - lag software on the level of hardware.
- Stage 3 (from the beginning of the 80-ies.) - The computer becomes a tool for non-professional user, and information systems - means of supporting its decision-making. Problems - the maximum satisfaction of user needs and creating an appropriate interface in the computer environment.
- 4th stage (from the beginning of the 90-ies.) - the creation of modern technology between organizational relationships and information systems. Problems of this stage are very numerous. The most important of them are:

– development agreements and the establishment of standards, protocols for computer communication;

– organization of access to strategic information;

– organization of protection and security of information.

For the most part, that brings the information system:

- Stage 1 (from the beginning of the 60-ies.) - Characterized by a fairly effective treatment information when performing routine operations with a focus on centralized collective resources of computing centers. The main criterion for evaluating the effectiveness of information systems has created a difference between the input of the development and savings resulting from the introduction of means. The main problem at this stage was a psychological - poor communication users who create information systems, and developers because of differences in their views and understanding of the problems to be solved. As a result of this problem, set up a system that users do not perceive and fully use in spite of their rather big opportunities.

- 2nd stage (mid-70-ies.) - Is associated with the advent of personal computers. The approach to the development of information systems - the focus shifted towards the individual user to support its decisions. This user is interested in the ongoing development, and wants to establish contact with the developer, there is a mutual understanding of both teams. At this stage, it is used as a centralized data processing, typical of the first stage and decentralized, based on the solution of local problems and working with local databases on the user's workplace.
- Stage 3 (from the beginning of the 90-ies.) - associated with the notion of analysis of strategic business benefits and is based on the achievements of the telecom distributed information processing technology. Information systems are intended not only increase the efficiency of data processing and support managers. Information systems should help organizations to survive in the competition and gain an advantage.

Used in manufacturing process. Such terms as a norm, standard, process, process step or the like can be applied in information systems. Before we develop these concepts in any system, including in the information, you should always start with the definition of goals. And try to structuring all alleged actions leading to the goal, and select the required software tools.

It should be understood that the development of the information system and its use should be further reduced to what must first be good to learn a set of elementary operations, the number of which is limited. Out of this limited number of elementary operations in different combinations drawn action and of the actions in different combinations drawn operations that define a particular process step. The set of process steps a forming process. It can begin at any level and include, for example, steps or operations, and only consists of action, of different software environments which may be used to implement the process steps.

Information system, like any other, must meet the following requirements:

- provide a high degree of subdivision of all information processing at the steps of the operation steps;
- include the entire set of elements necessary to achieve this goal;
- have a regular character of the process operations which can be standardized and unified, which will more effectively implement information management processes.

Modern material production and other areas are the more in need of information services, processing of vast amounts of information. Universal technical means of processing information, a computer that acts as an amplifier intellectual capacity of man and society as a whole, means of communication, using computers, are used for communication and data transfer. The advent of computers and the development - is a necessary component of the progress of society.

Computerization on the basis of implementation of computer and telecommunications systems is the reaction of society to the need for a substantial increase in labor productivity in the information sector of social production, where

more than half of the working population. For example, in the US information sector employs over 60% of the working population in the CIS - 40%.

The Internet provides an unprecedented way to get information. Opportunities for education, business and the growth of mutual understanding between people are simply stunning. Moreover, Web technology makes it possible to disseminate information throughout. The simplicity of this method has no parallel in history. The Internet provides a unique freedom of expression and identity information.

Like the use of domestic phone companies as to connect employees to each other and the outside world, Web is used for communication within the organization and between organizations and their customers, clients and partners. The same Web technology that enables small businesses to express themselves on the Internet, a large company can be used to transmit data on the current status of the project on the internal intranet that allows its employees to be always more aware and therefore more responsive than small nimble competitors. The use of the intranet within the organization in order to make information more accessible for their members, as a step forward compared to the past. Now, instead of storing the documents in a confused computer archive, it is possible (under the control of the means of protection) easily to search for and description of the documents, to make reference to them and be pointers. Due to business Web technology as well as the control becomes more effective.

Information processing technology is well structured solutions for problems, which the required input data and algorithms are known, and other standard processing procedures. This technology is used at the level of activity of the personnel performing low-skill in order to automate some routine repetitive operations of the administrative labor. Therefore, the introduction of information technologies and systems that will significantly increase the level of staff productivity, frees him from routine operations, may even result in a need to reduce the number of employees.

At the level of operational objectives:

- processing of transactions made by the company;
- creating periodic monitoring reports on the state of affairs in the company;
- getting answers to all sorts of current needs and design them in the form of paper documents or reports.

An example is a daily report on income and cash issuing bank, formed in order to control the balance of cash, or a request to the database for HR data, which will provide data on the requirements for candidates for certain positions.

There are several features associated with the processing of data that distinguish this technology from all others:

- performance of the company required for data processing tasks. Each company is prescribed by law and has to store data about their activities, which can be used as a means to establish and maintain control over the company. Therefore, any company must have necessarily be information

about processing system, and to develop appropriate information technology;

- decision of well-structured problems for which you can develop an algorithm;
- performance of standard processing procedures. Existing standards define the types of data processing procedures and require compliance by organizations of all kinds;
- perform the bulk of the work in an automatic mode with minimum human involvement;
- the use of detailed data. Records of the company's activity are detailed in nature allowing audits. In the course of the audit firm's work is chronologically checked from the beginning of the period to the end and from the end to the beginning;
- emphasis on the chronology of events;
- minimum requirement assistance in solving problems by specialists at other levels.

Storage of data: Many data on the operating level must be saved for later use, or here, or on a different level. Their databases are created, to store information.

Create reports (documents) in the information processing system is necessary to create documents for the management and employees of the company, as well as for external partners. This document can be periodically created on demand or in connection with the operation of the company, as well as it the end of each month, quarter or year.

The aim of the management information system is to meet the information needs of all our employees, without exception, dealing with decision-making. It can be useful on any level control.

This technology is focused on work environment management of information system and is used in the structuring of the worst tasks, when compared with the problems solved with the help of an information processing system.

Management Information System is ideally suited to meet the information needs of the workers of similar and different functional units or company management levels. Supplied them information contains information about past, present and the likely future of the company. This information takes the form of regular or special management reports.

For decision-making at the level of management control information should be presented in an aggregated form, so that the tendency of data changes, the causes of deviations and possible solutions. In this step, to solve the following data processing task:

- assessment of planned state control object;
- assessment of deviations from the planned state;
- identification of the causes of deviations;
- analysis of possible solutions and actions.

Management Information System aims to create different types of reports. Regular reports are created in accordance with the established timetable, the defining moment of their creation, such as the company's monthly sales analysis.

Special reports are generated on demand or when the managers in the company, if there was something unplanned. And those and other kinds of reports can take the form of summarizing, comparative and emergency reports.

- In summarizing reports data grouped into separate groups, sorted and presented in the form of intermediate and final results of the individual fields.
- Comparative reports contain data obtained from different sources or classified according to different characteristics and are used for comparison purposes.
- Emergency reports provide data of exceptional (emergency) nature.

The efficiency and flexibility of an information system depends on the characteristics of the interface, a decision support system. The interface defines: the user language; the language of computer communications, organizing dialogue on a display screen; user knowledge.

User Language - it is the actions that a user performs on a system by using the keyboard features electronic pencil writing on the screen, joystick "mouse" commands from the voice, etc. The simplest form of the language of the user is to create forms of input and output documents. After receiving the input form (document), a user fills it with the necessary data, and entered into the computer. Decision support system makes the necessary analysis and provides results in the form of the established form of the output document.

Language messages - this is what the user sees on the display screen (characters, graphics, color), data received at the printer, audio output signals, etc. An important measure of the efficiency of the interface used is the chosen form of a dialogue between the user and the system. Currently, the most common form of the following dialogue: a challenge-response mode, command mode, menu mode, the mode of filling gaps in the terms offered by the computer. Each form depending on the type of task, user features, and make decisions may have its advantages and disadvantages. For a long time the only implementation of the display language has been printed or outputted to a display screen or a report message. Now there is a new possibility of presenting output data - computer graphics. It allows you to create on-screen, and paper color graphics in three dimensions. Using computer graphics, greatly improves visibility and interpretability of the output data, it is becoming increasingly popular in the information system decision support.

User knowledge - this is what the user needs to know while working with the system. These include not only the action plan, which is in the mind of the user, but also books, manuals, reference data issued by a computer.

Improved interface, decision support systems, determines the success in the development of each of these three components.

The interface must have the following capabilities:

- manipulate various forms of dialogue, changing them in the decision making process at the user's choice;
- transmit data to the system in different ways;
- receive data from the various system devices in a variety of formats;
- flexible support (to assist upon request, prompt) user knowledge.

The greatest progress among computer information systems noted in the development of expert systems. Expert systems allow the manager or specialist to get expert advice on any problems which these systems have accumulated knowledge (see figure 1.1).

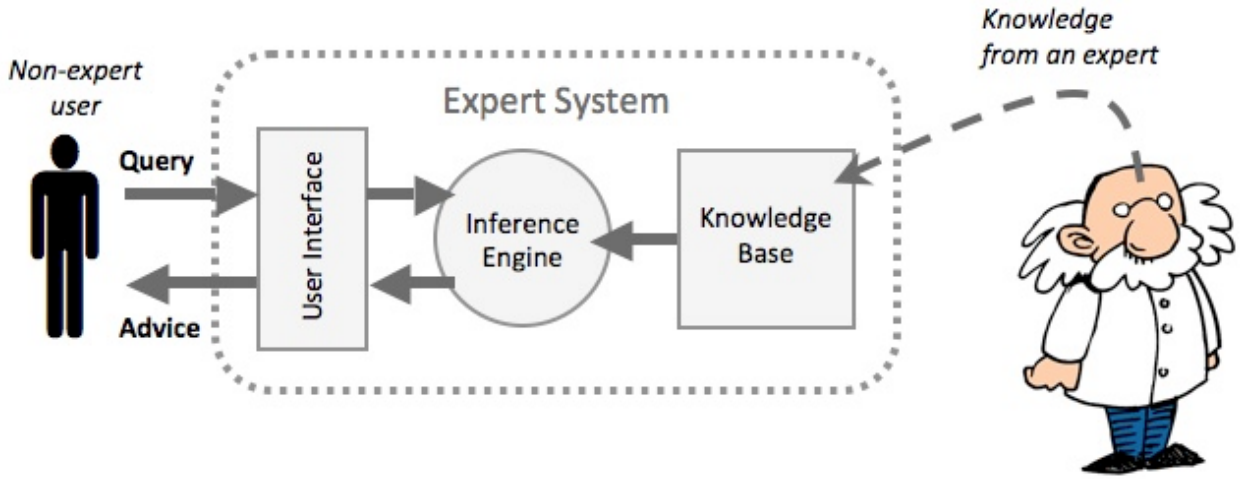


Figure 1.1 The Components of Expert Systems

Special tasks require special knowledge. However, not every company can afford to keep a staff of experts in all related to her work problems, or even invite them whenever a problem arises. The main idea of using expert systems technology is to obtain from an expert's knowledge and downloading them to your computer, use whenever the need arises.

The similarity of expert information systems and decision support systems is that they both provide a high level of support for decision-making. However, there are three significant differences.

- The first relates to the fact that the solution to the problem within the framework of decision support systems it reflects the level of user understanding and its ability to receive and understand the decision. Technology expert system, on the contrary, asks the user to make a decision that exceeds its capacity.
- The second difference of these systems is expressed in the ability of expert systems to explain their reasoning in the course of receiving the decision. These explanations very often prove to be more important to the user than the decision itself.
- The third difference is associated with the new component of the information system - knowledge.

The main components of the expert information system are: user interface, knowledge base, and interpreter, a module system creation.

The specialist uses an interface for entering information and commands in the expert system and receiving output data there from. Commands include parameters guides knowledge processing. Information is usually issued in the form of values assigned to certain variables.

Expert systems technology provides the opportunity to receive as output information is not only the solution but also the necessary explanations.

There are two types of explanations:

- explanations issued on request. The user may at any time require the expert system explanation of his actions;
- an explanation of the solution of the problem. After receiving the decision, the user can demand an explanation of how it was obtained. The system should explain every step of its reasoning leading to the solution of the problem. The technology is not a simple user interface of these systems which is works with an expert system it is friendly and does not usually cause difficulties in the management of the dialogue.

The knowledge base contains facts describing the problem area and the logical relationship between these facts. The central place in the knowledge base belongs to the rules. The rule specifies what to do in this particular situation, and consists of two parts: a condition that can be executed or not, and the action that should be performed if the condition is satisfied.

All materials used in the expert system rules form a system of rules, which, even for a simple system can consist of several thousand rules.

Interpreter - a part of the expert system that produces in a certain order of knowledge processing (thinking) that are in Knowledge Base. Interpreter working with technology reduces to the successive consideration set of rules (rule of the rule). If the condition is contained in the rule is observed, the appropriate action, and the user is given an option solution of his problem.

In addition, many expert systems introduce additional blocks: the database, the calculation unit, input unit and the data correction. The calculation unit is necessary in situations of management decisions. An important role is played by the database, which contains the plan, physical settlement, accounting and other permanent or operational performance. Input unit and data adjustments used for rapid and timely reflection of the current changes in the database.

Creating a system module - used to create a set of rules. There are two approaches that can be the basis for creating a module system: using algorithmic programming languages and the use of expert system shells.

Expert system shell is a complete software environment that can be adapted to solve specific problems through the creation of an adequate knowledge base. In most cases the use of membranes allows the creations of expert systems to work faster and easier as compared to programming.

For information systems, it is quite natural that they become obsolete and are replaced by new ones.

When introducing a new information system in the organization need to assess the risk of lagging behind its competitors as a result of its inevitable obsolescence over time as information products have an extremely high rate of turnover of new types or versions. Periods of turnover range from a few months to one year. If in the process of implementing new information system to this factor does not pay attention, it is possible that at the time of completion of the transfer of the company to new information system is already obsolete and will have to take measures for its modernization. Such failure of the implementation of technology information systems usually associated with the imperfection of the technical means, while the main reason for failure is the lack of poor methodology conceived the use of information systems.

Centralized processing of information on a computer data center was the first historical technology. Create large computer centers for collective use, equipped with large computer (in our country - UCS). The use of such a computer allows you to process large amounts of information and receive input on this basis, various kinds of information products, which is then passed on to users. This process was due to lack of equipment computer technology companies and organizations in the 60 - 70-ies.

Advantages methodology centralized technology:

- recourse user to large amounts of information in the form of databases and information products to a wide range;
- comparative ease of implementation of methodological decisions on the development and improvement of an information system with centralized their adoption.

The disadvantages of this methodology:

- limited liability lower staff that is not conducive to the rapid acquisition of information by the user, thereby preventing correctness of development of administrative decisions;
- limit user capabilities in the process of obtaining and using information.

Decentralized data processing associated with the advent of the 80-ies., personal computers and the development of telecommunication facilities. It is very important pressed the previous technology, as it gives the user ample opportunity to work with the information and does not limit its initiatives.

The advantages of this methodology are:

- flexible structure provides user space initiatives;
- strengthening the responsibility of lower-level employees;
- reducing the need to use a central computer and thus control by the computer center;
- more complete implementation of user creativity through the use of means of computer communication.

However, this methodology has its drawbacks:

- the complexity of the standardization of the large number of unique developments;

- psychological rejection of users recommended computer center ready software standards;
- uneven development of information technology at the level of local places that is primarily determined by the level of qualification of a particular employee.

Information systems have become part of our lives. The use of computers has become common place, although still quite recently the work place, equipped with a computer was a great rarity. Information systems have opened new opportunities for work and would greatly facilitate the work of man.

Modern society can hardly be imagined without information systems. A prospect for the development of computer technology today is difficult to imagine even for specialists. However, it is clear that we are waiting for something unusually in the future.

The transparency of the world is increasing with the developments of information systems, the speed and volume of data transmission between the elements of the world system, there is another factor in integrating the world. This means that the role of local traditions contribute to the development of self-contained inertial individual elements weakens. Simultaneously the reaction elements for signals with positive feedback. Integration would be welcome, if it did not get the result of the erosion of regional, cultural and historical features of the development.

Information systems have incorporated snowballing achievements of electronics and mathematics, philosophy, psychology and economics. The resulting viable hybrid marked a revolutionary leap in the history of information systems.

Today's society is filled and permeated with streams of information that need to be processed. Therefore, no information systems, as well as without the energy and transportation systems, it cannot function normally.

Socio-economic planning and management, production and transport, banks and stock exchanges, the media and publishing, defense systems, social and law-enforcement database, service and health care, educational processes, offices for processing of scientific and business information, finally, the Internet - everywhere Information Systems.

Review questions

1. What is the new stage in the development of information systems?
2. Describe the stages of the development of information systems based on the tasks and processes of information processing.
3. What is the main idea of using the technology of expert systems?
4. Specify the reasons for creating large computer centers of collective use in the 60 - 70-ies.
5. Why did information systems become a part of our lives?

Chapter 2 Information systems components

The term information system (IS) is used as broad and narrowly.

In a broad sense, the information system is the set of technical, software and organizational support, as well as personnel, designed to provide the appropriate people in timely manner appropriate information.

One of the most comprehensive IS definitions given by M. Kogalovski: "information system is a complex, which includes computing and communications equipment, software, linguistic tools and information resources, as well as the personnel system and provides support for the dynamic information model of a part of the real world to meet information needs of users ".

ISO / IEC 2382-1 standard provides the following definition: "Information system - information processing system, working in conjunction with organizational resources such as people, facilities and financial resources that provide and distribute information".

In the narrow sense, the information system referred to only a subset of IS components in a broad sense, including the database and specialized applications. IS in the narrow sense is considered as a hardware and software system designed to automate the end-user focused activities, ensuring, in accordance with the laid down in its processing logic, the ability to obtain, modify, and store information.

In any case, the main task of IS is to meet the specific information needs within a particular subject area. Modern IS's de facto inconceivable without the use of databases, so the term "information system" in practice merges within the meaning of the term.

Ideally, the company should operate within a unified corporate information system that satisfies all of the existing information needs of all employees, services and departments. However, in practice, the creation of a comprehensive IS too difficult or even impossible, so that the company usually operates a number of different IS decisive individual groups of tasks: production management, financial and economic activities, etc. Some of the tasks can be "covered" at the same time several IS part of the tasks - not automated. This situation is called "patchwork automation" and is quite typical of many companies.

The Components of Information Systems

Information systems are made up of five components (see figure 2.1): hardware, software, data, people, and process. The first three - fitting under the category technology. But the last two, people and process, are really what separate the idea of information systems from more technical fields, such as computer science. In order to understand information systems fully, we have to need understand how all of these components work together to bring value to an organization.

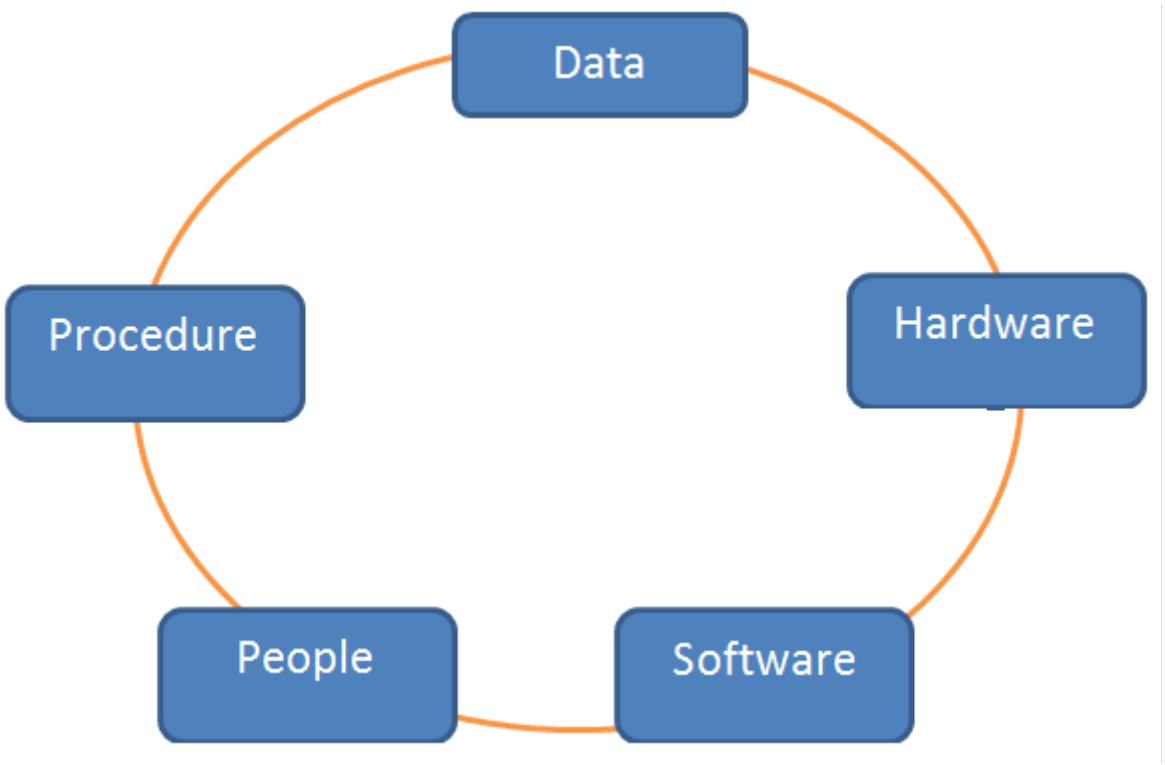


Figure 2.1 The Components of Information Systems

Hardware

The physical part of the computing devices - those that you can touch - called hardware. Computer hardware include digital devices, such as desktop computers, laptop computers, mobile phones, tablet computers, e-book reader, a data storage device (for example: Flash Drives), an input device (for example: keyboard, mouse and scanners), output devices (for example: printers, speakers).

In addition to these more traditional computer hardware devices, digital technology is now integrated into many household items. Examples of these types of digital devices include cars, refrigerators, washing machines, etc.

In the 1960-ies, at the beginning of the information revolution, Gordon Moore, later one of the founders of the Intel Corporation, noticed an interesting pattern in the development of computers. He noted that the amount of computer memory doubles approximately every two years. This pattern has become a sort of rule of thumb in the computer industry, and soon it turned out that not only the memory, but each component of your computer - the size of chips, processor speed, etc. -.. is subject to this rule.

The subsequent development of computers was going according to the "law" of Moore. Strikingly, but in recent decades we have witnessed several of these revolutions in technology. We have gone from computers to vacuum-tube transistors for computers based on integrated circuits and further - to a computer with a microprocessor, and every time Moore's Law is confirmed. In the 1960-ies, no one in Silicon Valley could not even imagine that modern technology will enable millions of items placed in a silicon crystal (chip) the size of a postage

stamp. But when, in accordance with Moore's Law was supposed to be such a degree of integration, it arose. However, Moore's Law seems to have become to act faster – over the past few years, doubling the performance period was reduced from two years to one and a half.

But sooner or later the laws of nature will put an end to the domination of Moore's Law. Take, for example, the dimensions of the elements of the chip. Law predicts that by 2060 they will have to be the size of a single atom - which is impossible from the point of view of quantum mechanics!

When personal computers were first developed, they were stand-alone units, which meant that data was brought into the computer or removed from the computer via removable media, such as the floppy disk. Beginning in the mid-1980-ies, however, organizations began to see the value in connecting computers together via a digital network. Because of this, personal computers needed the ability to connect to these networks. Initially, this was done by adding an expansion card to the computer that enabled the network connection, but by the mid-1990-ies, a network port was standard on most personal computers. As wireless technologies began to dominate in the early 2000-ies, many personal computers also began including wireless networking capabilities.

The use of network technology adds features that would have been considered science fiction just a few years ago. Here there are two of the latest ways that computing technology integrated into everyday products:

- ✓ The Smart House
- ✓ The Self-Driving Car

The personal computer has gone from a technical miracle to a part of our daily life, it has also become a commodity in the sense that there is very little differences between computers. Hundreds of vendors worldwide now produce parts for personal computers. Dozens of companies are buying these parts and assembled computers. The main factor that controls their sale is their price.

Personal computers are used for more than forty-five years. Millions of them have been used and discarded. Mobile phones are available even in the most remote corners of the globe and, after a few years of use, they are thrown out. Where ends the life of this e-waste?

He often goes to any country that will accept him. These dumps are beginning to be regarded as a health hazard to those who live near them. While many manufacturers have made progress in the use of materials that can be recycled, but the problem of electronic waste is relevant.

Software

The second component is an information system software. Simply put: The software is a set of instructions that tells the hardware what to do. The software is created in the programming process. work.

The software can be divided into two categories: the operating system and application programs.

The operating system provides several important functions, including:

1. The management of the hardware resources of the computer;
2. The software user interface components;
3. The creation of a platform for software developers to write applications.

All computing devices are running the operating system. For PCs, the most popular operating systems Windows, OS X, and different versions of Linux. Smartphones and tablets using the Android operating system, iOS, Windows Mobile, Blackberry and others.

Early personal computer operating systems were simple by modern standards; they do not provide multitasking and require the user to input commands to start the action. The most popular of the early operating systems was the operating system of the IBM Disk, or DOS.

In 1984, Apple introduced the Macintosh computer with the first commercially successful operating system with a graphical user interface. In 1985, Microsoft released the first version of Windows. This version of the Windows, not an operating system, it was the application for the DOS operating system that provides a graphical environment. Only in 1990, Microsoft released commercially successful Windows 3.0 operating system with a graphical user interface. Since 1990, Apple and Microsoft have released a lot of new versions of their operating systems, with each release, adding the ability to process more data at once and gain access to additional features, such as multitasking, virtual memory and voice input.

Linux - the third type of personal computer operating system that is gaining in popularity. Linux is a version of the Unix operating system that runs on a personal computer. Unix is an operating system used mainly by scientists and engineers at large minicomputers. This is a very expensive computer and software developer Linus Torvalds wanted to find a way to make cheap Unix to run on less expensive PCs. Linux has many variations and is now installed on most web servers in the world.

The second major category of software - applications. Application programs allow the user to achieve some goal. For example, if you need to write a document, you can use the program Microsoft Word application software. If you want to listen to music, you can use ITunes. To surf the web, you can use Internet Explorer or Firefox. Even a computer game can be considered as application software.

When a new type of digital device invented, there is usually a small group of technology enthusiasts who buy it just for the joy of figuring out how it works. For most of us, as long as the device can actually do something useful, we do not spend your hard-earned money on it. "Killer" application is an application that becomes so significant that many people will buy a device just to run this app. For the personal computer, the app "Killer" became a spreadsheet: VisiCalc, Lotus, Microsoft Excel.

Along with a spreadsheet, several other software applications have become standard tools for the workplace. These applications allow the office staff to perform their daily work. Many of these applications are packaged together, such as Microsoft Office package.

Microsoft popularized the idea of separation of office software, the release of Microsoft Office. This package continues to dominate the market and most companies expect the knowledge of employees of the software. However, many Microsoft Office competitors do exist and are compatible with the file formats used by Microsoft.

Two sub-categories of application software is worth mentioning: the application software and programming software. The utility includes software that allows you to correct or change your computer in some way. Examples: anti-virus software and the disk defragmentation software. These types of software packages have been invented to fill defects in operating systems. Many times, the subsequent release of the operating system includes the support functions as part of the operating system.

Software for programming a program whose goal is to make more software. Most of these programs provide programming environment in which they can write code to check it and convert it into a format then that can be run on the computer.

When installing the software, you will receive a license to use it. When you first install a software package, you will be prompted to accept the terms of service or license agreement. In this agreement, you will find that your rights to use the software are limited.

In the 1990s, the system of enterprise resource planning (ERP system) has been developed to integrate information resources of the organization in a single software application. ERP systems include functionality that covers all key business components. In addition, an organization can purchase modules for their ERP systems that meet the specific needs of, for example, production or planning.

In general, the implementation of an ERP system may take two to three years and a few million dollars. In most cases, the cost of the software is not the most expensive part of the implementation: this value consultants!

If done right, ERP system can bring the organization a good return on their investment. By consolidating information systems across the enterprise and use of the software to ensure best practice, most organizations saw an overall improvement after ERP implementation.

Mobile devices such as tablet PCs and smart phones also have operating systems and application software. In fact, these mobile devices in many respects just smaller versions of personal computers. The mobile application is a software application specially programmed to run on a mobile device.

Smartphones and tablets have become the dominant form of personal computing devices. Today, most mobile devices running on one of the two operating systems: Android apps or IOS. Android is an open source operating system was purchased and maintained by Google; The IOS is the mobile operating system from Apple.

Historically, for the software to run on a computer, an individual copy of the software had to be installed on your computer or on a disc or, more recently, after downloading from the Internet. The concept of "cloud" computing changes that.

Cloud computing has the following advantages:

- ✓ No cost to install or update software.
- ✓ Available from any computer with Internet access.
- ✓ The ability to easily scale to large numbers of users.
- ✓ New applications do not require installation and work very quickly.
- ✓ Services can be rented for a limited time as needed.
- ✓ Your information will not be lost if the hard drive has broken or your laptop is stolen.
- ✓ You are not limited by the available memory or disk space on your computer.

The disadvantages of cloud computing:

- Your information is stored on the computer for someone else - how safe is it?
- You must have Internet access to use it. If you do not have access, you are out of luck.
- You rely on a third party to provide these services.

Many organizations are understandably nervous about giving up control over their data and some applications via cloud computing. But they also see value in reducing the need for installing software and adding disk storage on local computers. The solution to this problem lies in the concept of a private cloud.

One of the technologies that are widely used as part of cloud computing is "virtualization". This virtualization process using software to simulate a computer or other device. For example, using virtualization technology, a single computer may serve several computers.

Modern software applications are written using a programming language. Programming language comprises a set of commands and syntax, which may be logically arranged to perform specific functions. This language is usually composed of a set of words read in conjunction with the symbols. Using this language, the programmer writes a program (the so-called source code), which can then be compiled into machine-readable form, ones and zeros necessary for execution by the processor. Examples of well known programming languages today include Java, PHP, and various versions of C (Visual C, C ++, C #). Languages, such as HTML and JavaScript are used to design Web pages. Most of the time the programming is performed in the programming environment; when you buy a copy of Visual Studio from Microsoft, it provides you with the editor, compiler, and support for many Microsoft programming languages.

When the PC was first released, it did not serve any practical need. Early computers were difficult to program. However, many computer enthusiasts immediately teamed up to create applications and solutions to problems. These computer enthusiasts were happy to share a program they have created or solution that they found. This collaboration has allowed them to more efficiently innovate and fix problems.

When the program started to become a business, sharing the idea fell into disfavor. When the program is spent hundreds of man-hours, it is clear that programmers do not just want to give it. This resulted in a new business model of

software licensing restriction that requires payment for the software. This model is dominant today. This model is sometimes referred to as closed source, so the source code is not available to others.

There are many ideas, however, thought that software should not be limited. In the 1990-ies, with Internet access, connecting more and more people with the movement of open source is gaining momentum.

Software open source makes the source code available for anyone to copy and use. For most of us, this idea gives little benefit, since we are not programmers. The good news is that open source software is also available in a compiled format, which you can simply download and install. Driving with open source led to the development of some of the most frequently used programs in the world, including the Firefox web browser, Linux operating system, and the Apache web server.

Many companies are wary of open source programs because the code is available for anyone to see. They feel that it increases the risk of attacks. Others argue that this openness actually reduces the risk, because the code is known to thousands of programmers who can make changes to the code to quickly fix vulnerabilities.

Today there are thousands of software applications with open source software, available for download.

Data and Databases

Data is the third component of the information system.

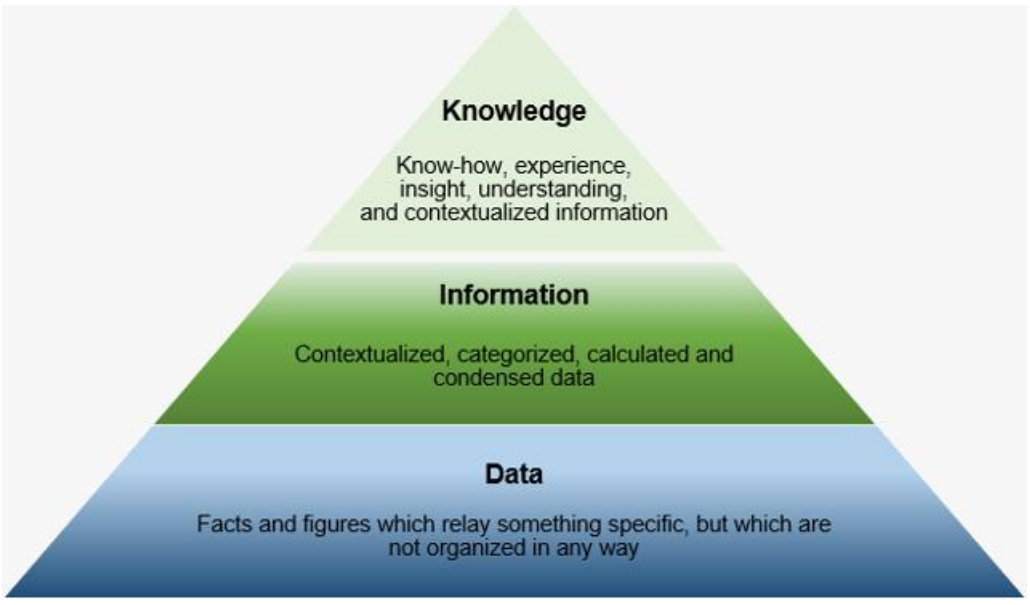


Figure 2.2 Knowledge pyramid

These are the raw bits and pieces of information out of context. If I told you, "15, 25, 43," you would not have learned anything. But I would give you the data.

Data can be quantitative or qualitative. Quantitative numeric data, the result of the measurement, a graph, or any other mathematical calculation. Qualitative data are descriptive.

By itself, the data is not useful. To be useful, context needs to be given to them. Returning to the example above, if I told you that "15, 25, 43" are the number of students who have registered for this course; you would have received the information. Adding context, I converted the data into information.

Once we put our data into context, we can use them to make decisions for our organization. We can say that this consumption information provides knowledge (see figure 2.2). This knowledge can be used to make decisions, set policy, and others.

The final step's ladder step information from the knowledge (knowing much about the subject) to wisdom. We can say that someone has wisdom, he can combine their knowledge and experience to gain a deeper understanding of the topic.

The aim of the information systems is to convert data into information to generate knowledge, which can be used for decision making. To do this, the system must be able to receive data to put the data in context and to provide tools for aggregating and analyzing. The database is designed for just such a purpose.

A database is an organized collection of relevant information. All information in the database should be connected as well; separate database must be established to manage unrelated information. For example, a database that contains information about the students, should not also contain information about the weather. Databases are not always digital - card file, for example, can be considered as a database form.

Databases may be organized in different ways, and take different forms. The most popular form of the database is the relational database. Notable examples of relational databases are Microsoft Access, MySQL, and Oracle. Relational database is one in which data is organized into one or more tables. Each table has a set of fields that define the character data stored in the table. Record -one copy of a set of fields in the table.

In a relational database, all the tables associated with one or more fields, so you can connect all the tables in the database through the common field (s). For each table, one of the fields identified as the primary key. This key is a unique identifier for each record in the table.

When designing a database, one of the most important concepts to understand is the normalization. Simply put, a database normalization means design is such that: 1) reduces the duplication of data between the tables and 2) gives a table as much flexibility as possible.

In determining the fields in a database table, we have to set for each field's data type. Some of the most common types of data are: text, number, yes / no, date / time, currency, paragraph text, object.

There are two important reasons why we should take into account to determine the correct type of data fields. Firstly, the data type, according to the

database, which functions can be performed on the data. The second important reason to determine the type of data, reducing the amount of disk space allocated to our data.

The primary way of dealing with relational database is to use the Structured Query Language, SQL as a method of analysis and processing of relational data. Many database packages, such like Microsoft Access, allow you to visually create a query that you want to build and then generate a SQL query for you.

The relational database model is the most widely used database model today. Nevertheless, many other database models exist which provide different advantages as compared to the relational model. The hierarchical database model, was popular in the 1960-ies and 1970-ies, linked together in a hierarchy of data, which allows for a parent / child relationships between data. The document - based model allows you to store data by placing the data in the "Documents", which could then be manipulated.

Perhaps the most interesting new feature is the concept of NoSQL (from the phrase "not only SQL"). NoSQL emerged from the need to address the problem of working with large-scale databases, distributed across multiple servers, or even around the world.

On the computer, the database appears as one or more files. To the data in the database are available for reading, change, add or delete, the program must have access to it. Many applications have this feature: ITunes can read its database to give you a list of your songs; software cell phone software can interact with the list of contacts. But to create or manage the database, or change the structure analysis there is a whole category of software applications, called database management systems (DBMS).

DBMS packages generally provide an interface for viewing and modifying the database design, query and reporting. The majority of these packages are designed to work with a specific type of database, but is generally compatible with a wide variety of databases.

The new buzzword that attracts the attention of business in recent years is a big data. The term refers to those massive big data sets that conventional database tools do not have the processing power to analyze them. For example, Walmart has to handle more than one million customer transactions every hour. Getting the best tools and techniques for the management and analysis of large data sets is a challenge for governments and businesses.

When the company began to use the database as a central element of their activities, it was necessary to study and use of the data collected. In addition, companies also want to analyze the data in the historical sense: As the data we have today compared with the same set of data, this time in the last month, or last year? Based on these needs arose the concept of the data warehouse.

Data warehouse concept is simple: extract data from one or more databases organize and load it into the data warehouse (which is in itself another database) for storage and analysis, in such a way that it meets the following criteria data warehouse should be designed:

- Used copies of the data from the active database;
- Data received timestamp;
- Data are standardized.

There are two ways of designing the data warehouse: from the bottom up and top down. Bottom-up approach starts with a small data warehouse, data marts known to solve specific business problems. Then they can be combined into larger data storage. Down approach suggests that we need to start by creating a data warehouse across the enterprise, and then, as far as identifying specific business needs, create smaller data marts from the data store.

Organizations find the data warehouse is very useful for a number of reasons:

- The process of developing a data warehouse makes the organization understand better the data that is currently and importantly collected, what kind of data is not collected.
- The data warehouse provides a centralized view of all data collected throughout the enterprise and provides a means for determining errors in the data.
- Once all the data is determined to be consistent, the organization can generate a single version of the truth.
- If data storage can be performed on data slices spend time and trend analysis.
- The data warehouse provides a means for combining the data, which can provide new information and analysis.

All companies accumulate knowledge for its existence. Some of the knowledge recorded or stored but not in an organized manner. Much of this knowledge is not written down; instead, it is stored in the minds of its employees. Knowledge management is the process of formalizing the collection, indexing and storage of knowledge in order to benefit from the experience of the company, during its existence.

Business Processes

The fourth component of information systems is a process. The process is a series of tasks to be completed to achieve the goal. The business process is a process that is aimed at achieving the goals for the business. Processes are what the company are held every day. The better their processes even more efficient business. Some businesses see their processes as a strategy for competitive advantage.

Every day, each of us will drive many of the processes, without even thinking about them, ready to go, use an ATM, read e-mails and etc. But, as processes become more complex, they need to be documented. For businesses, it is important to do this because it allows them to maintain control over how activities are carried out in their organization.

The easiest way to document the process is simply to create a checklist. For more complex processes, there is an administrative task management

documentation processes. Since the processes are constantly changing and improving, it is important to know which processes are most recent. Furthermore, it is important to document the process control system, the same could be easily upgraded!

Document Management System stores and tracks documents and supports the following features:

- Versions and timestamps. The document management system will keep multiple versions of documents. The latest version of a document is easy to determine, and will be served by default.
- Certificates and workflows. When the process has to be changed, then the system will operate as access to the documents for editing and routing the document for approval.
- Data exchange. When there is a process of change, those who carry out this process, need to be aware of the changes.

Of course, the document management system can be used not only to manage the business processes of documentation. Many other types of documents are managed in these systems, such as legal documents or project documents.

Enterprise Resource Planning (ERP) system is a software application with a centralized database, which can be used for the entire company. Let's take a closer look at the definition of each of these components:

- Application Software: The system is a software application, which means that it was designed with a specific logic and the rules behind it. It must be installed and configured for a specific organization.
- All data in the ERP system must be stored in a single central database. Centralization is the key to success in the ERP - the data entered in one part of the company can be immediately available for other divisions of the company.
- ERP can be used to control operations of an entire organization. If they wish, companies can purchase modules for ERP, which represent the various functions within the organization, such as finance, manufacturing and sales. Some companies prefer to buy a lot of modules, others choose only a portion of the modules.

Some of the most well-known ERP vendors are SAP, Microsoft and Oracle.

Many organizations are now claiming that they use to achieve the best practices when it comes to business processes. In order to verify and prove to their customers that they are indeed the best, these organizations achieve ISO 9000. ISO certification is an acronym for the International Organization for Standardization. This body determines the quality standards that organizations can implement to show that they are, in fact, manage business processes effectively. Certification ISO 9000 focuses on quality management.

People in information systems

People are virtually involved in all aspects of information systems: people create their own information systems, people develop information systems, people

support information systems, and most importantly, people use information systems.

The creators of information systems. This group of people plays an important role in the design, development and construction of information systems. These people tend to be very technical literate and have experience in programming and mathematics.

Systems Analyst. The role of the systems analyst is to identify business needs and presenting new or recycled computer system to meet those needs. This person defines the specific details of the system, which should be built. As a general rule, it requires to have a good understanding of the business, business processes, as well as the possibility of their formalization. The analyst will determine the various stakeholders in the information system and work to attract these people in the process.

When the requirements are defined, the analyst will begin the process of transferring these requirements in information systems project. The analyst will create a detailed document describing the new system.

Programmers spend their time writing computer code in a programming language. In the case of the development of systems, programmers usually try to fulfill specifications, it defined a system analyst. There are many different styles of programming: the programmer can work alone for a long time or can work as a team with other programmers. The programmer should be able to understand complex processes, as well as to understand the intricacies of one or more programming languages. As a rule, the programmer has good knowledge of mathematics, since mathematical concepts underlie any programming code.

Computer design engineers create computing devices that we use every day. There are many types of computer engineers who are working on many different types of devices and systems, and their officers often overlap instructions. Some of the most famous engineering works include:

- Engineer equipment;
- Software Engineer;
- System engineer;
- Network Engineer.

Another group of information systems professionals involved in the management and administration operations. Computer operator is the person who manages large computers. The work of this person is to monitor the mainframe and data centers in organizations. He is responsible for the content of the operating system in working condition, providing the amount of available memory and disk space, as well as supervision of the physical environment of computers.

The database administrator (DBA) is the person who manages the databases for the organization. This person creates and maintains databases that are used as part of an application or data warehouse.

Most mid-size and large organizations have their own information and help desk support. Help Desk is the first line of Computer Support company. Computer

users who experience problems or need information can contact the help desk for assistance. Help Desk is a great place to start a career in IT.

Computer instructor conducts classes to teach people certain skills work with computer programs. To be successful as a coach, you must be able to communicate technical concepts well, and also have a lot of patience!

Performance management is critical to the success of information systems within the organization. Here are some of the professionals involved in the management of information systems.

The CIO, or chief information officer, is the head of the organization's information system. This person coordinates the plans and operations of information systems with strategic objectives of the organization. This includes tasks such as budgeting, strategic planning, and human resources solutions for information systems. CIO should also be the face of the IT department within an organization. This includes working with top leaders in all parts of the organization to ensure good communication and planning.

As organizations increase the information system becomes more complicated and to manage separate sets of its functions are a group of people headed by a functional manager.

Organizations using ERP require one or more persons to manage these systems. These people support the ERP system to date, involved in the work to implement any changes in the ERP, which are necessary, and consult with various departments - users on the necessary reports or data extracts.

Project manager. Information systems - projects are notorious, are on a budget and are delivered with a delay. In many cases, the failure of the IT - project could spell doom for the company. The project manager is responsible for keeping projects on time and on budget. This person works with the participants of the project to keep the team organized and transmits information about the status of the project management organization. The project manager does not have authority over the project team; Instead, the project manager coordinating the schedules and resources in order to maximize the results of the project. The project manager must be a good communicator and a highly organized person. The project manager must also have good personal qualities. Many organizations require from each of its project managers, so that they are certified specialists in the field of project management professional (PMP).

Information Security Officer is responsible for the development of information security policy for the organization, and then monitors the implementation of this policy. Information security officer must ensure that information about the organization is safe from internal and external threats.

These job descriptions do not exhaust all the possible jobs within the organization of information systems. Larger organizations will have a special role; smaller organizations may combine some of these roles.

Review questions

1. What are the components of any information system?

2. Describe the different types of data.
3. What is a computer-based information system? What are its components?
4. What is the role of the systems analyst? What is the role of the programmer?
5. What is the role of the chief information officer?

Chapter 3. Information systems in organizations

Optimal control of the production process is a very time consuming task. The basic mechanism here is planning. Automated solution of such problem makes it possible plan, take into account the costs, carry out the technical preparation of production, efficiently manage the process of output in accordance with the production program and technology.

Workflow is a very important process of any enterprise. Well organized system of accounting document reflects the actual company current production activity and gives managers the ability to act on it. Therefore, workflow automation allows improving management efficiency.

Information system solves the problem of the operational management of the enterprise, based on the database, which records all possible information about the company. Such information system is a tool for business management and is commonly called a corporate information system. An information system for management includes a lot of software solutions for the automation of business processes, taking place in a particular enterprise (see figure 3.1).

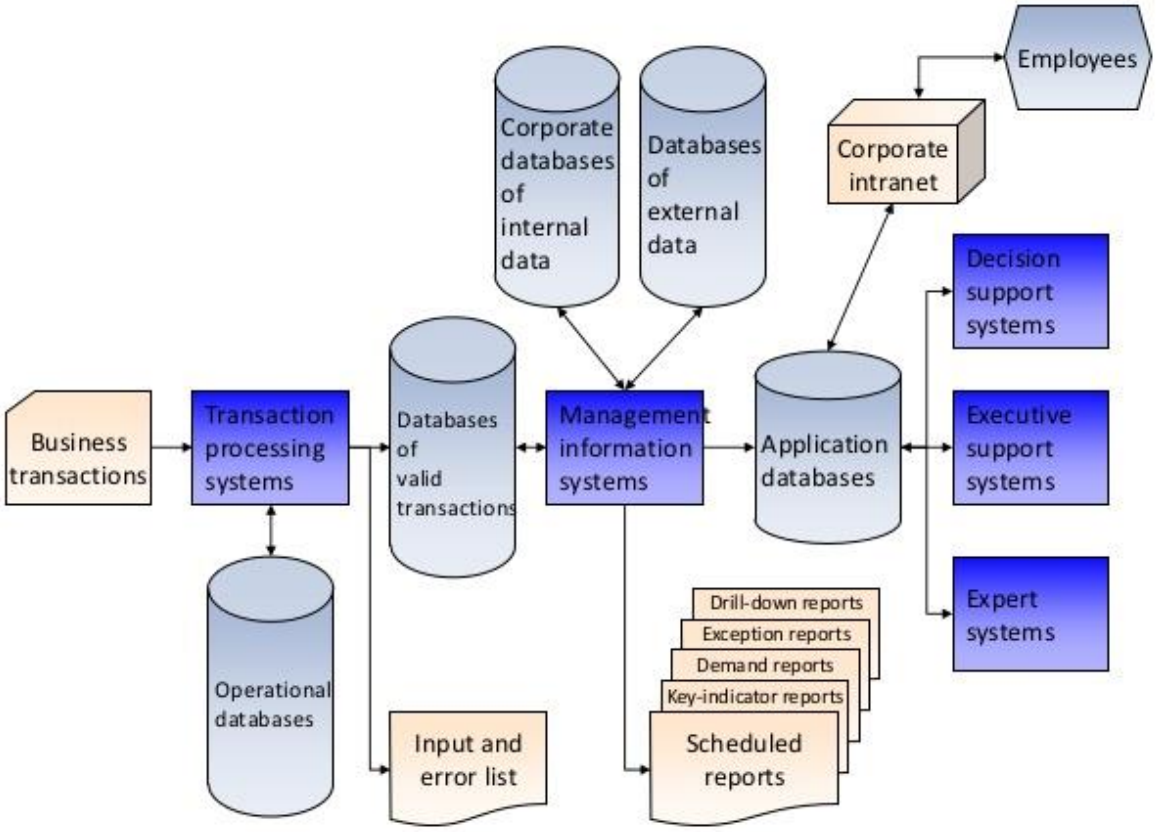


Figure 3.1 The Corporate Information Systems

The ideal enterprise information management system should automate all or at least most of the activities of the enterprise. This automation must be carried out taking into account the cost of it and give real effect to the results of financial and economic activity of the enterprise. Depending on the domain information systems can vary quite considerably in their functions, architecture and implementation. However, one can identify a number of properties that are common.

Information systems are designed for the collection, storage and processing of information, so the basis of them is the storage medium and the data access.

Information systems are focused on the end user who does not have high qualifications in the field of computer technology. Therefore, the information system client applications need to have a simple, convenient, easy to learn interface, which provides the end user with all the necessary features to work, and at the same time does not give him the opportunity to perform any extra actions.

The company must be a database that provides information storage and access to it for all the components of the control system. The existence of such database allows to generate information for decision making.

By itself, the information system is not a tool for management decisions. Decisions are made by people. But the control system is able to provide information in a way to ensure that decision.

Decision support systems are able to provide, for example:

- monitoring the effectiveness of the various sites and services;
- analysis of the individual units;
- compilation of data from various divisions;
- analysis of indicators of different areas of the company to highlight promising and unprofitable lines of business;
- identifying trends, developing the enterprise and the market.

We should not forget that the system will work with ordinary people who are specialists in their subject area but have average skills in working with computers. The interface of information systems should be intuitive to them.

There are different types of information systems. No single system can not fully meet the needs of the organization in all information. Organization can be divided into levels: strategic, managerial and operational knowledge; functional areas such as sales, marketing, manufacturing, finance, accounting and human resources. Systems are created to cater for the various organizational interests. Different organizational levels are served by four major types of information systems: of the system performance level, knowledge level of the system, the management level of the system and the system with the strategic level (see figure 3.2).

Operational level systems support control operations following the sale of elementary operations of organization types, payments, deposits cashing, payroll. The main goal of the system at this level is to answer questions and conduct ordinary transaction flows through the organization. To answer these kinds of questions, information generally must be easily accessible, timely and accurate.

Knowledge level of systems supports knowledge workers and data handlers in the organization. The purpose of knowledge level of the systems is to help integrate new knowledge in business and help organizations manage the flow of documents. Knowledge level of the Systems, especially in the form of workstations and office systems, today is the fastest growing applications in the business.

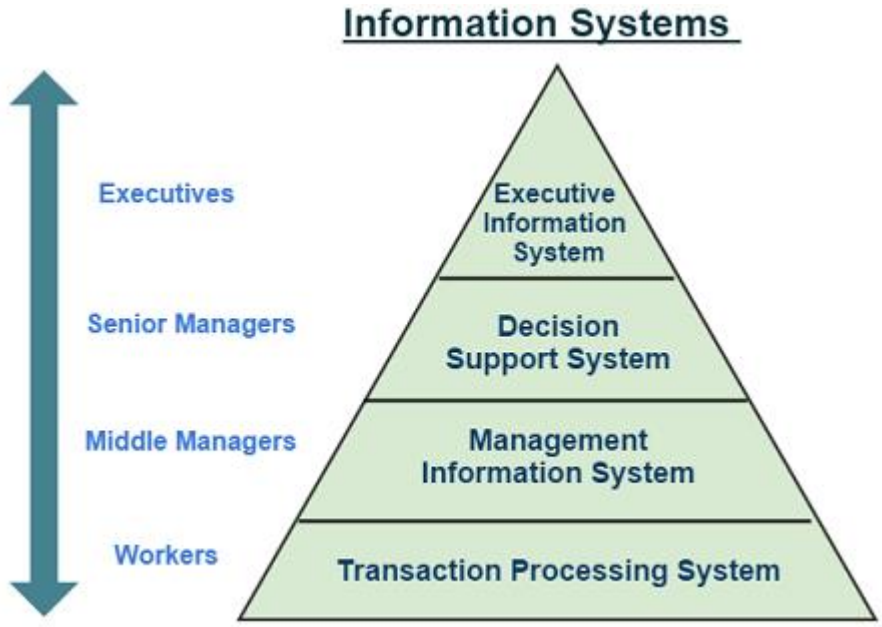


Figure 3.2 The Types of Information Systems

Level control systems are designed to serve the control, management, decision-making and administrative actions middle managers. They define objects and periodically inform it whether the work well. For example, the control system according to the movements of the moving of the total number of goods, the uniformity of the sales department and the department, funding costs for employees in all sections of the company, noting where the actual costs exceed budgets.

Strategic level systems – a tool to help top-level executives who are preparing strategic studies and long-term trends in the company and in the business environment. Their main purpose is to bring into line the changes in operating conditions with the existing organizational capabilities.

Information systems can also be differentiated functional manner. The main organizational functions are such as sales and marketing, manufacturing, finance, accounting and human resources services of their own information systems. In large organizations, sub-functions of these main functions also have their own information systems. For example, the function of production could have a system for inventory control, process control, plant maintenance, automated design and material requirements planning.

A typical organization has a system of different levels: operational, managerial, and strategic knowledge for each functional area. For example, the commercial function has a commercial system at the operational level, to record daily sales data and process orders. The system creates a level of knowledge appropriate displays to show the case of the company's products, level control system keep track of monthly sales data of all commercial areas and report on areas where the sale exceeds the expected level or falls below the expected level. forecasting system predicts sales trends over a five year period and serves the strategic level.

Functional feature determines the assignment of the subsystem, as well as its main goals, objectives and functions. The structure of the information system can be represented as a set of its functional subsystems, as a functional feature can be used for the classification of information systems.

In economic practice of industrial and commercial buildings typical activities that define the functional feature classification of information systems are: production, marketing, finance, human resources.

Production activity is related to the direct output and is aimed at the creation and introduction of scientific and technological innovations.

Marketing activity includes:

- analysis of the market of manufacturers and consumers, sales analysis;
- organization of advertising campaigns to promote products;
- rational organization of the logistics.

Financial activities are associated with the organization of the control and analysis of the financial resources of the company on the basis of financial, statistical, operational information.

Personnel activities are focused on the selection and arrangement of necessary company experts, as well as maintenance service documentation on various aspects.

These activities define a standard set of information systems:

- manufacturing systems;
- marketing system;
- financial and management accounting system;
- human resources;
- other types of performing auxiliary functions depending on the specific activity of the firm.

In large companies the basic information system functionality can be composed of several subsystems to perform sub-functions. For example, a manufacturing information system may have inventory management subsystem, process control, computer engineering, etc.

The type of information system depends on whose interests it serves, and on which management level.

The higher leading management level is, the lower is the amount of work performed by specialists and managers via the information system.

However, it increases the complexity and intellectual possibilities of information system and its role in decision-making manager. Any level of management needs information from all functional systems, but in different volumes and with varying degrees of generalization.

The base of the pyramid is the information system, through which the employees - the performers engaged in operational data processing and lower-level managers - operational control.

At the top of the pyramid and at the level of strategic management information systems change their role and become strategic, supporting activities of senior managers to make decisions under conditions of poor structuring tasks.

An information system for the level of support professionals – artists is processing data on transactions and events (bills, invoices, salary, credit, raw materials flow and materials). Assignment of IS at this level is responding to the current situation and track the flow of transactions in the company, which corresponds to the operational management. To cope with this, the information system must be easily accessible, continuously operating and accurate information.

Tasks targets and sources of information at the operating level are predetermined and highly structured. The solution programmed in accordance with a predetermined algorithm.

Information system of operational level is the link between the company and the external environment. If the system does not work well, the organization does not receive any information from the outside, or does not give information. In addition, the system is the main provider of information for other types of information systems in the organization, because it contains the operational and historical information.

Disabling this information system would result in irreversible negative consequences.

Information systems experts help professionals working with data, improve productivity and performance engineers and designers. The task of such information systems is the integration of new information into the organization and assistance in the processing of paper documents.

The industrial society is transformed into information; the performance of the economy will increasingly depend on the level of development of these systems. Such systems, particularly in the form of workstations and office systems, the fastest are growing business today.

In this class, the two groups can be distinguished information systems:

- information systems office automation;
- knowledge information processing system.

Information systems of office automation because of its simplicity and versatility are actively used by employees of any organizational level. They are often semi-skilled workers employed: accountants, secretaries, clerks. The main purpose is data processing, increasing their efficiency and simplification of office work.

Information Systems Office Automation ties together the information workers in different regions and help to communicate with customers, clients and other organizations. Their activities mainly cover document management, communication, scheduling, etc. These systems perform the following functions:

- word processing on computers using different word processors;
- production of high quality printed products;
- archiving of documents;
- electronic calendars and notebooks for the conduct of business information;
- email;
- video- and tele-conferencing.

Information knowledge processing system, including expert systems, absorb knowledge necessary engineers, lawyers, scientists in the development or creation of a new product. Their job is to provide new information and new knowledge. For example, the existing specialized workstations for engineering and scientific design allow for a high level of technical development.

Information level of the management system is used by employees of middle management monitoring (continuous monitoring), control, decision-making and administration. The main functions of these information systems are:

- comparing current performance to past;
- preparation of periodic reports for a certain time, and not issuing reports on current events, both at the operational level;
- providing access to historical information, etc.
- some information systems provide decision-trivial solutions. In the event that the requirements for information provision is not strictly defined, they are able to answer the question: "What would happen if ...?".

Two types of information systems can be distinguished at this level: for management and decision support system.

Management information systems are extremely small analytical capabilities. They service managers, who need a daily, weekly information on the state of affairs. Their main purpose is to monitor the daily operations of the firm and the periodic formation of a strictly structured summary of standard reports. The information comes from the operational level information system.

Characteristics of Management Information Systems are:

- used to support decision-making structured and semi-structured problems at the operations control;
- focused on monitoring, reporting and decision-making on the operational environment;
- based on existing data and their flow within the organization;
- low analytical capacity and inflexible structure.

Decision support systems serve semi-structured problems, the results of which are difficult to predict in advance. They have a powerful analytical apparatus with several models. The information is obtained from the management

information and operating systems. All of them use these systems that need to make a decision: managers, professionals, analysts and others.

Characteristics of decision support systems are:

- provide a solution to the problems, the development of which are difficult to predict;
- equipped with sophisticated tools of modeling and analysis;
- make it easy to change the setting of tasks and the input data;
- It is flexible and easy to adapt to changing conditions several times a day;
- have the technology, the most user-centric.

Strategic Information Systems. The development and success of any organization (company) is largely determined by the strategy adopted by it. A strategy is a set of methods and tools for solving problems of long-term perspective.

In this context, a "strategic approach" can be perceived, and the concept of "strategic tool", "strategic system", etc. Currently, due to the transition to market relations, the issue of the company development and behavior strategies have been paying a lot of attention, which contributed to a radical change in the views on information systems. They were regarded as a strategically important system that influence the choice of the change of company objectives, its objectives, methods, products and services, allowing you to get ahead of competitors, as well as to work more closely with customers and suppliers. A new type of information system – strategic.

Strategic information system is a computer information system, providing decision support for the implementation of the strategic long-term goals of the organization.

There are situations when a new quality of information systems forced to change not only the structure but also the profile of firms promoting their prosperity.

Information strategic level systems help senior managers to solve unstructured problems, long-term planning. The main task is the comparison occurring in the external environment changes to the existing potential of the company. They are designed to create an overall environment of computer and telecommunications support decisions in unexpected situations arise. Using the most advanced software, these systems are able to provide at any time information from many sources. Some strategic systems are characterized by limited analytical capabilities and play a supporting role and are used as a means of operational managers need information to make decisions on this level organizational information systems.

It is desirable to have some local information systems for different purposes, which interact with each other and support the management decisions at all levels.

Local information systems are organized by the connection of various nature and purpose. Some local information systems may be associated with a large number of company employees and systems have access to the external environment, others connected with only one or more related. A modern approach

to communication is based on the use of local in-house computer network with access to the same information system of another company or a division of the corporation. At the same time the resources of regional and global networks are used.

Based on the integration of different functions of information systems via computer networks in the company are corporate information systems. These information systems provide the user with the ability to work with both firm wide database and local databases.

The information system can have the greatest effect if a company viewed as a chain of operations, resulting in the gradual formation of the cost of manufactured products or services. Then with the help of information systems of various functional purposes, included in this circuit, it is possible to influence the strategy of management decision-making, aimed at increasing the company's revenues.

By custom or unique systems usually refers to a system created for a particular company, which have no analogues and are not subject to further replication. Such systems are used either for the automation of business with unique features, or to solve the extremely limited range of special tasks. Basically, these systems are used in government, education, health, military organizations. Custom systems are generally either do not have a prototype, or the use of the prototype it requires significant changes with qualitative. In this regard, the development of a custom system is essentially a research work. It is characterized by an increased risk in terms of obtaining the desired results. To reduce risks and development costs should be used to practice the proven methodology. Desirably, the methods included in the following items:

- a model of the process (a sequence of process steps, the requirements for input and output data and results);
- a model by the process control process (steps, quality control processes, the results to the professional development requirements);
- tools used in the design.

One example of such technique is the use of a comprehensive approach CDM Advantages, method of project management PJM and CASE-tools Designer / 2000 are as the tool of Oracle.

Review questions

1. What does the decision support information system provide?
2. What is the main purpose of information systems for office automation?
3. What does the Characteristics of Management Information Systems?
4. Who are the strategic information systems for help?
5. What should be used to reduce the risks and costs of developing an information system?

Chapter 4. Globalization

The general idea of the process of globalization is having in the first place, due to the constant increase in the understanding of various interactions and relationships in the world. This international co-operation in production processes, development and implementation of scientific and technological achievements, it is the intensification and information activities in all areas, and the impact of individual countries on the ecology of entire regions of the world. These and other processes require the international community's continued cooperation and even the formation of a unified strategy existence. Analysis of the overall picture of this process leads us to the realization that there is a continuous formation of a single world, a single social system of humanity on Earth, there is a transition from a bipolar to a unipolar world, which is characterized in the literature by the term globalization.

Figure 4.1 The Effect Of Globalization On National Economies And Business

(from https://www.linkedin.com/pulse/effect-globalization-national-economies-business-stamatis-alamaniotis)

Currently, globalization of the economy is one of the most important global trends. The interdependence of regional economies extremely increased in comparison with the previous process - integration. This trend is associated with the inevitable formation of a new information-economic space where the branch structure, a technology and information sharing, as well as the geography of

distribution of productive forces are determined taking into account the international situation, and the economic ups and downs become planetary scale.

The increasing globalization of economic processes is reflected in a sharp and steady increase in the rate and extent of movement of capital, exceeding the growth rate of international trade compared with the dynamics of the gross domestic production, formation and development of working around the clock in real-time global financial markets. Over the past decade, information systems and technology immeasurably increased the ability of financial capital to a rather rapid movement (which includes, inter alia, the capacity to destroy the seemingly stable economic systems).

Thus, the globalization of the economy is a complex contradictory process. On the one hand, globalization has greatly simplifies economic cooperation between the two countries creates good conditions for accessing the various states to the latest achievements of mankind, provides all-round economy of resources, stimulates the progress of mankind. On the other hand, globalization brings with it negative consequences, such as loss of their resources and the decline in living standards in underdeveloped countries, the gradual, but steady destruction of small and medium-sized businesses, etc. Therefore, among the challenges facing the international community is access to the fruits of globalization to the largest number of countries.

The most important trend in the development of civilization in the 21st century will surely be the most powerful process of ever-increasing globalization of society, due, above all, the globalization of the world information space, which is the result of intensive development and mass dissemination of new information tools and technologies rapidly transformed.

Innovative tools and technologies more widely and deeply penetrate into all areas of human activity that radically alters the standard way of life and professional activity of people in different countries around the world. This creates a fundamentally new, unprecedented in the history of mankind possible. However, a previously unknown human problems change patterns of behavior and ways of life of the society.

In fact, before our eyes there is a global information revolution, which will result in the transition of mankind to a qualitatively new level of development - the global information society, universal information space. Only the study of the latest information technologies can provide an answer to the question of what the consequences for the person can lead the further development of these trends.

Information aspect of economic globalization includes:

- the emergence of a fundamentally new markets, transport, banking and insurance services, as well as new financial markets, operating around the clock using the latest information technologies and tools;
- the emergence of new subjects of international interaction - multinational corporations, the World Trade Organization, the international network of non-governmental organizations;
- avalanche distribution and rapid obsolescence of information.

The analysis shows that the most radical changes that will have a decisive influence on the fate of civilization, it will occur in the information sphere. After all, it is the main driving force of human intelligence and erudition, his worldview and value system, which in the conditions of economic globalization evolving significantly. Today, therefore, we can safely say that humanity is at a critical stage of its development, on the verge of some kind of humanitarian revolution, economic and social consequences of which is essential to predict in advance.

We can consider the more fundamentally important trends of economic globalization, which are associated with the development of new information and communication technologies and the formation of a global information space.

One such trend is particularly noticeable manifests itself in recent years, the globalization of individual and especially of social consciousness that will have important implications for the future development of human society.

We single out the following most important factors contributing to the globalization of information space in the aspect of the transformation of public consciousness:

1. The development of the global broadcasting and television systems based on satellite communications, covering the entire surface of the globe. Almost anywhere in the planet today is provided welcome the world's largest television and radio around the clock (passed the most important news, information from the field of economy, science, education and culture).

2. The development of global information and telecommunication systems and networks. The Internet, for example, covers almost the entire globe, meanwhile, the number of users on the network continues to grow steadily.

3. The development and stabilization of telephony, especially mobile. mobile integration with computer networks and telecommunications. The appearance as a result of a fundamentally new integrated tools and technologies for data communications, providing integration of functions on your phone, the Internet, digital TV and video. Rapidly developing and emerging the Internet telephony technology for voice and video messages over the Internet network information paths. With the transition to a digital element base also expanded and standard television receiver function, providing not only receive information from computer networks, but also the transmission of the response of the digital information from its users in the computer network.

The combined effect of these factors creates a new global information space. As the humanitarian consequences of further development of these factors, we note the development of a human constant feeling "connected" to the world information space. Now people do not feel lonely; they quickly find out about all the events taking place in the world and feel ownership for these events. Through the development of advanced information communications virtually every person on the planet there is a very real possibility if they do not affect the socially significant events directly, then at least to express their opinion and attitude towards these events.

It should be noted that the phenomenon of the formation of a global information space is the third stage of globalization of consciousness in the history of mankind.

The first stage of the globalization of consciousness was associated with a trip around the world of Magellan and Columbus, in the first period mankind has realized the limitations of our own, seemingly endless earlier, the planet.

The second stage of the globalization of social consciousness can be attributed to the first manned flight into space, where humanity began to realize how small and fragile our planet, realized the need to protect it.

And finally, the third stage of globalization of consciousness we see today, in the process of purposeful formation of a global information space. At the present stage, the awareness of the mutual dependence of the information of all mankind is regardless of cultural development, racial, religious and political affiliations.

Another important trend is the humanitarian of the full increase in the level of information society sociability. The most important features of the manifestations of this trend are:

- intensification of information communications in the society on the basis of the exchange of information among individuals and across organizations, regions, countries and continents.
- and intensification of informatization of international relations on the basis of broad-based economic, scientific, cultural and educational cooperation.
- round development of the international division of labor and employment, especially in the information sphere.

As the humanitarian consequences of these trends should expect a significant intensification of the intellectual resources of the underdeveloped and developing countries. An interesting and instructive example is India coming out on top place in the world of software development for information technology. Volume developments in the field of offshore programming (software created by a given specification of foreign firms, and the results are sent to the Internet) in India is measured in billions of dollars.

In the intellectual sphere of the global information society and universal information space before the man opened entirely new perspectives and possibilities.

First of all, select increasing the availability of quality education for the general public due to the following main factors.

First and foremost. The development of distance learning technologies is based on the media of computer and telecommunications networks and the development of new ideas and didactic teaching of computer science in particular. Today a number of so-called mega-universities, each of which are trained in various forms over 100 thousand students (without limitation geolocation and age) is in place in the world. However, only a small fraction of students actually

enrolled in the parent universities, and others - in the branches and offices of the universities located in different regions of the world.

Second. The formation of so-called "virtual universities" and "open education" system makes it possible to simultaneously study at several schools or in several departments of the university, which allows to realize in practice, the principles are based on the individual and differentiated approaches to learning. In learning, there is a real opportunity to choose their own individual educational trajectory.

As a result, these new features are to expect a significant increase in the overall level of quality of education and professional competence of the professionals in all sectors of the economy. Already there is an unprecedented expansion of the higher education system, which will result in humanity's transition to a new technological level. Technologies of the 21st century will be knowledge-based so that it is not only to design and build, but also for their effective implementation and widespread use of highly qualified experts required in absolutely all spheres of society. In this regard, the most technologically advanced country in the world (e.g., Japan) is planning to move to a system of public higher education.

The main result of increasing the availability and quality of higher education in the world becomes a general increase in the level of human development and, consequently, the intellectual capital. This intellectual capital is dominant in today's world share in the capital of large companies and corporations, as well as in the national wealth of each state. As a result, the development of research programs specialist at the UN, it was found that the overall structure of wealth, which today has our planet, two-thirds of it is intellectual capital and one-third of all accounts for natural resources and industrial infrastructure together.

Thus, the latest information technologies are currently the most effective means of increasing intelligence and the development of creative abilities of the individual. We are at a critical stage of development of civilization man has created a tool to improve their intelligence, allowing to develop the creative abilities of human - memory, logic, spatial thinking and imagination. Therefore, new intellectual revolution is taking place in the mental sphere of society. Its main results should be:

- increasing the intellectual capital of the world community as the main resource for its further development and prosperity;
- the creation of economic conditions for the practical realization of the creative potential of every individual, which lies in human nature.

This trend of development of information technologies in the modern world as what is happening today, the formation of a new information culture of the society. Define the information culture of society as its ability to generate, organize and use in all areas of all kinds of information resources and modern means of information and communications and information technology in order to ensure proper functioning and development of society. It should be noted the contribution to the formation of information culture of the entire education system. After all, it

gives a person a wide vision, knowledge bases on the science backbone, generates new information in human's abilities, skills and needs, craving for creativity.

It would like at the same time stress that modern information culture is not limited to the skills of human use of computers and telecommunications systems in their daily activities. This concept is much broader. It includes the ability and willingness (desire), people perceive new information, assuming thus the appropriate level of the overall development of the intellect, and the possession of the main languages of international communication, which presents its own information, current scientific, economic and other knowledge, including communicative culture, i.e. the ability to communicate with other people.

Another important trend of modernity is manifested in the formation of a new information lifestyles. The new information space quickly forms new vision in humans, new habits, patterns of behavior, new cultural demands, and even the new values. People quickly use enjoy the benefits and amenities that we provide our information systems and technology to give them seems impossible. And most importantly - no amenities in the home; the new information environment changes not only the human himself and his way of life, but professional work. A typical example is the widespread decline in transport communications and accordingly, the costs for the exchange of information, including meetings, conferences. Modern information and communication technologies allow quite successfully to collaborate on a common project of people, even if they live in different cities or countries, while employees can use the information and technology, housed in a centralized information system and its regional portals. The network economy, network distributed teams, all this have become a reality today, and certainly will evolve in the future. In fact, society comes to the death of such a conservative attribute of any business or organization, as an office, office space becomes unnecessary, the entire organization of life activity can be carried out remotely from the virtual or mobile office. Modern information systems allow not only to abandon the desktop (now every employee, all the documents placed on the desktop of his personal, and even portable, computer), but also to use the virtual office, where the order should not be a man, computer and information system.

Like any development of new technologies, globalization of the economy on the basis of information society bears a single person not only benefit and convenience, but also new challenges. Some of them are global in nature and are beginning to manifest itself today. One of these problems is the formation and deepening of the digital divide between people, countries and regions in the new information society space. These problems have been given attention in the Okinawa Charter on Global Information Society, which was adopted at a meeting of leaders of the "Big Eight". The signatories of this document leaders announced their intention to join forces of their countries, not only in order to build a global information society, but also deal with the information inequality.

The problem of the digital divide is now integrated: global economic, geopolitical and social, as well as cultural-logical. The real possibility or impossibility of using the solid benefits that a person of new information systems

and technologies, informatics tools, depends not only on the level of economic development of a country. To a large extent, this factor depends on the level of education and general culture of the society and the particular individual, human orientation to new information vector direction of development of modern civilization. We have to admit the fact that the issue of the digital divide today are just beginning to attract the attention of economic and political forces, and the scientific community in the coming years, it will only escalate, to address this challenge on a global scale will be necessary to take special measures not only at national, but and at the international level.

Today, the problem is acute and maintenance of information safety of man and society. It acquires new content and includes not only information and computer crime. Many evils are the tools and technologies of influence on mass consciousness (the manipulation of consciousness), which can be carried out through the media and via global computer networks, as well as the problem of the destruction of the traditional national culture under the influence of the globalization of society.

Another danger lurks in the way of the world are increasingly technocratization society which is becoming more prominent in recent years. According to many forecasts, in the XXI century, society will dominate technocracy. Of course, the competent people when the power in the country come to who not only have their own capital, but also are able to do work, produce new products. Here the important thing is not to lose while the humanitarian values of the society, not to allow substitution of these values technocratic.

Dehumanization of society, which is now observed almost everywhere, it is strategically very dangerous. Our world is becoming more dangerous, and high technology that danger not only shoot, but also further reinforce. It is quite appropriate to recall the words of Immanuel Kant: "There are only two things that I cannot help wondering: the starry sky above and the moral law within me." The moral imperative that can serve as a real guarantee safe development of humanity.

The most important trends in the development of modern society, associated with the process of globalization, it will have to give very serious and multifaceted impact on many components of the humanitarian sphere of society. The combination of these actions will be the main content of the new civilizational phenomenon, which is already becoming increasingly manifests itself today and which reasonably can be qualified as a new humanitarian revolution. The development of this revolution can be expected in the next decade of the XXI century. Even today, it is clear that this revolution will lead not only to a radical change in education, science and culture, but also in many ways change the world and people around the world, their relationship to nature, oneself and other people. In the middle of the XXI century, it is likely we will live in a completely different world.

The process of globalization of society can be viewed as a natural reaction of the world civilization to new threats of its future sustainable development. Today, there is a struggle between the two main contradictory trends - increasing

information interconnectedness of different parts of the world community, which, of course, should increase its stability as a complex self-organizing system, and another trend - the destruction of traditional national cultures under the influence of globalization.

The latest trend reduces the cultural diversity of the global community and therefore should be regarded as negative. It reduces civilization resistance to destructive influences. Which of these trends will prevail remains to be seen? However, in any case, today it is quite clear that the main problem of humanity of future will be decided not in the economic or political spheres, and in the sphere of information, which should be in the coming years, the focus of attention in the context of the challenges of sustainable development of civilization.

Thus, the deployment of a global information technology (information and telecommunication) revolution - a revolution in telecommunications facilities based on microelectronics, cybernetics, satellite and digital communication systems, the emergence of a worldwide network "Internet" computer communication (in its historical significance, it is comparable to the invention of printing). This enabled a new, qualitatively higher (global) level of "grip" of national economies and the various economic agents in the global economy, giving the process of reproduction which is really global in nature.

The main areas of information and communication globalization of the 21st century will be:

- the development of global space communication systems;
- the development of personal communication systems and global positioning;
- the creation of global business management systems, industrial processes and household-based information and communication systems;
- computerization and robotics growing number of human life processes.

Review questions

1. What is reflected in the growing globalization of economic processes?
2. What does the information aspect of economic globalization include?
3. Indicate the most important factors that contribute to the globalization of the information space
4. Describe the stages of globalization of consciousness in the history of mankind.
5. Tell us about the problem of the formation and deepening of the digital gap between people.

Chapter 5 Valuing information systems

The practice of creating information systems showed that automation without reengineering of business - processes and upgrading the existing control system does not bring the desired results and is not efficient.

If an automation solution adopted and approved by senior management, the introduction of software modules made with parent companies and divisions, and the process of building a corporate system is much faster and more effective than the introduction of a system initially in grassroots units. Only with the introduction of top-down and active assistance of the guides can be initially correctly assess and carry out all complex of works without incidental charges.

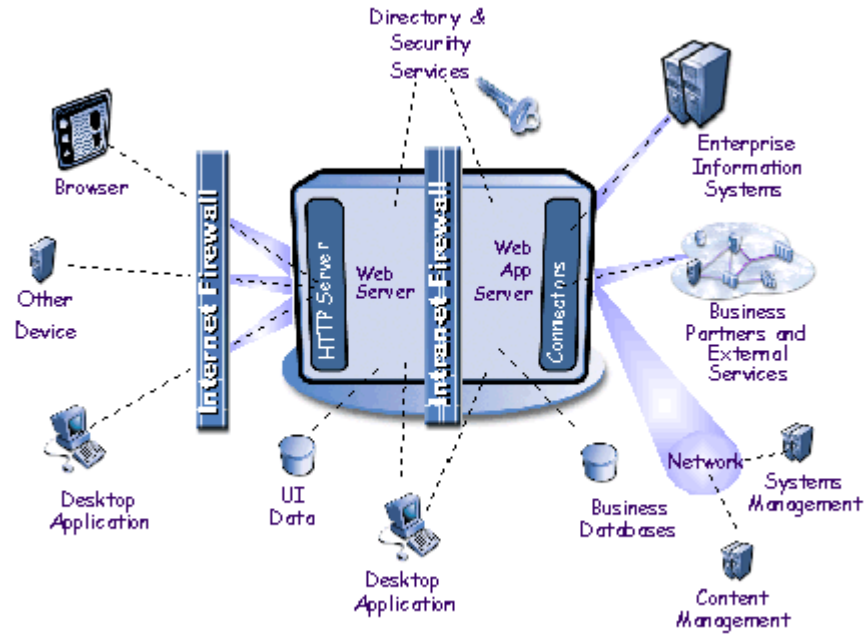


Figure 5.1 The Model of Information Systems

Since the overall automation - a process which involved almost all the structural divisions of the enterprise, the phased introduction of technology is the most preferred. The first objects of automation are those areas in which it is first necessary to establish a process of formation of accounting and reporting documents for the parent bodies and related entities.

When carrying out complex automation company - integrator of changing functions of the department of information technology of the company - customer, and increasing their role in the overall management process.

During implementation of the project department staff with the developers work with data and models (see figure 5.1) to be involved in deciding on the choice of technology and, most importantly, organize interaction solution providers and employees. When operating information system on the shoulders of the automated control system lies with service and support system. The specialists of

the customer are the initiators and executors of the preparation of proposals for the improvement and development of the existing system. This allows them to better adapt it to your needs, so these claims should be thoroughly thought out that information technology is not used there, where you can easily cope with the task management using pen and paper.

The system should support such a scheme of interaction between modules and workstations, which would meet the requirements of the user and technical possibilities. The most important parameters of the information system are reliability, scalability, security, therefore the creation of such systems based on the architecture client - server. This architecture allows you to divide the work between the client and server parts of the system, provides for the development and improvement in accordance with the characteristics of tasks.

The introduction of enterprise management information system is a complex and often painful process. Nevertheless, some of the problems arising from the implementation of the system, well understood, and have a formalized methodology for effective solutions. Early studies of these problems and prepare them greatly facilitate the process of implementation and further enhance the effectiveness of the system.

The first stage of the creation of the system should be carrying out work on pre-screening (consulting). While not described or analyzed all business - processes of the enterprise, not constructed business model "as it is today," not stated valid claims to the new system, not a model of the future system "as it should be" not developed terms of reference can not be considered purchase or the beginning of the development of the system.

The purpose of this pre-work is to develop an understanding of the future system, describe the functional and information model of the future system and defend it in front of the customer. Only then can invest in the purchase or development of the system.

It is necessary to take into account the level of training of specialists, who will work with the application, as well as the purpose of the application. If users have a great experience working with software applications, you can use multi-window interface, pull-down menus, etc.

If we are talking about employees, whose hard "both hands three click buttons", the interface of the system should be as simple as possible, and the sequence of actions - obvious. Similarly, if the mode of use is critical fast data entry, then on the first place there is the convenience of the interface. It makes sense before putting the information system into operation to provide developers with the opportunity to try yourself in the role of end-users.

The problem of software adaptation of automated control system was realized from the start of works on automation of management.

The content and methods of adaptation evolved together with the methodology of creation and implementation of systems. The problem is that each automated production management system is unique, but at the same time are inherent and common, typical properties. Any subsystem software displays both

sides of automated control system. In the technological sense, software adaptation of automated control system - is the transition from the base system, displaying the typical features of the system, to a final solution, adapted for use in the automated control system.

Requirements for adaptation and the complexity of their implementation greatly depend on the area of concern, the system scale, the degree of correlation between the formalized and formalized in solving management problems.

Even the first program solved separately manage tasks created taking into account the need for them in the settings. Since the early acute was the question of providing computing power, the main focus was on setting requirements for RAM, stop mode for solving optimization problems, management of the program to bypass the software modules that are not used in a given calculation.

With the advent of standard solutions in the form of software packages there is a need for special pre-generating procedures. Treatments include parameters that determined the software mode of operation, the requirements for data provision, the terms of connection and use of external programs. Application software packages as the basic systems has led to an increase in the formal part of the enterprise management system. Complicating and adapting systems to the enterprise environment. There were divisions operating software is involved, including the issues and adaptation of software systems. It became evident that adaptation to automated production management system is not only the software and hardware, but also an organizational challenge.

Interactive systems, managers at all levels have made the direct users of computer systems, and have led to a new understanding of the problems of adaptation. The root causes were the same - the ratio between the displacement of a formalized and formalized towards formalizing management processes. The main difficulty was that the formalization affected not only standard, but also the unique functionality in the enterprise management system.

Of the many problems that emerged at this stage of development of automated production management system should focus on two.

The first - the organization of user-friendly interface between the user and computer environment. During the development of control systems in the arsenal of the organization of the interface menu includes various kinds of electronic boards and panels, charts, chart type and Chernoff Ishikawa, graphics and more.

The second difficulty was systematic. The former approach - setting system by consultants with little or no participation of managers - became impossible. It was found that in many cases, ineffective organization of introduction, in which future users first formulate the requirements for the system, taking into account the specifics of the enterprise in all its details, and then set up a system of advisors to the application conditions.

There are several reasons for this inefficiency. Firstly, as a rule, managers - not own practice methodologies of systems analysis. Second, the amount of information concerning the details in the management of the organization on a particular company, is too great. Third, do not always this information is useful

and consultants by virtue of its disposable nature. Fourth, such an arrangement is difficult to realize the principle of the new challenges for implementation of this process would require an additional iteration.

Therefore, methods have been proposed development and implementation of software, which are based on new principles were:

- involving users in the development of systems, including software development;
- software prototyping;
- the combination of the learning process users to work with the base system of development of software prototype.

An example is the approach proposed by Computer Associates in the early 90s for MRPII / ERP-type projects based on CA-CAS system.

Software prototype of automated control system can then be used in the following works:

- when teaching a broader range of personnel;
- when the trial operation;
- with modifications in order to obtain the final version of the software.

This approach has led to a certain extent to solve the management problem of adaptation and dynamics, as employees of the company during the prototyping acquired skills for dealing with the design and modification of the system.

Further development of methods and tools for adaptation of basic systems designed to achieve the following objectives:

- increase the level of automation system design and implementation;
- software configuration management, and continuous system operation at all stages of its life cycle;
- reducing the time changes in the configuration and parameters of the system as the modernization of production and management;
- the combination of standard solutions, proven practices, with decisions depending on the specific conditions of the enterprise.

An example of one of the many means of adapting the basic systems methodology is Orgware, used by BAAN.

Development of an automated production management system in the enterprise can be conducted as a "zero", and on the basis of the Reference Model.

Referential model is a description of the system appearance, functions, organizational structures and processes typical in any sense (industry, type of production, and so on). It reflects the typical features characteristic of a particular class of business. A number of companies - manufacturers of adaptive automated production management system, together with the large consulting firms for a number of years has been developing referential models for various industries. There are similar models for the automotive, aviation and other industries. Each model is a typical design decision, on the basis of which it is possible to build specific projects.

It should be noted that the adaptation and referential models are part of many MRPII / ERP class systems, which can significantly reduce the time of their introduction in the enterprise.

If the disposal of the company there is no referential model, the model level it is necessary to create in the design process as a starting point. On the basis of the original model, then there is the design, specification and detailing the control system. Referential model at the beginning of work on the enterprise management can be a description of the existing system and serve, so the starting point at which begin work to improve the management system.

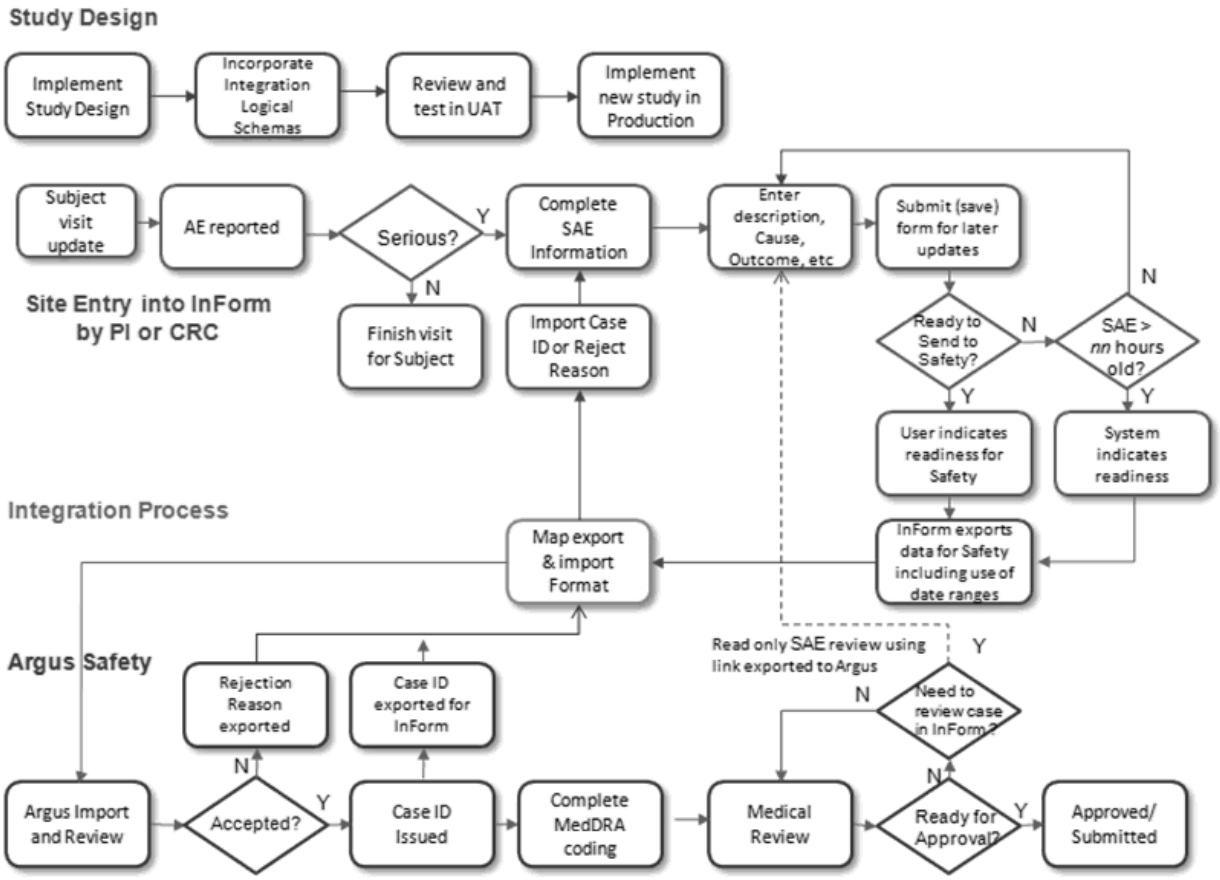


Figure 5.2 The model of designing the system

The process of designing the system may include several phases(see figure 5.2).

The results of the first phase: the borders of the future system of action and conceptual business model that reflects a bigger functional structure of the management and control functions for a bunch of different types of orders through the system.

In the second phase is created and documented repository referential business model. Typically, referential model comprises the following components:

- hierarchy of business functions, which is a top-down hierarchical structure that describes in bigger form the functional structure of the future system. This task may be more embodiments for the lower elements of the structure;
- business process model. This is the deeper model, showing how functions should be realized. Outwardly, they resemble traditional flowchart and describe the sequence of elementary actions that can be performed system, other applications, manual operations, business processes deeper level;
- model organizational structure, which describes the structure of the organization, the relationship between departments and individuals and the roles prescribed by managers.

In the next phase of the project creates a model of the enterprise (Project Model), which is the development and refinement of the functional structure for a particular company. It can be created and bypassing the referential model, but this approach is not effective for complex projects.

The final phase - linking project model to roles, specify the detailed organizational structure of the model, to system functions and facilities. This creates a complex configuration of the software and organizational support, technical means.

Then run trial operation and completion of the system.

As is known, automated control systems (ACS) can be classified according to various criteria.

By type of production:

- discrete automated production management system.
- continuous automated production management system.
- automated control systems for discrete-continuous production.

In terms of performance: automated shop floor management system, production industry.

According to the decision made type: Information system that provides users with a simple background information. Examples of systems of this kind are the famous system of "Siren" or "Express".

Information and advising system that provides the user with various options for solutions to their estimates. Such systems are known as decision support system or expert system.

Management Information System. The output of this system is the result of exposure to the controlled object. Among the most well-known representatives of such systems can be called machines with numerical control, robotics, automated process control system (PCS).

By appointment: Examples of classification systems may be intended for industrial use automated control systems, economic systems, information retrieval systems, etc...

For the upper class, similar to the previous-called high end, are systems that have a high level of economic activity of the enterprise details. Modern versions of these systems provide the planning and management of all resources of the organization and therefore are called ERP-systems (Enterprise Resource Planning).

As a rule, the introduction of such systems are manufactured in the company modeling of existing business processes and configure your system under the requirements of the business. However, a significant redundancy and a large number of configurable system parameters cause a long term its implementation, as well as the need for a special unit at the enterprise or a group of experts who will carry out the migration of the system in accordance with the business process changes.

Currently on the market there is a large selection of high-end systems, and their number is growing every day. It is unlikely that any domestic development can be called of ERP-system, so we are talking only about the foreign software products. A recognized world leader in this area and, of course, the leaders are products of the R / 3 of the SAP, the company WAIPA. WAIPA IV and Oracle Application of Oracle. All of them are quite localized and implemented correctly or successfully implemented in some domestic companies.

At the mention, foreign automated enterprise management systems should be said about the accepted classification of software features that belong to this category. We consider the following options (types of) systems:

- MRPII or ERP-system.
- System configuration.
- Planning systems demand.
- Planning systems.
- Advanced system.
- Supply chain management systems.
- Financial systems.
- Business management and accounting systems.
- Systems of transport planning.
- Warehouse Management Systems.
- Control systems operation.
- Operational planning systems.
- Data management systems.
- Distribution system planning.
- Project management systems.
- Quality Management Systems.
- MES (Manufacturing Execution Systems).

In other words, it is a system that collects and uses the data to optimize production processes, focused on the issue of final goods:

- System performance of the supply chain.
- Control systems.
- entry-level systems.

Entry-level systems cover a limited number of business processes of the organization. Such systems are on everyone's lips, and many small businesses have successfully used them in their daily activities. In the first place, here include accounting systems, personnel systems, storage and trading systems, and the simplest document management system.

Software products of this class are very different from each other for their intended purpose, value, sales and so on. N., But they all have a lot in common.

Historically, many software products developed by small teams of programmers to a specific customer. Upon receipt of an acceptable version of the attempts to sell his creation to someone else, and in the case of the success of this enterprise a small group of programmers was transformed into a small company for the development, promotion and support of its software products.

The number of possible users of entry-level systems ranges from one employee (for example, the chief accountant and head of the personnel department) to a few dozen. This ratio illustrates the evolutionary path that software of this kind took place in the period from the late 80s to late 90s. From the local DOS- or Windows-based applications, they have become a system running a modern industrial DBMS. Overall, however, such systems are less demanding on the resources allocated, allowing them to operate successfully in small enterprises.

At the mention of the entry-level systems often used the term "boxed product". By this is meant that buying a system, such as accounting, the user can install it and start to operate. This is only partly true, as the company - developers are trying to invest in their own software products maximize opportunities that allow them to use a wide variety of plants, which necessitates additional configuration. Furthermore, some entry level systems have the ability to dock with other software of this class, with different manufacturers. All this leads to the fact that the cost of services that would be required under the organization of the system purchase, can range from zero to amounts several times higher than the cost of the "box". In addition, for professionals engaged in the implementation and configuration of the system, often used hourly rates of pay.

The appearance on the market of mid-range systems was due to the needs of the customers get their hands on a tool that would give the opportunity to work with a wider range of tasks. Some of the companies have tried to extend the functionality of their products. In addition, modern methods and means of development allowed to create turnkey solutions that cover a wide range of needs of enterprises in a relatively short time. As a rule, their composition may include the following subsystems: Accounting, Production Management, Procurement and marketing, planning, manufacturing. Moreover, planning and production realized in a very truncated form. However, the undoubted advantage of this class of systems is the ability to keep track of virtually all areas of the company.

Such systems are designed to operate in enterprise networks with a significant number of users. As a rule, they have a file - server or client - server architecture. The cost of automated enterprise management system of this class may vary from a few hundred dollars to tens of thousands of dollars depending on the size of the organization, as well as from the company - the manufacturer and the platform on which the system is implemented.

Due to the fact that middle-class system allows you to keep track of virtually all areas of the company, the number of settings in it reaches a significant number.

When buying such a system should pay attention to the value of not only software licenses, but also services for the implementation of the system. In a typical composition of services, such as typically may include the following:

- analysis of the enterprise (or pre-project survey), which includes the collection of data on typical business - processes of the company, its document management, etc., with the presentation of information in a form understandable for buyer (checking compliance to describe the real situation), and for company professionals - developers, who will in the future to install and configure the system;
- installation and configuration of the system in accordance with the results of the previous stage;
- training users to work with the system;
- sales service on the required dates ("hot line", leaving consultants, software upgrades, and so on. n.).

The introduction of the midrange success largely depends on the quality of performance analysis of the company. This should not underestimate the business leaders at all levels, who have decided to use such a system in their organization.

Many companies are now part of its production and planning capabilities. However, only MRPII or class ERP system allows a fully functional planning for all key business - processes of modern companies (primarily for production). Thus, the market there are high-end systems.

Modern versions of the higher-level systems provide the planning and management of all resources of the organization. In systems of this class contains a description of thousands of business – processes. Indeed, they must have a large redundancy to be used successfully on a wide variety of enterprises. The number of adjustable parameters in this system can reach tens or even hundreds of thousands. Of course, increased and the total cost solutions, with the first place there are the costs associated with implementation. While many companies offering ERP-system, and claimed that the cost of their implementation is equal to or less than the cost of licenses for the system, actually the situation is somewhat more complicated.

Firstly, the accepted papers payment system is not a fixed price for the western companies, and with the hourly wage. Therefore, even if any one of Kazakh companies - integrators involved in the implementation of ERP-systems, and indicates the final cost of implementation, it should always be borne in mind that it may take additional use of external consultants.

Secondly, the introduction of complex systems often requires a reorganization of the activities, and this is, if not direct, significant indirect costs.

Third, for the successful operation of the system in the enterprise requires a unit that would deal with reconfiguration of the system in accordance with business requirements. This includes changes to existing business process models, as well as the creation of new models and advanced training users to work in a new way.

However, the prospect of significant cost should not scare. After all, with the introduction of the ERP-system heads the organization and its staff receive a tool to actually plan and manage production. And in a modern market economy, this may give an undeniable competitive advantage.

In addition, many of the ERP-system allows to dock with the CAD / CAM-systems (computer-aided design - CAD and automated process control systems - SCADA), to provide an integrated solution that combines the processes of development, production and supply.

Most managers manage their company only on the basis of his experience, his intuition, his vision and quite unstructured data about its condition and dynamics. As a rule, if the manager asked to describe in any form of activity of the enterprise structure or a set of provisions on the basis of which it takes management decisions, the case quickly comes to a standstill. Correct assignment of tasks management is an important factor influencing both the success of the enterprise as a whole, and on the success of the automation project. So the first thing to be done to ensure that the project implementation of enterprise management information system was a success - the most formalize all the control loops, which are actually planned to automate. In most cases, for this cannot do without the involvement of professional consultants, but from experience, the cost of consultants is simply not comparable to the losses from a failed automation project.

The need for partial or complete reorganization of the company structure.

Before the implementation of information management system in the enterprise, it is usually necessary to make a partial reorganization of its structure and business technologies. Therefore, one of the most important stages of the project implementation is complete and fair examination of the company in all aspects of its activities. On the basis of the findings obtained in the survey, all further construction scheme of the corporate information system. Sure, you can automate everything on an "as is", but this should not be done for several reasons. The fact that the survey is usually fixed a large number of places of occurrence of unreasonable additional costs, as well as inconsistencies in the organizational structure, the elimination of which would reduce production and logistics costs, as well as significantly reduce the time of execution of the various phases of the main business - processes. You cannot automate the chaos, for automated chaos will result from this. The reorganization can be carried out in a number of local outlets, where it is objectively necessary, it will not cause a significant decline in activity of the current business activities.

The need to change the technology of working with information and business principles

Effectively built information system cannot make changes to an existing planning and control technology as well as process control. One of the most important features for the head of the corporate information systems are modules of management accounting and financial controlling. Now each functional unit can be defined as an accounting center, with an appropriate level of responsibility of its

head. This, in turn, increases the responsibility of each of these leaders and provides the hands of top manager’s effective tools for clear monitoring of performance of individual plans and budgets.

In the presence of enterprise management information system is capable of receiving the head-to-date and reliable information on all sections of the company, without time delays and unnecessary gear units. In addition, the information is fed to the head in a convenient form of "sight" in the absence of human factors, which may be biased or subjective to interpret the information in transit.

However, some managers are not used to make management decisions on the information in its pure form, if it is not attached opinion of the person who delivered it. This approach, in principle, has the right to life and the presence of enterprise management information system, but often it has a negative impact on the objectivity of management.

Implementation of enterprise information management system introduces significant changes in the management of business processes. Each document is displayed in the information field during or completion of a cross-cutting process, the integrated system is created automatically based on the original document, discovered the process. Employees are responsible for this process, only the monitor and, if necessary, make changes to the position of instruments built system.

For example, the customer has placed an order for products that must be fulfilled to a certain number of months. The order is entered into the system, on the basis of its system of automatically created account (based on the existing pricing algorithms), the score is sent to the customer, and the order is sent to the production unit, where the explosion of the ordered product by the individual components. On the basis of the list of components in the module procurement system creates orders for their purchase and production unit accordingly optimizes the production program to the order has been fulfilled exactly on time.

Of course, in real life, different variants fatal disruption of supplies of components, equipment failure, etc., so every stage of execution of the order must be strictly controlled in charge of his circle of employees who, if necessary, should establish administrative impact on the system, to avoid adverse effects or to reduce them. Do not assume that the work in the presence of enterprise management information system will be easier. On the contrary, a substantial reduction in red tape accelerates the process and improves the quality of processing of orders, raises the competitiveness and profitability of the enterprise as a whole, and all of this requires greater discipline, competence and perpetrators. It is possible that the existing production base will not cope with the flow of new orders, and it, too, will need to make organizational and technological reform, which subsequently have a positive impact on the enterprise prosperity.

Resistance to the company's employees. The difficulties most companies are very similar.

This system of Directors longer needed, he even engaged in its implementation. Often, the decision to implement an information system is not the

solution of the company or at least a consolidated solution top - managers and shareholders, and the solution of one of the functional managers, for example, the CFO or Director of Production. In this case, the information system is being introduced for the benefit of the leader is, the majority of top - managers of the enterprise does not take part in the implementation process and as a result, can uniquely evaluate the process itself, and the results of implementation of the system as a whole.

Moreover, often with the introduction of a system of accents can be shifted so that further comprehensive implementation of the work necessary to have made a serious remodel. Examples of such automation meet. The question "Why?" "We had to try to make a wrong to all management realized as it should not hold management automation. But now all the leaders understand the need for personal involvement in the work on the overall automation of enterprises."

It is difficult to say whether such an approach is justified, but also to challenge the implementation of information systems at the enterprise initiators difficult, because otherwise "the company would not have to pay attention to questions of automation." In fact, in the case described in the company's own mistakes are being trained how to properly implement information systems. As a consequence, repeated projects, the company's management has much more accurately understand what purpose wants to achieve as a result of the introduction of the system, what efforts need to arrange for the conduct of the project, which you need to invite professional consultants and how many can actually cost the project implementation of an integrated information management system.

With the introduction of enterprise management information system in most cases, there is resistance to the field staff, which is a serious obstacle for consultants and is fully capable to disrupt or significantly delay the implementation of the project. If the system is not like the staff, it means bad.

Even large enterprises sometimes view lower-level employee (something I do not like, is not suitable, it is inconvenient, the fine print, "all the old system was intuitive," etc.) is quite capable to slow down the implementation of the system.

Company executives often, especially if they do not pay enough attention to the process of implementation, judging the quality of reviews on the staff of the system, whose interests are often at odds with the interests of the head. As a result, instead of achieving optimal management system implementation purposes, considerable time is spent on the adaptation of interfaces, implementation of ergonomic every detail, despite the fact that the real value of such improvements are not present, but significantly affect the budget, and most importantly - the date of introduction. Business executives who decided to automate their businesses, in such cases, should make every effort to promote the responsible group of experts carrying out the implementation of enterprise management information system, to conduct explanatory work with the staff, and, in addition:

- New employees of all levels of a firm sense of the inevitability of the introduction.

- Vest implementation of a project manager with sufficient authority, because the resistance is sometimes (often unconsciously, or as a result of undue ambitions) occurs even at the level of top - managers.

Often difficulties may arise in the very moment when the head suddenly realizes that with the introduction of the system, he falls into a kind of trap: growing awareness that provides a system minimizes the uncertainty of the current production situation and thus limits the possibility of making decisions based solely on the subjective opinions. The new control technology also facilitates the identification of incompetent leadership.

Always reinforce all organizational decisions on the introduction of the publication of the relevant orders and written orders.

During the trial operation, and in the transition to commercial operation of the system for some time is necessary to conduct business, as well as in the new system, and continue to maintain their traditional means (paper document and maintain a system of pre-existing). In this regard, the individual stages of the project implementation of the system may be delayed under the pretext that employees have enough urgent work for its intended purpose, and the development of the system is incidental and distracting task. In such cases, the head of the enterprise, in addition to conducting outreach to evading the development of new technologies by employees should:

- Raise the level of employee motivation to the development of the system in the form of rewards and acknowledgments.
- Take organizational measures to shorten the life of doing things in parallel.

The need for the formation of a qualified group of system implementation and maintenance, the choice of a strong team leader.

Implementation of most of the major enterprise management systems is performed by the following technologies: small (3-6 people) formed a working group in the company, which runs the most complete training to work with the system; then this group falls much of the work to implement the system and its further support. The use of this technology is due to two factors: firstly, the fact that the company is usually interested in the fact that he had on hand were experts who can quickly solve most operational issues when setting up and operation of the system, and secondly, the training of its employees and their use is always much cheaper than outsourcing. Thus, the formation of a strong working group is the key to successful implementation of the project implementation.

A particularly important issue is the choice of the head of the group and the system administrator. The head, in addition to the basic knowledge of computer technology, must have a sound knowledge of business and management. In domestic practice, the introduction of such a role systems, as a rule, plays the chief of MIS department or the equivalent. The basic rules of the organization of the working group are the following principles:

Specialists working group should be prescribed taking into account the following requirements: knowledge of modern computer technologies (and the

desire to develop them in the future), communication skills, responsibility, self-discipline.

With special responsibility to approach the selection and appointment of the administrator of the system, since it is available in almost all corporate information.

Possible dismissal from the group of experts in the process of implementation of the project implementation may negatively affect its results. Therefore, the group members should be selected from a dedicated and reliable employee, and develop a support system of this devotion throughout the project.

Once the staff members of the implementation team, the project manager must clearly paint a circle to solve each of these problems, the form of plans and reports, as well as the length of the reporting period. In the best case, the reporting period shall be one day.

As a result, we can conclude that the overall strategic aim of creating a corporate information system is to improve the manageability, which allows to increase economic efficiency and improve quality indicators of industrial enterprises. Achieving this goal as part of a corporate information system should be implemented through the use of the enterprise of the whole complex of information technology, namely:

- the collection of reliable information;
- operational processing of data about the facts of production and business activities;
- analytical support of managerial decision-making.

The structure of the company it makes sense to plan support for embedded systems division, so that after the trial operation, this chore is not hung on the strong and talented programmers, which it is advisable to direct the realization of new projects. The goal of computer support systems for strategic decision-making is to ensure that senior management direct and free access to information on the key factors that are critical in the implementation of the strategic objectives of the firm.

The introduction of enterprise management information system - how to repair - it is impossible to finish, you can just stop. Since that introduction, in fact, never end, the system must be improved all the time in the course of its commercial operation, along with the progress of information technology and business management methodologies.

Productivity paradox

In the late 80s, Professor Robert Solow MIT discovered a phenomenon, later called productivity paradox. It consisted in the fact that investment in computerization of production on the market as a whole, on the one hand, do not lead to an increase in profit and the improvement of labor productivity (and this is statistically significant!), On the other hand - oddly enough, it leads to more investment in computerization of production.

Statistics - a stubborn thing. According to official data, the cost of computer equipment and software rose from 18.2% in the total share of business - costs in 1987 to a peak of 46.7% in late 2000. Then began a long and steady decline, which took with them some hope for whatever profit on investment in computerization of billions of dollars. To date, it is clear that information technology for the majority of companies are no longer a priority investment in the 1990-s. Get loans for IT - projects today can only theoretically.

Most executives understand the strategic importance of technology. However, they are responsible for the allocation of financial and human resources of an entire corporation across all lines of business. Like all rational thinking people, leaders want to invest in the proposal most likely to return.

Other destinations competing with information technology for a fraction of the budget. As budgetary resources are limited, the representatives of each department set out their arguments in favor of financing their unit. It is difficult to convince a financial expert alone attractive price. Moreover, income departments in most organizations have a greater voice than the support (such as information technology).

The initial investment in computer equipment focused on the automation of routine tasks. Businesses seem an attractive idea to save money on replacing "real" employees, the payment of which is continuously growing, computers, whose value was falling rapidly.

Investments in computerization became very popular way to "spend" the money, despite the fact that technology is rapidly becoming obsolete. The rapid drop in prices for office equipment only adds fuel to the fire. If the prices in January 1993 taken as 100% by the end of 2001, on the mainframe market, prices have fallen to 25.4%, while the PC market - even more, to 5.9%.

The matter seemed very, very effective. Companies computerized workplaces, labor productivity as if it started to grow. However, at the same time it began to increase the danger of mass unemployment, which led to major changes in the labor market. According to official statistics, over the past 20 years the number of professionals and managers has increased by 74%, while the number of office workers of low qualification - only 14%. It meant nothing more than a shift in the economy towards what is called the information (information-based) economy.

In connection with the increase of salaries of computer professionals and the threat of unemployment on the market of office workers quickly became the latest in computer adepts, accumulating the necessary skills and were more highly paid employees. The percentage of payroll spent on maintenance of IT professionals, slowly crept up and reached in 2001 68% of the salary fund. According to rough estimates, the profits from the personal level of automation of routine tasks were, according to official statistics, between 80 and 400 billion dollars per year. And suppliers of computer equipment and software rushed to pro-actively use these figures to justify the need for more investments in IT.

There was only one problem ...

... These 400 billion dollars saved money hardly covered half the money that the corporation would have to spend on something, to serve and to use IT.

For 17 years (from 1983 to 2000) the number of specialists and managers, which was absolutely necessary to employ to ensure the normal operation of IT departments, increased by 17.3 million people. Expenditure on the new professionals has resulted in an additional 84-160% of the wage fund in the form of salaries and bonuses. However, only 6.8 million employees from among the aforementioned 17-odd million were the result of expansion of job offers. The remaining 10.5 million - is already available on the market labor, forced to retrain for work in new conditions.

So, what happened in reality? To work in the office were now needed is not just office workers, computer-literate and office staff that can be controlled with computer hardware and software of increasing complexity. In addition, the professionals needed to service this equipment. In other words, the simple user in the workplace has been replaced by more qualified, who had to pay more, not to mention the fact that it was still necessary to pay for the service fleet of computers.

Those who saw it knew that the promised savings somehow did not develop. Decades of investment in computer technology, initially reinforced the belief that these investments will eliminate the need for labor, on this same faith is not gone. The average cost of IT workers, and its share in the total cost of the enterprise grew faster than in all other sectors. Moreover, it was found that although 90% of IT staff and use computers, many professionals and managers are still not effectively controlled by a computer that was poured slowly into an increase in the amount of time it took to complete a given task, and "appreciation" final product.

Most vividly and eloquently Solow paradox showed the following figures. It turned out that with all the time spent to perform the necessary tasks with the help of computers needed 20 billion. Hours ahead to perform the same tasks, but without computers. And these tasks are now carried out by employees with a salary of about twice as high.

Anyone who has seen the problem and tried to "slow down", and for suppliers of equipment and software to start a «dark» time. In order to somehow justify the cost of IT vendors "rolled" the new slogan, which consisted in the fact that computerization reduces the cost of enterprise assets (corporateassets) due to more efficient and rapid turnover of equipment and inventory and improved models of the use of existing industrial capacity, that supposedly led to an increase ROA (returnonassets).

To see firsthand that the vendors here again "played on the popularity of" and not really understood the essence of the matter, pay attention to the ratio of real assets (netassets, the difference between total assets and debt) for income. In fact, it turns out that the average ratio of real assets to the income increased by 47%, which means that the ROA figures have not improved in any way - just the opposite.

Under the sauce reduce transaction cost.

The next most frequently cited reason for computerization had the computer technology will improve and facilitate communication between employees, on the one hand, leads to a closer and more effective working with customers and suppliers, and on the other - makes it easier to work together (workflow), increases a shared knowledge and simplifies the hierarchical structure of the company. All this, according to vendors, a positive impact on final prices for the products of any company.

In other words, the second trump card IT suppliers, justifying ever-increasing investment in IT has become a game that is called in the economy decline in the value of transaction. The transaction - this is a necessary element in the management of the process of moving goods from suppliers to users. The cost of the transaction is traditionally calculated as the sales value + cost of general and administrative expenses.

However, in this link vendors cunning - the analysis of statistics on indicators "cost + total sales and administrative cost" to the total sales clearly shows this. According to statistics, this figure is not only not declined, but rose by 42% in less than 20 years. This meant that the cost of sales and maintenance personnel have grown faster than sales figures and profits themselves.

Under the intellectual capital sauce.

After that began the next period of the game on the expectations, when the consultants began to feed the market with tales of what computerization will give extraordinary returns from the thus created "intellectual capital» (knowledge capital). Accordingly, the well-paid staff, supported by powerful computers, will create added value and thus somehow cause an increase in profit performance. This stage continues to this day. Remember how many times the last time you heard about knowledge management, decision support systems, data warehouses, and similar things ...

However, not all so bad. Generally speaking, there is little doubt that consumers are greatly benefited from the widespread computerization and automation. Unfortunately, these advantages are especially so far not materialized. Robert Solow paradox, until recently, worked without any noticeable glitches, however, seems to be the paradigm of the time gave a strong bias towards a healthy economy and finance. We may recall in this regard the words of Paul Strassman, "CIOs will now have to pay at least as much time checking and rechecking of economic benefit, how much they spend on promoting technological advantages."

Below is a collection of approaches to IT payback evaluation. Companies can use their own approaches to the determination of the impact of IT, which correspond to their level of investment or the nature of the industry. In any case, the overall picture is made up of three large categories: profitability, productivity and value indices for consumers.

Profitability. This approach is mainly examine the financial measures designed to assess the final result of investment in IT. Consider the most common methods.

Cost-benefit analysis. This method involves the study of the difference between the costs incurred and the profits derived from the investment. Usually costs are defined as the sum of the costs of development of the system, including hardware, software and consulting. Additional costs include training, maintenance, customer support, license payment, future upgrades, and communication with existing systems. Profit - refund to the organization, implemented the system. This is where the snag, as the benefits may not always be expressed in money. It can occur in profitability, productivity or performance values for the user. If the margin is determined relatively easily, the increase in performance, especially valuable indicators for the customer, it is difficult to assess. Organizations considered acceptable a system where profit exceeds expenses.

Return on invested capital (ROI). IT professionals like to show ROI, because it shows the importance of the department of information resources for the organization. Like the cost analysis, the ROI is determined by the total amount of investments and profits, but profits taken for a certain period to determine the percentage of the invested capital.

A simplified example: if a company invests in $ 100,000 and a profit of $ 12,000 per year, the annual STC will be 12%. This STC must be adjusted to reflect the costs for the acquisition of capital and reduce the cost of the system over time.

Performance. Methods for evaluation of performance will vary depending on the nature of work and industry. For example, McDonalds's restaurants an additional monitor connected to the system of cash registers, can improve employee productivity in the kitchen for 30 seconds on each sandwich. To help service personnel increase overall performance could mean three additional call per hour from the searchable database. Jagger FedEx service to quickly deliver the right package to the appropriate address through a computerized sorting system.

Efficiency. In simplified form, performance evaluation allows to correlate results with the resources invested. If the automated system design (CAD) reduces the time to design car parts without the use of additional resources, it will be considered effective.

Quality. Although quality assessment system can be isolated in a separate category, to improve the quality of work, which reduces the time for processing of the product or service, can affect the performance. The production company discover that even if some parts are not strictly conform to the specifications, in the collecting unit, these shortcomings do not show up. Using a model of the detail to determine its suitability, information system simulates its installation during final assembly.

Valuable indicators for the consumer. Often the company, to invest in technology, not observed directly improve profitability and performance, but there is a benefit, and it gets the consumer. The question arises: why do organizations spend money on technology, the benefits of which will get someone else? The

answer is that if the consumer is satisfied, or (even better) depends on the system will increase loyalty. It is easier and cheaper to retain existing customers than to find new ones.

Return on IT: whether to continue investing? So why do companies continue to invest in IT, where there is industry with a predictable return on investment? Because we know many forms of intangible benefits. Companies have realized that employees comfortable position entails loyal¬nost to the company. In many companies, there is now a system of administration of online revenue, where employees can enter their vacation or sick leave hours to check the balance on a flexible payment invoice hospital. Often, organizations are investing in new information systems, to create a positive image in the market, even if the benefit from this get few customers.

If the performance of organizations increases, companies still often give part of the proceeds to its customers in the form of lower prices, expand services or both that, and another. An example is the experimental Wal-Mart directory management system of the company. The question arises: why Wal-Mart is investing in an information system, and ultimately get the same profit as its competitors? This is due to the strategy of Wal-Mart business, aimed at reducing costs, the transfer of savings to consumers and increase revenue through higher sales volumes. Other examples of the continuation of investment is guaranteed, can serve as a struggle for survival in industries with declining profitability. In US hospitals showed a significant fall in profitability from the 1990s, however, they continue to invest in information technology. Hospital managers understand that if they can survive for several years, while other hospitals will be closed, they will have a competitive system. Other reasons for investing in IT are difficult to estimate, if at all possible. When advanced information systems integrated product development process, resulting in a reduction of investment becomes time for excretion of products on the market. Similarly, the return on knowledge management systems can affect the development of new products or reducing the development costs.

The government and businessmen, operating in the field of trade, and invest in information systems with little potential for increasing profitability and productivity of the organization, such as the tracking information associated with AIDS, or the desire to meet the requirements of Commission on Equal Employment Opportunity. The most striking example in the IT capital investments, which is not paid off, the attempt to become the investment in testing information systems in connection with the year 2000 (Y2K). Finally, organizations are investing in software upgrades, as the supplier may not support older versions.

Most people are not too certain about the role of information technology. In his keynote speech at the International Conference on Information Systems Arno Penzias, a former vice president and director of AT & T BellLabs Research Department, Nobel laureate, he told about the research, in which the negative effects of IT have been identified. However, he cited the case when information technologies have played a positive role.

Management of public transport in New York did not need to open a new airport for 2 decades, even as the number of flights has tripled. The reason for this was the increase in productivity due to improved IT. New technologies have played an important role in booking tickets, passenger check-in, customs inspection of baggage, the development schedule of the crews, distribution terminals and runways, and many other applications, to enable the Office to cope with the increase in traffic volumes.

Many just like Arno Penzias, recognize the existence of cases in which IT can become one of the impact of factors, but in general a critical look at the issue.

Why is the issue of return much more relevant today than it ever was? To name a few reasons. In the last few years have seen an unprecedented increase in investment and the application of new technologies. 45% of the capital invested in the United States in information technology. Today, the organization estimated investment in technology as a way of competing, allowing at the same time increase productivity, profitability and quality of work. It became apparent in recent years through a series of articles devoted to the study of information technology payback. Public debate about "IT productivity paradox" has caused a lot of excitement in this area.

Factors contributing to the paradox of IT payback.

Episode evidence. One of the cardinal errors when extracting conclusions from the experience and analysis is the tendency to generalize findings. In other words, when we see a single result, we tend to believe that it is applicable to all cases. We find in the literature on the impact of IT, a lot of regulations in that spirit. In this case, there is a generalization that the implementation of enterprise resource planning (ERP) can be a nightmare, on the basis of a specific example of Hershey's company. The initial implementation of the project ERP vendors candy, calculated at $ 112 million, led to a lot of confusion, including shipment delays and unfulfilled orders. The fact that IBM has reduced the time for delivery of spare parts, from 22 to 3 days, does not guarantee that other ERP implementation can lead to similar results. The main characteristic of this argument is that the individual cases of incorrectly interpreted as a generally applicable. However, when we read about controversial cases, the sense of paradox arises in our minds.

Instant view. All studies payback of IT have a common feature: they studied the question of return at a certain time. It's not so bad if we consider the use of technology and return after a sufficiently long period. In reality, it takes time to assess the full potential of IT. Therefore, to assess the real return on IT is very important, when we begin to study the impact. Many studies have found the profitability of information technology at the end of a significant period of time. The reason for this delay is the fact that during the phase immediately following the introduction, there is a study of the new system and adapting to it. During this period, it is unlikely a significant increase of efficiency of functioning. The actual profit that would be observed at the end of this initial period, there may be a few

days or months, and in some cases - even years, depending on the size and complexity of IT deployment.

Therefore, it is necessary to take into account the aspect of the time delay and assess the profits at the end of a period of study in any of the benefits of information technology. Our own study of the phenomenon of the impact of IT shows that researchers who have tried to track the impact of IT over a longer period of time, have a better chance of determining the real benefits, if any.

Separation of IT effect. Company Protech Solutions - the leader among the providers of application informational basis for manufacturing firms and service industries. The final implementation of the system was a technology that helps to capture and re-use knowledge 10000 Protech employees. Knowledge management - a concept whereby organizations unite, organize and share their knowledge in the area of resources, documentation, and people skills. The introduction took place at great expense and difficulty. The knowledge manager and chief information officer of the company should have to justify the need for the new system to the executive director and managing director. The following presentation of them was able to demonstrate at the operational level, the number of new orders in the last quarter (which was the period of the implementation of knowledge management) turned out to be 35% higher than in the previous one. In general, they also identified that part of the 85% profit increase compared to the same period last year was the result of the introduction of a new information system. The only question is, which cause similar studies in the boards of directors throughout the world: "Is it possible to attribute the increase (or decrease) in efficiency of the IT implementation?"

During the discussion in the company Protech decided that this is likely not the case. IT industry is experiencing a general upswing, and increasing the efficiency of it was attributed to him. Management does not succumb to the argument that it is an information system has raised the level of organization, which was the reason for the significant increase in the efficiency of the quarter.

History Protech typical. The main question that we face - whether it is possible to separate the impact of IT on the efficiency of the company by other factors - competition, the economic cycle and many other context-sensitive questions.

Levels of analysis. Research into the impact of IT held on the levels of the economy, industry and company. different goals were the study of these levels. Consideration of the issue at the level of the economy to determine the overall impact of information technologies on all businesses, without division into a company with high technology and primitive. Analysis at the industry level is useful for assessing trends in the industry in the transformation of IT into business value. A detailed study on the level of the firm allows us to separate the impact of information technology on other factors.

In terms of the results of many studies have observed payback of IT at the level of the economy show a negative relationship between the technology-dependent variables and operation efficiency. However, at the economic level, it is difficult to separate from the company's highly inefficient. It is impossible to

separate the various factors at this level. At the sectoral level, the results are mixed character: some studies show a positive impact of technology investments, while others do not show any advantages of investment in IT.

At a more detailed level - the level of the company - the results indicate a positive relationship between technology and operation efficiency. The trend is manifested in these studies suggests that the higher the level of detail of analysis, the more chances to identify the impact of IT, if any.

The cumulative analysis. One of the reasons that the relationship between technology and productivity seems elusive, is a comprehensive analysis. We consider the organizational level, and the technology is implemented at the process level. This discrepancy makes it difficult to influence the selection of any particular technology.

Recent work in the area of the impact of IT is great importance in the new scheme of studying the issue. It appears concept of "looking from the point of view of the process" to invest in technology. A characteristic feature of this approach is that IT investments are shown in the achievements of the organization only if the intermediate point - assets and effects - are aimed in the right direction. The mere fact that the organization invests in information systems cannot guarantee a tangible impact on the efficiency of the operation. Looking from the perspective of the process suggests that IT spending should be converted to the corresponding information assets. Proper use of these assets leads to the fact that technology is beginning to work. Impact of IT, aimed in the right direction, leading to increased efficiency of the organization functioning.

Additional factors. Another result of the analysis of the payback of IT has been the emergence of the concept of complementarily. This approach assumes that to achieve the maximum benefit from IT investments are necessary not only in them, but the reconstruction of the existing information and process tasks. Barua and his colleagues presented the theory of complementarity value of business assets. In the theory of complementarity activities are complementary, if one of them increases the profitability of the other. One of the arguments based on this theory is the fact that IT investments and reorganization cannot succeed separately from each other. As the technology and business processes are considered as complementary factors to improve the functioning of their effectiveness must be coordinated transformation.

The approach from a process standpoint.

Evaluation payback information technology is often regarded as one of the causes of the productivity paradox. Experts believe that many researchers have used inappropriate methods or influence IT assessment tools. Our own analysis shows that the return on the studies undertaken of high technology applied a wide variety of assessment tools.

Professionals can be divided into two main camps relative to evaluation. The first are those who believe that the return on investment in IT should be judged by

change in the results - sales growth, increased market share and reduce costs. This position is called the approach in terms of changes.

In another approach (“approach in terms of process”) investments in information technology are estimated in the application of IT in achieving the final result. When approaching from the standpoint of process efficiency should be measured at the intermediate stages, such as the creation of the necessary information assets and their impact on business processes up to the impact on the organization as a whole.

The theoretical aspect. The theory of change suggests that in assessing the impact of IT is necessary to determine the conditions that are "necessary" and "sufficient". Prerequisites - these are the conditions necessary to ensure that the results appeared. Sufficient conditions - these are the conditions that explain most of the profits from the changes in IT. Once we have defined the terms of reference are being sought differences in the impact of these changing conditions. For example, when the corporation finances the implementation of the system of electronic data interchange (EDI) and training of personnel, the return determined by the size of net income, and the introduction of EDI systems and training are considered to be two conditions that affect net income.

The theory of change suggests that we study the difference in the amount of net income to expenditure on the implementation of EDI systems and training, and after investing in IT based on other factors (total sales, seasonal changes and general economic conditions), which can also affect the amount of net profit. Most studies have used the theory of change and carried out a statistical study of such changes. In these examples, the approach in terms of changes considering the cost of technology and training as necessary and sufficient conditions that cause the appearance of the difference in net income.

The theory of the process offers to study the process of investment and the sequence of events that lead to a change in net profit. There is speculation that, even though we know the "necessary" conditions (such as the introduction of EDI and training) necessary for generating a profit from IT, you need to make sure that these conditions are "sufficient". Net income may also be affected by changes made to partner organizations to ensure the accuracy of the data used. In other words, the process of IT investment may consist of a number of factors, including unknown or difficult to measure that may facilitate or hinder the identification of a possible return.

Advantages of this approach in terms of changes and processes.

The advantage of the approach in terms of the change is that it is based on statistically accurate methods of assessing the impact of this method also allows you to create a quantitative model to predict the effects of IT investment and expected profit. Quantitative models of the theory of change is set mathematical relationship between the variables and the size of the effect, that is, show how the net profit by increasing the level of investment by 10%. This method is suitable for large-scale studies (e.g., more than 50 points), surveys and economic analysis,

when you want to assess the impact of IT investments on the level of the industry or the economy.

On the other hand, if the object of study is the impact a single company or a small number of organizations is more appropriate approach in terms of the process for carrying out a detailed, based on the specific case analysis. This method allows you to explore the context of the implementation of IT investments, the expected success and other, less obvious factors that can affect the outcome. For example, we know that internal political alliances have an orientation on how to give priority to projects within the organization, and hence the resources necessary for their implementation. Although political pressure not find formal expression, it often affects the fate of initiatives. This can be found out in the study of information assets and the impact of IT on the process level. Unless it is not pre-determined variable approach based on changes lose sight of this "sufficient" condition for payback information technology.

Another advantage of the approach from the standpoint of the process is shown in those cases where little or no gain. Using the approach in terms of changes, we can see that investment has not produced results, but do not understand why it happened, while using the approach in terms of the process; you can find the point of the process in which the error was made.

The approach from the standpoint of the process is also useful for understanding the causes of random spending on information technology. For example, the increased costs of the organization in the field of IT may be an attempt to protect market share or management errors that led to the loss of the market. Considering that changes based on the analysis does not consider the sequence of events, the approach from the standpoint of the process may determine the sequence of events in order to select the appropriate action.

The approach from the point of view of the process: presentation. Marcus Cor and we learned all the differences between the two approaches, and took as a basis the existing schemes, the proposed approach in terms of the process for assessing the profitability of information technology. Based on these findings, they suggested that IT spending in conjunction with the successful management of information assets created, the proper use of which gives a positive result of the action of new technologies. Only after these effects of IT are realized, we can expect profits to the organization. Creation of information assets and their subsequent use should be treated as profits from the transfer of IT to the next stage of the process the value of the organization. However, the impact of investment in high technology in the efficiency of the company depends on the dynamics of the industry and the market position of the organization in the market. For example, due to the competitive nature of the industry, the benefits derived from improved processes and technologies in the production of personal computers, is transferred to the final consumer through lower prices.

The approach from the standpoint of the process opens the "black box" the relationship between investment in information technology and the impact and

allows us to understand the importance of additional investments to ensure the success of IT investments.

We do not claim that by means of an approach in terms of changes it is impossible to examine each of the above steps. If you have a set of effective and consistent evaluation methods approach in terms of the changes can be very effective. However, until we have reached the point at which it is possible to determine what are the additional investment. The approach from the standpoint of the process offers us an effective means of studying the issue of recoupment IT. Model asset-effects Soga and Marcus helps to understand and correctly implement all stages of investment in information technology. Now that we have an idea about the benefits of approaches to IT payback in terms of process and change, it makes sense to consider a scenario in which the approach in terms of the process.

The approach from the point of view of the process: the application.

In the 1990s there was a wave of reorganization of business processes, many companies have invested significant resources in the reconstruction processes and ways of doing business. These reforms have affected different areas - from customer relationship management to order fulfillment, from designing aircraft parts to the dissemination of information within the organization. Examples of the brilliant success of the reorganization of business processes in the field of process improvement can serve as the company FordMotor (improvement of payment system) and CIGNA Corporation (improving customer service and improving product quality while reducing operating costs).

But you can bring as much examples of business process reorganization did not justify expectations. So, the question remains: Does the reorganization brings business processes benefit the organization? In studying this issue, Kohli and Hodl at the Centre in the field of information studies in Baltimore began a study in 1995 in order to understand how organizations evaluate the results of reorganization of business processes. They studied the experience of 200 companies that conducted business process reorganization. However, the study did not achieve its goals. Firstly, companies have different definitions for the reorganization of the business process - from incremental improvements to radical changes in the process, so it was impossible to make a valid comparison. Secondly, expectations regarding the results of business process reengineering varied considerably within organizations, therefore, that the success was the same organization could be considered as another failure. Thirdly, the evaluation system is varied depending on the organizations and processes, from customer satisfaction scores to the return on investment and reduce cycle time. It was clear that the approach in terms of changes will fail in the absence of clearly defined evaluation purposes. Therefore, an approach from the standpoint of process was used herein. three organizations for the study of business process reorganization of the evaluation process were selected.

The results showed that organizations which attention is concentrated on one of the goals - increased productivity, profitability or providing consumer cost - had more chances to observe the benefit from the reorganization of business processes.

Another discovery was that when the company belonged to the restructuring of business processes as a black box, the results have often been based on faith and not on fact. Consequently, firms systematically studied the process of reorganization of business processes, received the expected profit. The third revelation was the fact that the owners of the process sought to maximize the local impact of the reorganization of business processes, not paying enough attention to the overall effect on the company. In some cases, the improvement of the process going on at the expense of another. The approach from the standpoint of the process found cases where assets were created for a significant reorganization of business processes and there is value added to the process level, but the consequences for the organization were minor. For example, a modern system ensures accurate and efficient entry of orders and transfer them to the appropriate department performance. Although the system of registration of orders was significantly improved, the organization is not a lot of benefit from it, because the orders were carried out not in the pipeline mode. Because of this, the fulfillment of orders took more time, as they had to be sorted, and also increased the number of errors.

One of the main difficulties of managing IT in general, and the construction of the standard model of such management in particular, is a relatively "young age" of the problem. Indeed, strange as it sounds today, until the mid-1980s to the managers of large companies (with the exception - firms operating from the IT sector) was not the task of IT management. Companies - manufacturers of the equipment, as a rule, made all the system software, and applications for a significant part of their systems. As a result, it has developed a platform concept - closed complex hardware n software, produced by the same manufacturer and are not compatible with the hardware and software of any other manufacturer. Among the most famous designers of the time platforms - IBM, Burroughs, CDC, DEC. Leading the list was the IBM, and its popularity was so high that in the 1970s there was market IBM-compatible processors, memory and peripherals. Thus, the buyer usually had a choice of a platform and then selecting the required his model (s) within the platform. Moreover, the equipment is generally not sold to customers in the property, and the lease, and the lease agreement entered and obligations of the manufacturer for technical support.

As a consequence, IT management challenge for enterprise client was relatively simple: it consisted in choosing the cheapest solution among those who met the challenges posed to the IP. Of course, "cheap solution" implies not only the low running costs, but also the low cost of increasing processing power in the future, which somewhat complicates the problem of choice. However, control in this area is considerably simplified due to the following reasons:

the number of suppliers, as well as non-compliant or partially compliant standards was small;

- ✓ the high price of computer technology limited its application only the most obvious areas related, usually with prompt access to the large data bases (in

an example, the booking of air tickets or hotel accommodation). This avoids the forecasts of economic efficiency of implementation;

- ✓ provider was responsible for the final result - the performance of the information system as a whole, including hardware and software, peripherals n etc .;
- ✓ due to the wide spread of leasing share of the investment cost was small, it takes the edge off the problem of assessing the return on investment and simplifies the calculation of the financial result of the application of computer technology.

This overall favorable situation for IT management quickly came to naught with the distribution system of the intermediate class (midrange) on the basis of RISC-processors under UNIX operating system, and then the personal computer. As a result of the factors that make it easier to control in this area, in the short term lost meaning:

- ✓ a small number of clearly defined, incompatible with each other platforms has been replaced by the increased number of limited-compatible solutions. On the question of compatibility to replace the clear "yes / no" era came platform limited compatibility, characteristic, for example, for a variety of UNIX dialects;
- ✓ depreciation of computer equipment per unit of power has led to the expansion of the circle of tasks. For new tasks, such as office automation, the effect was not so obvious and demanded a special feasibility study;
- ✓ a single set of hardware and software (mainframe computers), produced and installed at the customer by the same supplier, have been supplemented by cheaper systems on a smaller scale, built on a different technical basis, even if they were produced by the same supplier. The software, network and peripheral equipment for these systems is usually supplied independent producers. Although these changes have led to a sharp reduction in price of information systems, their side effect was the shift of responsibility for the performance of the enterprise information infrastructure as a whole from one to several manufacturers. Each manufacturer responsible for one or more components of the information infrastructure, but the responsibility for operation of the system as a whole has moved to the information service of the customer;
- ✓ the predominant form of distribution of the intermediate class systems and personal computers began to sell in the property, rather than leasing, the former basic form of the realization of universal systems. As a result, costs are not only down, but also moved into the category of investment that has put on the agenda the issue of payback of such investments;
- ✓ reduced the level of decision-making on procurement of information systems. The decision to lease or purchase of mainframe cost from hundreds of thousands to millions of dollars, as a rule, taken at the senior management level, and once the next few years. The decision to purchase the intermediate class systems cost tens of thousands of dollars or personal computers cost

1000-5000 dollars was taken at a much lower level, and the frequency of such decisions has increased dramatically. Meanwhile, every such decision is still to a greater or lesser extent, affect the overall enterprise information infrastructure. Moreover, the above-described plurality of providers and standards led to the fact that it is influenced less predictable. As a result, there is a need develop rules and policies that help to preserve the control of the enterprise information infrastructure with decentralized decision-making.

Thus, new classes of information systems put in front of the enterprise information service several fundamentally new management challenges:

- ✓ support information system performance as a whole;
- ✓ assessment of return on investment in information technology;
- ✓ the development of policies and decision rules that ensure total control of the information infrastructure of the enterprise with decentralized decision in the field of information technology solutions.

These problems in IT management theory came close at the end of the 1980s. Answers to these questions have been fully received by the end of the 1990s.

IT management problems in business today.

The above trends in IT development to develop and deepen during the 1990s. The result has been, on the one hand, the reduction in price of computing power and the associated expansion of the vast scope of the computers in the business, on the other hand - the appearance of a number of IT management problems that did not exist or insignificant until the first half of the 1980-ies.

Two main IT management problems of this period, most can be considered as two sides of the same problem of increasing the return on IT investments. On the one hand, during the 1970-ies – 1980-ies, IT costs have increased several times and reached in the large companies 3% of the budget to the beginning of the 1990s. In companies with intensive information processing, for example in banks, this proportion reached 15%. On the other hand, the return on these investments was much more controversial than ever before. The massive use of personal computers in the business increased employee productivity, but hardly affected the performance of the organization as a whole. At the same time investments in personal computers accounted for half of the IT budget, or 1.5% of the companies budgets. Meanwhile, the range of problems solved on large mainframes, expanded due to problems financial return from which was not nearly as obvious as before. As a result, by 1990, the IT industry has entered a crisis, characterized by a sharp (up to zero or negative) reduction of the impact of IT investments. To overcome the crisis theorists and industry practices have offered a range of solutions in general reducible to the two main areas. The first of these, which can be described as "technical", it is an attempt to find a technical compromise between large mainframes and personal computers. The first was assigned the role of coordinating the business process based on a common corporate database, the second - the role of a friendly interface to access a database. Numerous attempts to

such a compromise, known as «unbundling» (downsizing), consolidation (upsizing), balancing (rightsizing), etc., is rapidly gaining popularity, and just as quickly lost it.

The second direction, which can be described as "reengineering", was aimed at finding a new business model, which allows to take full advantage of new information technologies. The result is a concept of business process reengineering, developed in the classical work of M. Hammer and J. Champy. This trend, which proved much more successful than the first, in turn faced with two obstacles. Firstly, the concept was by no means universal, and reengineering projects - not always successful. Secondly, in case of success of the project of reengineering the bottleneck in the new business process model is represented by IT. New business processes, initially focused on the widespread use of IT, proved to be much more sensitive to disruptions and bottlenecks of IT - infrastructure than had taken place earlier. Thus, business process reengineering, on the one hand, gave a new business model to overcome the crisis of the impact of IT investments, on the other - it revealed weaknesses adopted while IT management processes.

The need for a shift in focus of information systems IT services.

In the 1990-ies, under the auspices of the UK government began a large-scale collection and analysis of best practices organizations IT business processes. This project has received the name of ITIL - IT Infrastructure Library. Fundamentally important point of the project consisted in the selection of successful practical solutions for managing IT - regardless of their compliance with one or another theoretical concept, developed at the time. Initially, the project covers a number of UK companies, but eventually joined by companies from other countries. Results of the analysis are published in a constantly updated library of works (currently includes 10 main and 30 auxiliary volumes), which covers the key business processes of IT, generalizable. Do not attempt to replace or summarize the results of this project, we note among the results obtained some of the most versatile:

1. The main objective of the enterprise information service - maintenance of the existing IT infrastructure. This conclusion may seem trivial, but in reality, is not. The wide spread of personal computers gave rise to an idea of the simplicity of programs for their development. As a result, in the 1980-ies in the West, and often still in Russia, the main objective (or at least one of the main tasks) IS is the immediate satisfaction of users' needs by developing on the basis of productivity applications solutions - from dBase to office Word package / Excel / Access. Practice has shown that the products obtained thus can be used in making the best as prototypes. Applications that automate the processes of the company, should be based on industry - and is usually purchased - solutions.

2. As part of the IT infrastructure maintenance tasks of IS services business unit to meet the needs of business enterprises. By itself, the conclusion is obvious, but the real IS is not always consider it quite consistently.

3. Business units consume no information systems and IT services, i.e. business needs of IT decision means. This business decision evaluates not only provide functionality, but also on the quality of service. The most effective process ensures interoperability giving business units and IS market or quasi-market character. In this case, the volume of services provided to IS business units, fixed in value terms, and payment for services performed from the budgets of the business units. The results for all their external evidence indicate a serious change of information service management model. Faced in the mid-1980s with the need to work together disparate systems, IS are focusing its efforts on building the optimal architecture of the information environment of the company. The object of the control, in this case became information systems, and to control - providing technical possibility of their sharing. As a result, support of business objectives have been tampered with the technical objectives, which led to the return on IT investments fall.

Best practice ITIL IT returns to its original purpose - the business information service. This does not negate the IS activity but the organization of the technical cooperation of heterogeneous systems, in contrast, gives it focused. At the same time on the agenda and put other tasks aimed pa business service improvement. Finally, the solution to all problems of IS fits into the framework of a single consistent model of business processes.

So, the main objects of control in the new model of information systems business processes are IT services. Under the IT service hereinafter refers to a service provided by the information system business unit using IT. IT service has the following parameters:

- ✓ content (or functionality), that is, the composition of tasks and a set of tools to deal with them;
- ✓ availability - the time period during which the IS supports this service, you have promptly removes the problems associated with its use. For example, the availability of 24x7 means that the IS supports this service 24 hours a day, 7 days a week. Availability of 8x5 means that the IS supports the service 5 days a week on weekdays and 8 hours per day, that is, during the working day;
- ✓ level, that is, the period of time during which a guaranteed fix the problem. The level of service is always determined for certain categories of problems - the time to fix a paper jam in the printer may not coincide with the time required to replace the server affected by the fire;
- ✓ performance, i.e. volume specific category of operations per unit time;
- ✓ service price for the business units. Subject to full outsourcing we are talking about the real cost of services otherwise - of the internal settlement prices of the company. Anyway, the effectiveness evaluation of the IS will be more accurate closer to the market price of IS services to business units.

Let's see what it means for the information systems management processes to transition IT services as a control object. The main elements of any management

process are planning, organization of work, control and measurement of results. Consider the role of IT services for these elements.

Planning and Budgeting. Planning and Budgeting Services (instead of information systems) mean that the business brings to the information systems necessary for him options of IT services and information systems ensure the development and maintenance of the relevant services. Information systems in this case act as some of the information systems, along with other resources (staff, budget, etc.), And their development is determined by the plans for the development and maintenance services. In the process of budgeting mapped business requirements to the service and the cost of compliance with these requirements. When the financial outcome of the planned service business determines the revenue stream associated with the use of the service, while information systems determine the flow of the costs associated with its development, implementation and maintenance. The addition of both streams and gives financial result. Projects of development services that meet with the criteria of the enterprise, shall be entered in the budget; other excluded.

The organization works. Services Organization (instead of information systems) leads to several changes. Firstly, the service support - a broader concept than support information system. In particular, when a serious failure that means a switch to an alternative information system to maintain the service operational. Secondly, the same concepts expansion occurs relative to the development of the service. In developing the service psychologically and administratively easier to give up a software and hardware platform for the benefit of another. Third, changes related to changes in the composition and configuration of hardware and software. The need to maintain existing services, enshrined in the rules and processes, information systems, determines much tighter change control procedures than in the case where the object is to control the system.

Monitoring and measurement of results. Necessary business service parameters are the natural basis for the inspection results information service activities. In this case, the activities of information systems is controlled by parameters which are of direct value to the business - users. When monitoring information system parameters, on the other hand, there is a conceptual barrier between the business - the users and staff of information systems: technical parameters of the system is extremely difficult to explain the business - the user, while the user's requirements are not available to employees of information systems. In all these cases, the main control parameters are parameters of services. For this reason, ITIL recommends formalizing the parameters of the IT services provided by the business - users, in the form of a document fixing the parameters of services provided by the information systems business, on the one hand, and the resources provided by the company management information systems to ensure that these parameters, on the other. As this document recommends ITIL Service Level Agreement. Signed at the highest level (preferably the head of the enterprise), it becomes a regulatory framework for all business processes of information systems.

Thus, the basic principle of modern information systems management model - management of IT services. The conceptual model is based on ITIL has provided a project dedicated to collecting and analyzing data on best practice, information systems management in modern companies. The set of ITIL books now provides a kind of "common denominator" of information systems management processes - basic information systems management procedures similar to those in a large number of modern companies. However, ITIL not free from drawbacks. First, the library equipment on the principle of "common denominator" lead to the exclusion of a number of processes and procedures. The reason is that a number of management processes, such as processes of information systems interact with business, by its nature cannot be standardized for most companies. Secondly, the ITIL, as a non-profit project, does not involve the development of software to support its proposed management principles. As a result, major software vendors to manage complex information systems - IBM, Hewlett-Packard, Spectrum - based on ITIL develop their own models of business processes of information systems. From these models, to date, the economic aspect of the most developed in the Hewlett-Packard ITSM model of the company.

Using the methods of investment analysis to assess the payback.

The company's management may pursue different objectives when deciding to invest in information technology. Not all of these goals can be purely economic or even measurable. On the other hand, the end result of the company is making a profit, and all the actions taken, requiring investment, should be tested in terms of what kind of added value they bring to the company. Therefore, it would be logical to consider investments in information technology as well as other assets of the company.

The essence of the investment, in terms of investor (equity owner) is the refusal to make a profit "today" in the name of profit "tomorrow". Operations of this type are similar to the provision of bank loans. Accordingly, for a decision on long-term capital investment is necessary to have information in one degree or another the two fundamental assumptions supporting:

(1) investment must be fully reimbursed;

(2) The profit received as a result of this operation, must be large enough to compensate for the temporary abandonment of the use of funds, as well as the risk that arises due to the uncertainty of the final result.

Thus, the problem of making a decision about investing is to evaluate the plan of the proposed developments in terms of how the content of the plan and the likely consequences of its implementation of the expected results. In the most general sense, the investment project called the plan or program of capital investment with a view to subsequent profit.

Form and content of investment projects can be very diverse. In all cases, however, there is a time lag (delay) between the moment of the beginning of investment and the time when the project starts to make a profit.

The time factor plays a key role in the assessment of the investment project. There are three main phases of project development: pre-investment, investment and operational. The total duration of these stages of life of the project.

The first phase immediately preceding the main volume of investments, in many cases, cannot be determined with sufficient accuracy. At this stage, the project is developed, it is preparing a feasibility study, carried out market research, negotiations with potential investors and project participants.

Also, the legal registration of the project can be carried out here (enterprise registration, registration of contracts, etc.) and conducted issuance of shares and other securities.

As a general rule, at the end of pre-investment phase to be prepared detailed business plan for the investment project. All of the above actions, of course, require not only time but also costs.

The next period of time allotted to the investment stage or phase of implementation. The principal difference between this phase of the project development of the previous and the next phase is, on the one hand, that starts to take actions that require much more costly and wearing already irreversible, and on the other hand, the project has not yet been able to ensure its development through own funds.

At this stage, formed by permanent assets of the company. When implementing investment projects at this stage of the analysis and optimization of business processes, which should optimize the implemented technology.

When implementing investment projects at this stage of the analysis and optimization of business processes, which should optimize the implemented technology.

Since the commissioning of the implemented technology begins the third stage of the investment project - operational phase. This period is characterized by the start of production of products or services, and related income and current expenses.

A significant impact on the overall characteristics of the project will have the duration of the operational phase. Obviously, the farther it will be assigned during the time of its upper boundary, the greater will be the total value of income.

It is important to determine the time at which the project cash flow can no longer be directly linked to the initial investment (the so-called "investment limit"). In the case of information technology, it will be a life full of moral and physical wear and tear.

The general criterion of the duration of the life of the project or the period of use is a significant investment of money incomes caused by them from the point of view of the investor. So, during the banking expertise on the subject of the loan, lifetime of the project will coincide with the term of repayment, and the fate of the lender's investment will not be interested.

As a general rule, to establish terms roughly equivalent has developed in this sector of the economy payback periods or repayment of long-term investments. The increased investment risk conditions, the average duration taken for the

implementation of projects is likely to be lower than in a stable economic environment.

The time value of cash flows.

The main drawback of simple methods for evaluating the effectiveness of investments is to ignore the fact of inequality of identical amounts of receipts or payments related to different periods of time. Understanding and accounting for this fact is essential for the correct evaluation of projects related to long-term investment.

The difference in the current estimate of cash and the same amount of the future may be caused by:

- ✓ the negative impact of inflation, in connection with which there is a decrease in the purchasing power of money;
- ✓ the possibility of alternative investment funds and their reinvestment in the future (the factor for loss of profits);
- ✓ increasing the risk associated with the probability of default of invested funds (the longer the term of the capital, the greater the risk of investment);
- ✓ consumer preferences (better receive less income in the near term than to expect more, but in the long run).

The problem of an adequate assessment of the attractiveness of the project, associated with capital investment, is to determine how future revenues justify the current costs. Since the decision has to take "today", all indicators of future activity of the investment project should be adjusted taking into account the decrease in value (importance) of monetary resources as distancing operations related to their expenditure or receipt. In practice, the adjustment is to bring all the values that characterize the financial side of the project, in the scale of prices, comparable to the existing "today". Operation of such a conversion is called discounting.

Performance Indicators Project.

A discounting method with the largest base can be attributed to the standard methods of analysis of investment projects. In the practice of evaluation, various modifications of them, but the most widely used estimates the net present value of the project (NPV) and internal rate of return (IRR).

Finally, we note that the use of discounted net cash flows allows more correctly, taking into account the time factor, to determine the payback period (PB).

Payback.

The payback period (Payback period, PP, PB) can be determined in different ways. This is the time required to cover the initial investment by the net cash flow generated by the investment project. This is also the duration of the smallest period, after which the current net income in the current or deflated prices become in the future is non-negative. It can be called and the minimum time interval beyond which it becomes an integral effect in the future is non-negative, or period

from which investments and costs associated with the investment project covered by the summary results of its implementation.

Payback period in accordance with the specification on the calculation of the efficiency can be calculated either from the base point in time, either from the start of the investment, or from the date of commissioning of fixed assets of an enterprise. In evaluating the effectiveness, it usually serves only as a limitation.

Discounted payback period.

Discounted payback period (discounted payback period, DPB) - is the length of the smallest period, after which the current net present value becomes in the future is non-negative.

This figure gives a more realistic assessment of the payback period than the RV, provided a correct choice of the discount rate.

Key pieces of information to evaluate the project.

The information necessary to calculate the commercial viability of the project, includes four main blocks. These include is:

- ✓ project revenues;
- ✓ running costs of the project;
- ✓ investment costs of the project;
- ✓ sources and project financing conditions.

Let us consider the structure of the source of information used to assess investment projects.

Features of the definition of income for different types of IT - projects.

The concept of "project revenue" is not always as obvious as it seems at first glance. We can distinguish three types of information technologies for their impact on the company's financial results. These include:

- ✓ the information technology developed for sale;
- ✓ the information technology, optimizing the enterprise and reduce costs;
- ✓ the information technology, enhancing the overall efficiency and competitiveness of the company.

Determine the revenues from the project for information technology of the first type can be most accurately. It is defined circulation implemented software and the cost of a single copy.

The effect on the second group of information systems associated with the savings on individual cost items. With the introduction of these information products, such as accounting systems, inventory management software, ERP-systems articles obtain the effect can be the following:

- ✓ decrease in payroll due to automation;
- ✓ decrease in average inventory levels;
- ✓ decrease in the value of accounts receivable;
- ✓ reducing the time of procurement of raw materials and shipment of products;
- ✓ accelerate the turnover of circulating assets;
- ✓ reduction in scrap rates and so forth.

The introduction of a third type of technology - websites, online stores, financial programs and marketing analysis, of CRM-programs is the effect of the implementation may be associated with the following articles:

- ✓ improve the quality of management decisions (reducing the risk of making wrong decisions);
- ✓ attracting more potential customers;
- ✓ increase in the level of satisfaction and loyalty of existing customers;
- ✓ improve the profitability of each customer;
- ✓ improving control of material, financial and human resources, and so forth.

It is obvious that the precise numerical value for the parameters of the second and especially the third group is more complicated than for the first performance. Therefore, if there is such a possibility, it is better to take into account only the effect of the article on which the data will be the most reliable. If this is not possible, you can use a probabilistic approach, or to evaluate the effect of an expert way.

For a correct account of the project revenues following points should be taken into account.

1. By the results of the project should be attributed only to the analyzed index increase compared to the base value, and not the entire index. This is especially important when considering projects related to cost savings.
2. In determining project revenues should be used earnings growth rather than sales revenue.

Features determine current costs for different types of IT projects.

Block "current expenses" should include information about the costs associated with the use of information products for the entire period of its operation. The composition of these costs fairly constant for all kinds of information products.

1. Costs for maintenance and service information product. Depending on the method of creation, information product can be served on their own organization or with the assistance of developer services.
   In the first case for service are recruited new specialists or expand the powers already taken. The costs will include salaries of new professionals or extra wages for workers, as well as the unified social tax on this amount.
   If the service is engaged in an information product developer (eg, design studio is engaged in the support of the created site), he determines the size of monthly payments. Some developers also sell their software products on the conditions of use, which is necessary to periodically renew for an additional fee.
2. The cost of maintenance of an information product. In addition to the information product, the introduction of the project may include the acquisition or modernization of computer, network or other types of equipment. According to the purchased equipment must take into account the costs of maintenance, repair and renewal.

Features of the definition of investment costs for different types of IT projects.

Block "Investment costs" should contain some form of estimate development costs (acquisition) software and its implementation in the enterprise.

In the case of the introduction of information technology, there are two principal options, including the purchase of ready-made solutions and the development of software and information technology in-house organization.

Depending on the option selected in the development of labor costs (purchase) and implementation of an information product may include the following main components:

Depending on the option selected in the development of labor costs (purchase) and implementation of an information product may include the following main components:

1. Development of automation strategy. This phase includes the definition of the goals, objectives and ways of automation, detection limits. This step is particularly important for large enterprises to provide a systematic approach to automation.
2. Inspection of the enterprise and the formation of technical specifications. Obviously, the development or acquisition of software cannot be made without the need to assess it and determine the requirements for its capabilities. In developing its own means, as a rule, developed detailed terms of reference (TOR), which is the basic document for developers. The cost of this phase should be assessed through a spent man-hour.
3. Re-engineering of business processes. The practice has long proven that automation incorrect, outdated business processes does not lead to the improvement of enterprise performance and to exacerbate its problems. Therefore, today the introduction of information technologies is to build on 80% of new effective schemes of work and 20% - the use of adequate tools in the new conditions. Without going into details, the costs for the re-engineering can be estimated as the cost of labor experts, as a rule, the use of consultants.

4.1. Develop an information product. In this block, you need to clearly define the effort for the development of information products and others related to the current activities of the organization. For example, if the software development department entrusted with ACS, to take into account the entire department the wage fund for the development period as the investment costs - inadmissible, as the department is engaged in parallel and solution of current issues.

4.2. Selection tool. In the event that the company decides to purchase "boxed" product, it is faced with the task of choosing the software that best suits your need for set of criteria -. The price, quality, functionality, integration, etc. This step may include an analysis of materials competing companies, the use of the demo version, consultation with the developers.

5. Implementation of the information product. Not all ready-made solutions can be incorporated into the company's activities on their own. Often it requires a complex installation and configuration, which can be performed only by specialists-selling company. The same applies to the developed software products. The introduction of a new software product is a certain amount of stress for the organization, as it requires prompt change information flows and personnel functions.

   It should be understood that the implementation cost can be comparable to the cost of the starting material. In addition, the duration of the implementation may be several months, which pushes back the time to benefit from the implemented information technologies.
6. Training. This is a necessary step, for maximum efficiency and rapid deployment of information technology is necessary that the company staff was fully aware of the capabilities and features of the new system. phase value is calculated depending on the number of trained personnel and training costs. In the case of life-long learning must also take into account the costs associated with the diversion of personnel from production.

In case of purchase of finished ("box") of the product is necessary to calculate its value. Cost is determined either as a lump sum (for example, the development of the Internet site) or as the product of the number of copies purchased at the price of a single copy. It should be noted that the price of a single copy can vary depending on the number of purchased copies.

In addition to labor costs in the value of investment costs may include the cost of accessories and software. Depending on the extent and frequency with which the company develops its own software products, it may or may not be appropriate development tools (programming tools, database, additional servers, network equipment, etc.). If the need for such instruments originated, they must be taken into account in the investment cost of the project.

In some cases, the introduction of new information technologies required to improve the technical basis (installation network, the acquisition of new servers, improving the parameters of workstations). These costs should also be taken into account in the final evaluation of the effectiveness of the project.

These costs are reflected in the final estimate of the investment costs for the overhead line. If the magnitude of the uncertainty can be overhead in the amount of 40-50% of the effort.

When planning the investment costs must also consider how these costs will be distributed in time. It is necessary for drawing up the schedule of investment and, no less importantly, to determine the start date of the project operational phase.

In the case where the investment phase is less than 1 month, the schedule can be compiled.

Still, the question of how, and how information systems affect the performance, remains open. We should not forget that the consequences of the introduction of new infrastructure technology may be complex and not always predictable. Cannot be complacent on the growing threat of falling prices, the transfer of jobs to qualified technicians in countries with cheap labor and the destruction of traditional competitive advantages. Information systems do not change everything, but they change much. Some changes - for the better, while others - for the worse. But those and others need further careful and objective analysis.

However, not all so bad. Generally speaking, there is little doubt that consumers are greatly benefited from the widespread computerization and automation. Unfortunately, these advantages are especially so far not materialized. We may recall in this regard the words of Paul Strassmann, "CIOs will now have to pay at least as much time checking and rechecking of economic benefit, how much they spend on promoting technological advantages."

Review questions

1. Specify the objectives of developing methods and tools for adapting information systems.
2. What information systemsystems provide planning and management of all resources of the organization?
3. What are the factors contributing to the company's IT payoff paradox?
4. What types of information technology affect the financial results of the company?
5. What tools should be considered in the investment cost of the project?

Chapter 6. Information systems infrastructure

An information system consists of many components, the actual composition can vary due to the specific features requested by the users of the system. Nevertheless, a core part of any information system is the data storage.

The task begins with an overview of the elements comprising modern computer systems. Then selected hardware, software, personnel, and management topics are addressed. Specifically covered there as follows:

- hardware issues and trends;
- software issues and trends;
- collaboration and communication technologies;
- data and knowledge;
- facility;
- services;
- personnel issues and trends;
- partnerships.

Hardware

Key elements of information systems hardware are:

- Input Devices. Used to enter information into a computer.
- Processing Devices. Transform inputs into outputs.
- Output Devices. Deliver information to users in a usable format.

These processing functions correspond closely to the electronic and electromechanical devices that comprise what are collectively referred to computer hardware. Figure 6.1 illustrates the relations among selected hardware devices.

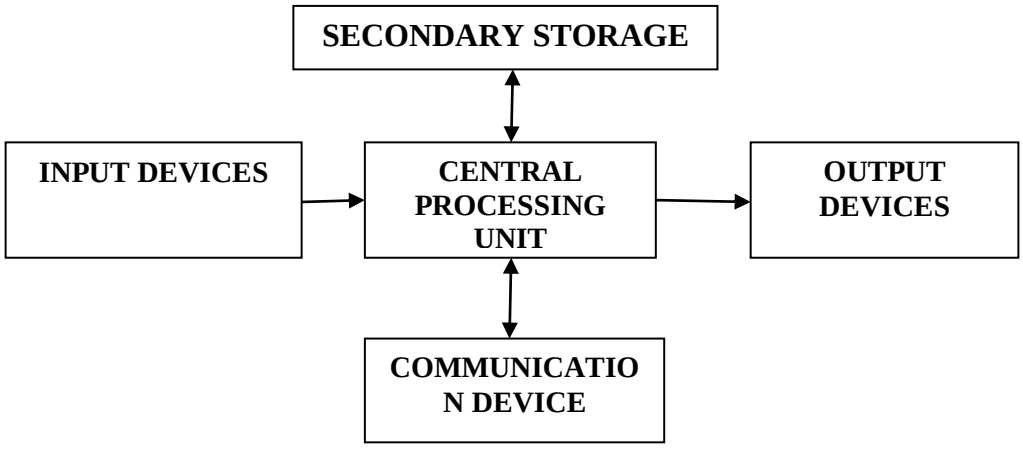


Figure 6.1 Selected hardware devices

An additional basic processing function derives from the desirability that all processing is error free. Some validation activity, thus, is necessary within each processing function.

As noted, that hardware simply permits these processing functions to transpire. For processing to occur, hardware must be directed by software – sets of

instructions generally referred to as programs. Two categories of software are required with modern computer systems. Applications software refers to programs that directly support organizational activities (e.g., a payroll, sales analysis, or inventory control program). Systems software creates information resource environments that enhance the performance capabilities of computer systems and personnel.

Three classifications of computer personnel are typically employed: operations, software development and administrators. Personnel operations refer to those who execute already implemented information systems applications. Normally, this involves manual procedures associated with entering data, disseminating output, readying secondary storage devices, and monitoring the processing units. Software development personnel are those who design, develop, and maintain programs. Administrative personnel refer to those who manage an organization's investment in information resources.

Hardware issues

Central Processing Unit

A large portion of the productivity gains being realized with information resources can be traced to the computer's central processing unit, as it is a purely electronic device. To appreciate the implications of these developments, a brief excursion into the technical realm of the central processing unit is beneficial.

The central processing unit contains three main components: a control unit, an arithmetic-logic unit, and a primary memory. Programs being executed and data being manipulated reside in the primary memory. The arithmetic-logic unit contains circuitry that manipulates data, while the control unit contains circuitry that directs arithmetic-logic unit processing.

Programs are executed one instruction at a time, with each instruction consisting of two segments: an operator code denoting which arithmetic-logic unit circuit is to be activated, and an operand denoting the primary memory locations, termed addresses, holding the data to be manipulated. Program instructions for execution must be in machine language – that is, each operation must correspond to an arithmetic-logic unit circuit. Viewed simply, the execution of a single instruction involves the following steps:

- The instruction to be executed is located into an appropriate control unit storage area.
- Activation of a control unit circuit "decodes" the instruction into its operator and operand segments.
- The control unit readies the appropriate arithmetic-logic unit circuit.
- Needed data items are copied by the control unit from primary memory to appropriate arithmetic-logic unit storage areas.
- The arithmetic-logic unit circuit is activated.
- The manipulated data items are copied by the control unit from the arithmetic-logic unit to their primary memory locations.

Modern central processing units possess a limited number of electronic circuits providing data manipulation capabilities. A computer's instruction set, the operation repertoire available to programmers can be expanded through microcode – instructions permanently maintained in (read only) primary memory – that initiate the predefined, ordered execution of specific arithmetic-logic unit circuits. The computational power of any computer thus depends on the number and versatility of the hardwired circuits in its arithmetic-logic unit and its microcode - instruction set. Larger, more expensive computers have both faster circuitry and more comprehensive instruction sets. It is possible, nonetheless, to perform many information system applications with computer systems possessing quite limited instruction sets – it simply takes longer to accomplish each task.

A second architectural feature worthy of note is a computer's word size, the number of bits that can be referenced as a unit. A bit is a storage area that can represent one of two values, "0" or "1". Typical word sizes are 8, 16 and 32 bits, though larger word sizes also exist. As word size increases, the production costs of a computer increase in a greater-than-linear fashion. Two main advantages, however, accrue with larger word size: higher-precision mathematics and an ability to reference a larger primary memory.

The benefits of the second advantage are subtle. As all data manipulation by a central processing unit involves transfers of program instruction and data to and from primary memory, control unit storage areas must represent the addresses in primary memory of needed program instructions or data. With an 8-bit word, the largest possibly represented address is 256; with a 16-bit word, the largest address is 16,536. Consequently, a computer's word size can severely limit the amount of PM that can be accessed. This, in turn, drastically limits the capabilities of a computer system because only small programs can be loaded into primary memory. Such limitations can be circumvented through hardware or software, but this adds to the complexity and cost of the computer system.

Storage Devices

Storage devices are generally classified as belonging to storage levels: primary, secondary and archival. Primary storage (memory) is normally used to hold data or programs that are regularly exercised and archival to maintain data less regularly or only rarely referenced. Three levels will be explained below. Table 6.1 provides relative comparisons of the performance characteristics of the three storage levels, as well as individual devices. Access time refers to the amount of time required to store or retrieve one piece of data. The cost figure represents the expense of storing one bit of data for one year.

Table 6.1 Characteristics of the three storage levels

Levels	Device	Access Time	Cost per Bit, per Year
Primary storage	High performance Main Low performance	10^{-8} 10^{-7} 10^{-5}	10^{1} 10^{-1} 10^{-2}
Secondary storage	Drum	10^{-2}	10^{-2}

	On-line disk Off-line disk Mass storage On-line tape Off-line type	$5 * 10^{-2}$ 10^{2} 10^{1} $5 * 10^{1}$ 10^{2}	10^{-3} 10^{-5} 10^{-6} 10^{-3} 10^{-6}
Archival storage	Computer output microfilm Laser	10^{1} 10^{-3}	10^{-6} 10^{-7}

With secondary storage devices, two important distinctions are necessary. First, on-line and off-line refer to whether the storage medium, (i.e., the magnetic recording material), is (on-line) or is not (off-line) directly accessible by the central processing unit at a given time. If a tape reel or disk pack is off-line, it must be loaded onto an appropriate read/write unit (i.e., the storage device) prior to being accessed. Second, drums and disks are direct-access devices: any storage location can be immediately accessed. Taper is a sequential device: the tape reel must be searched from its beginning to locate a particular storage location. Mass storage devices (of which there are numerous types) provide a compromise between direct access and sequential devices by providing direct access to a large number of short sequential devices, e.g., ten thousand strips of tape, each a foot long.

Archival storage devices may also be used as secondary storage devices. While it is quite easy to produce computer-output microfilm, it will be currently quite expensive to input data from microfilm to the central processing unit. Consequently, humans must typically read data that has been stored on microfilm. Lasers are used to store data by etching patterns in silicon materials; such etching, however, is irreversible.

Computer systems have been designed with a number of storage levels to meet two conflicting objectives:

- It is desirable to maintain data and program elements on inexpensive storage devices. Generally, however, less expensive devices have low data transfer rates (the speed with which data flow from one device to another).
- Data and program elements are constantly being transmitted between hardware devices. When transmission is between two devices that vary markedly in speed, the faster device must operate at the speed of the slower. To use fast, expensive components at their engineered performance levels, data and program elements should be maintained on fast and hence expensive storage devices.

Two strategies are taken to resolve this conflict. First, extensive use is made of storage hierarchies that minimize speed discrepancies between devices. Just before processing, the tape file is copied onto a disk file. While off-line disk storage is slightly more expensive than off-line tape storage, on-line disk storage is comparable in cost to and faster than on-line tape storage. During processing, data items are brought into the arithmetic-logic unit via a series of transfers: from disk to a low-performance, low-cost form of primary memory; from low-performance primary memory; from main primary memory a high-performance, high-cost or of primary memory; and from the high-performance primary memory to the

arithmetic-logic unit. With the second strategy, rather than require all data processing to be performed in the central processing unit, certain functions (normally set-up or validation activities) are accomplished by using small, limited capability, slower, and less expensive processing units incorporated within other hardware components. As a result, these selected processing functions occur at speeds and costs more compatible with the devices involved, and the central processing unit is used for its particular engineered advantages.

Input Devices

Input devices can be grouped into three performance categories: those used for source data capture (immediate input without human intervention), those used in on-line data entry (immediate input via a human operator), and those used for offline data entry (conversion of input items to a form more amenable to computer processing). As one moves from off-line data entry to on-line data entry to source capture, the timeliness increase in cost, which is often balanced by a capability to handle large volumes of data, thus actually reducing unit cost.

Source data capture devices make use of pattern recognition to interpret original, preprinted and imprinted items. A wide diversity of devices has been developed in response to the varied environmental demands of particular applications. Optical character readers can examine handwritten or preprinted characters, may require that printed characters are written in magnetic ink, and can be fixed or portable, such as wands or light guns. Optical mark readers may examine printed materials (e.g., coded answer sheets or universal product codes) or permanently imprinted items (e.g., badge readers). Developments in computerized speech recognition are making voice input a viable alternative in certain situations, such as those requiring limited vocabularies.

With on-line data entry, a human operator captures the input items and then submits them to computer system through some terminal. Again, a wide variety of devices exist. Possible ways of distinguishing between terminal types include

- primarily input only (such as point-of-sales terminals or key-entry data terminals on a shop floor) versus the human operator being able to receive prompts and responses,
- typewritten versus screen printing,
- graphics or color graphics capability,
- Key-entry versus more “natural” forms such as that made possible by light pens and touch-sensitive screens.

A readily available and inexpensive “terminal” increasingly used is by the touch-tone phone!

Off-line data entry finds a human operator capturing data form a source document and recording it on an intermediary storage medium for later input to a computer system. While the traditional medium of such intermediate storage has been punched cards, most organizations with large data volumes are now using cassettes and diskettes.

Output Devices

Output devices are perhaps best categorized in terms of performance by their interactive. Interactive devices such as terminals or telephones allow for a dialogue between the end-user and the program being executed.

Communications Devices

Data communication is accomplished by linking hardware devices through communication lines and equipment. Communication lines vary in capacity and cost. Narrow-band lines (e.g., teletype) transmit 150-300 bits a second and are relatively inexpensive. Voice-grade lines (e.g., telephone) transmit 4,800-9,600 bits a second and are moderate in cost. Broad-band lines (e.g., microwaves) transmit 19,200-230,400 bits a second and are relatively expensive. As an organization's data volumes increase so that a higher capacity line can be fully utilized, it becomes economically attractive to do so.

Communication lines can be public or private. A public network is available to anyone, whereas a private line is leased for the sole use of one organization. While private lines tend to be of better quality and permit access to be tightly controlled, public lines have the advantage of readily available backup, as well as flexibility and ease of operation. As a general rule, private lines are advantageous when a concentrated terminal population exists at one location and when line activity is high. Many types of subscription plans are available, and all alternatives should be carefully examined in deciding on a line strategy.

Extremely important communications devices encountered when communication networks are being configured by the control units that handle much of the actual processing associated with data communications. Front-end processors (located at the computer end of a communications network) relieve the central processing units of much of the processing required when communicating from remote sites to the computer system. This processing, which might otherwise exhaust a significant amount of a central processing unit's capabilities, is performed with communications-oriented circuitry and hence becomes more cost effective. At remote sites, communication processors are directed toward enabling a number of input/output devices to transmit over a few lines, thus increasing line use and lowering overall communications costs. Examples are concentrators, which enable a cluster of input/output devices to compete for a single line, and multiplexors, which enable a cluster of input/output devices to concurrently share a single line.

Hardware trends

Future improvements in microelectronics are expected to sustain existing trends toward larger performance at less cost. With smaller central processing units gaining increased capabilities, processor specialization will dominate computer architecture – rather than having a single large central processing unit computer, systems will possess a number of small central processing units, and each designed for particular processing functions. As primary storage costs decline, primary

storage may become competitive with most other storage alternatives. When this occurs, information resource costs will decline even more drastically as much software overhead can be eliminated. Increased capabilities of small central processing units will also foster current trends toward developing "intelligent" hardware components.

Secondary storage, input and output devices, as they are electromechanical in nature will not experience the full benefit of microelectronic performance improvements. Nevertheless, gains are expected to occur, particularly with devices designed for minicomputers and microcomputers. Existing hardware support for small computer systems lags behind that large systems, primarily because of the more severe environments allowed and the relatively recent emergence of small systems capable of providing a full range of processing support.

The increasing availability of satellites and conversions to fiber optic lines should greatly expand communications possibilities for all organizations. While cost declines will not be large as those associated with microelectronic equipment, comprehensive communication capabilities will become economically viable for even small organizations. The information services of special importance are – technical literature, consumer industry data, financial/investment data, news services, training aids, etc.-being offered in increasing numbers by telecommunications linkages.

Software issues

Software is the communication medium by which people (end-users, analysts, programmers, etc.) interact with or direct computer hardware for productive purposes. While all processing must ultimately be performed in terms of the specific instruction set of a central processing unit (i.e., the program must be in machine language form), human interaction is typically well cushioned from this inner level of processing.

Applications Software

The ultimate objective with applications software is to support organizational functioning as effectively as possible. This leads three basic requirements:

- design and processing interactions should be performed by individuals who understand organizational functioning,
- the development of applications should occur rapidly so benefits can be quickly realized,
- Applications should not be affected by subsequent hardware expansions or modifications.

It is consequently advantageous for applications software to be written in higher-level language forms.

It will be discussed in depth later, software development tends to be expensive and time consuming. While each organizational context is unique, great similarity exists in the information processing undertaken within all organizations.

Applications such as those related to payroll, accounts payable, and inventory control, for example, are often structured very similarly in quite different organizations. As a result, a great variety of applications packages can be acquired-often with little or no modification-for far less than it would cost to develop an equivalent program from scratch.

The advantages of acquiring, rather than developing, applications software can be significant. Just as important as costs are the following:

- fewer requirements for in-house programmers,
- faster realization of benefits,
- fewer problems, as they have been discovered in previous implementations of the package,
- Likelihood that the program design is better because of the package's specialized designers and developers.

It is not always possible to locate suitable packages: an organization's needs may truly be unique, too much modification of a package may be required to fit it within an organization, or an organization's hardware may not be compatible with available packages. Nonetheless, the advantages of using software packages are so great that these packages should always be considered.

Software Systems

Software systems play two main roles in information system. First, it frees higher-level language (communication) forms from the need to understand the technical details of the hardware devices being employed. Consequently, applications software can be written in a general manner, which is then "translated" via systems software to run on the existing hardware configuration. Second, and more important, software systems can dramatically expand the inherent capabilities of a hardware configuration. Each of these roles will be made clear as the various types of systems software are introduced.

Software Trends

While systems software greatly enhances the capabilities of a computer system, it is expensive and often requires substantial computers resources (e.g., extensive PM as well as high-performance secondary-storage devices). Three interrelated developments, however, make possible the implementation of sophisticated systems software on smaller computers: hardware performance price improvements, improved computer architectures that enable processing functions to be performed quicker while using less memory, and the use of firmware (software instructions permanently stored in primary memory as microcode), which again enables functions to be performed quicker while using less memory.

Quality application packages, often designed for a specific industry segment, are becoming more available. Thus, many organizations can obtain computer-based support without expensive software development efforts. These packages are often "parameterized" so they can be easily customized to meet the particular requirements of an organization.

An opposing trend with application software is the consideration of more complex organizational functions as candidates for computer-based support. Software development costs usually increase in nonlinear fashion with application complexity. Furthermore, these complex applications are often not of a general nature and, hence, are likely not available as a software packages.

Personnel issues and trends

Operations Personnel

Operations personnel typically include computer operators; program/data file librarians, data entry personnel, and their supervisors. With today's sophisticated operating systems, fewer operations personnel are required. This is most evident in smaller computer systems, which often require no operations personnel; employees with clerical skills and minimal training more than adequately "run" the computer.

Software Development Personnel

Software development personnel are those individuals who design and develop software. The general classification commonly employed is: systems analysts, who determine the requirements to be met by a program; system designers, who arrive at hardware/software composites that meet started requirements; and programmers, who design, code, and test sets on program instructions that reflect particular designs. The same individual often performs two or all three of these activities.

The main problem facing the computer industry today is the scarcity of analysts and programmers. Many reasons have been offered to explain this situation, the two most common being that vendors continue to produce more products at lower costs for an ever-widening spectrum of organizations, and that educational programs cannot staff faculties large enough to produce enough computer science of information systems graduates to meet the demand. With the increasing availability of standardized software packages, it is generally believed that the demand for programmers will eventually level off or even decrease. Despite such projections, however, demand remains high. No decline has been forecast for systems analysts, however, as their tasks must be performed, regardless of how software is acquired.

One solution to the scarcity of software development personnel lies in automating the software development process. Considerable effort is currently being devoted toward this end. The day is not too far away when end-users will be able to interact with a computer system to produce most applications software.

Administrative Personnel

Administrative personnel are those individuals who manage an organization's investment in information resources. Two trends have been increasing the number of administrative organizational functions receive computer-based information system support, the scope of the information system functions

necessarily enlarges, requiring more administrative personnel. Second, an increased organizational awareness of the importance of information has resulted in the creation of management roles that focus on defining the scope of information in an organizations, and in elevation in the organizational hierarchy of the chief information executive (with a resulting increase in middle-management positions). Both movements are expected to intensify. Interestingly, many of these administrative positions require individuals whose prime asserts are organizational, thereby permitting much needed cross-fertilization between the information systems function and the rest of the organization.

One decision is whether to provide an in-house computer facility or to make use of a service center.

Service Centers

Some organizations make their computer systems available at a price to others. Such service is termed time-sharing if the system can be accessed from a remote terminal at the client's location; otherwise it is termed a service bureau. Providing the service may be purveyor's main business, or it may be a response to excess computer capacity, such a bank has during the evening or night. The cost often may be lower and contracts simpler when one deals with an organization whose main sources of revenue derive from activities other than providing computer services. The risk exists, however, that the excess capacity may cease to be made available.

Service centers typically provide a full range of computer-related services: access to processors, specific data files, storage devices, input/output devices: application software; programming support; data entry operations; and others. The service center often specializes in a particular industry segment, such as physician or lawyer client-billing, wholesale/retail inventory control, or savings and loan institutions.

Many organizations use service centers. Most savings and loan institution, for example, handle all their information processing in this fashion. Also, many organizations with in-house computer systems use service centers when their internal capabilities are exceeded or for specified, often analytic needs. Some common justifications for using a service center are as follows:

- a first-time computer user is leery of sinking funds into a technology not understood very well,
- an application requires a large amount of computer resources but runs only occasionally,
- a service center already has the required application software,
- a one-time application arises,
- Short-term in-house capabilities are inadequate.

A subtle risk of using a service center is the tendency not to reevaluate the decision. Eventually is might be less expensive to acquire or expand in-house capabilities.

In-house Computer Services

Three basic alternatives are available in obtaining in-house computer capabilities: use of a systems house, employment of a facilities management company, or establishment of an in-house staff of handle the acquisition and provision of information services. Table 6.2 summarizes the advantages and disadvantages of each option.

Table 6.2 In-house Alternatives

Alternative	Advantages	Disadvantages
Systems house	Minimal in-house staffing requires System house personnel evaluate organizational information processing needs and design appropriate computer system	Limited to relatively unsophisticated, common applications Needs assessed by individuals not intimately related with organization Difficulty in evaluating system house recommendation
Facilities management	No recruitment, development, or evaluation of technical staff required Information resource costs known in advance	High cost of facilities management services Technical staff may not be familiar with organization Technical staff not committed to organization
In-house staff	Technical staff more knowledgeable about organization and more committed to organization Information resource 'learning' remains within organization	Recruitment, development, and evaluation of technical staff required.

Systems House

Some vendors provide complete (usually small) computer systems for specific (usually limited) application environments. These vendors deal directly with computer manufactures and acquire or develop software to meet client needs. If much in-house staffing is required by organizations acquiring computer systems through system houses.

System houses can play a valuable role for the new computer user who intends to provide computer-based support for a limited and well-defined set of organizational functions. While most system houses are extremely capable, the naivety of many clients has attracted a few disreputable and incompetent individuals to this segment of the computer industry. All claims should be closely checked and reference of other clients required.

Facilities Management

Facilities management firm completely takes over the management and operation of information resources for its clients. While the technical staffs are employees of the facility management firm, all information resources are the property of client organizations. Many organizations find this an attractive option,

particularly when the organization's investment in computer resources is perceived to be poorly managed by an in-house staff. A common strategy of a facilities management firm is to offer and provide a similar level of service at a lower overall cost than that being experienced by the organization. The disadvantages that accompany facility management services - a loss in internal control over a large investment, the need to expose sensitive information to outsiders, a lack of organizational commitment on the part of computer professionals, and the potential problems encountered when changing back to in-house staffing, etc.-have prevented this alternative from being enthusiastically adopted by many organizations.

Facilities management services tend to be best received in areas where industry information processing needs are standardized or tightly regulated (e.g., hospitals and insurance companies). Such services also seem most appropriate for medium-size firms.

While in-house staffing undoubtedly provides the greatest potential for exploiting the information resource, the problems associated with recruiting, developing, and maintaining a complement technical staff cannot be minimized. The demand for qualified personnel exceeds the supply, particularly when individuals experienced in particular technical or functional areas are needed.

It is possible to maintain a relatively small in-house staff and supplement the capabilities of these individuals through service centers, systems houses, software houses, and consultants. This practice should be encouraged because of the knowledge, objectivity, and "freshness" of outside perspectives. However, as an organization's information system applications become more pervasive and interdependent, the desire to maintain total control over information resources and to internalize the benefits of organizational learning about information resources leads organizations to emphasize in-house servicing.

Service Quality and Partnership

Information technology outsourcing is a service provided by an external vendor that could involve various facets of a firm's information technology development, operations, and management. Marketing literature provides important insight into service evaluation and the nature of buyer-seller relationships. This literature has been reviewed so as to provide an understanding of the implementation of an organization's decision to outsource information system functions.

Service Quality

Behaviors such as willingness to help and trustworthiness are considered in overall service quality evaluation. Because of the imprecise nature of services and the difficulty in assuring consistent quality, service receivers often form ongoing relationships (e.g., partnerships) with service providers. The ongoing relationships are formed in an effort to specify service requirements and desired quality levels are better.

Partnership

Marketing emphasizes the process of buyer-seller interactions as a key feature of exchange. It is possible to model buyer-seller interactions along two principal dimensions-integrative and distributive. Integrative interactions are characterized by cooperative behavior. Buyers and sellers seek ways to achieve mutual objectives while bargaining. Distributive interactions demonstrate competitive behavior motivated by self-gain at the expense of the other party Firms demonstrating integrative behaviors are likely to achieve mutual goals. Thus, integrative interactions can form a base for long-term relationships.

The network/interaction theory of industrial marketing stresses supplier-customer interactive relationships. The network/interaction theory emphasizes a long term perspective for buyers and sellers to establish a smooth working relationship. The need for building relationships, stating that it is necessary to gain understanding of the market structure, then develop strategic relationships with other key companies and people in the markets. They must build relationships with suppliers and distributors, investors and customers. Change in the market can alter prices and technologies, but close relationships can last a lifetime, if not longer.

Review questions

1. What is a core part of any information system?
2. The next action after the selection of hardware, software, personnel, management topics.
3. The main elements of information systems hardware?
4. Classification of storage devices.
5. What do interactive devices such as terminals or telephones allow for?

Chapter 7. The internet and WWW

E-Business

E-commerce is the exchange of goods and (or) services based on existing relationships with the help of electronic means of communication. The concept of "e-commerce" is equivalent to the concept of "e-business".

The growth of goods and services in sales via the Internet (e-commerce) is one of the most notable trends in the development of modern business. More and more companies are considering the World Wide Web as a tool for increasing profits and the acquisition of new customers. Multifunctional, reliable and high-performance information technology solutions need to achieve these goals.

Types of e-commerce: Social commerce (uses a channel of social Internet services and network sales) mobile commerce (providing customers with the possibility of select, order and pay through a mobile device for goods and services).

Business-to-business (B-to-B) refers to a situation where one business makes a commercial transaction with another. This typically occurs when:

- a business is sourcing materials for their production process (e.g. a food manufacturer purchasing salt).
- a business needs the services of another for operational reasons (e.g. a food manufacturer employing an accountancy firm to audit their finances).
- a business re-sells goods and services produced by others (e.g. a retailer buying the end product from the food manufacturer).

B-to-B is often contrasted against business-to-consumer (B-to-C). In B-to-B commerce it is often the case that the parties to the relationship have comparable negotiating power, and even when they don't, each party typically involves professional staff and legal counsel in the negotiation of terms, whereas B-to-C is shaped to a far greater degree by economic implications of information asymmetry.

In most cases, the overall volume of B-to-B transactions is much higher than the volume of B-to-C transactions. The primary reason for this is that in a typical supply chain there will be many B-to-B transactions involving subcomponents or raw materials, and only one B-to-C transaction, specifically sale of the finished product to the end customer. For example, an automobile manufacturer makes several B-to-B transactions such as buying tires, glass for windscreens, and rubber hoses for its vehicles. The final transaction, a finished vehicle sold to the consumer is a single (B-to-C) transaction.

However, in certain cases, for example a toothbrush manufacturer may make lesser B-to-B transactions of raw materials than the number of B-to-C transactions of toothbrush units that are sold.

Internet is a global information system, which elements are connected to each other through (based on the TCP/IP protocol) a single address space providing users access to numerous information and business resources, and e-mail.

Intranet is a distributed corporate network with application software products and Internet technologies, designed to organize the internal information storage and processing. Employee's access are organized through the local network of the organization or protected connections on global networks.

Extranet (Extranet) - a corporate network that is used to deploy enterprise portals, working both with the employees and authorized users of other companies.

E-government (e-government, EG) - a system of new relationships with direct and inverse relationships between the main manage actors which social processes carried out with the help of modern information and communication tools, in order to ensure the constitutional rights and freedoms of citizens, improve the quality of government services to the public and improve the efficiency of public administration.

Web 2.0 Technologies

With the foundation of Web 2.0 technology, a new approach to social networking, i.e. online social networking or social media has emerged and become quite popular. Web 2.0 is "commonly associated with web applications that facilitate interactive information sharing, interoperability, user-centered design, and collaboration on the World Wide Web," allowing users to interact, edit or add to website content. Web 2.0 concept was first used in 2004 to describe as a platform whereby content and applications are not only created and published by users, but instead are always modified by all users in a reciprocally and joint manner. Although Web 2.0 does not signify to any particular technical update of the World Wide Web, there is a group of fundamental operations that are essential for its functioning.

Blogs

Blogs are particularly relevant for examining narrative processes at work within the social utilities offered by Web 2.0. We suggest that agentive processes of structuring and meaning-making are necessary to participate in an inherently unstructured and ill-defined information Web that is the 'blogosphere'. The blogosphere, with its importance in facilitating online communication, arguably enjoys increasing importance in informal, as well as formal, learning contexts. We explore the demands made on the user, whose perspective is core to constructing meaning within this context. Despite syndication tools, blog rolling (recommendations of sites appearing in the sidebar of blogs) and search ability supported by tagging, engagement demands high levels of 'weaving' and 'sorting' – the technologies only become learning tools by acts of meaning-making brought about by the users. While tools like blogs and wikis make possible the 'educational transaction' by collaborative sharing and construction of knowledge across time and space, at the same time, they potentially create barriers around lack of linearity of information presentation, distributed storage across a myriad of locations and resource banks, and lack of indexing and linking as well as systematicity of classification of information. Resources and information are generally much more

ephemeral and less structured, available in nontraditional formats only and presented in adherence to new conventions which pose challenges in relation to their reliability and validity. There is a lack of systematicity by which blogs are indexed and come to readers' attention. One key issue for research, therefore, is that around the potential of the concept of a 'narrative trail' as a means by which users create coherence in Web 2.0 contexts which are ephemeral and distributed. The trail provides a way for users to achieve meaningful encounters with blogs by bringing of systematicity to the wealth of possible choices available. Reading a blog frequently involves following links to further related digital content of a variety of forms. We conceive of the trail as composed of a number of narrative 'nodes', or catalytic moments around clusters of choices for the reader. The nodes conduct a cohesive function, and create the network of engagements with content by which the reader experiences the blog. The narrative trail also provides a way of understanding the conceptual work that goes on, in the meaning-making which takes place around these choices, by which content 'makes sense' according to users' pre-existing schema.

While blogs can include iterative and transactional aspects (by the extent to which individual postings, implicitly or explicitly, relate to others, for example, through hyperlinking and commenting), blogging is a highly heterogeneous practice, and its value as a potentially dialogic one in Wegerif's terms is yet to be understood. Communities are no longer defined by technological platforms and, judging by bloggers' blog rolls, are more loosely defined: while certain blogs and sites appear time and time again in particular topic-based communities and communities of practice, there is also a considerable divergence in the range of blogs linked to and, by implication, regularly read by individual bloggers. At present, we would argue, the criteria that determine what makes blogs iterative, and what does not, as well as what makes individual postings productive as 'teaching texts', their inter- and intra-textuality, is little understood. Research is needed into the ways in which users visualize and realize relationships between individual postings and different blogs into meaningful learning trails which may have dialogic potentials. These are all manifestations of narrative as practice, by which learners engage with Web 2.0 technologies and make sense.

New forms of collaboration

Social networking

Social networking is the practice of expanding the number of one's business and/or social contacts by making connections through individuals, often through social media sites such as Facebook, Twitter, LinkedIn and Google+.

There has been a significant increase in popularity of social networks. It is not surprise that such resources are interested in almost all categories of users, each of which can select the service to his own. Social networks are now used for many purposes, including for the promotion of brands and products.

Social networks such as Vkontakte, Odnoklassniki, Twitter, Facebook and many others make it possible for people to communicate with each other and share

all kinds of data, such as videos, photos and messages. Despite the fact that risks associated with the use of social networking increasing, their popularity is not reducing.

Due to the ever-growing interest in such resources analysts sections like "News of Kazakhstan" and "Internet News" magazine for investors, "Market Leader" versed in the preferences of the people of Kazakhstan are making social networks popular in the country.

"Mail.ru"–the most popular social network in Kazakhstan
A rating of popularity of social networks in Kazakhstan is based on the following criteria:

- evaluation of the frequency of words for the Yandex. Direct per month, calculated using wordstat.yandex.ru service;
- the number of mentions on social networks in the online media in Kazakhstan and electronic media outlets are calculated using the aggregator.

"My world" is the most popular social resource for the residents of Kazakhstan, featuring striking design, simple interface and the ability to easily search for old friends, acquaintances, etc.

Social network "Classmates" is the second popular social network which became a best assistant to find schoolmates, colleagues, and it provides a lot of additional features, exciting apps, videos and audio recordings.

Virtual teams

Virtual team is a group of people who are working together to achieve one (unique) purpose of taking into account the constraints and within a certain life cycle, the project team members are geographically distributed and method of communication between the two is virtual communication (E-mail, Skype, chat, etc..). Virtual team is a group of people who were united to carry out strategic initiatives that use electronic technology to communicate more often personal, live and work in different countries. Virtual is determined by how the team members work and how to interact with each other, rather than those where they are physically located.

Problem in virtual teams are:

- cross-cultural differences
- time zones: the time difference makes it difficult to coordinate
- difficulties in conjunction with strangers
- latent discontent, tension conflict
- avoidance of participation in meetings of the delay timing, misinterpretation
- incorrect perceptions and interpretation statements, findings, problems
- problems with the exchange of information
- communication Difficulties

Trainings:

- how to use virtual means of communication: features, rules and etiquette;
- project management skills (technical competence of the STC);

• team meeting to the project for the training session and teambuilding.

Relations:

• team members are familiar with each other;

• the roles and tasks, responsible for the areas of work;

• communication of the selected channels;

• create a certain atmosphere in commands.

The role of manager:

• the selection of a team of people, distribution of directions;

• training, motivation, positive attitude to what is happening;

• encourage interactions, creating atmosphere of trust;

• consideration of the characteristics and wishes of the participants and virtual teams.

Trust appears to a man who radiates reliability, competence and care for the welfare of others.

Nothing can motivate and retain members in a virtual team, in addition to the existing relationship and atmosphere for work, and most importantly, trust.

Keys of success: Trust (it is impossible to work as a team without trust) Development of Project Team: Tracking conflict, conflict resolution takes longer.

Virtual Marketing

Virtual Marketing is a system of knowledge about the reasonable offers of goods on the market, on the basis of information technologies that integrate marketing activities in the internal and external environment of the enterprise. The use of computer technology allows following advantages for virtual marketing:

- the ability to carry out activities without being tied to a specific territory or a local market;

- providing the possibility of shortening the time to search for partners, the implementation of deals, new product development, etc;

- reducing of transaction costs;

- reduction of time for the development and implementation of the new projection, sound pricing policies, reducing the number of middlemen and selling expenses, and so on.

By the features of the functions Virtual Marketing can be divided into three areas: the study of the environment, the internal organization of marketing activities, the specific areas of activity.

Practical implementation of virtual marketing possible through the creation of a marketing information system of the enterprise, i.e. continuous monitoring, storage and processing of marketing data needed to develop management solutions.

The marketing information system of companies may include:

1) The information unit (database);

2) Bank of models and techniques;

3) Software and integrated systems.

Marketing information unit consists of a database that can be completed by conducting field and desk research. Field studies in the virtual marketing techniques are implemented on the basis of electronic questionnaires and teleconferences. Desk research carried out by searching for secondary information in electronic and paper form. To study the external environment of marketing, apply general statistical and demographic data to assess the state of the market, the prospects for its development, and trends in supply and demand.

The second component of the IIA is necessary to systematize and standardize raw data - the least-researched element. The main reason is lack of qualified specialists in related areas of expertise (marketers - in the field of programming, the programmers - in the field of marketing research).

The third essential component of the information system is data processing means. These include software, expert systems and decision support tools, and a variety of integrated management system, which allows to standards the procedure for adoption of marketing decisions.

Taking the level of development of information technology into account, financial and psychological preparedness of businesses and users, you can select a number of constraints to the development of virtual marketing. The deterrent factor is related to the peculiarities of the information, the terms of its production and processing. Difficulties arise with the formation of the IIA in the enterprise. First of all, there is a subjective factor related to the underestimation of the role of information and information systems in the activities of enterprises. These difficulties are largely objective and will be eliminated gradually, following the dynamics of technological progress.

Crowdsourcing

Crowdsourcing is the process of getting work or funding, usually online, from a crowd of people. The word is a combination of the words 'crowd' and 'outsourcing'. The idea is to take work and outsource it to a crowd of workers.

Famous Example: Wikipedia. Instead of Wikipedia creating an encyclopedia on their own, hiring writers and editors, they gave a crowd the ability to create the information on their own. The most comprehensive encyclopedia this world has ever seen.

Crowdsourcing as a work model, financial model, and business model are here to stay. Leveraging collaborative practices and tools leads to disruptive business implications and transformative innovations. If existing enterprise are not prepared to adapt and embrace this new opportunity, they will be disrupted. Knowledge and understanding of collaborative business practices will be a required skill for C-level suite executives and entrepreneurs.

Review questions

1. The definition for «e-commerce» says?
2. One of the most notable trends in the development of modern business?

3. What goals multifunctional, reliable and high-performance technology solutions need to achieve?
4. What are the main types of e-commerce?
5. Against what business to business e-commerce is often contrasted?

Chapter 8. Security of information systems

Nowadays, information is one of the most powerful and valuable products of human activity. The effectiveness of the organization largely depends on the availability of relevant information, the methodology of its use and the concept of protection of the information system. Threats arise because there are systems and processes, and not because they have any particular their shortcomings, so there is a threat of fire for all facilities regardless of the amount spent on them fire-prevention measures. Threats to security information system may be associated with an employee (the offender), the object (faulty equipment or software) or event (fire, earthquake, landslide, etc.).

Threats information systems

Threats of information processed in information systems depend on the characteristics of the information system, the physical environment, personnel and process information with restricted access.

The main types of security threats to information systems are:

• natural disasters and accidents (flood, earthquake, fire, etc.);

• faults and restore the system (hardware);

• the consequences of design errors, and development of information systems components;

• operating error (users, operators and other personnel);

• deliberate actions of violators and intruders (disgruntled individuals from among the staff, criminals, etc.).

All the many potential threats on the nature of their origin are divided into natural and man-made. Man-made threats are threats to the information system, human-induced hardware and systems. Natural hazards are threats caused by impacts on an information system and its elements of objective physical processes, or spontaneous natural phenomena, which do not depend on the person. Among the man-made threats, based on the motivation of action can be identified on the specified and unpredictable.

The main man-made threats are provided by:

• the physical destruction of the system (by means of an explosion, arson, etc.) or disabling all or some of the most important components of the information system (device carrier system information, individuals from among staff, etc.);

• disabling subsystems ensure the information system (power supply, ventilation, communication lines, etc.);

• action to disorganization of the functioning of the system (changing modes of devices or programs, setting the active interference on the frequency of the system devices, etc.);

Information systems are set of interrelated components that retrieve, process, store and distribute information to support decision making and control in organizations. Information system basically consists of data, hardware, software, procedures and people which are usually developed to support business function.

In the present scenario information systems have become an essential aspect, and an integral part of any business is graduated from being just a tool and information provider to facilitator in effective decision making to help in improving efficiency. Growing dependence of most organizations on their information systems has provided problems such as theft of data, attacks using malicious code, denial of service etc.

Organizations become increasingly dependent on information systems for strategic advantage and operations, the issue of information system security also becomes increasingly important. The information must be protected from harm caused due to threats leading to loss, non-availability, alteration and wrongful disclosure.

Threats include errors and omissions, fraud, accidents and intentional changes. The main goal of information security is to protect the interest of stakeholders by ensuring confidentiality (disclosure of information to the righteous persons), availability (information systems are available and usable) and integrity (information is protected against unauthorized changes). Thus, Information Security is a key aspect of information systems governance.

There are numerous threats to Information Systems:

- Hardware failures
- Software failures
- Upgrade issues
- Disasters
- Malicious intent

Managing security for information assets is a critically important and challenging task. As organizations provide clients with ubiquitous access to information systems, and the frequency and sophistication of security threats grows, the need to provide security assumes more importance. Effective information security management requires security resources deployed on multiple fronts, including attack prevention, vulnerability reduction, and threat deterrence. Using a system dynamics model, this study evaluates alternative security management strategies through an investment and security cost lens, to provide managers guidance for security decisions. The results suggest that investing in security detection tools has a higher pay off than does deterrence investment.

Security of information systems

Security of information systems is a part of broader problem: security of computer systems, or even a more general problem - information security. In this regard, we are going to discuss some of the common approaches to security that will largely apply with regard to information systems. Information as a product that satisfies the specific needs of the subjects that they get through the information systems should have the following properties:

• availability of information - the possibility of a acceptable time to perform a particular operation on the data, or receive the necessary information as it is.

Note, that the data protection from damage is only a special case of protection against violations of access to information.

• integrity of information - this is the relevance and consistency of the stored information. The relevance in this case should be understood as a reflection of the rapid changes occurring in the subject area, in the information-based.

• confidentiality - information security from unauthorized access.

Sometimes there are other properties such as reliability information. Under the reliability of the information, the information storage usually refers to the approximation of its domain, which corresponds to a given data warehouse. The accuracy is not so much subject of information security, as determines the value of stored information. The reliability of the relevant EC supported the organization of work. We can say that the security of information systems is security information and supporting infrastructure from accidental or intentional exposure to natural or artificial nature that may disturb the availability, integrity and confidentiality of information.

Under the protection of information we mean a set of measures aimed at ensuring information security.

Information security, which is based on protecting the availability, integrity and confidentiality of information is often called the CIA model. The reduction comes from the English terms Confidentiality, Integrity, Availability.

Next, we will focus more on all three components of information security threats to these components and how to protect against these threats. With regard to protection against threats, we note that in relation to information systems can talk about the possibilities of most IP data protection and external measures.

Under the threat of information security will be understood by an action or event that could lead to a breach of veracity, integrity or confidentiality of stored, transmitted or processed information. We are talking about protection, not only stored in the database of information, but also information that is transmitted through the communication channels and processed by the software.

Let us define some of the concepts that are often used, when the IP security analysis.

Threat Classification

One possible approach to the classification of threats to information systems was in fact set out in the previous section. Thus threats can be divided into three classes: threats to the availability of information, threatening the integrity of information and threats to information confidentiality. In the following sections, we will elaborate on all three classes of threats. Threats can be divided into those components of IP and its infrastructure on which this threat is aimed directly. In this case, we can speak about a threat directly to the data, the threat of software IP, the threat of system software, the threat of computer hardware and network equipment, etc. Is dividing all threats by their nature leads to the division of information security threats at random and deliberate. Random threats arise independently of the will and desires of the people, although people can be sources

of these threats. Deliberate same threats are always created by people, and their intentional actions.

Finally, the security threats can be divided according to their sources. We can distinguish three groups:

• Natural hazards. Natural hazards are random and are related primarily to the direct physical impact on a computer system or life support systems. The sources of such threats are natural disasters. We can't to prevent such phenomena, but we can anticipate them and reduce their adverse effects to a minimum.

• Technical threats. Technical threat - a threat caused by malfunctions of technical equipment (computers, communications and others) and problems in the software. In the latter case it is necessary to distinguish between problems in the functioning of the software, which is part of the information system and malfunction of the system software (operating system, drivers, networking software). By the same technical and threats include problems in life support systems (buildings, heat, water, etc.). Technical threats can not only anticipate, but negate the possibility of implementing some of them. Timely repair of life-support systems, the presence of uninterruptible power supplies, and even better alternative all this is part of the information security.

• Threats by people. Threats by people can be divided into threats from people working directly with the system (maintenance personnel, programmers, administrators, operators, administrative staff, etc.).

Threats caused by external attackers, including hackers, computer viruses, and others.

In addition to the above features, which can be classified as information security threats, threats can be divided into direct and indirect. Indirect directly threats do not lead to any adverse events in the computer system, but they can be a source of new direct or indirect threats. For example, writing to the disk of the infected computer virus file can only have a chance to cause problems in the operating system. In turn, the problems in the operating system also have a chance to lead to malfunctions in the information system. Knowledge of the possible indirect threats helps to calculate the immediate threats to the information system and improve safety.

Computer security and electronic data processing auditing

As discussed in earlier chapters, information systems provide innumerable opportunities to improve an organization's internal functioning and to enhance its products or services. The information systems also expose organizations to significant risks as they become increasingly dependent on information resources must be recognized as well. Most typically experienced through interrupted operations or a loss of assets, these dangers arise for the following reasons:

• large, complex information systems tend to be fragile, difficult to back up, and difficult to understand.

• large, sophisticated corporate data bases can be accessed by knowledgeable criminals or naive end-users.

• on-line environments permit access to operating applications (which often involve one-step, invisible actions) and do not automatically provide for an audit trail.

• with data files replacing accounting ledgers, Information System specialists, typically not as sensitive as accountants to the need for internal controls, become responsible for the integrity of organizational financial reporting.

Increasing the potential for disaster are the rapid rates of technological change being experienced with information resources and the current shortage of Information System specialists.

Threats to Information System security fall into four broad categories. First, many forms of disasters can destroy equipment facilities, and program or data files. These include natural disasters, fires, power failures, and acts of sabotage (bombing, application of a magnetic field, programmer or operator actions), among others. Not only may such disasters disrupt normal operations, but the cost and time required to recreate program and data files can be exorbitant. Most disaster losses are associated with fires. Computer facilities are typically cramped and full combustible material, and even small fires are accompanied by elements that can cause significant damage to electrical components, such as toxic fumes, smoke, heat, water, and high humidity.

Second, the potential for errors they are associated with data entry, computer operations, programmer mistakes, or hardware–must constantly be faced. Even minor errors may have massive repercussions. For example, an operator error that causes a bank to miss a Reserve collection deadline could prevent the use of hundreds of millions of dollars for a day! Figure 8.1 shows twelve control points that must be checked to detect information processing errors.

Third, the last decade has seen large increases in reported computer crimes. Computer crimes generally fall into two categories: fraud into two categories: fraud (the diversion of financial assets through the manipulation of programs, data files, or input data) and theft (the unauthorized appropriation or use of computer resources, programs, and data files). While all organizations are susceptible to computer crimes, financial institutions have been most vulnerable. The most likely targets in the future, however, are insurance companies, pension funds, investment houses, government agencies, and the many small firms from all industries that are making their initial acquisitions of information resources. Theft of software has proven particularly perplexing, as most “business” software, which can represent a considerable investment, cannot be copyrighted but can be easily copied.

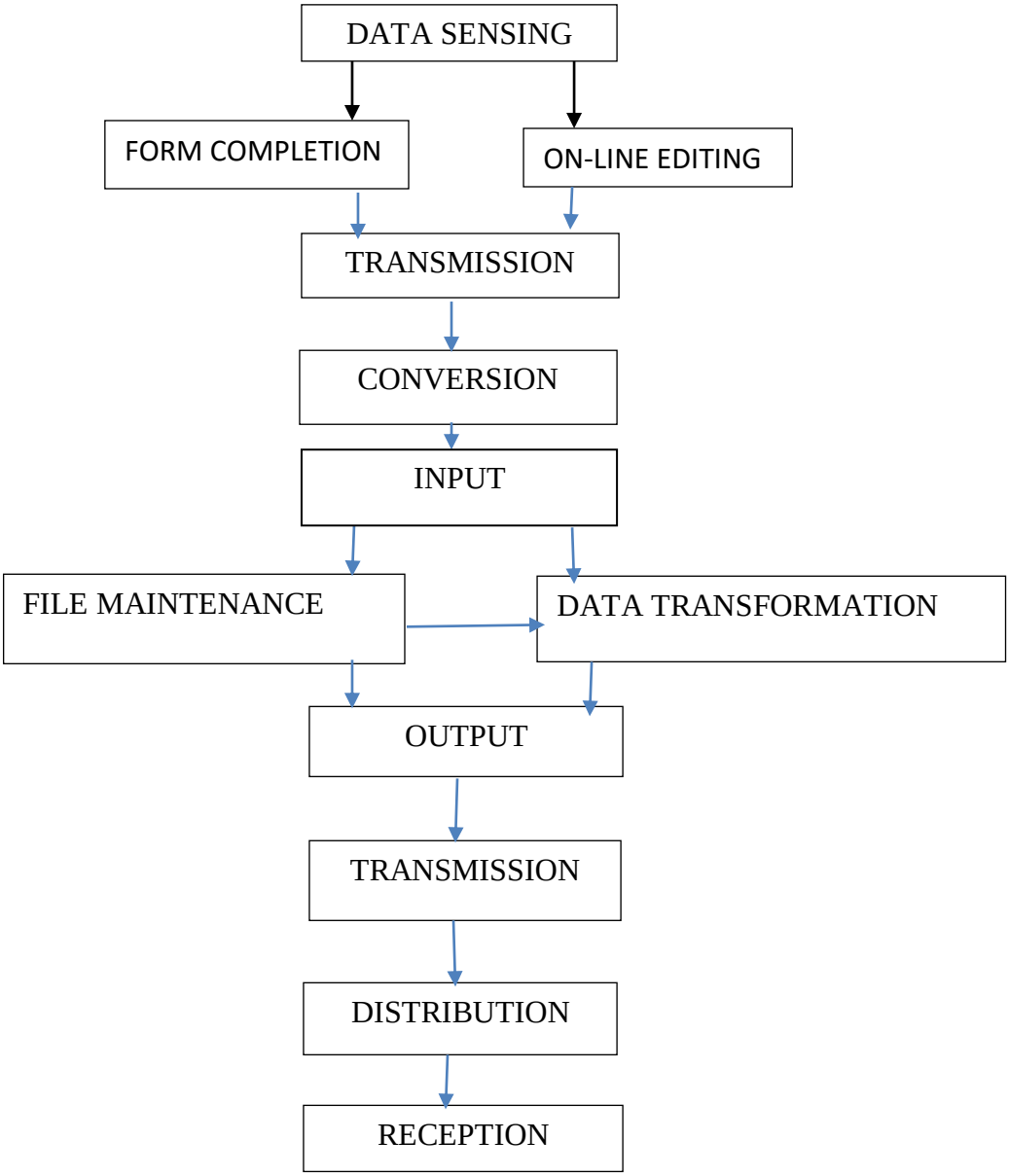


Figure 8.1 Control points of information processing

Finally, information privacy has been recognized as a basic right of a citizen. The act provides for civil remedies and criminal penalties when discrepancies arise with regard to how and under what authority data are stored and used, how data can be disclosed to a third party, and how individuals can gain access to and request corrections in data on themselves. Essentially, an organization collecting data about citizens is borrowing the use of those data and must protect them from misuse. With many states and other nations enacting their own legislation, the threat of class action suits over privacy issues is affecting more and more organizations.

Security Measures

A number of protection or detection mechanisms are available to meet these and related threats. Seven basic categories of security measures are defined in Table 8.1. Physical access to information resources must be limited to individuals whose work requires direct contact. Additionally, information resources must be protected from natural as well as man-made disaster. Hardware failures can be prevented (or their effects minimized) directly through the hardware devices themselves or through a redundancy or fall-back capability built into a configuration.

Table 8.1 Security Mechanisms

Physical	**Hardware**	**Software**
Access to facilities Badges Voice and fingerprints Alarms Site location and construction Fire protection Air conditioning Uninterruptible power supply Insurance	Multiple sites Backup components Duplicate circuitry Read-only memory Self-diagnostic circuitry Preventive maintenance Encryption circuitry	Monitors Logon File access and use Abnormal transactions Shrinkage Errors Volumes Amounts Access schemes Encryption shemes
Operations	**Software development**	**Administrative**
Input-output controls Processing controls Recovery procedures Console interaction Logs Limited Changing access means Keys Passwords Phone numbers Paper shredders Memory and screen blanking	Standards Documentation Change control	Authorization schemes Security classifications Separation of duties Supervision of operations Rotation of personnel Background checks Removal of disgruntled employees

By inserting software modules into systems software (operating systems, data base management system, communications packages, etc.), one can monitor and selectively control access to information resources. However, since software mechanisms are programs, they can be accessed, analyzed, and then circumvented by knowledgeable individuals. The need to keep a tight physical inventory of all program and data files and to back up such files should be clear. If computer operations are not scrutinized for security gaps, they can provide innumerable opportunities for security violations. Attention to security gaps (e.g., passwords or account numbers on printouts placed in trash receptacles or left on unattended screens), along with other mechanisms, can prevent many violations. Software development, if properly controlled, can prevent acts of omission and thwart acts of commission. Finally, administrative procedures provide the first line of defense

against security threats. Many main violations have occurred solely because of inadequate attention to the assignment and supervision of tacks.

While most organizations recognize the need for security mechanisms, organizational responsibility for computer security is often fragmented among information resource, staff, and line management. However, the need to view security as a unified problem is increasingly recognized. Consequently, some organizations have established an independent internal auditing function that judges the adequacy of security and recommends improvements. For such an auditing group to maintain its objectivity, implementation and maintenance of security mechanisms should remain the responsibility of those organizational units that have authority over resources the involved.

Review questions

1. With what threats to security information system may be associated?
2. What does threats of information processed in information system depend on?
3. The main types of security threats to information systems.
4. The meaning of «man-made» threats on the nature.
5. What are the basic components of information system?

Chapter 9. Business Intelligence.

9.1.Organizational decision making, functions and levels

Originally a term coined by the Gartner Group in 1993, Business Intelligence is a broad range of software and solutions aimed at collection, consolidation, analysis and providing access to information that allows users across the business to make better decisions.

Business Intelligence categories:

- Reporting
- Data Mining
- Knowledge Management
- Expert Systems

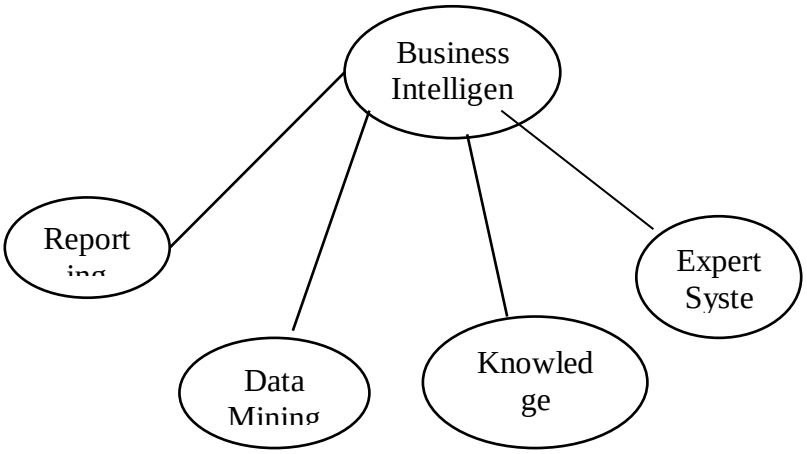


Figure 9.1 Business Intelligence

Business Intelligence refers to skills, processes, technologies, applications and practices used to support decision making.

A popular umbrella term used to describe a set of concepts and methods to improve business decision making by using fact-based support systems. Web search engines are commonly used to locate information for business analysis. They typically produce lists of numerous results upon users' query. Although search engines may put a number of relevant results on top of a long textual list, many relevant results are still buried in the list. Analysts may not be able to summarize all he results visually or to find meaningful subgroups within the entire set of results.

In this chapter the properties and potential of decision support systems are introduced. The chapter begins with a review of some basic notions regarding the decision-making process and how information system might support this process. The decision support systems concept is then explored in depth, after which existing decision support systems and emerging decision support systems trends are discussed. Finally, another category of information system, programmed in decision systems, is discussed briefly.

Regardless of the effort spent designing effective planning and control systems, organizational success ultimately depends on the capabilities of the organizational members-particularly those responsible for critical organizational functions-to competently carry out day-to-day tasks. While in information reporting systems reports may provide invaluable guidance to organizational members handling day-to-day situations, many of these situations do not involve clearly defined, well-structured, pre analyzed issues; today's world simply feels no compulsion to mold itself to the current design of an organization's existing information system.

Organizational members, particularly those filling staff and managerial roles, spend much of their time on short-term, operating decisions: resolving a problem that unexpectedly arises, assessing a suggested alternative to a standard procedure, determining whether a potential opportunity should be explored in depth, and so on. These activities are largely unanticipated and rarely recur. Additionally, they must generally be handled within a relatively short time, sometimes within one hour. Having resolved, they may lead to similar decision situations. Information support of such activities that fails to meet time constraints becomes irrelevant – the organizational member must employ whatever support is available and resolve the situation.

Task characteristics such as those described above apply as well to a number of other key organizational roles. Planners, high-level executives, and boundary-spanners (among others) often find themselves in non-routine, semi-structured situations in which the ability to access or analyze particular information elements can greatly contribute to a rapid, effective resolution of a problem.

The reporting capabilities of information reporting systems lack the scope, timeliness, and flexibility to meet many information needs of these organizational members. What is not needed, is simply more information that could be provided by information reporting system. To support information needs, computer-based systems must provide convenient, easy, and quick access to data bases and analysis tools so decision-makers can "rummage around" to extract and manipulate data base fragments in ways that mesh well with the individuals' normal ways of viewing and resolving decision situations.

Recent technological advances-data base management systems, storage and retrieval of nonnumeric data, telecommunications, microprocessors, experience in producing user-friendly interactive facilities, etc. provide means to support these decision situations by information system. Since a common impetus to the development of such information system is the need to find means to resolve specific decision situations, these forms of organizational support are generally referred to decision support systems.

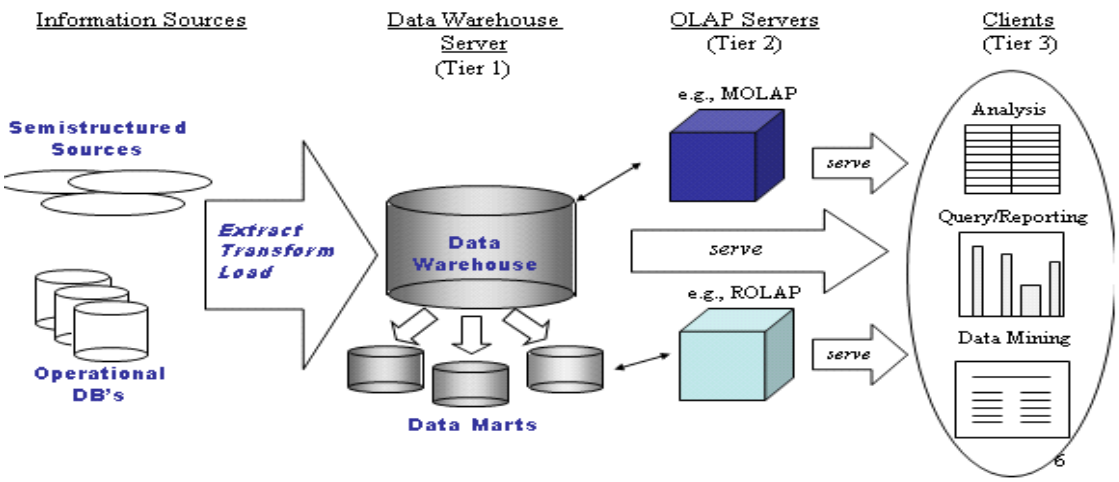


Figure 9.2 Decision support systems

Organizations: functional perspective

An organization can be viewed as a collection of work units, each of which performs functional roles related to organization-wide objectives. Each work unit comprises organizational resources (human, financial, materials, facilities) bound together through a complex of responsibilities reflecting degrees of authority over resources. To understand an organization or organizational segment, it is valuable to identify each functional work unit and to uncover the organizational role(s) performed by each work unit. Once this is accomplished, concern shifts to describing the relationships among work units.

The organizational responsibility centers identified as work units can be characterized along two dimensions: horizontal, or related directly to operations performed by the organization in providing products or services, and vertical, related to the management of organizational resources. The horizontal dimension is representative of what Mintzberg refers to as the operating core. The responsibilities involve mainstream activities, such as securing resources, converting resources into products or services, securing clients or customers, and distributing products or services, as well as supportive activities, such as personnel, maintenance, and administration. Table 9.1 describes common mainstream functions for a variety of organizations to illustrate the universality of this perspective. Supportive activities, such as the need to hire and develop employees, are more generally recognized as being relevant in all organizations.

The vertical dimension includes the hierarchical structures used to facilitate efforts associated with setting objectives, devising plans, allocating resources, directing activities, and evaluating the degree to which plans are attained. Again using Mintzberg's terminology, one can identify three main vertical zones of responsibility: operating managers, who have direct supervisory responsibilities within the operating core.

Table 9.1 Mainstream activities

Activity	Manufacturing	Retail	Banking	Health	Public safety
Marketing	Identifying products Securing orders	Identifying products Securing customers	Identifying service Securing customers	Identifying service Identifying client	Identifying service Handling complaints
Resource acquisition	Purchasing raw materials and produces components	Purchasing retail goods	Purchasing equipment and supplies	Purchasing equipment and supplies	Purchasing equipment and supplies
Operations	Manufacturing	Presenting product	Providing financial treatment	Providing medical treatment	Providing safety services
Distribution	Shipping	Delivery	Transmitting funds	Providing outpatient care	Delivery to judiciary

Human information processing

The world we inhabit is complex. Let's consider the simple act of driving a car in a residential area and the resultant pool of data captured by your five senses: sight provides constantly changing images of your environment; hearing provides a continuous stream of sounds; touch, smell, and taste provide multiple sensations regarding the "feel" of the ride, the condition of the car, the immediate environment, and your own physical condition. Some of these data are critical if your ride is not to end in tragedy, some are enjoyable, but many are irrelevant. How do you make sense of a mass of data? The answer lies in the most sophisticated information system known-the human information processing system.

Through evolution, we have developed an internal means of directing environmental searches for relevant data, of filtering the data sensed, of establishing and maintaining representations of our environment, and of transmitting responses back to our environment. This "means" is the elaborate data capture, analysis, storage, and response system referred to as the HIPS.

While many scientists have developed models and theories to explain human-environmental interaction, the ideas of cognitive psychologists will be perhaps the most meaningful to our eventual study of organizational information systems. Environmental stimuli enter the human information processing system through sensory registers (eyes, ears, nose, etc.). A limited number of these stimuli is actively attended to in short-term memory, where they are identified and readied for further processing. Short-term memory is characterized by extremely short retention (around one second) and relatively small capacity, most of this processing must be automatic, i.e., predetermined as to what is expected and how it is to be handled. Stimuli no are actively attended to be lost.

When too many stimuli are directed toward the human information processing system, compensating behaviors are often invoked to overcome short-term memory limitations. These behaviors normally take the form of filtering processes in which less relevant stimuli are ignored and other stimuli are only partially captured. In this way an "abstracted" representation of reality is maintained. The likelihood of errors occurring during information processing, while always high, clearly would increase during information overload.

When automated processes cannot be applied but stimuli are judged important, the stimuli are brought into working memory for controlled processing, i.e., analysis, problem solving, decision making, comparison with existing models of reality, etc. working memory is believed to possess limited storage capacities and characterized by a retention period of ten to thirty minutes. Responses back to the environment can be transmitted automatically from short-term memory or consciously from working memory.

Because of the limited storage capacity of working memory, entities (problems, solutions strategies, tasks, algorithms, models, heuristics, etc.) are often maintained as "chunks" consisting of mental tags representing more detailed representations of some components. Problem solving, for example, commonly involves breaking a problem into parts and working on one part at a time to build and overall solution. By maintaining most of the problem in the form of chunks, one can examine each part in depth without losing the context of the larger problem.

The models of reality used in working memory are the results of a lifetime of experience and learning organized in long-term memory and composed of interrelated sets of data (facts and experience), processes (skills, rules, and procedures), and higher-order entities (concepts, goals, values). Long-term memory is believed to possess a vast storage capacity and a limitless retention period. However, while items are not lost, they can be "misplaced" in that mechanisms for retrieval can be forgotten. An example is the common experience of having an answer at the "tip of your tongue" but not being able to verbalize it.

Long-term memory is organized as complex, often subconscious relationships among stored entities. As the associations between entities reflect an individual's unique set of life experiences, quite varied associations are likely to exist for any two people for even a small number of entities. That the same "trigger" may result in different entities' being retrieved from long-term memory should not be surprising.

Finally, cognitive frameworks referred to as schemata are believed to reflect the organization of long-term memory, and hence to direct the human information processing system. Each schema represents, a world view representing an individual's unique perception of reality. Schemata encode both the automated processes of short-term memory and the models employed in working memory. Many schemata exist: some provide a universal context for behavior, while others account for situations that repeatedly arise. A critical factor in the functioning of the human information processing system is the appropriateness of existing

schemata to a given situation. When discrepancies arise, a new schema must be activated or, as is more likely, the active schema must be modified.

In summary, the purpose of the human information processing system is threefold. First, communication with the environment is provided through the reception of stimuli and emission of responses. Second, guides for action (some automated, others merely suggested and controlled by the individual) make it possible to deal with repetitious or similar situations. Third, the most important, and cognitive context is provided with which to interpret and react to environmental stimuli. Such contexts that enable one to quickly assess a new or changing situation and activate appropriate schemata. Without this ability, humans would be unable to distinguish relevant from irrelevant stimuli, resulting in a state of perpetual chaos.

A final point must be introduced regarding the human information processing system. Schemata evolve over time from individual experience and individual learning. As these tend to be unique experiences, each individual's schemata are unique. The perceptions and behavior of any two people encountering the same situation may differ significantly because of dissimilarities in the schemata activated by (other factors, such as a person's mood or the degree of attention given the situation, add further distortions). It should not be surprising, then, that people from different experiential, educational, social, or cultural backgrounds often have difficulty communicating with one another. Similarly, the error in expecting uniform behaviors from a heterogeneous group of individuals should also be clear.

Organizational information systems

The handling of information flows is as important for organizations as for individuals. Organizations, like humans, must facilitate exchanges of information with their environment. This implies the establishment of linkages (i.e., sensory registers) with key organizations and individuals in the organization's environment. The captured stimuli must be interpreted, evaluated as to importance, reacted to, and stored for later retrieval. Responses (products, services, requests for resources, etc.) must flow back to the environment. Finally, models of reality, guides for action, values, and objectives must all be maintained to guide information processing tasks.

The human information processing system operates within a single processing unit-the individual. Information systems must enable multiple processing units-vertical and horizontal work units-to interact in coping with an environment. Consequently, information flows among work units must be handled as well as those linking work units with the environment. This layered aspect of information system becomes even more complex as one recognizes that individual work units develop their own information system, just as each organizational member evolves a unique human information processing system. The desirability of establishing organization-wide schemata that influence the functioning of all

these information system and human information processing system should be obvious.

Even without the problems accompanying a consideration of individuals, information system still take a variety of forms. The main difference among information system is a formal-informal distinction. A formal information system is designed and controlled by the organization. In other words, it is developed by organizational members to serve a definite purpose associated with the attainment of organizational objectives, and it is modified by these or other individuals over time to reflect shifts in objectives of organizational or environmental changes. An informal information system develops spontaneously to respond to a previously unforeseen situation or enable individuals to transmit unofficial information (rumors, tentative plans, secrets, etc.) within and between organizations. Table 9.1 provides examples of common formal and informal information system.

Observations of individuals in organizations indicate that much of the information they require to perform their duties derives from informal information channels. As the focus moves up the organizational hierarchy, this reliance on informal channels increases. It often represents more than 70 percent of the information used by top managers. Three questions naturally arise. Why is informal information more useful than formal? What can organizations do to improve the flow of informal information? Finally, what is the role of formal information systems in organizations?

Table 9.2 Common organizational information systems

Formal	Informal
Scheduled meetings	Grapevine
Memorandums	Conversation
Reports	Observation
Policies/procedures manuals	Public and private information sources
Planning/control	(newspapers, internet, trade journals, magazines, TV, etc.)

Functions of Information Systems

As with the human information processing system, information systems serve three main purposes in organizations. First, they provide (by plans, budgets, reward systems, etc.) organizational schemata that reduce the need for organizational members to continuously monitor their environments. Through a process of organizational socialization, these schemata become assimilated into each individual's human information processing system, thus avoiding what would otherwise be an exhaustive human information processing system efforts. Second, they provide (by policies, procedures, rules, controls, etc.) guides informing organizational members of when and how to act. Third, they provide (by plans, budgets, resource statuses, activity statuses, etc.) means of coordinating interdependent work units. All three purposes reduce the information processing

loads of organizational members by focusing attention on specific areas and by automatically providing relevant information.

While many benefits can accrue from form information system, if too much reliance is placed on them the information system itself may dictate the behavior of organizational members. As stated earlier, formal information tends to be limited in scope, general in nature, untimely and unreliable. It should provide a broad context for behavior, it should not direct behavior! If organizational reward systems are closely tied to formal information system, these information systems will naturally begin to direct organizational functioning. Information that is easily measured tends to permeate formal information system; information difficulty to measure is not used. Whether or not measurable information is meaningful, is obviously situation dependent. A more important concern may be the relevance of unmeasurable information.

Formal information system is designed by individuals, design assumptions and intention will reflect the designers' human information processing system. As a result, incompatibilities may arise between a formal information system and organizational members expected to make use of it. The more divergent are the schemata employed by designers and users, the more is the likelihood such problems will arise.

Decision making

Decision making consumes much of the time and efforts of organizational members. The need to choose between two or more action alternatives continuously arises: whether or not to move in a new direction, whom to assign a given task, how best to use a scare resource, which complaint to address first ,how to bypass an operational bottleneck, how best to mollify disagreeing subordinates, whether to begin a task now or delay it two months, etc. while individuals attack decision making in a wide variety of ways, a general understanding of what comprises a decision situation and how individuals resolve such situations which are emerging.

A decision situation arises whenever an individual is unsure which of two or more options should be followed. Each option is associated with certain outcomes, and certain contingencies affect which outcomes are to be expected if particular events take place. One's understanding of options, outcomes, and contingencies may be fairly complete (i.e., a structured decision) or incomplete (i.e., a semi-structured or poorly structured decision). The less complete one's understanding is, the more situational uncertainty exists and the more is the likelihood that a less appropriate actions will be taken.

A number of researchers have undertaken to develop an understanding of the decision process. The model of the decision-making process in Figure 9.1 reflects the finding of these researchers.

RECOGNIZING THE DECISION SITUATION

- Compare current realities with those expected.
- Diagnose the situation.
- Assess the situation's urgency and importance
- Define the situation.

STRUCTURING THE DECISION SITUATION

- Arrive at appropriate criteria, objectives, variables.
- Identify viable alternatives.

RESOLVING THE DECISION SITUTION

- Assign appropriate values to probabilities and outcomes associated with each alternative
- Evaluate alternatives.
- Choose an alternative.

IMPLEMENTING THE DECISION ACTION

- Prepare (explain, persuade, etc.) to take action.
- Take action.
- Monitor action taken.

Figure 9.3 Steps in the Decision-Making Process

The first stage in decision making involves recognizing the need to make a decision. This activity is often bypassed as a superior, subordinate, peer, customer, or client explicitly presents a decision situation or as organizational information system signals the existence of the situation. Nonetheless, the ability to recognize and diagnose decision situations is a valuable skill-possibly the most critical managerial skill an individual can acquire.

Detection of a problem or opportunity leading toward a decision situation requires that a model of the "real world" is monitored maintained and real world activities so deviations from the model are recognized. Usually recognition arises by means of pattern matching – if a certain series of events occur, situation x exists. Thus situation recognition requires either a continuous monitoring of an activity or the ability to monitor the activity at discrete intervals. Key design issues related to such supports involve selecting appropriate models (historical trends, future plans, actions of competitors, desires of customers, etc.) and identifying relevant variables or critical events to monitor.

The second stage in decision making concerns the decision-maker's "framing" of the decision situation and the generation of alternatives for resolving the situation. A decision frame represents the decision-maker's conceptualization of the objectives, criteria, constraints, and relationships that "model" the situation; alternatives and the actions can be taken, along with associated outcomes and contingencies. Clearly, the frame adopted in response to emerging situations will influence the actions, outcomes, and contingencies that seem most relevant.

Decision frames and sets of likely alternatives may already exist when a decision situation arises especially if the decision circumstance, or a similar

circumstance, has previously been observed. Searching and screening must then occur either in the decision-maker's mind or through support mechanisms, if the accumulated knowledge and experience about a situation are to be exploited. When a decision situation is unique, the involved individual is ignorant of existent frames or alternatives, the decision-maker must create an appropriate structure for the situations. Support mechanisms facilitating this design activity can be very helpful.

The third stage of decision making, situation resolution, involves evaluating alternatives and selecting the most appropriate. While some of the analysis accompanying these efforts is rational and quantitative, much of it requires decision-makers their judgment and intuition, as well as to negotiate among one another. Both types of analysis the rational and quantitative, the subjective and political can benefit from computer-based support mechanisms.

The final phase in the decision-making process, associated with efforts is taken to implement a chosen alternative: preparing the organization for action (explanation, education, persuasion, etc.), taking action or directing others to take action, and monitoring organizational outcomes of taking action. Support mechanisms oriented toward communicating to others why actions are being taken and toward monitoring organizational outcomes are invaluable in facilitating these activities.

A number of caveats to this view of decision making are necessary. First, the stages of decision making should not be conceived of solely as a sequence of orderly activities. These activities are interdependent, hence involve iteration and feedback. Second, when two or more individuals conspire to revolve a decision situation, they will probably work together on certain issues but independently on other issues. While this might lessen the time required to revolve the decision situation, the fact that these individuals possess unique human information processing systems, affecting the way each structures the decision and presenting communication difficulties, can add considerable complexity to the process of decision making. Finally, this view of decision making should be recognized as a very simplified model of what actually transpires.

As an illustration, let's consider the decision situation faced daily by an investment analyst who is responsible for managing a number of client's accounts. Each account consists of a portfolio of securities, and each client has stated certain risk and return objectives for his or her portfolio. The investment analyst's tasks revolve around interacting with clients, reviewing, revising portfolios and analyzing the securities market.

A very common decision situation handled by the investment analyst is to assess whether or not any portfolios should be changed.

Considerable uncertainty arises in each decision stage. However, by accessing and manipulating data describing the historical, current, and expected performance of a client's portfolio and of market securities, the analyst should identify and take action that helps meet the client's objectives.

All four decision-making stages are gone through if change is made:

Recognition	Realizing that a certain portfolio is not meeting its planned objectives or that there is an opportunity regarding a particular security that is consistent with a portfolio's planned objectives
Structuring	Constructing a model of portfolio performance; Identifying potential securities to add or delete; configuring alternative changes to be made
Resolution	Forecasting performance of alternative version of the portfolio; contrasting performances with client's objectives; deciding on change to enact
Implementation	Initiating market transactions; explaining changes to client; monitoring performance of revised portfolio

Support of decision making

The activities that make up decision-making behavior are highly varied. Nonetheless, it is possible to categorize these activities into a relatively limited number of decision tasks:

Search	Scanning or browsing through facts, reports, previous results, etc.; may be directed or free-form
Computation	Applying mathematical, statistical, or qualitative analysis tools
Specification	Structuring a decision situation
Inference	Deriving conclusions from data
Assimilation	Pulling together fragments of a situation to arrive at an understanding of what is involved
Explanation	Justifying choices made in decision making to members of the decision group, superiors, implements, etc.

Each decision activity could well occur repeatedly, in varied forms, throughout the decision-making process.

The issue at hand is to assess how information system capabilities can best support such activities. Clearly the powerful computational capabilities of computers can directly support computation and enhance both inference and assimilation, and the facility to quickly access large numeric and textual data bases directly supports search and enhances specification. Some opportunities that may not so clear are the use of computer graphics to aid in specification, inference, assimilation and the benefit of imposing a consistent decision framework to overcome the communication difficulties that tend to arise in group decision making or negotiation. Table 9.3 summarizes these decision activities and suggests how each might be directly supported through information system.

Table 9.3 Support of decision making

Decision Task	Examples	Information systems support
Search	Inquiring, browsing, briefing	Fast, convenient access to data and textual information sources
Computation	Evaluating, predicting, estimating, analyzing, simulating, optimizing	Fast, convenient, access to computational models and results
Specification	Constructing, designing, forming hypotheses	Retrieval of previously used decision structures and alternatives, modeling tools, cues that facilitate modeling in particular context
Inference	Reaching conclusions, generalizing	Computational tools, visual aids for pattern recognition, retrieval of information about similar situations
Assimilation	Making sense of facts, pattern matching, determining relationships	Computational tools, visual aids for pattern recognition and relating elements, retrieval of information regarding similar situations
Explanation	Justifying choices made	All of the above to provide consistent, common, and objective decision framework

It is through combining information system strengths, however, that the most significant benefits of computer-based of decision support making emerge. By searching through historical and current data bases, information system might detect decision situations, suggest a diagnosis, provide a starting structure or an initial list of alternatives, or suggest analytic tools to use or decision facets that would benefit from examination. Such artificial intelligence enables a decision - maker to greatly improve his or her understanding of the decision context.

Through effective information system support it is possible to expand the decision-maker's ability to resolve decision situations. However, information system support of decision making is limited by the characteristics of any computer-base system: all information system is directed by prespecified software, can access only data already stored on a computer-readable medium are oriented toward quantitative analyses, and possess no natural creativity, insight, or reasoning capability. When supporting decision making through computer-based technologies, one should aim to create a human-machine decision-making team exploits the capabilities of both the computer and the human decision-maker.

Such view does not mean that the decision-maker must directly interact with a decision support systems-only that these computer-based capabilities are realizable. Direct interaction with the decision support systems for its own sake is not the issue. What is of concern is providing an appropriate combination of people, data, interaction modes, hardware, and software to resolve a decision situation in a convenient, timely, and cost-effective manner. Exactly what

combination is best depends on many factors: the decision situation, the personal characteristics of the decision-maker, the organizational climate, and the availability of computer-based resources.

Finally, decision-makers will not use information system support simply because it exists; they must utilization as in their best interests. If the perceived costs of learning to use and actually using a decision support system exceed the perceived benefits, little use will occur. Successful decision-makers have arrived at personal strategies of decision making independent of computer-based support. Convincing such individuals to embrace computer technology is not easy, but it is precisely already successful decision-makers who have the experience, insight, and knowledge about specific decision areas, as well as about the art of making decision, who can best exploit decision support systems capabilities.

Organizational Levels

There are different ways to define levels of business organization such as the terms used in business process modeling. This method has three levels of organization - the organizational level, the process level and the business activity level. Each level offers different perspective of an organization's activities. In business process modeling, levels of organization help managers to analyze how to increase efficiency.

At the organizational level, it's important to consider all major functions of the business. An organizational-level analysis might include listing functions that support each product family in a manufacturing company. Listing of the functions helps to define the business's overall capacity to serve its customers. In a smaller company, such as a construction company, there might be only a few functions such as sales, a project management and an accounting function. Other functions might be important to the construction company, but might be performed by outside labor, such as subcontractors.

Business Process Modeling

A business can use three levels of business process modeling to analyze how work is performed. Every work of process must be documented in a form that includes flowchart symbols and written descriptions. This written form shows how any product or service is handled by different employees. Using a flowchart, stakeholders such as managers and employees can troubleshoot problems and suggest improvements to the way business activities.

Process Level

Inside the organization, it's important to study the flowcharts of all business activities in one process. A process might consist of all activities that support a major service that a company provides to customers. Experts in different areas of the business process can analyze how the business process works in an interdisciplinary task force. Experts in one activity might suggest improvements

for another business activity to make it more efficient, with the end goal of benefiting the customer.

Activity Level

Inside a business process, each business activity consists of a manager and employees who assist in creating very detailed descriptions of performed work tasks. These employees have firsthand knowledge of work tasks and can suggest improvements to their own work. They also understand how tasks performed by others in their activity contribute to the activity's efficiency. When these task experts participate in cross-functional task forces, involving employees from different business processes, they can suggest how changes at the organizational level will impact their activity. A task force might decide that one business activity should occur in a different order in the sequence of work activities in a business process, or chain of production.

Review questions

1. When was a «business intelligence» term coined?
2. What does a «business intelligence» term mean?
3. What must computer-based systems provide to support information needs?
4. Why entities are often called chunks?
5. What are the models of reality used in working memory?

9.2. Information and knowledge discovery

Reporting systems

Organizations were described in task 9 as purposeful social systems striving to accomplish certain aims. However, numerous forces inhibit the realization of those intentions:

- environmental changes as well as unexpected problems continually arise.
- organization subsystems often acquire vested interests far removed from organization-wide interests.
- the degree of coordination required to tie together interdependent but differentiated subsystems may be excessive.
- errors always arise in communicating and executing organizational "purpose".

Consequently, organizational direction and redirection must be constantly attended to if organizational aims are achieved.

A simple illustration of how direction can be provided for any system is shown in Figure 9.4. Directives are prescribed for the system's processors by a planning function indicating how and when inputs are to be transformed into outputs. Concurrently, a control function can monitor system behavior (statuses and flow rates), providing feedback on how well these directives are being met. The arrows in Figure 9.4 going to and from the planning, control functions represent planning and control information. Essentially, the planning function plots a future direction for the system, while the control function assesses whether that direction is being maintained, whether the direction remains appropriate, and which corrective actions are needed when redirection is required.

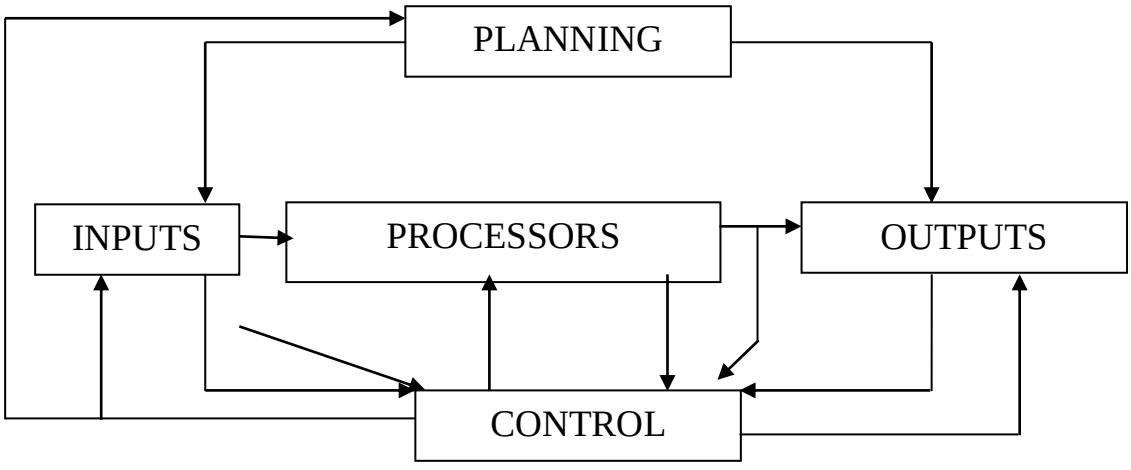


Figure 9.4. Planning and control functions

Let's consider, for example, an interstate trucking firm. Considerable direction must be provided about truck, driver, cargo availabilities and subsequent routing assignments. Without suitable direction (and redirection), organizational aims will probably not be met. Many things can disrupt what might otherwise have

been an effective operation, including breakdowns, bad weather, and delays in preparing clients' cargoes for shipment. Through a constant monitoring of drivers, trucks, and clients, however, problems can be recognized and responded to (and opportunities exploited) without serious disruptions in operations.

The information system supports systems, known as information reporting systems which are used to provide such direction in organizations. An information reporting systems cannot support the situation-specific activities of organizational members; rather, it induces desired behaviors by providing cues, directing attention, reviewing past performance, and raising questions. While such systems perform best in environments that are simple, static, and routine, information reporting systems can also support activities of complex, dynamic organizational environments. For example, certain activities in all organizations tend to be well defined and repetitious, and variation in many organizational activities, while unpredictable, can be bounded. All organizational activities can be forecast, though poorly in many instances.

Key information reporting systems characteristic prohibiting its use in situational support is that input data, procedures, and decision rules incorporated within processing program, as well as output information are predefined. The information reporting systems users must specify their precise needs an advance. These needs are then reflected in the software that is developed or acquired, and any changes in the needs require that the software is modified or replaces (a step often requiring considerable delay and expense). Since the technology required to develop information reporting systems is well understood and readily available and most organizational needs can be met at least partially by information reporting systems, even with this limitation information reporting systems currently account for most of the information system used in organizations for managerial and staff supports.

Three basic reporting environments are observed with information reporting systems. Periodic reporting involves the distribution of reports to individuals or groups of individuals at regular intervals. Examples include quarterly financial reports, monthly sales analysis, weekly expense reports, and monthly analysis of profit contributions of specific products or services. Exception reporting involves distributing reports to individuals or groups of individuals only when reports are triggered by a decision rule embedded in the processing program. Examples include listing of late shipments for the previous month (no report is sent if no shipments were late), notifications that inventory levels are dangerously low, and reports issued when maintenance expenses exceed a given amount. Demand reporting involves distributing reports only when they have been specifically requested. Examples include sales forecasts for particular lines, analysis of wages and salaries for a personnel director, and detailed breakdowns of operating costs.

Each of these reporting environments provides a unique information context. Periodic reports tell organizational members which issues demand constant attention and serve as a ready information source for these issues. On the other hand, the information being produced doesn't always need when the report is

received, such reports may be viewed by some. The costs of periodic reporting (processing, paper distribution, disruption, etc.) can become high relative to the benefits gained by organizational members unless the relevance of these reports is regularly assessed. Exception reports, which can meet 80-90% of an organization's information reporting system needs, are not expected, and hence can very effectively organizational actions. While the operating costs of exception reports are less those of periodic reports, considerable efforts must be devoted to assessing the meaningfulness of the decision rules that trigger reports. Even with well-designed exception reporting systems, much beneficial information is often not produced because of the decision rules being applied. Demand reports, while, having extremely low operation costs, may never be demanded! If used effectively, however, demand reports can provide extremely useful information to organizational members facing but routine decision tasks.

In this theme the purpose and potential of information reporting systems will be examined. The chapter begins with an introduction to basic planning and control notions and continues with suggestions for how information systems can best support these organizational functions. It concludes with an examination of the concept of management information and its presentation within information reporting systems.

Business Intelligence enables the business to make intelligent, fact-based decisions.

Online analytical processing

Until recently, data mining required expensive and cumbersome data mining software or a database expert who could accurately translate a request for information into functional, preferably efficient, query. Database warehouses and online analytical processing (OLAP) offer an attractive and readily available alternative.

As compared to a database, a data warehouse has faster retrieval time, internally consistent data, and a construction allows users to slice and dice (i.e., extract a single item (slice) and compare items in a cross-tabulated table (dice)). The primary difference between a data warehouse and a traditional transaction database lies in the volatility of the data. The information in a transaction database is constantly changing, whereas data in a data warehouse is stable; its information is updated at standard intervals (monthly or weekly). A perfect data warehouse would be updated to add values for the new time period only, without changing values previously stored in the warehouse. Thus, microarray databases can be data warehouses, because the data in them is consistent and stable. Gene expression values in any given experiment remain the same and usually only new data from new experiments is added. Data warehousing software is incorporated in most of the main relational database management systems such as SQLServer2010 and Oracle 10g.

OLAP represents a class of software that enables decision support and reporting based upon a data warehouse. A schematic view of how OLAP software interacts with the data warehouse is shown in figure 9.5.

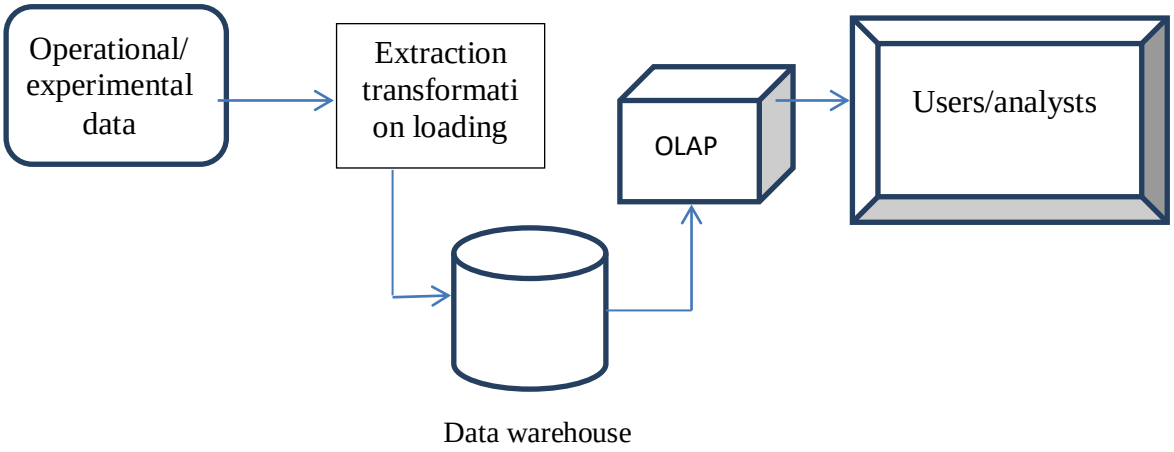


Figure 9.5. Online analytical processing

OLAP allows for the fast analysis of shared multidimensional information. It is fast because most system responses to users are delivered within 5 seconds, with the simplest analysis taking no more than 1 second and very few taking more than 20 seconds. However, speeds vary by OLAP vendor and system hardware. The key feature of OLAP is that it provides a multidimensional, conceptual view of the data, including full support for hierarchies and multiple hierarchies.

OLAP, cubes and where they fit in a data warehousing solution. OLAP provides efficient and easy-to-use reporting tools and graphical interface, to enable users to mine a data warehouse for hidden information.

OLAP's underlying structure is the cube. A cube is defined by any number of data dimensions; it is not limited to three; and sometimes an OLAP cube may have fewer than three dimensions. The data dimensions describe an OLAP cube just as width, height, and depth describe a geometrical cube. Where it is appropriate, dimensions can be organized into any number of levels (hierarchies).

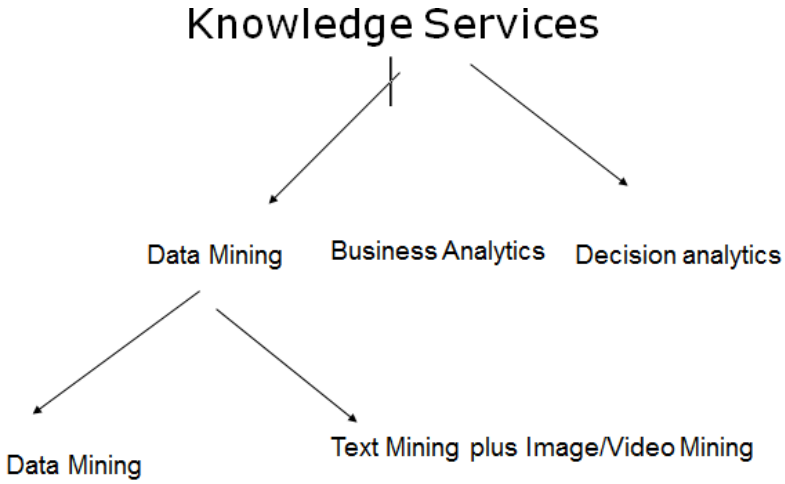
In relational database systems, OLAP cubes are constructed from a fact table and one or more dimension tables. A fact table is the relational table in the warehouse that stores the detailed values for measures (the thing you are measuring). For example, this could be the values for the relative change in gene expression. The dimension tables however are more abstract, containing only one row for each leaf (lower) member in the fact table. They are used to create summaries and aggregates of the data in the fact table. Ad hoc calculations and statistical analysis can also be achieved, but are vendor specific. Analysis Services 2000 (used here) is capable of such ad hoc calculations on complex data.

Server OLAP:

- Multidimensional OLAP (MOLAP).
  - The database is stored in a special, usually proprietary, structure that is optimized for multidimensional analysis.

    - + : very fast query response time because data is mostly pre-calculated
    - -: practical limit on the size because the time taken to calculate the database and the space required to hold these pre-calculated values
- Relational OLAP (ROLAP)
    - The database is a standard relational database and the database model is a multidimensional model, often referred to as a star or snowflake model or schema.
    - +: more scalable solution
    - -: performance of the queries will be largely governed by the complexity of the SQL and the number and size of the tables being joined in the query
- Hybrid OLAP (HOLAP)
    - a hybrid of ROLAP and MOLAP
    - can be thought of as a virtual database whereby the higher levels of the database are implemented as MOLAP and the lower levels of the database as ROLAP

Data, text, and Web mining



Data Mining is the process of identifying valid, novel, useful and understandable patterns in data.

Data Mining is defined as the process of analyzing large databases, usually data warehouses or internet, to discover new information, hidden patterns and behaviors. It's an automated process of analyzing huge amounts of data to discover hidden traits, patterns and to predict future trends and forecast possible opportunities. Data Mining is a relatively new interdisciplinary field involving computer science, statistical modelling, artificial intelligence, information science, and machine learning. One of the main uses of Data Mining is business intelligence and risk management. Enterprises must make business critical decisions based on large datasets stored in their databases, Data Mining directly affects decision-making. Data Mining is relied on in retail, telecommunication, investment, insurance, education, and healthcare industries they are data-driven. Other uses of Data Mining includes biological research such as DNA and the

human genome project, geospatial and weather research for analyzing raw data used to analysis of geological phenomenon.

Applications of Data Mining: E-commerce, marketing and retail, finance, Telecoms, Drug, design, Process, control, Space and earth sensing, etc.

Data Mining Tasks Classification: regression, probability estimation, Clustering, Association detection, summarization, Trend and deviation, detection, Etc.

A related field is Text Mining, which deals with textual data rather than records. Text Mining is defined as automatic discovery of hidden patterns, traits, or unknown information from textual data. Textual data makes up huge amounts of data found on World Wide Web WWW, aside from multimedia. Text Mining is related field to Data Mining, but differs in its techniques and methodologies used. Text Mining is also an interdisciplinary field encompassing computational linguistics, statistics, and machine learning. Text Mining uses complex Natural Language Processing techniques. It involves a training period for the Text Mining tool to comprehend patterns and hidden relations. The process of mining text documents involves linguistically and semantically analysis of the plain text, thus structuring the text. Finally relates and induces some hidden traits found in the text, like frequency of use for some words, entity extractions, and documents summarizations. Text Mining is used, aside from business applications, for scientific research, specifically medical and biological. Text Mining is very useful in finding and matching proteins' names and acronyms, and finding hidden relations between millions of documents.

The other mining technique is Web Mining. Web Mining is defined as automatic crawling and extraction of relevant information from the artefacts, activities, and hidden patterns found in WWW. Web Mining is used for tracking customers' online behavior, most importantly cookies tracking and hyperlinks correlations. Unlike search engines, which send agents to crawl the web searching for keywords, Web Mining agents are far more intelligent. Web Mining works by sending intelligent agents to certain targets, like competitors sites'. These agents collect information from the host web server analyzing the web page itself. Mainly they look for the hyperlinks, cookies, and the traffic patterns. Using this collected knowledge enterprises can establish better customer relationships, offers and target potential buyers with exclusive deals. The WWW is very dynamic, and web crawling is repetitive process where contentious iteration will achieve effective results. Web Mining is used for business, stochastic, and for criminal and juridical purposes mainly in network forensics.

Business analytics

Poor information system products are frequently due to the adoption by requirements analysis participants of overly narrow perspectives. Too often participants take as given for their analysis the initial situational diagnosis, existing organizational structures, and current organizational procedures. What often results is the provision of an inflexible information system product, a product that resolves

only the easy (visible) problems, or a product that totally ignores underlying organizational deficiencies.

For example, rising concern about problems such as declining productivity, excess inventories, missed shipments, customer complaints, and material shortages has encouraged many manufacturers to develop information system to help manage their materials and their production operations. These information systems however, have not experienced overwhelming success, with 40-50 percent of the manufacturing organizations reporting dissatisfaction with them. The basic cause of these failures lies not with faulty information system design, but with basic manufacturing system design flaws (i.e., manufacturing systems that are not consistent with the strategic and organizational requirements of the organization). Effective manufacturing information system cannot be implemented when existing manufacturing system are ineffective.

It might prove beneficial to view the requirements analysis activity as an opportunity to redesign the organization. Initially, little should be taken as fixed, and any strategy for improving organizational functioning should be examined. The ideal result of a requirements analysis effort might be a relatively simple organizational redesign requiring little, if any, organizational investment in information resources.

The requirements analysis process to be presented adopts perspective that can overcome the overly restrictive approach representative of many requirements efforts. (Nonetheless, this process is rarely observed in practice.) The overall sequence of activities is shown in Figure 9.6. Essentially, a conceptual model of the target organizational context is developed and then iteratively refined so multiple interests, constraints, and alternatives are consolidated in an integrated, holistic fashion.

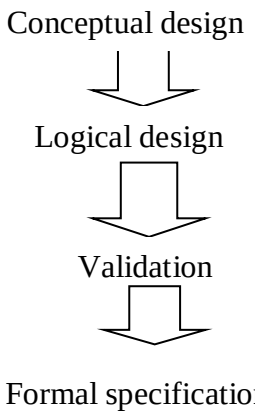


Figure 9.6. The Requirement Analysis Process

Requirements Analysis Strategies

Information system of implementation in general, the sequence of requirements analysis takes place considerably, depending on factors associated

with the ability of participants to cope with the uncertainty faced. A number of strategies is possible:

- No requirements analysis activit, as a requirement specification already exists (e.g., an existing manual system is to be automated as is).
- Participants sequentially move through conceptual design, logical design, validation, and formal specification.
- Substantial iteration between these stages is observed.
- Prototyping is employed.

The more unstructured of the organizational situation, is the more naive is participants about their requirements analysis roles, the more innovative of the is application, the more desirable strategies are that allow information discovery and exchange.

Decision-Oriented Versus Data-Oriented Analysis

With decision-oriented analysis, as shown in Figure 9.7, one begins by identifying organizational objectives, traces key management decisions, and then derives information needs to support these decision situations. By focusing on objectives and critical functions, one increases likelihood that the specified requirements will include those issues most relevant to the long-run aims of the organization. Additionally, decision-oriented analysis tends to stress normative solutions to organizational problems, and thus is less subject to organizational bias and narrowness.

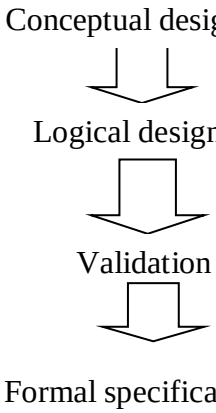


Figure 9.7. Decision-Oriented Analysis

With data-oriented analysis, on the other hand, one focused on current operations and the existing means (manual or computer-based) of information processing. Initially, current problems or short-run aims are identified and examined. Then decisions associated with issues such as allocating resources, evaluating operations, and ensuring there materials to be used are defined and analyzed relative to required information support. Data-oriented analysis tends to more completely describe the range of current activities than decision-oriented analysis.

Decision-oriented analysis is generally more expensive than data-oriented analysis because it is best directed by managers or users, rather than information system specialists, it requires more participants and higher participant opportunity costs, and it tends to take longer. However, it often results in a better set of requirements when the organizational functions are involved less structured, emphasize planning tasks, or tightly linked to the future.

Recognizing the growing popularity of business analytics, business intelligence application vendors are including some business analytics functionality in their products. More recently, data warehouse appliance vendors have started to embed business analytics functionality within the appliance. The main enterprise system vendors are also embedding analytics, and the trend towards putting more analytics into memory is expected to shorten the time between business event and decision/response.

Review questions

1. How can be directives for the systems processors prescribed?
2. What activities an information reporting system cannot support?
3. What does a periodic reporting involves?
4. What is the main task of periodic reports?
5. What is the difference between database and a data warehouse?

9.3. Application systems

Companies use business intelligence to improve decision making, cut costs, increase competitive advantage, improve operational efficiency, enhance customer service and identify new business opportunities.

Recall that the term “business intelligence” refers to technologies, applications and practices for the collection, integration, analysis, and presentation of business information. The main purpose of business intelligence is to support better business decision making. Typically, business intelligence systems are data-driven decision support systems. Business intelligence is sometimes used interchangeably with briefing books, report and query tools and executive information systems.

Importance of business intelligence tools or software solutions lies in the fact that business intelligence systems provide historical, current, and predictive views of business operations, most often using data that has been gathered into a data warehouse or a data mart and occasionally working from operational data. Software elements support reporting, pivot-table analyses, visualization, and statistical data mining. There are many applications of tackle sales, production, financial, and many other sources of business data for purposes that include business performance management.

Currently organizations are starting to see that data and content should not be considered as separate aspects of information management, but instead should be managed in an integrated enterprise approach. Enterprise information management brings business intelligence and Enterprise Content Management together.

An executive, management and operations support systems

Business intelligence vendors are often targeting only top of the pyramid but now there is a paradigm shift moving toward taking business intelligence to the bottom of the pyramid with a focus of self-service business intelligence.

Business intelligence uses the following types of applied information systems:

1. **Executive Support System**
2. **Management Support Systems**
3. **Operations Support Systems**

Interrelation between these types is illustrated in Figure 9.8.

Figure 9.8. Interrelation executive, management and operations support systems

1. **Executive Support System**

Executive Support System (ESS) is a reporting tool (software) that allows you to turn your organization's data into useful summarized reports. These reports are generally used by executive level managers for quick access to reports coming from all company levels and departments such as billing, cost accounting, staffing, scheduling, and more. In addition to providing quick access to organized data from departments, some Executive Support System tools also provide analysis tools that predict a series of performance outcomes over time using the input data. This type of ESS is useful to executives as it provides possible outcomes and quick reference to statistics and numbers needed for decision-making.

Several companies offer pre-designed executive support system packages (usually suited to one particular industry), while others offer packages which can be customized for your organization's needs.

Essentially, executive support system is:

- A reporting tool (software)
- Also known as Executive Information System (EIS)
- Allows you to turn your organization`s data into useful summarize reports
- These reports are generally used by executive level managers for quick access to reports coming from all company levels and departments.

Executive information systems provide critical information from management information systems, decision support systems, and a wide array of both internal and external sources in very practical displays to executives and managers.

The characteristics of executive support system are:

- computer based information system
- enables users to extract summary data and solve complex problem
- provides rapid and direct access to timely information and management reports
- capable of both accessing both internal and external data
- provides extensive online analysis like trend analysis, scenario analysis, etc.
- can easily be given decision support systems support for decision making.

Executive information system components can typically be classified as:

1. Computer hardware
2. Computer software
3. User interface
4. Networking and telecommunications technology

Recall that hardware - are devices like the monitor, processor, printer and keyboard, all of which work together to accept, process, show data and information. The concept of hardware resources includes all the physical devices and materials that are used while processing information.

The basic hardware includes next components:

a) devices of input data-entry that allow the executive to enter, verify, and update data immediately;
b) the central processing unit, which is the kernel because it controls the other computer system components;
c) data storage files where, most often the executive can use this part to save useful business information, and this part also help the executive to search historical business information easily;
d) output devices, which typically, provide a visual or permanent record for the executive to save or read. This device refers to the visual output device, for example monitor or printer.

Recall that software - are the programs that allow the hardware to process the data. The concept of software resources includes every set of information that processes instructions (both programs and procedures). Three examples of software resources are system software (i.e. Microsoft Windows), application software (i.e. word processing, accounting) and procedures (operating instructions). In addition a typical executive information system includes next software components: text-handling software; database; graphic base; model base.

The user interface is very important because an executive information system must be efficient to retrieve relevant data for decision makers. As well as, in some cases several types of interfaces can be available to the executive information system structure, such as scheduled reports, questions/answers, menu driven, command language, natural language, and input/output.

Networking and telecommunications technology consist of computers, communications, processors and other devices connected by communications media and controlled by communications software. Typically, transmitting data from one place to another is crucial for establishing a reliable network, as well as in addition, telecommunications within an executive information system can accelerate the need for access to distributed data.

EIS applied in many areas, especially, in manufacturing, marketing, and finance areas.

2. **Management Support Systems**

Management support systems - support of managerial decision making i.e. provide information and support for effective decision making by managers, such as:

- *Management Information Systems* provide information in the form of reports and displays to managers, for example, daily sales analysis reports;
- *Decision Support Systems* that provide interactive ad hoc support for decision making, for example, a what-if-analysis to determine where to spend advertising dollars;
- *Executive Information Systems* that provide critical information for executives and managers, for example, easy access to actions of competitors.
- Also there are other categories such as:
- *Expert Systems* that provide expert advice and act as consultant to users, for example, process monitor, credit application advisor;
- *Knowledge Management Systems* that provide supports creation, organization of business knowledge, for example, internet access to best business practices;
- *Strategic Information Systems* that provide support operations/management processes that provide strategic product/services for competitive edge, for example, online stock trading, shipment tracking.

3. Operations Support Systems

Operations support systems - support of business operations, such as:

Transaction Processing Systems that provide record and process data from business transactions, for example: sales processing, inventory systems, accounting systems;

Processing Transactions that consist of the Batch Processing and Accumulate transactions over time and process periodically, for example, a bank processes all checks received in a batch at night;

Online Processing that provides process transactions immediately, for example, a bank processes an ATM (Automated teller machine) withdrawal immediately;

Process Control Systems that provide monitor and control physical processes, for example, in a petroleum refinery use sensors to monitor chemical processes;
Enterprise Collaboration Systems that provide enhance team and work group communications, for examples: e-mail, videoconferencing.

Decision support systems

A decision support system (DSS) is a computer-based application that collects, organizes and analyzes business data to facilitate quality business decision-making for management, operations and planning. A well-designed DSS aids decision makers in compiling a variety of data from many sources: raw data, documents, personal knowledge from employees, management, executives and business models. DSS analysis helps companies to identify and solve problems, and make decisions

Decision support systems provide direct computer support to management in the midst of the decision making process. Figure 9.9 shows the scheme of the decision support system.

Figure 9.9. Scheme of decision support system

Decision support system could be designed to support decision - makers at any level in an organization and also support operations decision making, financial management.

Decision-making analysis was conducted by the Carnegie Institute of Technology in the late 1950s and early 1960s. The Massachusetts Institute of Technology applied computer technology to decision-making theory in the 1960s. By the 1980s, intensive research on DSS was underway, and new theories and concepts emerged from single-user models of DSS, including organizational decision support systems, group decision support systems and executive IS. By 1990 DSS was broadened to include data warehousing and online analytical processing.

Information gathered by a DSS may include:

- Projected revenue and sales figures, some based on new product sales projections;
- Comparative sales figures between selected time periods;
- Inventory data organized into relational databases for timely analysis.

In some decision support system applications, timely analysis includes the consequences of different decision alternatives.

DSS applications are used in many diverse fields, including medical diagnosis, credit loan verification, evaluating bids on engineering projects, business and business management, agricultural production at the farm and policy levels, forest management and railroad (for evaluation of defective rails).

There are support systems management decisions making, such as:

- Excel and Access MS Office package;
- Project Expert Program - for the analysis of efficiency of investment projects submitted by clients;
- Audit Expert - the tool a comprehensive analysis of the financial condition and the results of the financial activities of the enterprise;
- ESS systems - executive information systems;
- Data Mining Systems - provide intelligent production of knowledge, similar to the systems of artificial intelligence (example: artificial neuron, neural networks, Deductor package).

A decision support system provides a computer-based capability to support organizational activities for which IS support was previously deficient those day-to-day situations that cannot be prespecified. As such organizational activities represent many tasks engaged in by management and staff personnel in organizations, the potential impact of DSS technology on organizations is large.

A PDS can be implemented whenever decision actions, information elements, and explicit rules resulting in the effective resolution of a decision situation can be incorporated within a computer program. In such cases, the organizational activity involved can be handled more accurately and consistently and less expensively by PDS than by human decision-makers. Applications are most successful when applied to simple, repetitious, and stable decision situations.

Much organizational activity involves unanticipated and poorly structured situations. Supporting such activities by IS requires convenient, easy, and quick access to data bases and analysis tools. A decision support system provides such capabilities.

A number of researchers have undertaken to develop an understanding of the decision process. The model of the decision-making process reflects the findings of these researchers in next steps:

1) Recognizing the decision situation
 - compare current realities with those expected
 - diagnose the situation
 - assess the situation’s urgency and importance
 - define the situation
2) Structuring the decision situation

- arrive at appropriate criteria, objectives, variables, constraints, parameters, relationships and etc.
- identify viable alternatives

3) Resolving the decision situation
- assign appropriate values to probabilities and outcomes associated with each alternative
- evaluate alternatives
- choose an alternative

4) Implementing the decision situation
- prepare (explain, persuade, etc.) to take action
- take action
- monitor action taken.

Decision making involves choosing among alternatives under conditions of uncertainty. Consider example of the decision situation faced daily by an investment analyst who is responsible for managing a number of clients' accounts. Each account consists of a portfolio of securities, and each client has stated certain risk and return objectives for his or her portfolio. The investment analyst's tasks revolve around interacting with clients, reviewing and revising portfolios, and analyzing the securities market.

Consider components of the decision support systems. A DSS is a total decision-making system; thus, the hardware, software, and human components should be viewed as an integrated whole.

The most crucial hardware element is an interactive graphics terminal that provides for responsive, natural, and rich communication between the human and software DSS elements. While microcomputers are becoming more powerful and can function as a limited DSS, to attain sophisticated DSS capabilities a terminal (or microcomputer in terminal mode) linked by telecommunications to a more powerful processor would likely be required. Telecommunication capabilities might as well provide access to external information services. Since a microprocessor is being used, local data storage devices can support a local data base capability, providing fast access to data and model elements.

At least four software components are required: a query language through which decision-maker commands are interpreted and DSS responses are presented, a data base management system, a model management system, and a DSS control structure that links these three. The query language should provide a set of command - graph, list, select, describe, get, etc. Commands that tell what is desired rather than how it is produced are preferred. Model management systems are similar in function in that they provide a capability to generate, maintain, and use a collection of models. Models, like data, are valuable organizational resources. An effective model management system supports the construction, testing, and maintenance of models in resolving a decision situation.

The human elements include the decision-maker and possibly an intermediary who interacts with the DSS in place of the decision-maker. There are, in fact, three human roles to be filled - model-builder, model user, and decision-

maker. The advantage of the decision - makers filling all three roles is that the symbiotic benefits of direct decision support are greatest. The benefit of employing specialists for each role is that through specialization any dysfunctional aspects associated with learning and task interruption may be lessened.

A DSS enables a decision-maker to converse with a computer-based system to access and manipulate both data and models to operate on these data in ways that need not have been precisely specified. The decision-maker may converse directly with the DSS or indirectly through a human intermediary.

Can be defined two basic *types of DSS:* institutional, which address families of tightly defined decisions, and general, which provide a modeling capability for building and then using a DSS.

Institutional - address a family of tightly defined, closely related decisions. Because the support provided is intertwined with a particular decision context, flexibility and range of use are reduced. The query languages used with an institutional DSS, however, can exploit this familiarity with a specific decision context and provide a collection of commands that parallel the terminology normally used by decision-makers.

A *general*, on the other hand, provides a generalized modeling language for building and executing a DSS. While its development requires considerable technical expertise, a general DSS enables DSS capabilities to be quickly, easily, and inexpensively provided throughout an organization. Often decision-makers themselves, rather than computer specialists, can develop these institutional DSS. As has occurred with data base management systems, the software industry- realizing that a market for DSS is emerging- has begun to market such software systems. For the most part, these systems are the best described as financial planning languages.

The most readily available general DSS are financial planning languages. These software packages have been produced for most computer systems. Their cost and sophistication vary widely.

It is unlikely that a decision-maker will use a DSS if the personal costs involved in learning about and then using the DSS are believed to be greater than the benefits.

An intriguing area of DSS support for decision making involves the aiding of intuitive as well as analytical decision styles.

A PDS can be an effective means of decision support whenever explicit decision rules can be incorporated into computer software. In such situations, the act of decision making is transferred from a human to an IS. Responsibility for the decision, however, remains with the human.

By applying artificial intelligence principles to PDS, one can construct PDS that are self-adjustable.

Example DSS: a national on-line book seller wants to begin selling its products internationally but first needs to determine if that will be a wise business decision. The vendor can use a DSS to gather information from its own resources (using a tool such as OLAP) to determine if the company has the ability or

potential ability to expand its business and also from external resources, such as industry data, to determine if there is indeed a demand to meet. The DSS will collect and analyze the data and then present it in a way that can be interpreted by humans. Some decision support systems come very close to acting as artificial intelligence agents.

DSS Applications are not single information resources, such as a database or a program that graphically represents sales figures, but the combination of integrated resources working together.

Most known software DSS tools and package are:

1. Software for strategic decision,
2. Software for financial simulation and modeling (FINANSEER, Budget Expres, MicroSIMPLAN etc),
3. Statistical and econometric software (SAS, Forecast Master Plus, ESP etc.),
4. Software for building matrices and tree of decision (Expert Choise, Decision Aide, Decision Pad etc.)
5. Software for special applications (PROMCALC, GAIA, TACDSS, TAPS) etc.

Functional area information systems

Information systems can be designed to support the functional areas or traditional departments such as marketing, finance, accounting, human resources and manufacturing of an organization. Such systems are classified as "functional information systems" that typically follow the organizational structure.

Functional information systems are typically focused on increasing the efficiency of a particular department or a functional area.

One disadvantage of functional systems is that although they may support a particular functional area effectively, they may be incompatible to each other (no interaction between internal systems).

Organizations have realized that in order to be agile and efficient they need to focus on organizational processes. However a process may involve more than one functional area and therefore some information systems concentrate on one particular business area (accounting for example), but some information systems are cross-functional that can affect several different business areas (for example accounting, human resources, production, etc.)

Now we consider define functional area information systems that provide the support for each functional area of the organization. Each functional area requires applications to perform all information processing related to the function.

The popular functional areas of the business organization are: financial information system; marketing information system; information system for accounts; production/manufacturing information system and human resource information system. Let us consider each of them.

Financial information system is a sub-system of organizational management information system, which supports the decision-making process of financial functions at the level of an organization.

Financial information system is used to describe the IS subsystem that provides information to persons and groups both inside and outside the firm concerning the firm's financial matters. They have next functions: integrate financial and operational information from multiple sources; provide easy access to data; make data available immediately; analyze historical and current financial activity; monitor and control the use of funds over time.

The job of financial managers is to manage money as efficiently as possible by:
- collecting payables as soon as possible;
- making payments by the latest time allowed by contract or law;
- ensuring sufficient funds are available for day-to-day operations;
- taking advantage of opportunities to accrue the highest yield on funds not used for current activities.

Financial information system supports financial managers in decisions such as the financing of the business, the allocation and control of financial resources within the business. Functional business systems focus on operational and managerial applications that support business functions such as marketing and accounting.

The categories of major financial management system: cash management (collects information on all cash receipts and disbursements on a real-time or periodic basis); investment management (helps the financial manager make buy, sell, or hold decisions for each type of security and helps the financial manager develop the optimum mix of securities in order to minimize risk and maximize return); capital budgeting (involves evaluating the profitability and financial impact of proposed capital expenditures and allows financial managers to analyze long-term expenditure proposals for plant and equipment); financial forecasting and planning (evaluate the present and projected financial performance of the company, help determine financing needs and analyze alternative methods of financing and explore «what», «if» and «goal» seeking questions). Figure 9.10 shows the areas in which financial information systems are used.

Figure 9.10. Scope of financial information systems

Marketing information system is a sub-system of management information system, provides information about various functions of the marketing system of an organization. Marketing is another functional area of the business organization, which is engaged in marketing /selling of its products to its customers. In other words, marketing information system is a computer based system that works with other functional information systems to support the firm's management in solving problems that relates to marketing of the firm's products.

The marketing process includes following important functions: the marketing identification function; the purchase motivation function; the product adjustment function; the physical distribution function; the communication function; the transaction function; the post-transaction function.

Marketing information systems provide information technologies that support major components of the marketing function, for example interactive marketing (customer focused marketing process and based on using Internet, intranets and extranets to establish two-way communications between customers or potential customers and the business, where customers can become involved in product development, delivery and service issues

Marketing information systems are able to do market research where statistical models help market researchers find the best populations for new and existing products. Also have targeted marketing, where database management systems help define potential customers as narrowly as possible, where inputs: transaction processing data; marketing research data; marketing intelligence data; external environment data; strategic plan and outputs: product planning; place planning; promotion; pricing; budget allocation; sales forecast.

Marketing systems have five targeting components:

1. community (customize their web advertising messages and promotion methods to appeal to people in specific communities and also virtual communities);
2. content (advertising, for example electronic billboards or banners can be placed on various web site pages, in addition to a company 's home page and these messages reach the targeted audience);
3. context (advertising appears only in Web pages that are relevant to the content of a product or services and so these advertising is targeted only at people who are already looking for information about a subject matter);
4. demographic and psychographic (marketing efforts can be aimed only at specific type of class of people, for example unmarried, twenty-something, middle income, male college graduates);
5. online behavior (advertising and promotion efforts can be tailored to each visit to a site by individual).

Sales Force Automation include following: the sales force is connected to marketing websites on the internet, extranets, intranet and equipping salespeople with information technology to facilitate productivity (IT allows salespeople to present different options for products and services on the spot and increases

productivity of sales force speeds up the capture and analysis of sales data, also allows management to provide improved delivery information and better support of the sales force).

Internet plays an important role as a marketing and selling medium, because web lets companies reach more shoppers and serve them better, also mobile commerce is the newest form of marketing and commercial announcements pervade the web. In Figure 9.11 shows an example of a marketing information system supporting the decision-making process in marketing.

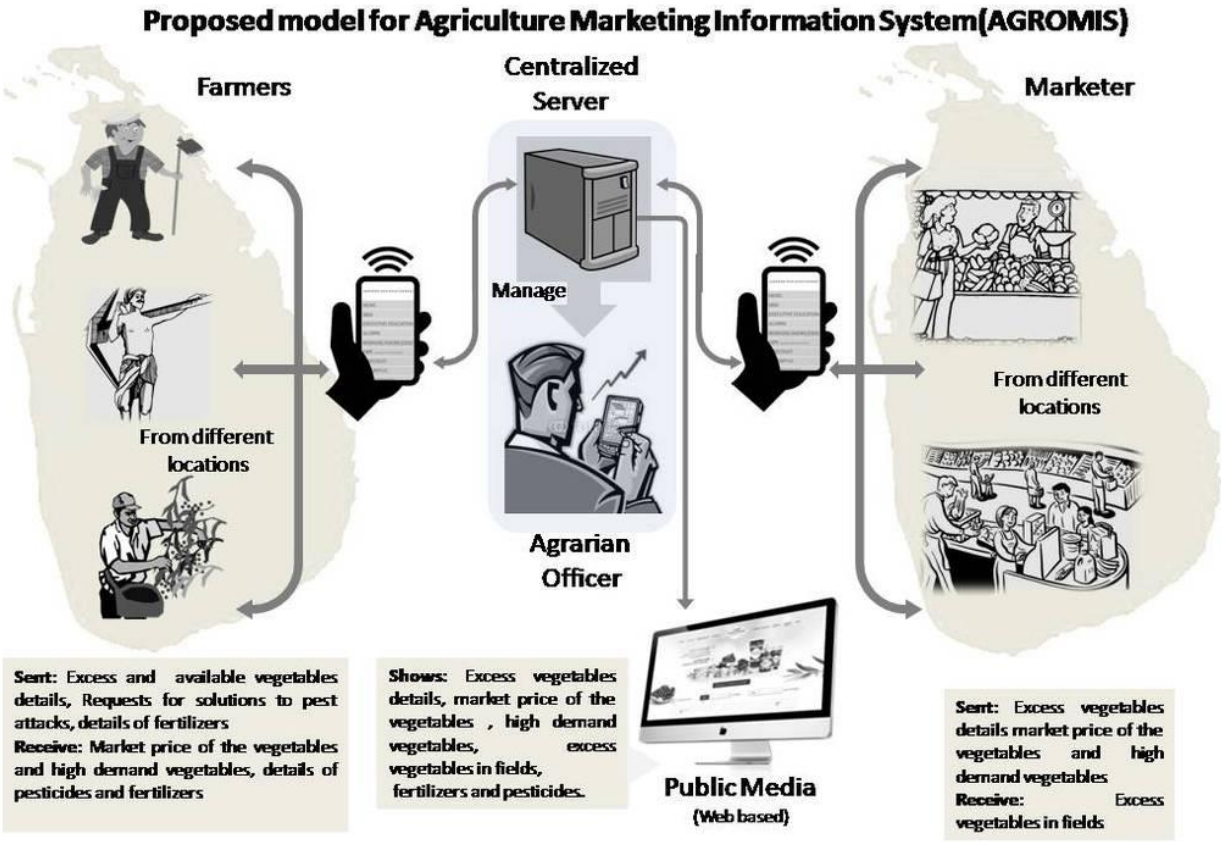


Figure 9.11. Example of an marketing information system

Accounting information system performs the firm's accounting applications with a high volume of data processing characterizes these applications. Also deals with data processing, data storage and document preparation. They have the following processes: recording; posting to subsidiary ledger; posting to general ledger; posting cycle.

When firms cannot achieve business objectives these objectives become challenges and information systems often present solutions, partially or fully, to these challenges. The use of information systems in business services: accounting (accountants): summarize transactions; create financial records; organize data; perform financial analysis, with skills IT, software used in auditing, accounting functions, system and network security issues, enterprise systems for financial

reporting and financial management services: develop financial reports; direct investment activities; implement cash management strategies, with IT skills, software used by financial managers and financial services firms, new technologies for financial transactions, trading, enterprise systems for financial reporting.

There are six widely used accounting systems:

1. order processing (which include captures and processes customer orders and produces data needed for sales analysis and inventory control);
2. inventory control (processes data reflecting changes in items in inventory, helps provide high-quality service while minimizing investment in inventory and inventory carrying costs);
3. accounts receivable (keeps records of amounts owed by customers from data generated by customer purchases and payments);
4. accounts payable (keeps track of data concerning purchases from, and payments to, suppliers);
5. payroll (receives and maintains data from employee time cards and other work records);
6. general ledger (consolidates data received from accounts receivable, accounts payable, payroll and other accounting information systems).

Accounting system in automatic information systems automatically post transactions in the books and automates generation of reports for management and legal requirements and also record and report business transactions and other economic events.

Currently accounting information systems are being affected by internet and client/server technologies. Using the internet, intranets, extranets and other networks changes how accounting information systems monitor and track business activity. Figure 9.12 shows some major components of accounting information system

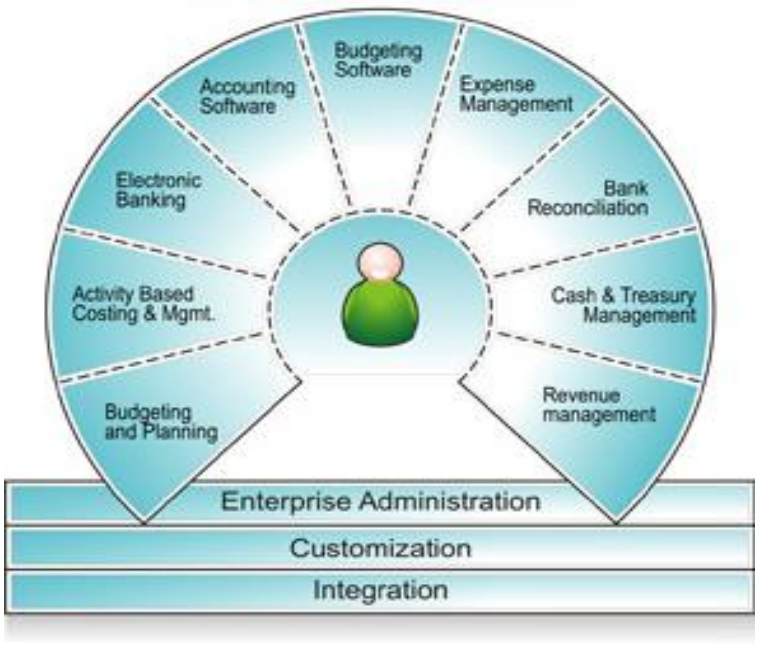


Figure 9.12. Major components of accounting information system

Production / manufacturing information system is a set of tools for managing the flow of manufacturing production data throughout the enterprise. This information system was designed to provide tools for both IT and operations personnel, who would deliver services to anyone in the plant.

These information systems solve the following tasks: plant activity scheduling; material requirement assessment; material reallocation between orders; dynamic inventory management; grouping work orders by characteristics; resource qualification for task completion.

Production information systems have next types: automation systems; logistics systems; material requirement planning; manufacturing resource planning; agile manufacturing environment and enterprise resource planning.

These information systems have next production process: schedule production source; raw material; check inventory; receive order; allocate resources; complete job; quality testing and send order.

Production systems include support the production and operations function and also assists firms in:

- material requirement assessment,
- planning, monitoring, and controlling inventories, purchases, and the flow of goods and services,
- material reallocation between orders,
- plant activity scheduling,
- resource qualification for task completion,
- computer-integrated manufacturing (manufacturing approach of using computers to control the entire production process).

Production information system have next objectives: simplify production processes, product designs and factory organization as a vital foundation to automation and integration; automate production processes and the business functions that support them with computers machines and robots and integrate all production and support processes using computers telecommunications networks and other information technologies.

Production system supports the concepts of flexible manufacturing systems, agile manufacturing and total quality management such as computer-aided engineering, computer-aided design, material requirements planning and also systems that automate the production process

Manufacturing execution systems includes shop floor scheduling and control, machine control, robots control, and process control systems. Production systems can control process control with the use of computers and also machine control with the use of a computer to control the actions of a machine.

The figure 9.13. below from Industry Directions (August, 2002) highlights the functionality of an manufacturing execution systems application and how it acts as the control layer between management and the people on the shop floor where production occurs.

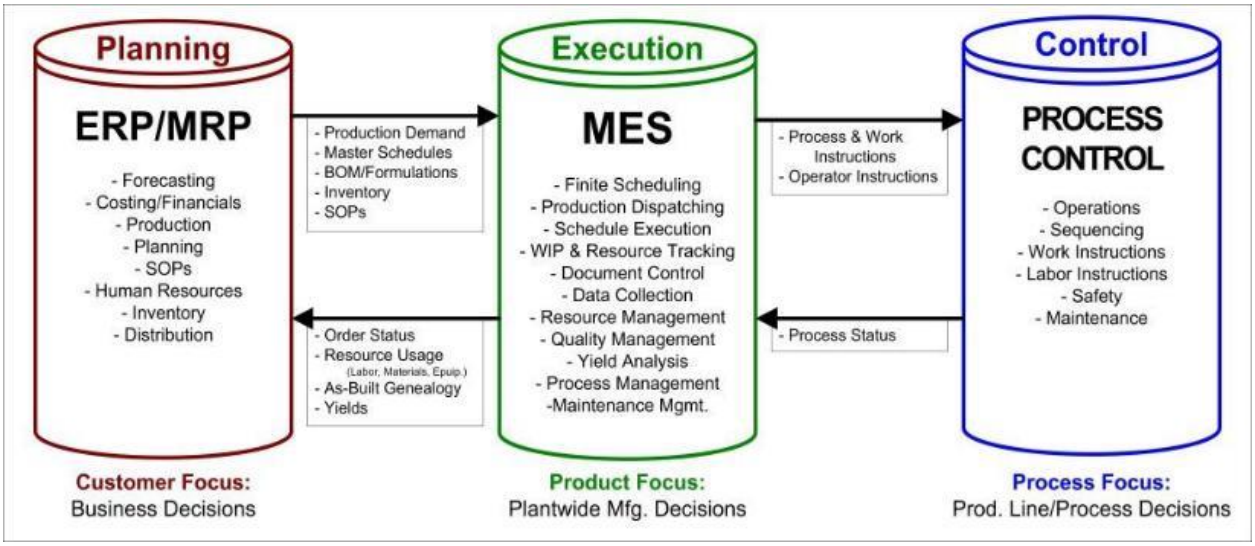


Figure 9.13. Manufacturing execution systems application

Human resources information systems used to support the following actions: planning to meet the personnel needs of the business; development of employees to their full potential; recruitment, selection and hiring; job placement; performance appraisals; employee benefits analysis; training and development.

Also in domain health, safety and security: employee record management (reduce space needed to store records, time to retrieve them, and costs of both); promotion and recruitment (search databases for qualified personnel, use intranet to post job vacancies and use the web to recruit); training (multimedia software training is replacing classrooms and teachers and training software simulates an actual task or situation and includes evaluation tools); evaluation (evaluation software helps standardize the evaluation process and adds a certain measure of objectivity and consistency); compensation and benefits management (for example calculate salaries, hourly pay, commissions and taxes and also automatically generate paychecks or direct deposits). Special software helps manage benefits, such as health insurance, life insurance, retirement plans, and sick and leave days.
Human resources management system and the internet allows companies to process most common applications over their intranets, also allows companies to provide around-the-clock services to their employees, besides it allows companies to disseminate valuable information faster and allows employees to perform tasks online.

Human resources management information systems help managers optimize the assignment of employees and provide payroll, benefits, and other employee related services.

Also like to note that the examples of the functionality of information systems are enterprise resource planning system. Enterprise resource planning systems integrate the planning, management and use of all resources of the organization. The system can help "manage" portions of the business. That is, enterprise resource planning systems are designed to break down the information silos of an organization. Some information systems were developed for specific

functional areas and did not communicate with systems in other functional areas. An enterprise resource planning is a set of highly integrated systems that help monitor, track and assist in decision making, where all phases of an organization communicate with one system that gathers a consistent set of data.

Benefits of enterprise resource planning systems are: they can make organizations more flexible, agile, and adaptive, they can improve managers' ability to make better, timelier decisions and they can improve customer service, production, and distribution. But they have limitations, for example they may require organizations to change existing business processes to fit the predefined business processes of the enterprise resource planning software and can be complex, expensive, and time consuming to implement.

Functional area information systems generate a wide variety of different reports: routine reports (i.e. monthly or weekly sales reports by product), ad hoc (on demand) reports (i.e. how many supplies did we sell this week) consist of the drill-down reports (allows users to click on an item in a report and be able to access underlying details about that item), key-indicator reports (summarizes the performance of critical activities), comparative reports (i.e. what are the sales of watermelon supplies versus lime supplies) and exception reports (include only information that falls outside certain threshold standards).

Collaboration technologies in Business intelligence

Today enterprises become more automated, real time and most often support online, operational decision making at all levels in the enterprise. Collaboration ended up in IT.

Business intelligence (BI) has spread to the enterprise within business decision-making, both across the organization and within specific departments, such as HR (Human Resource) and marketing, because the need for analytical tools is growing as enterprises gather statistics from the internet via cloud-based dashboards and browser-based mash-ups of rich media streams and begin to release the customer-specific information embedded within them.

Also people have embraced social networking applications and thread-based discussions to communicate and share ideas and insights in many walks of life. In much of the same way, business intelligence office includes social connectivity for people to share and collaborate on their data projects and business analytics.

A collaboration technology combines communication technologies (such as online social media tools) with business intelligence software, to place individuals conducting data analysis for the purpose of creating business intelligence into an active community of colleagues. They can provide useful context for business intelligence findings, supply knowledge and help improve decision-making by drawing upon the unique data and experience of other individuals, and the group as a whole. But the technologies and collaborative and social computing features offered by the different vendors can vary considerably because, for example, software for content management, search and process management might come standard with one platform and be sold as separate components or options with

others. Besides, these platforms usually work with the vendor's own BI tools. The products usually include support for user communities and team based workspaces, but they often lack formal or informal decision making procedures, collaborative connections to business processes and workflows, and the ability to record and track business decisions.

Data analysis is displayed to decision makers using dashboards, which will be discussed in task 12, visual analysis tools or reports. Collaborative business intelligence vendors include SAP and Microsoft. Microsoft Share Point, which focuses on content management, is a popular collaborative product. Also other collaborative software includes Lotus Notes.

Increasingly many enterprises have successfully deployed business intelligence (data warehousing, reporting, data mining, analytics, and information visualization) technologies to enable strategic decision making. How we see sort of high quality information and analytics tools are needed by the many knowledge workers who have to make many operational decisions as they engage in the business operations of the enterprise. Most of these business processes are performed by multiple knowledge workers, and require collaborative decision making, sometimes involving business partners for example outsourced vendors, suppliers, and service providers outside the enterprise. In this task, we introduce the concept of collaborative business intelligence, which is a combination of business intelligence and collaboration technologies targeted at collaborative decision making.

Collaborative business intelligence widely applied to enterprise-wide reporting and analytics, making the sharing process easier and enabling more efficient decision making among team members who have been working to reach conclusions on an individual basis

Collaboration technologies include *Enterprise Collaboration Systems* that represent the type of information system. Enterprise collaboration systems is a combination of tools, groupware, internet, extranets and other networks needed to support enterprise-wide communications, such as the sharing of documents and knowledge to specific teams and individuals within the enterprise. Most often examples of enterprise communication tools include e-mail, videoconferencing, collaborative document sharing, project management tools and others. Today the goal of enterprise collaboration systems is to provide each user with the tools for managing communications, documents and other information that individuals need to manage their own tasks efficiently in their departments. Figure 9.14. illustrates the elements of modern enterprise collaboration.

Figure 9.14. Elements of Modern Enterprise Collaboration

Enterprise collaboration systems imposes such new requirement on business intelligence as:

1. Business operations involve multiple geographically distributed workers, who need to collectively make decisions, for which they need to share knowledge, information, tools and applications. The participants may have different areas of expertise and play different roles and may even belong to different organizations such as business partners, vendors and external service providers.
2. The traditional business intelligence architecture, where data is periodically extracted from on line transaction processing (OLTP) database systems, integrated, cleaned, transformed and loaded into a data warehouse, and then served up to reporting and analytic applications, is no longer adequate. Operational decision making requires the capture of relevant events as they occur and the integration of historical, real time data extracted from many different types of sources. Web data feeds and semi-structured or unstructured data sources, in addition to the relational OLTP databases.
3. Unlike traditional business intelligence systems, whose users are typically trained analysts, operational business intelligence involves knowledge workers with different skills and expertise engaged in performing a variety of operational

tasks, the process and tasks he is engaged in, and the applications and tools appropriate to his tasks. This requires rich visual and multi-modal interfaces that support the in-context delivery of and interaction with relevant information.

Also collaboration technologies include enhance team and work group communications (examples: e-mail, instant messaging, videoconferencing), that provides next capabilities:

The first is collaborative interaction, where business managers and workers need to interact with one another to improve communication as part of business intelligence initiatives. They must be able to share business intelligence findings and discuss their meaning and possible options for improving business performance. Ease of discovery and documentation of ensuing discussions are key features of collaborative business intelligence. This collaborative interaction is most often supported by integrated instant messaging and email interfaces to applications example Microsoft Office, Google Docs and Lotus Notes, which are part of the office environment. Some business intelligence vendors also enable business intelligence results to be integrated into collaboration platforms; that extends this environment with content management, search and other collaborative features. Besides, BI vendors may interface to social media sites such as Facebook, LinkedIn, Twitter and YouTube.

Secondly is a collaborative decision making, because the ultimate goal of any business intelligence program is to make timely and better business decisions. A collaborative business intelligence environment supports team efforts to assess situations and make decisions. It also must enable organizations to track decisions and analyze their validity and business impact. Most often such analyses provide feedback that can help improve the decision process, allowing companies to document best practices and monitor the types of information that provide useful input for decision making. But products in set of the collaborative decision-making system category usually are developed from the ground up for organizations looking to implement collaborative processes for making decisions. Both on-premises and cloud-based implementations are available; two examples of cloud-based offerings are Salesforce Chatter and SAP Stream-Work. Products in this category are at various levels of development but are evolving to support the three main features of collaborative BI. They are also being integrated with the BI and office environments, and in some cases with enterprise collaboration platforms.

Third is information enhancement, because users must be able to add their own knowledge to business intelligence results. Through collaborative processes, work groups can share information about why events are unfolding the way they are to provide a business context to findings, and they can point to related data and content. Published business intelligence results can be enhanced through feedback mechanisms such as ratings, comments and tagging also, in some cases, microblogs and blogs. The application sets in the office environment include email systems, word processors, spreadsheets, presentation tools and personal databases; in some cases, they also feature on-premises and cloud-based tools for social computing.

But not all users need use all of its capabilities, and so important to determine which personnel require what features. For example, users who execute assigned tasks may simply require collaborative interaction, whereas business managers may require all three of the collaborative business intelligence capabilities outlined above.

Collaborative business intelligence can be applied to enterprise-wide reporting and analytics, making the sharing process easier and enabling more efficient decision making among team members who may have been working to reach conclusions on an individual basis. Compared to more solitary, conclusion-based traditional business intelligence tools, collaborative business intelligence emphasizes the problem-solving process. Tools allow peers to analyze data and exchange information and ideas through Web tools like blogs and wikis. Modern tools also support brainstorming through social networking-like features, which continue to gain popularity for both business and personal use.

Data is displayed to decision-makers using dashboards, visual analysis tools or reports. Collaborative business intelligence vendors include SAP and Microsoft. Microsoft SharePoint, which focuses on content management, is a popular collaborative product. Other collaborative software includes Lotus Notes.

Business intelligence collaboration combines communication technologies (most often online social media tools) with business intelligence software, to place individuals conducting data analysis for the purpose of creating business intelligence into an active community of colleagues.

Business intelligence collaboration can provide useful context for business intelligence findings, supply knowledge, and help improve decision-making by drawing upon the unique data and experience of other individuals, and the group as whole business intelligence.

That trend has spread to the enterprise, where the same collaborative potential of social platforms is being unleashed within business decision-making, both across the institution and within specific departments, such as human resource and marketing.

Business intelligence is at the heart of it, because the need for analytical tools is as enterprises gather statistics from the internet via cloud-based dashboards and browser-based mash-ups of rich media streams and begin to release the customer-specific information embedded within them.

People have embraced social networking applications and thread-based discussions to communicate and share ideas and insights in many walks of life. In much of the same way, business intelligence office includes social connectivity for people to share and collaborate on their data projects and business analytics.

Consider how to make business intelligence collaborative. Adding commentary and annotations to data often completes the business analytics cycle above and beyond the plain analytics process itself. Whether reviewing the current results in a dashboard or simply analyzing data in the latest refresh of the organization's data models, users can initiate, conduct and discuss their thoughts and insights with peers and colleagues in a convenient, in-built social-collaboration toolset. Conversations can be centered on books, reports, components, or cell-level data and allows users to provide both typed and audio related commentary in a given thread.

Business intelligence office provides a self-contained social networking toolset or it can be deployed to fully integrate with third party social platforms like Jive, Yammer and Chatter. The tools are designed to blend the best of collaborative tools and processes with the nuances of business analytics.

At the same time, the discussions can be designed to run using group and role security to ensure that the collaborative processes do not run contrary to the confidential nature of the content and data itself - adding the all-important "governance" layer to social collaboration.

Intelligent System

One of the examples of application systems of business intelligence is an intelligent system. Intelligent System is a machine with an embedded, internet-connected computer that has the capacity to gather and analyze data and communicate with other systems.

Essentially, an intelligent system is anything that contains a functional, although not usually general-purpose, computer with Internet connectivity. An embedded system may be powerful and capable of complex processing and data analysis, but it is usually specialized for tasks relevant to the host machine.

Requirements for an intelligent system include security, connectivity, the ability to adapt according to current data and the capacity for remote monitoring and management.

Intelligent systems exist all around us in point-of-sale terminals, digital televisions, traffic lights, smart meters, automobiles, digital signage and airplane controls, among a great number of other possibilities. As this ongoing trend continues, many foresee a scenario known as the Internet of Things, in which objects, animals and people can all be provided with unique identifiers and the ability to automatically transfer data over a network without requiring human-to-human or human-to-computer interaction.

Currently an intelligent system enables data to flow across an enterprise infrastructure, spanning the devices where valuable data is gathered from employees and customers, to the back-end systems where that data can be translated into insights and action. So with this capability, companies can unlock hidden value from data previously out-of-reach, and act on new insights to increase business value.

Intelligent Systems are professionally very competent. They are flexible when changing of plans, proactive and trustworthy and you can rely on what they say.

Consider some examples of application intelligent systems. Examples solutions from intelligent systems of airport include: Post and luggage sorting for airports, supervisory Control and Data Acquisition, warehouse Management Systems, handheld solutions and applications, web-based reports, statistics, data collection and calculation, production optimization, tracking of material and components, traceability and quality control, system integration and communication and qualification and counseling regarding choice of hardware for specialized solutions.

Artificial Intelligence can be used in many areas like Computing, Speech recognition, Bio-informatics, Humanoid robot, Computer software, Space and Aeronautics's etc.

Intelligent systems for business systems deliver next types of services:

- project services (software and systems development on project basis at a fixed price);
- consultancy (consultancy services for developing industrial software, automation and logistics systems, product development and project management);
- support services (support for industrial software systems).

The widespread use of intelligent systems is in medicine. Intelligent Systems develops intelligent tracking and monitoring, fully automated and integrated storage, transport and logistics for hospitals.

Intelligent hospital logistics

At hospitals of the future food, medicine, clothing and instruments all come out of the wall - where you need it when you need it. Intelligent hospital logistics is a revolutionary logistics solution that automates and integrates storage, transport and logistics. Intelligent sample handling and sorting - the solution ensures traceability, monitoring and automatic handling of blood samples for hospitals biochemical laboratories. The solution provides increased safety, quality and efficiency and faster response to the patient. Innovative project that improves the quality of test results and diagnoses through automation and intelligent monitoring, when blood samples or other samples sent for analysis at the hospitals from local medical practitioners.

Knowledge management systems

To uncover this topic, consider the basic concepts:

Knowledge management system is IT- system for applying and using knowledge management principles that stores and retrieves knowledge, improves collaboration, locates knowledge sources, mines repositories for hidden knowledge, captures and uses knowledge, or in some other way enhances the knowledge management process. These include data-driven objectives around

business productivity, a competitive business model, business intelligence analysis and more.

Also is a method for the improvement of business process performance. A knowledge management system is most often used in business in applications such as information systems, business administration, computer science, public policy and general management. Common company departments for knowledge management systems include human resources, business strategy and information technology.

Knowledge is

- personalized information
- state of knowing and understanding
- an object to be stored and manipulated
- a process of applying expertise
- a condition of access to information
- potential to influence action

The sources of knowledge of the organization are:

- intranet,
- data warehouses and knowledge repositories,
- decision support tools,
- groupware for supporting collaboration,
- networks of knowledge workers,
- internal expertise.

Knowledge management is important today. The major business drivers behind today's increased interest and application of knowledge management lie in four key areas:

1. Globalization of business (organizations today are more global - multisite, multi-lingual, and multicultural in nature);
2. Leaner organizations (we are doing more and we are doing it faster, but we also need to work smarter as knowledge workers - increased pace and workload);
3. Corporate amnesia (we are more mobile as a workforce, which creates problems of knowledge continuity for the organization, and places continuous learning demands on the knowledge worker - we no longer expect to work for the same organization for our entire career);
4. Technological advances (we are more connected - information technology advances have made connectivity not only ubiquitous but has radically changed expectations: we are expected to be on at all times and the turnaround time in responding is now measured in minutes, not weeks).

A knowledge management system is made up of different software modules served by a central user interface. Some of these features can allow for data mining on customer input and histories, along with the provision or sharing of electronic documents. Today knowledge management systems can help with staff training and orientation, support better sales, or help business leaders to make critical decisions.

As a broad designation, knowledge management can be applied in a lot of different ways to individual business processes. It's up to top-level managers to use these systems in ways that make the most sense for a particular enterprise.

There is a subtle, but very significant difference between knowledge management and information management, linked to the differences between knowledge, information and data.

Information management is "the provision of the right information to the right people at the right time". Knowledge management goes beyond this, and provides not just information, but insight, guidance, experience and know-how, for the purpose of decision support and effective action. Knowledge management is as much about connecting people than connecting personal computers, more about building communities than building databases, and more about reflection and analysis than about architectures and taxonomies. Knowledge is a lot harder to manage than information, as it is mainly stored in heads rather than hard disks. However knowledge management needs to be built on a foundation of good data management and information management.

A knowledge management system includes a range of practices used in an organization to identify, create, represent, distribute, and enable adoption to insight and experience. Such insights and experience comprise knowledge, either embodied in individual or embedded in organizational processes and practices.

Purpose of knowledge management system is improved performance, competitive advantage, innovation, sharing of knowledge, integration.

Experience and information accumulated by employees are the most critical intellectual capital and competitive advantage of any organization. To preserve and make best use of it, you need knowledge management software to store, organize, distribute, and enable adoption of this knowledge within your organization efficiently. For example Absolutely!™ is an enterprise wiki style knowledge management software. It works on top of Google Apps, allowing authors to mix and match various documents / web pages in one article, and add external materials as well. It is shown in the figure 9.15.

Figure 9.15. Example of "Absolutely" knowledge management software an enterprise wiki style

Review questions

1. Describe the distinctive features between executive, management and operations support systems.
2. What is the need for decision support system and what technology skills do managers need?
3. Uncover appointment of marketing, finance, accounting, human resources and manufacturing information systems.
4. How collaboration technologies can boost business performance?
5. What are the various areas where Artificial Intelligence can be used?
6. What is the difference between information management and knowledge management?

9.4. Information visualization

Information visualization comprises all concepts, methods, and tools used for the visual representation of information from data bases, digital libraries.

Visual analytics

Visual analytics is the science of analytical reasoning supported by interactive visual interfaces. [****] Visual analytics - the science of combining interactive visual interfaces with automatic algorithms to support analytical reasoning and build synergies between humans and computers. Visual analytics combines automated analysis techniques with interactive visualizations for an effective understanding, reasoning and decision making on the basis of very large and complex data sets.

Every day, decisions all over the world are made by entities from the largest organizations down to the most solitary individuals, and many if not most of those decisions are informed by data. Over the last decades data was produced at an incredible rate but, the ability to collect and store this data is increasing at a faster rate than the ability to analyze it.

Visual analytics is used in all areas spanning science, engineering, business and government; examples of specific application areas include intelligence analysis for homeland security, business intelligence support to help businesses acquire a better understanding of their commercial context, mobile graphics for emergency first responders, network log analysis for computer security, and health monitoring for disease outbreak prediction and response.

The data being examined may range from quantitative business information, stored in spreadsheets and databases, to textual documents such as news reports and articles. Often, the data is a heterogeneous collection of items drawn from different sources, but common to all these types of data is our need to draw information from it.

Purposes of information visualization - to help:

- Explore;
- Calculate;
- Communicate;
- Decorate.

Explore/Calculate include analyze and reason about information, communicate - explain, make decisions. Data visualization is not a new practice and everyone can recognize a line graph or a pie chart. But with modern computer systems that can collect and analyze literally trillions pieces of data, we need similarly sophisticated tools to deal with it all. Currently researchers are developing new, interactive visualization techniques and systems that provide multiple and flexible perspectives on the data being examined. These systems help people and organizations to browse, explore and analyze data that is important to them. Fundamentally, these interactive visualizations are tools for sense-making; they assist us in understanding data by presenting it in a form that can be organized, queried and explored in order to gain new perspectives and insights about it.

Visual Principles:

- Types of Graphs
- Pre-attentive Properties
- Relative Expressiveness of Visual Cues
- Visual Illusions
- Notions
    - Graphical Excellence
    - Data-Ink Ratio Maximization
    - How to Lie with Visualization

Types of symbolic displays:

- graphs (examples: scatter-plot, bar-chart, layer-graph);
- charts (discrete relations among discrete entities structure relates entities to one another lines and relative position serve as links);
- maps (internal relations determined (in part) by the spatial relations of what is pictured labels paired with locations);
- diagrams (schematic pictures of objects or entities parts are symbolic, how-to illustrations figures in a manual).

Visual analytics methods allow decision makers to combine their flexibility, creativity, and background knowledge with the enormous storage and processing capacities of today's computers to gain insight into complex problems. Visual analytics evolved from information visualization and automatic data analysis.

Visualization has three major goals:

a) Presentation to efficiently communicate the results of an analysis,

b) Confirmatory analysis as a goal-oriented examination of hypotheses,

c) Exploratory data analysis as an interactive and usually undirected search for structures and trends.

Main components of visual analytics:

- analytical reasoning;
- interactive visualization;
- computation analysis.

Currently there are many different programs products for visual analytics, for example SAS Visual Analytics (SAS is the world's largest private IT company working in the field of business intelligence) and Visual Analytics (Visual Analytics, Inc..). These products provide quickly create dazzling interactive reports and dashboards, and easily share them via the internet, mobile devices and Microsoft applications.

Now predictive analytics combined with easy-to-use features mean everyone can assess possible outcomes and make smarter, data-driven decisions - without coding. Many scientists can use interactive predictive modeling environment, SAS Visual Statistics. Mobile BI capabilities give executives and front-line employee's access to dashboards and reports they can interact with easily from tablets and smart phones - anytime, anywhere.

In past visual analytics consisted of: visualization methods, data analysis and user interaction - all separately.

Now of visualization, analysis and user interaction - all in conjunction intersect.

In future all, closely interlinked, considered as a whole as visual analytics. The visual analytics process show in Figure 9.16.

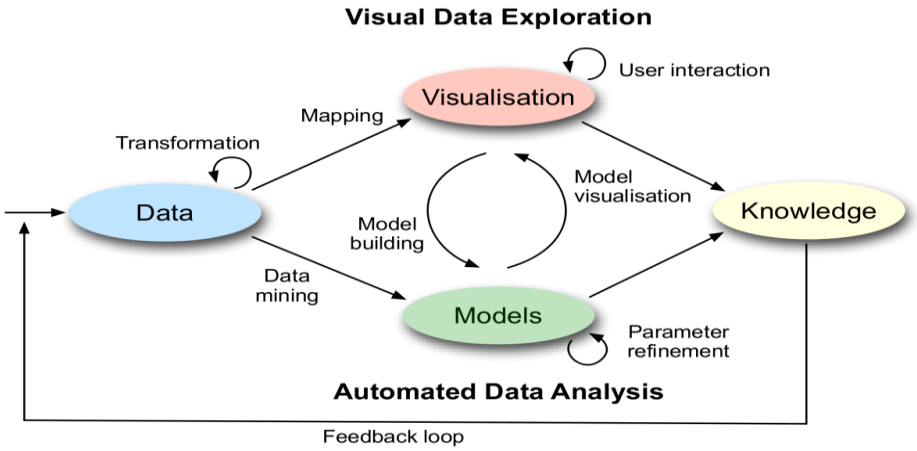


Figure 9.16. Process models of visual analytics

Features applications for BI:

- data exploration and analytics (design and distribute BI reports and dashboards and explore data through interactive data visualization and easy-to-use analytics);
- collaboration and storytelling (dynamic charts, visuals and reports through familiar Microsoft Office and SharePoint applications);
- using auto charting to automatically pick the best graph for data;
- easy-to-use analytics (have forecasting, goal seeking, scenario analysis, decision trees, path analysis and other techniques);
- interactive charts, dashboards and reports (enable everyone to glean insights from any size and type of data);
- integration with mapping technologies (easily add geospecific information to reports).

Thus like other types of business intelligence and business analytics initiatives, visual analytics applications must incorporate effective data management strategies in order to integrate, unify and standardize data coming from different source systems. Visual analytics is especially helpful in applications involving large, complex data sets and analytical processes that require a high degree of monitoring and interaction, for example, big data analytics and data mining uses.

In the business intelligence domain the main visualization tools are dashboards.

Dashboards

The ability to analyze data to predict market trends of products and services, and to improve the performance of enterprise business systems, has always been part of running a competitive business. With ever-increasing competition and rapidly changing customer needs and technologies, enterprise decision makers are no longer satisfied with scheduled analytics reports, pre-configured key performance indicators or fixed dashboards. They demand ad hoc queries to be

answered quickly, and actionable information from analytic applications using real-time business performance data, and they require that these insights be accessible to the right people exactly when and where they need them. Furthermore, since there are too many overlapping data sources with varying qualities, they require more control over the data used for analysis, as insights derived from out of date wrongly purposed and poor quality data can do more harm than good.

Purpose of dashboards is to help monitor aspects of business performance, by highlighting with charts key performance indicators, that indicate success of project management and progression of development teams.

Currently there are different systems, for example consider MicroStrategy tool (company MicroStrategy Inc. is a provider of business intelligence, mobile software, and cloud-based services.), which provided a framework for integrating information, people, and processes across all of the organizational boundaries. The benefits of utilizing the system included:

- single sign-on to multiple aspects of the reporting structure was made possible, eliminating the need to maintain multiple passwords and having to log in to multiple applications;
- efficiency was greatly increased as management could now go to a single location to access a variety of related and unrelated information;
- it allowed the establishment of a central point, to deploy many of the organizations business intelligence applications;
- management were provided with a single location to access their dashboards as well as documents, presentations, and online discussions, along with other applications.

The interface gives users the ability to apply filters to these reports, with the capability to drill down to the underlying data. If there is a requirement for a particular report which is not being generated automatically by the system, users have the capability to generate their own personalized reports based upon their individual queries. This level of report generation gives key personnel within the organization the capability to oversee all facets of the supply chain. Specific locations within the supply chain, where inventory is building up can be quickly identified. It is also relatively easy to identify those products which are generating the most margins, and which products are not. This provides management with the ability to apply different marketing strategies within their product range to ensure that slow moving items are priced more competitively in order to boost sales for these particular items. Scorecards, which are generated by Micro Strategy allows each member of the sales team to see how they are performing against the set goals on a continuous basis. This provides members of the sales team with real-time data of how they are performing against the set targets. It is also possible to segment revenue data based on the particular channel that generated it. In this way, the performance of the individual retails stores can be quickly evaluated, and this in turn can be compared to revenue generated from the e-commerce channels. The portal provided the ability to access Web-based applications through hyperlinks,

with these links being embedded in the most relevant areas of a dashboard portal page. This proved extremely useful to management which wanted to access information that had relevant context to a dashboard or a component on a dashboard. For example, a hyperlink to a detailed financial report could be placed next to a financial chart showing actual and budget figures for an entire Profit and Loss report. This proved to be very helpful in assisting management to visualize and track their goals and tactics. The dashboards were than able to display key performance-related charts and indicators together with strategy maps and scorecards to assist the management team to focus their resources on the most important performance related, activities and drivers.

Dashboards - information visualization. The concept of dashboards has become increasingly popular as organizations discovered their ability to communicate complex information. Business Intelligence transforms data into powerful dashboards, from the business needs, functional design, and platform-driven configuration. MicroStrategy offers a solid and easy-to-use platform. Dashboards may turn out to be a very useful asset for organizations wanting to deploy a decision support system for any given business domain. Business domains such as financial and investment, insurance, healthcare, retail, and logistics may use the power of MicroStrategy Business Intelligence. Using this, executive users and business analysts can build dashboards and scorecards on their own. Business analysts can also share the reports with other business executives, or save it at the Shared reports location for use and collaboration by other users and analysts.

Dashboard Types

Dashboards can divide into two categories: Management and Operational. Management dashboards are used by different levels of management and are based on the end goal, where these dashboards can divide into two categories: strategic (align with the organization's strategic objectives and is geared more toward executives, where lists the key performance indicators and provides some supporting information) and tactical (have more tactical in nature using up the minute information.). These dashboards use historical data rather than real time data for trend analysis.

Operational dashboards are near real time focused and aimed at front-line staff. Operational dashboards include:

- detect and respond, with goal - prevent disaster;
- incent and motivate, with goal - aid competition.

There are five steps to building dashboards:

- determine what the users wants to measure;
- create sample layouts and build prototypes;
- collect the supporting data;
- create the final dashboard;
- shepherd the user adoption process.

Dashboard examples: Executive Dashboard, Retail Analysis Dashboard, Marketing Campaign Dashboard, Lead Generation Dashboard, E-Commerce Dashboard, Healthcare Dashboard, HR Dashboard, Investor Dashboard.

Oracle and Microsoft are among the vendors of business intelligence dashboards. BI dashboards can also be created through other business applications, such as Excel. Business intelligence dashboards are sometimes referred to as enterprise dashboards.

Geographic Information Systems

Geographic Information System (GIS) is designed to capture, store and display, communicate, transform, analyze and archive geo-referenced information which is tied to specific locations on the Earth's surface. A GIS has the ability to integrate hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. A GIS provides the ability to view, understand, question, interpret, and visualize data in a number of different ways that can reveal relationships, patterns and trends, in the form of maps, globes, reports, and charts. A GIS can answer questions and solve problems by looking at data in a way that is quickly understood and easily shared. GIS enhance and to some extent replace the traditional role played by maps, but they are also capable of handling information in the form of satellite images of the Earth's surface, as well as information from surveys and administrative records that have been geo-referenced.

A geographic information system is critical to any utility's business. A successful GIS will store and map a vast amount of information about the utility's electric, gas, and water systems, as well as outside plants. The figure 9.17. illustrates the application of GIS.

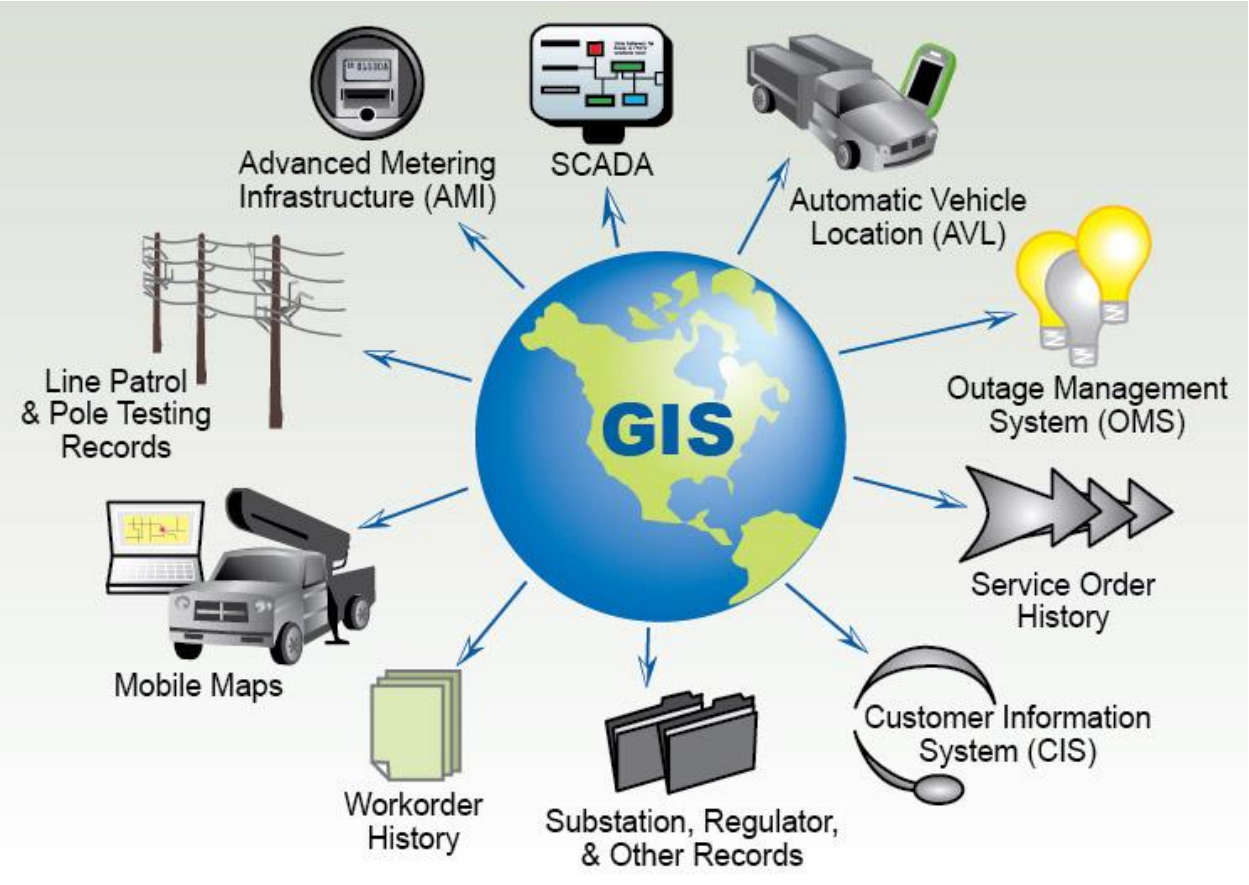


Figure 9.17.Application of GIS

They are increasingly used in the social sciences to support research based on cross sectional data or studies for which geographic location and context are important and useful. The real power of a GIS comes from the ability to relate different information in a spatial context and to reach a conclusion about this relationship. The bulk of the information in relation to our world contains a location reference, placing that information at some point on the globe. When a significant meteorological event occurs, it is important to know where the event is located. This is done by using a location reference system, such as longitude and latitude, and perhaps elevation. In a more general sense, users require the possibility to display data on maps, to allow them to compare maps of different terrain or different times, to enable research into these maps to get more details, or conversely to roll up data to visualize maps displaying a range of global information, and to display these maps along with tables and statistical charts to get more insights into their datasets. Multidimensional modeling and On-Line Analytical Processing (OLAP) allows for fast intuitive and easy analysis of huge volumes of data. In general, OLAP provides aggregated summary information, collected from multiple sources, and modeled in multidimensional structures. The combination of GIS and OLAP has resulted in Spatial On-Line Analytical Processing (SOLAP) where OLAP engines provide multidimensional perspective of data and GIS provides the cartographic representation. SOLAP's are designed to be client applications sitting on top of a multi-scale spatial data warehouse

however, the non-expert can visualize them as a new type of user interface for multi-scale GIS applications and Web mapping.

The interface of a SOLAP tool is composed of two main parts: the visualization space and the navigation panel. The visualization space allows the user to see the desired information in the form of one to many maps, statistical diagrams or tables with the possibility to change the displays in order to see the information in the most meaningful way, along with the possibility to synchronize all the displays. All the displays are dynamic in the sense that the user can use different operators to «navigate» inside the dataset through the displayed elements.

Using a SOLAP tool, a user has the ability to conduct analysis without having to master a query language or to know and understand the underlying structure of the database. With a SOLAP tool, the analyst focuses on the results of the analysis rather than on the procedures required by the tool to compute the analysis results. In the context of information exploration, maps and graphics do more than make data visible, they are active instruments in the end-users thinking process. All the possible views, displayed as maps, diagrams or tables, do not have to be prepared in advance, but are dynamically managed by the SOLAP server. Although the maps produced by the tool are similar to maps produced by current GIS software, the underlying difference is in the way these maps are produced using multidimensional data cubes. The major benefit is a higher level of flexibility and rapidity for interactive data navigation. The navigation panel allows the user to select one or more members of each dimension, and also the measures, to be viewed in the visualization space. All the possible combinations of dimension members and measures are available, and are presented to the user through lists or tree views. The user clicks on the elements in the lists and the displays are automatically updated to reflect the new selection.

Business Intelligence Reporting An essential component that contributes to the success of many organizations is their ability to take advantage of all the available information distributed across all the various functions. This challenge becomes more difficult as the volume of information increases, both internally and externally. This problem is further compounded by the fact that many organizations are becoming increasingly «knowledge-centric», and therefore a larger number of employees need access to a greater variety of information to be effective. As data sources proliferate it is becoming increasingly difficult for companies to produce consistent and timely operational reports. Many companies are implementing scorecards and dashboards as key components of their BI initiatives. These tools visually summarize large amounts of data related to organizational performance. Two technologies have been central in improving the quantitative and qualitative value of the knowledge available to decision makers: BI and knowledge management. BI has applied the functionality, scalability, and reliability of modern database management systems to build ever larger data warehouses, and to utilize data mining techniques to extract business advantage from the vast amount of available enterprise data. Knowledge management technologies, while less mature than BI technologies, are now capable of

combining today's content management systems and the Web with vastly improved searching and text mining capabilities to derive more value from the explosion of textual information. With the aid of dashboards which have been designed easily, see how actual performance compares to goals, benchmarks, and previous performance.

The objective of a BI solution is to offer a tool where end users can easily access data for analytical purposes. Unfortunately, databases have a reputation for being somewhat user-unfriendly. To make data access easier for end users most vendors of reporting solutions have provided the possibility to create a layer between the database and the reporting tool. In this layer the database fields can be translated into «objects», each having a clear business definition. These objects can be dragged and dropped onto a report, making report creation a much simpler task. The semantic layer and the reports represent only the tip of the iceberg for a person within the IT department, but for most of the end users they are the only visible part of the BI solution. IT professionals tend to give less attention to the reporting part of the BI application. For end users the availability of reports, access to the reporting tools, correctness of titles and descriptions attached to the reports is crucial, and lack of attention on this side may result in a serious failure of the BI programmer, even with a correctly modeled data warehouse, perfect architecture and good quality data. The richness of reports that can be provided to end users is sometimes outside of the comprehension of typical IT people, but also outside of the imagination of the business community. IT people often know too little of the business to format a report into the most readable, easiest understandable graph, while business users can often have too few insights into the technical possibilities of the platform and have been forced to think within the limits of the same graphs and tables they have always worked with. A good deal of attention needs to be paid to the collaboration between IT and business in order to build a good set of reports that maximizes the return on investment of the BI programmer.

The advantages of GIS:

- Time minimization
- Accuracy improvement
- Data can be managed efficiently
- High cost/benefit ratio

The main components of GIS: People, Data, Hardware, Software, Methods.

The GIS functions:

- Data acquisition (spatial and non-spatial)
- Data processing (data management)
- Data analysis (spatial & statistical analysis)
- Data storage (store data more efficiently)
- Data output (maps, graphs, tables, reports)

The «Software» as one component of GIS

- Operating System (OS) – Windows/NT, UNIX
- Graphic software (CAD, Microstation)
- Database software (dBASE, Oracle)

- Statistical packages (SPSS, SAS, Minitab)
- Word processing (Ms Word, Word Perfect)
- Image processing (IDRISI, ER Mapper, ERDAS)
- GIS systems (Arc/Info, ArcView, MapInfo)
- Presentation (Ms PowerPoint, SCALA, Coral Draw)

It is important to identify the end users for each functional set of reports. A good allocation of report ownership, and clear rules for version and release management will help to keep control of the many reports that will be created. Despite the very successful implementation of the ERP system that was very successful in resolving quite a number of issues within the organization, many problems were internal to the organization, and they did not represent the complete solution that they were looking for in terms of competing within the external environment. Many organizations realized that ERP within itself does not represent an all-embracing solution to their problems. The need for complementary solutions through the use of alternate technological solutions was clearly identified. Of particular concern to the management team were the two issues of CRM and Electronic Data Interchange. Aware, that the days of offering a personal shopping experience to individual customers within their stores was something, that was of the past, and that this type of service, in the main, was no longer possible, however they realized the importance of targeting specific customer segments, and of providing a personalized experience to their customers, based on the data that they already held in relation to each customer. They therefore decided to pursue a Web-based CRM strategy in order to accomplish this. Effective CRM has become a strategic imperative for companies in virtually every business sector. Enabled by advanced information technologies, companies can now collect a significant amount of in-depth data in relation to their customers, and, then utilize the information for their strategic business purposes. Here, the important issues are: to identify what kind of information they need, about whom they will collect this information, and how they will manage such information for future use. Companies are moving closer to their customers, expending more effort in finding new ways to create value for their customers, and transforming the customer relationship into one of solution finding and partnering rather than one of selling and order taking. Organizations will be more successful if they concentrate on obtaining and maintaining a share of each customer rather than a share of the entire market. It has been illustrated in practice that retaining an existing customer is more profitable than acquiring a new one.

Review questions

1. What does visual analytics provide and in what areas is applied?
2. What is business intelligence dashboard?
3. Explain the benefits of using dashboards in various applications.
4. Discuss briefly Data «Information», «People», «Hardware» and «Software» as one component of GIS.

5. Explain next areas of GIS Application: fire, police and ambulance (911 and emergency vehicle routing), telecommunications, government and academia.

Task 10. Enterprise-wide information systems

Enterprise resource planning

Enterprise resource planning (ERP) systems are integrated systems with mechanisms based on planning and forecasting, which support the management of the entire enterprise and integrate all its activities. The effective implementation of such a system can bring about many benefits, such as enterprise management and information flow enhancement. Consequently, improvement of economic indicators is achievable, which finally leads to an increase in enterprise profitability. However, the achievement of these aforementioned benefits depends upon the effective implementation of the full functionality of the ERP system, which is quite difficult. There are a great many implementation projects that do not bring about the planned effects, or even end up in project abandonment. The duration and budget of the implementation projects significantly exceed initial estimates, and the planned scope of the implementation is limited.

ERP systems are computer-based systems designed to process an organization's transactions and facilitate integrated and real-time planning, production, and customer response. In particular, ERP systems will be assumed to have the following characteristics:

- ERP systems are packaged software designed for a client server environment, whether traditional or web-based;
- ERP systems integrate the majority of a business's processes;
- ERP systems process a large majority of an organization's transactions;
- ERP systems use an enterprise-wide database that typically stores each piece of data once;
- ERP systems allow access to the data in real time.

In some cases, ERP allows an integration of transaction processing and planning activities (e.g., production planning). Moreover, ERP systems increasingly are assumed to have the following additional characteristics:

- support for multiple currencies and languages (critical for multinational companies);
- support for specific industries (e.g., SAP supports a wide range of industries, including oil and gas, health care, chemicals, and banking);
- ability to customize without programming (e.g., switch setting).

Enterprise resource planning systems are powerful software packages that enable businesses to integrate a variety of disparate functions. In particular, ERP systems can provide the foundation for a wide range of e-commerce-based processes, including web-based ordering and order tracing, inventory management, and built-to-order goods. Figure 10.1 shows the scope of ERP systems.

Figure 10.1 Application ERP systems

This textbook examines the advantages and disadvantages of ERP systems, explains how they work, and highlights their role at the heart of e-commerce. The author considered specific systems, such as SAP, and their capabilities, then discussed the risks associated with the adoption of ERP systems.

Enterprise resource planning systems are a corporate marvel, with a huge impact on both the business and information technology worlds, including each of the following dimensions. ERP advantages:

- affects most major corporations in the world;
- affects many SMEs (small and medium enterprises);
- affects competitors' behavior;
- affects business partner requirements;
- has changed the nature of consulting firms;
- provides one of the primary tools for reengineering;
- has diffused many «best practices»;
- gave client server computing its first enterprise product;
- has changed the nature of the information systems function;
- has changed the nature of jobs in all functional areas;
- cost is high;
- has experienced huge market growth.

In the past several years many organizations have initiated enterprise-wide / ERP projects, using such packages as SAP, PeopleSoft, and Oracle. These projects often represent the single largest investment in an information systems project in the history of these companies, and in many case the largest single investment in any corporate-wide project. These enterprise-wide / ERP projects bring about a host of new questions because they represent a new type of management challenge. Oracle is the second - largest supplier of software in the world. However, they are perhaps best known for their database system, not their ERP applications. Oracle was founded in 1977 in the United States. Oracle's applications were developed for the U.S. market in 1989 and for the international market in 1993. In 1997, Oracle

announced that they were going to market to specific industries and improve the international characteristics of their software.

PeopleSoft (PeopleSoft, Inc. the company that developed application software for organizations (HRMS, ERP and CRM)) was founded in 1987 and went public in 1992. PeopleSoft is the third-largest ERP vendor. In 1997 their share of the ERP market was 6%, and in 1998 their revenues exceeded $1.3 billion. PeopleSoft can be scaled to accommodate from 10 to 500 users. PeopleSoft has become known for the broadest human resources capability. In many cases, firms have chosen some other ERP (e.g., SAP) for all other modules and PeopleSoft for human resources. In some cases, the quality of this human resource module led some clients to adopt the rest of PeopleSoft's ERP modules. The largest market share for ERP is held by SAP (Systems, Applications, and Products in Data Processing). In 1997 SAP had a 33% market share and supplied 60% of ERP used by multinational companies. In 1998, that market share had increased to 36%. SAP is the fourth-largest supplier of software, trailing only Microsoft, Oracle, and Computer Associates International. SAP was founded in 1972 in Walldorf, Germany.

In 1995, SAP generated 90% of their revenues from large global companies, but by 1997 SAP expected 50% of its revenues to come from SMEs (small and medium enterprises).

In the early1990s, client server computing was an available technology that offered many advantages over existing main frame solutions. Unfortunately, there was limited software available to exploit the advantages. Enterprise resource planning changed all that when it became one of the first dominant corporate applications of client server computing. ERP has changed the Nature of the Information Systems Function. His topically, the job of the information systems function was primarily one of designing, developing, and implementing software. Now, with ERP systems, the design and development functions are being outsourced. Enterprise resource planning systems are replacing major portions of most firms' software needs. This changes the basic nature of the information systems function from one where systems analysts and programmers are needed to one where knowledge of existing software packages is critical. Not only have needs changed, but personnel have become more mobile. Historically, information systems personnel would have knowledge only of firm-specific legacy applications. With ERP software that changes, knowledge can be used at more than one firm. Knowledge of almost any ERP package is useful not just in one organization; it is useful around the world. Thus, as the use of ERP package software grows, there is more mobility among personnel in information systems than has ever been seen. In addition, this mobility is changing the consulting business that supports ERP package software. Consultants armed with knowledge about such a package can now take that knowledge from one firm to another. The consultant actually becomes more and more valuable with each new implementation of the software. Enterprise resource planning has changed the nature of jobs in functional areas, such as manufacturing.

There is a huge demand for users or line-of-business personnel who also have professional level IT skills. But traditional IT types who know only about technology and nothing about the business are not needed now as they once were.
Enterprise resource planning systems provide firms with transaction processing models that are integrated with other activities of the firm, such as production planning and human resources. By implementing standard enterprise processes and a single database that spans the range of enterprise activities and locations, ERP systems provide integration across multiple locations and functional areas. As a result, ERP systems have led to improved decision-making capabilities that manifest themselves in a wide range of metrics, such as decreased inventory (raw materials, in-process and finished goods), personnel reductions, speeding up the financial close process, and others. Thus, ERP can be used to help firms create value. In particular, ERP facilitates value creation by changing the basic nature of organizations in a number of different ways.

ERP Integrates Firm Activities. Best practices can be used to improve the way that firms do business. Choice and implementation of an ERP requires implementation of such best practices.ERP Enables Organizational Standardization Enterprise resource planning systems permit organizational standardization across different locations. As a result, those locations with substandard processes can be brought in line with other, more efficient processes. Moreover, the firm can show a single image to the outside world. Rather than receiving different documents when a firm deals with different branches or plants, a single common view can be presented to the world, one that puts forth the best image.

Enterprise resource planning systems put all the information into the same underlying database, eliminating many information asymmetries. This has a number of implications:

1) It allows increased control.
2) It opens up access to information to those who need it, ideally providing improved decision-making information.
3) Information is lost as a bargaining chip; since information is now avail-able both up and down the organization.
4) It can “flatten” an organization, because information is widely available, there is no need for non–value-adding workers whose primary activity is to prepare information for upward or down-ward dissemination. ERP Provides On-Line and Real-Time Information.

ERP Allows Simultaneous Access to the Same Data for Planning and Control Enterprise resource planning uses a single database, where most information is entered once and only once. Since the data is available on-line and in real time, virtually all organizational users have access to the same information for planning and control purposes. This can facilitate more consistent planning and control, in contrast to legacy systems. ERP Facilitates Intra-Organization Communication and Collaboration Enterprise resource planning also facilitates intra-organization (between different functions and locations) communication and collaboration. The existence of interlocking processes brings functions and

locations into communication and forces collaboration. The ERP system provides the information backbone for communication and collaboration with other organizations. Increasingly, firms are opening up their databases to partners to facilitate procurement and other functions.

ERP Life-Cycle may be broken down as follows:

- Deciding to Go ERP
- Choosing an ERP System
- Designing ERP Systems
- Should Business Processes or ERP Software Be Changed
- Choosing Standard Models, Artifacts, and Processes
- Implementing ERP
- After Going Live
- Training.

Electronic Commerce Enterprise resource planning provides information backbone that can provide a basis for building electronic commerce applications. Ultimately, ERP systems must integrate with other systems, or ERP vendors must generate their own solutions to electronic commerce. In either case, ERP systems can facilitate electronic commerce.

Yet where there are huge opportunities for growth and value creation, there are also huge opportunities for risk. A definition of «risk» is a problem that has not happened yet but could cause some loss or threaten the success of your project if it did. A number of research studies have investigated the issue of the relative importance of various risks in software development projects and have attempted to classify them in various ways. Much has been written about the causes of information system project failures. Poor technical methods are only one of the causes, and this cause is relatively minor in comparison to larger issues, such as failures in communications and ineffective leadership. Studies dealing with risk factors in information system projects describe issues of organizational fit, skill mix, management structure and strategy, software system design, user involvement and training, technology planning, project management, and social commitment. Lack of user commitment, ineffective communications with users, and conflicts among user departments are also sources of risk.

Risk factors include technological newness (need for new hardware, software), application size (project scope, number of users, team diversity), application complexity (technical complexity, links to existing legacy systems) and failure of technology to meet specifications.

Project management, project cost and time overruns can occur because of a lack of a measurement system for assessing and controlling project risk. Project management and control failures, caused by inadequate planning and tracking, can contribute to unrealistic schedule sand budgets and project failure

Risk factors and risk outcomes need to take into account distinctive human and organizational practices and patterns of belief and action. In information technology projects, there is a tendency to discount problems and their severity may remain unknown for a long period of time. When projects run into difficulty,

there is a tendency to escalate projects because of societal norms (for example, needing to save face) and to keep pouring resources into a failing project. This may augment risk. To minimize problems, it is essential look for opportunities to use external feedback to recognize the problem and then to redefine the problem. This may entail considering alternatives to accomplishing the project's goals and preparing key stakeholders for the decision - especially if the decision is an exit strategy.

Supply Chain Management

Supply Chain Management (SCM) is the oversight of materials, information, and finances as they move through the extended supply chain from the supplier to manufacturer to wholesaler to retailer and eventually on to the consumer. The imperative for organizations to adopt SCM as a top strategic objective and major e-business application development initiative is because SCM enables order processing, just-in-time inventory management, and timely order fulfillment. Fundamentally, supply chain management helps any firm get the right products to the right place at the right time, in the proper quantity and at an acceptable cost.

The main objective of SCM is to manage this process efficiently by forecasting demand, controlling inventory, enhancing the network of business relationships a company has with customers, suppliers, distributors, and others, and receiving feedback on the status of every link in the supply chain. In order to achieve this, firms today are turning to Internet technologies to Web-enabled supply chain processes, decision making, and information flows.

Supply chain management flows can be divided into three main flows:

- The product flow
- The information flow
- The finances flow

The product flow includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs. The information flow involves transmitting orders and updating the status of delivery. The financial flow consists of credit terms, payment schedules, and consignment and title ownership arrangements.

There are two main types of SCM software: planning applications and execution applications. Planning applications use advanced algorithms to determine the best way to fill an order. Execution applications track the physical status of goods, the management of materials, and financial information involving all parties.

Some SCM applications are based on open data models that support the sharing of data both inside and outside the enterprise (this is called the extended enterprise, and includes key suppliers, manufacturers, and end customers of a specific company). This shared data may reside in diverse database systems, or data warehouses, at several different sites and companies.

Consider steps in a typical supply chain management process which are shown in the figure 10.2.

Figure 10.2 Steps in a typical supply chain management process

The typical steps in a supply chain process are: Shareholders, Sales and Product Development, Procurement, Suppliers, Manufacturing, Warehouse, Logistics, Consumers.

1. Shareholders: There is growing awareness of the shareholder value the supply chain can bring to organizations. Shareholders provide initial and continuing investments with expectations of a return slightly better than other available options.

2. Sales and Product Development: Supply chains are both internal and external to an organization. Before an organization can radically improve its external chain, it must first look at its internal flow. The Sales & Operations Planning (S&OP) process, in many cases, forces the organization to see its level of disconnects. Sales and product development must be aware of the market to be able to forecast customer needs and desires. This can more readily be accomplished through establishing relationships with key customers and the use of Customer Relationship Management (CRM) software. This helps an organization to know who are its key customers, their habits and desires. Having sales and product development as the first step may help to keep the organization customer focused.

3. Procurement and Suppliers: Once the sales team is able to determine a forecast, then procurement can work with key suppliers for needed materials. Ideally the organization utilizes Supplier Relationship Management (SRM) software to help it track performance and determine who its key suppliers are. Through cooperative relationships, both organizations can attempt to reduce costs, build better products, and provide a better quality product to the consumer. Whether these relationships are competitive or cooperative, they must be continuously cultivated and monitored.

4. Manufacturing: If the required supplies are present, then manufacturing can begin. At this point, warehousing and logistics are also involved in getting the supplies to the manufacturer, storing items before, during, or after production, or delivering products to the customer upon completion.
5. Warehouse: Some items are manufactured to go into stock in the warehouse and others are made for immediate delivery to the customer. Lean Six Sigma is heavily involved in reducing waste throughout this process and also in standardizing processes and ensuring quality.
6. Logistics: Logistics works with Sales to determine the best packaging, presentation, and delivery method of the product. The goal is to have the right product, with the right packaging and documentation, at the right place, at the right time. If it is one of 8 percent of products that is returned, then the organization works through entirely separate processes to evaluate the product, determine its destination, and if needed return it to either the producer or the initial supplier. Some items are discarded; others are repaired and sold on a secondary market.

SCM define as the systemic, strategic coordination of the traditional business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole. Unlike logistics, which focuses on the inbound and outbound flow of products, services, and related information from a focal organization's perspective, this definition leads us to the conclusion that SCM is a management process that deals with inbound and outbound flows, from the perspective of the focal organization, its suppliers, and its customers. This means a fundamental aspect of supply chain management is the consideration of not just the cost and profit goals of one company (the focal organization), but of all the companies involved in managing the supply chain. Thus, SCM encompasses all the traditional business functions, their coordination within individual companies, and their coordination across companies in the supply chain. First, supply chains today consist of all suppliers and customers, and they exist in a global environment. We don't know about any company that does not sell in a global market, source globally, or compete with a company that does. Second, all the traditional business functions must be coordinated within individual companies before they can be coordinated across companies in the supply chain. Third, the intra company concepts of trust, commitment, risk, and dependence must be managed with the inter-company concepts of functional shifting, third-party providers, relationship management, and supply chain structures, to efficiently and effectively manage the flows of any supply chain. Finally, efficiently means with minimal commitment of financial resources, and effectiveness means providing customer satisfaction and value, which leads to profitability, which leads to competitive advantage.

A supply chain's responsiveness includes a supply chain's ability to do the following:

- Respond to wide ranges of quantities demanded.
- Meet short lead times.

- Handle a large variety of products.
- Build highly innovative products.
- Meet a high service level.
- Handle supply uncertainty.

Many organizations are now experiencing environmental changes resulting from the new economics of information, and the increasingly dynamic and global nature of competition. Currently organizational survival depends on the construction and integration of knowledge fostering the adaptation to the environment, as well as stimulating environmental changes through the firm's knowledge and practices. Organizations realized that it would be necessary to employ supply chain analytics in order to reduce cost and improve customer service. This could only be realized by defining the analytical needs of the organization through a well-defined key set of metrics in line with the organizational strategy. Supply chain efficiency can be monitored by a number of key metrics:

- cost of goods sold;
- inventory turn;
- inventory service level;
- inventory carrying cost;
- lead-time;
- vendor performance.

The intelligent use of BI enabled for the continuous monitoring and analysis of key critical indicators that provide value within the organization, such as current transportation time for shipping, transportation cost and utilization of any transportation vehicle. The utilization of BI in real-time, allowed for the early detection of situations, with regard to planning and coordination of the logistics within the supply chain, for example a delay of freight, or loading goods into a wrong container. When situations like this were detected, action could be taken to either change the transportation route, or change the mode of transportation. In cases where a failure of the internal distribution network, could not respond to customer requirements, use could be made of specialist carriers in order to ensure delivery to the customer in a timely manner. In an extreme case, which resulted in failure of delivery, the real time BI system automatically sent out a notification to the customer, advising of the delay, and the new estimated delivery date.

The role of information systems in supply chain management

Given the role of information systems within the firm and the role of information systems with suppliers, customers, and the supply chain, researchers concluded:

- as the business environment continues to emphasize more variety and quicker response to a dynamic customer driven marketplace, better and more effective information systems need to be developed;
- one of the best ways to serve a demanding marketplace is to develop effective intra firm information systems;

- intra firm information systems such as enterprise resource planning systems are an important precursor to improve the flow of information between firms;
- managers need to determine if the benefits of effective and efficient information flow mitigate the risks associated with developing partnerships with either suppliers or customers;
- by developing relationships with members of their supply chains, firms can develop more efficient and effective information systems that facilitate better supply chain integration utilizing the enabling capabilities of the internet;
- in the future, the internet will allow true supply chain management through the transparent, real-time connection of all supply chain links.

Managerial Conclusion: managers have little choice but to embark on the path to develop supply chain enhancing and integrating information systems. This augments the competitiveness of firms in terms of lower costs, improved customer value, and maintaining long-term competitive advantages in the rapidly changing, customer driven, internet-enabled, e-commerce business environment.

The role of customer service in supply chain management

Considering the elements of customer service management important to supply chain management, performance outcomes associated with customer service activities and their contribution to supply chain objectives, and customer responses to the outcomes of a firm's customer service activities, researchers concluded:

- To achieve supply chain objectives, customer service activities must be strategic in nature and must be designed based on an understanding of the service levels important to critical customers.
- Important customer segments must be identified and the requirements of those segments understood for both immediate and downstream customers.
- The impact of service levels on customers should be understood and internal capabilities designed to deliver service levels that optimize the overall performance of the supply chain.
- The quality of the customer interface is likely to influence the level of trust and openness of information exchange between firms, which can contribute to a better understanding of the customer's needs and improved performance of supply chain management activities. It is important to measure customer service outcomes as perceived by the customer and understand which performance outcomes are most valued by customers at various levels of the supply chain.
- Customer service requirements and performance, as well as the influence of customer service levels on customer behavior, should be understood and monitored for both immediate and downstream customers in a supply chain.
- Customer service is not the ultimate objective of supply chain management but rather an outcome of supply chain management that can create value for customers through improved efficiency or effectiveness.

- Creating value for customers superior to that created by competition is expected to result in greater customer satisfaction and competitive advantage and influence customers to behave in ways that improve the performance of the supply chain as a whole.

Managerial Conclusion: Customer service is often cited as a key objective of supply chain management. However, only if service offerings create value for customers will they lead to behaviors that improve supply chain performance. To achieve this objective, it is important for supply chain managers to manage customer service strategically and develop supply chain capabilities to deliver services viewed as important by critical downstream customers.

Customer relationship management

The term customer relationship management (CRM) emerged in the IT vendor and practitioner communities in the mid 1990's. It is often used to describe technology-based customer solutions, such as Sales Force Automation. Gartner Inc. defines CRM as a «business strategy, the outcomes of which optimize profitability, revenue and customer satisfaction by organizing around customer segments, fostering customer satisfying behaviors, and implementing customer centric processes». Thus, CRM technologies enable greater customer insight, increased customer access, more effective interactions and integration throughout all customer channels and back office enterprise functions.

CRM is comprised of the methodologies, software, and usually Internet capabilities that help a business to manage its relationships with customers in a directed and structured way. Within small and medium sized businesses, CRM has shown itself to be an effective marketing tool, resulting in increased business and profitability for many organizations. CRM embraces all aspects of dealing with prospects and customers, including the call centre, sales force, marketing, technical support and field service. Figure 10.3 shows the scope of ERP systems.

Figure 10.3 Application CRM

CRM systems are successfully used by many different industries, including financial services, high-tech, manufacturing, media, fashion and boutiques, startups, as well as governmental organizations, non-profits and more.

The main modules of a CRM system may include: marketing, sales, service desk and inventory.

The primary goal of CRM is to improve long-term growth and profitability through a better understanding of customer behavior. Within the academic community, the terms «relationship marketing» and CRM are often used interchangeably.

From a strategic viewpoint, CRM is not simply an IT solution that is used to acquire and grow a customer base, it also involves; a deep understanding of the strategic vision, a corporate understanding of the nature of customer value in a multichannel environment, the utilization of the appropriate information management and CRM applications, high-quality operations, along with fulfillment, and service.

CRM unites the potential of relationship marketing strategies and IT to create profitable, long-term relationships with customers and other key stakeholders. CRM provides enhanced opportunities to use data and information to both understand customers and to create value with them. This requires a cross-functional integration of processes, people, operations, and marketing capabilities that is enabled through information, technology, and applications. According to researchers, customer information can be classified into three types:

1. Information of the customer
2. Information for the customer
3. Information by the customer

1. «of-the-customer» information includes personal and transaction data about a customer. It is the type of information most widely collected for CRM implementations. Organizations, once they have obtained the personal data, are then able to understand the customer's sales volumes, profitability, purchasing patterns, frequency, and preferences, along with other requirements. In this regard, financial institutions, banks, and credit card firms keep a considerable amount of «of-the-customer» information in their database systems related to, opening, maintaining, and billing customer accounts, and also to identify the most, or least profitable of their customers. Database marketing, also called target marketing, is based on the strategic use of «of-the-customer» information.

2. Product, service and organizational information that is perceived to be useful by customers is referred to as «for-the-customer» information. This type of information is presented through a range of communication media so that customers can acquire and process it, in order to make more informed decisions. Firms can provide such information by direct mail, automatic response systems, or Internet home pages.

3. This is the non-transactional customer feedback information that includes customer complaints, propositions, claims, and a range of other details and facts. Information of this type should be included in the expanded customer data profile because such information is what makes customer interactions powerful. Since it contains customers' direct complaints, needs and suggestions, this type of information can be applied to develop new products and services or improve critical business processes.

At the relationship initiation stage, firms identify customers by collecting and recording «of-the-customer» information. Registering customers into the firm's membership and providing bonus point programs are typical methods which are used for customer identification and retention. For the identified customers, it is possible to provide various «for-the-customer» type information, including, newsletters, special promotion notices, bonus point status, order status, as well as providing a range of other customized services. Some of the identified customers, who after a certain period are deemed to be providing a satisfactory relationship will, eventually evolve into core customers who satisfy one or more of the criteria which are required in order to be regarded as a core customer.

As identified customers evolve into core customers, the organization enters the «expansion phase» in its CRM. In this phase, core customers actively participate in the two-way interactions with the firm and expand the firm's customer base by word-of-mouth marketing. Feedback or suggestions from these core customers, through the use of «by-the-customer» information, may prove to be vital to allow the firm to introduce new products, improve business processes, and satisfy customer needs. The boundary between the firm and its customers, first becomes translucent, and then transparent within this phase. The objective of a good CRM program should be to deliver a higher level of customer satisfaction than competing organizations deliver. Managers today realize that customers match realizations and expectations of product performance, and that it is critical for them to deliver such performance at higher and higher levels as expectations increase due to competition, marketing communications, and changing customer needs. In addition, research has shown that there is a strong, positive relationship between customer satisfaction and profits. Thus, managers must constantly measure satisfaction levels and develop programs that help to deliver performance beyond targeted customer expectations.

Review questions

1. What is ERP? Discuss the advantages and disadvantages of ERP systems and explains how they work.
2. Why ERP-systems do not always achieve the objectives?
3. What is supply chain management? What are the SCM goals, requirements and scope?
4. Why is it important to use CRM software?
5. What are the most important modules in CRM?
6. What industries CRM is used in?

Task 11. Development and acquisition

Systems development life cycle

Development and acquisition of a IS refers to the overall process of initiating, designing, developing, installing, using, and maintaining a IS product.

Software development difficulties are a major factor in both the high cost of IS products and the existence of IS products that do not meet the needs of organizational members. Many problems associated with software development are a direct result of its labor intensity, its changeability, and management difficulties. The objective in software development is to produce products that are relevant, maintainable, and portable. The structured approaches to software development reflected in modem software practices help achieve this objective by emphasizing design, comprehension, and communication throughout the development process. A considerable effort is being made to automate software development activities.

The major software development activities include feasibility analysis, requirements analysis, system design, system acquisition, system development (program design, coding, and testing), system testing, conversion, quality assurance, training, and documentation.

The traditional approach to software development views these activities as occurring sequentially. Additionally, the traditional approach tends to be directed by systems analysts and tends to emphasize technical concerns.

Alternative approaches to software development explicitly recognize that IS are subject to constant and dynamic change. Hence, the IS implementation process is oriented to facilitating change by improving communication flows among participants and permitting rapid feedback from users to developers. Two alternatives are the evolutionary and prototype approaches.

User participation in IS implementation activities provides numerous benefits, but these are not without costs. There is great variety in the way users can participate in IS implementation. Deciding on the proper roles for both users and technical specialists requires consideration of the task requirements of each implementation activity and the nature of the IS being implemented.

Failures of IS implementation can usually be traced to the implementer's in ability to manage the uncertainty that pervades IS implementation.

The ***life cycle*** defines a methodology for information systems development, software and the overall development process. A software development life cycle it is a process of creating systems, and methodologies and models that people use to develop software. The sequence of activities traditionally followed in implementing information systems is defined in Table 11.1. These activities - aside from training and documentation - generally occur sequentially, that is, requirements analysis begins on completion of the feasibility study, system design on completion of requirements analysis, etc.

This conceptualization of the information systems implementation process is consistent with the internal development of a systems product, with the external acquisition of the product, and with situations in which certain portions of the product are internally developed while the remainder is externally acquired.

Table 11.1 Descriptions of IS implementation activities

Activity	Description
Feasibility study	Analysis to generate information to determine whether or not to commit organization resources and implement the IS product
Requirements analysis	Determination of the input, processing and output attributes of the IS product so it meets organizational needs
System design	Configuration of hardware, software and human components that enable a set of IS requirements to be achieved
System acquisition	Effort to develop proposals and solicit and evaluate bids when hardware or software must be acquired from vendors
System development	Internal programming effort to provide a software product
System testing	Assurance of the correctness of an internally developed software product
Acceptance testing	Evaluation of a IS product, acquired externally or developed internally, by the product sponsors (users) prior to accepting "ownership" of the product
Conversion	Introduction of the TS product into the sponsoring organization
Quality assurance	Continual evaluation of the organizational 'fit' of the IS product (and subsequent maintenance) after its introduction
Training	Provision of necessary skills, knowledge and understanding to facilitate the implementation effort
Documentation	Description f the evolving IS product and creation of a history of the implementation effort

Requirements analysis is the most critical activity undertaken in implementing a IS and often it is impossible to derive a complete and correct requirements specification in most cases. To produce a definitive requirements specification, the following conditions must be met:

- All of the organizational system's variables must have been identified, as well as all the relationships affecting these variables,
- The future must be «frozen» into the IS product,
- The handling of each implementation activity must be perfect.

Clearly, one cannot produce definitive requirements, but one can produce a successive iteration of partial requirements specifications by formally describing and validating each partial specification and by creating and managing structures that facilitate the inevitable changes.

The quality of resulting specifications is largely a function of participants' intents (what users want, think they want, or state they want, what the IS specialists perceive these wants to be, the technical predispositions of the IS specialists, etc.) and participants' commitment (the extent to which participants are motivated to use all their inherent abilities, insights and experiences). This need to rely on participants' commitment reflects how difficult it is to evaluate the efforts put forth by participants. Certain processes, however, lead to better requirements specifications. These include the emergence of «up-front» conflict, which is then productively resolved, lack of communication barriers between participants and joint user-IS specialist problem solving so cross-education results. Given these observations, three conditions seem necessary for a successful requirements analysis effort:

- Appropriately motivated and knowledgeable participants,
- Application of appropriate methods,
- Appropriate planning, control and reward structures.

These three conditions can be met with effective management practices. Requirements analysis it should be increasingly evident because the key to IS success lies in planning and design. Accordingly, establishing a valid set of requirements to guide product design is the most critical activity undertaken in IS implementation. If the requirements statement is inconsistent, ambiguous, incomplete, or otherwise incorrect, the following outcomes are likely:

- Costly design errors are made,
- Testing becomes difficult,
- Modem software practices cannot be used,
- It becomes difficult to manage the IS development process,
- User-IS staff communication problems abound,
- Users have little real influence,
- Maintenance costs increase,
- User dissatisfaction rises.

Such outcomes have on the overall cost of a IS project. If errors are recognized early, the project cost increases negligibly, but if product changes must be introduced later in the product's life cycle (when the code has been written, testing has been completed, or the system has become operational), costs can increase substantially.

Requirements, however, are often very difficult to derive and, as pressure to produce a IS product increases, tempting to delay or avoid doing thoroughly. This difficulty may arise for many reasons. The organizational functions may be complex or ambiguous. The IS specialists may not fully grasp what is involved in the functions. The users may not realize what they need (e.g., they may not know what is possible through IS support, or they may not have formally analyzed their tasks). Even when a valid set of requirements has been stated, an organization's natural evolution may eventually make the specification outdated.

This last point requires some elaboration. Requirements should be stated in terms of the forecast life of the IS product. Requirements must initially be

specified in terms of the organizational realities expected to exist when the IS introduced into the organization (not the realities that existed when the project began), and the basic design should allow for all changes expected to arise throughout the product's useful life. If these changes are not allowed for in the product's initial control structure, future changes are likely to be very expensive (and perhaps impossible).

There is a form for writing requirements. The objective of an effective requirements specification is to provide a comprehensive, formal depiction of a IS product from the user's perspective. At the least, an *overview*, detailed description of *outputs* and of *inputs* required to produce the outputs, description of the *processing environment*, and forecasts of *future changes* in the IS product should be included.

The overview should clearly describe why the IS product is being introduced and what it is to accomplish. To convey such an understanding of IS purpose, narrative or visual descriptions of the organizational functions involved, the way the IS product will perform or support these functions, and current organizational problems and opportunities are prepared. The overview should conclude with a formal statement of project objectives (i.e., what specifically should be gained from the IS implementation), and an informal appraisal of expected organizational impacts, both positive and negative.

Outputs of IS are the documents, reports, and inquiry capabilities that directly support organizational functioning. Each output should be identified and described in terms of its basic properties and organizational influence. By basic properties is meant such attributes as medium, layout and format, accuracy and correctness levels, contents (along with value types and ranges, measurement scale, codes, etc.), transformation rules or algorithms, and input data required for transformations. Organizational influences of each output refer to issues such as who will receive the output, how, when, and how often they will receive it, and how it will be used. These types of concerns are included in a requirements statement because they tie each output to the overview, and they initiate valuable dialogues among implementation participants (often resulting in an improved set of requirements).

Inputs are data items that trigger processing or are directly used in the processing activity. Each input item should be identified by name and by its relationships) with IS outputs. Also included should be data item attributes such as source (data file or entry), correctness and accuracy, value types and ranges, measurement scale, codes, layout or format, medium, and retention policy.

The processing environment includes the hardware and software environment, the mode of operation, and security concerns. All hardware (input-output devices, storage devices, processors) and software (data base management system, other IS applications) directly linked with the IS product should be identified. Visual representations (a systems flowchart, for example) provide a very concise and informative means of identifying these hardware and software elements and illustrating the relation of each with the IS product. The mode of

operation reflects the actual processing context with which organizational functioning is supported:

- Batch, on-line, or real-time processing,
- Resulting response times, throughputs, and turnaround times,
- Input, output, and storage volumes,
- Assigned priority in scheduling or execution.

Security covers access or use restrictions, backup (redundancy), fallback (no redundancy), recovery, privacy, and input-output controls.

Finally, forecasts of product modifications, enhancements, or expansions over the life of the IS should be indicated. Such changes could affect any facet of the requirements statement; thus, the full anticipated impact of each change on the complete set of requirements must be described.

Requirement analysis process consists of the following sequence of activities:

- Conceptual Design
- Logical Design
- Validation
- Formal Specification

The purpose of *conceptual design* is to construct a normative model of the organizational context in which the IS product is to be introduced and an ideal means of IS support. The normative model should reflect the critical factors affecting the organization (environmental forces, organization-wide goals and policies, current and anticipated problems and opportunities, etc.) and the basic resource, product, and service flows that represent organizational functioning. This initial IS solution should not be bound by organizational realities, as to do so might impose undue constraints on what could be achieved. Most important, these designs must be documented in a way that is readily grasped by all organizational members.

There are three major objectives behind the conceptual design activity:

1) It provides for a common view among users, managers, and IS specialists that should facilitate communication when their interaction is required;

2) It serves as a base of knowledge for all implementation participants that should permit the cross-education necessary for implementation success;

3) It acts as a frame of reference to guide the gradual evolution of the requirements statement from an abstract notion to a formal set of detailed specifications.

The objective of *logical design* is to appraise the conceptual design, given relevant organizational (resources, maturity, attitudes, politics, priorities) and technological (existing IS capabilities, data availabilities, personnel) realities. The logical design should provide a IS product that can be implemented and that is consistent with the basic structures in the conceptual design.

Prior to preparing the formal requirements specification (which is then used to drive the implementation effort), it is advantageous to subject the logical design to an analysis that provides some assurance that if the IS product were implemented, it would provide the anticipated outcomes. The impossibility of this

task is clear- the IS product does not yet exist. However, these steps can help determine whether or not a valid set of requirements has been produced.

First means of *validation* involves - users other than those participating in the requirements analysis effort must examine and critique the requirements. Reviewers should include users involved with all aspects of the IS product - data entry, output utilization, evaluation, etc. and should examine both conceptual and logical design. Reviewing written specifications, however, can be a tedious, difficult, and time-consuming task, particularly for nontechnical organizational members. A second - «hands-on» experience through providing users with report or screen mock-ups. Such a strategy is especially useful when organizational members are expected to have difficulty understanding how IS capabilities might enhance their task environments.

There are many ways one can determine IS requirements. The approaches emphasize different organizational factors and require different organizational perspectives, if multiple requirements approaches result in essentially the same set of requirements, one might assume a valid set of requirements exists. Even if the requirements differ, a final specification that integrates the key features of each should be more valid than the individual specification. This is a third means of validation.

However, if a considerable investment must be made in IS implementation or if IS failure would prove disastrous and then may be advisable to have two teams independently determine the requirements specification. The advantages include those given above for employing multiple approaches, plus the benefits of having requirements specifications that probably represent different sets of assumptions and individual perspectives. While using multiple teams is expensive, it may prove worthwhile when the costs of an invalid set of requirements are considered.

Formal specification is to prepare a document that clearly and completely communicates the results of the requirements analysis. Organizational standards should define what is to be included in a requirements specification and how it is to be described Otherwise, requirements specifications tend to be presented in an ad hoc fashion that causes misunderstanding.

Thus, specifying a valid set of requirements, a formal depiction of a IS product from the user's perspective, is the most critical activity undertaken in IS implementation.

A requirements specification must consider the entire forecast life of a IS product. Included in a requirements specification are an overview of the IS product, detailed descriptions of its outputs and inputs, descriptions of its processing environment, and forecasts of future changes.

The first step in specifying requirements is to build a conceptual design, an ideal configuration, of the IS product. This is followed by the construction of a logical design, a pragmatic version of the conceptual design. This design should then be subjected to a validation process. Finally, a formal depiction of the specification should be prepared.

When considerable uncertainty arises about requirements, iteration and prototypes are often used in the requirements analysis process.

The most important tools in performing a requirements analysis are those that are used to communicate an evolving design. Three description tools particularly useful in requirements analysis are decision tables, matrices, and data flow diagrams.

There are five requirements analysis approaches: operational modeling, information analysis, variance analysis, the critical success factors method, and future analysis. These approaches differ from each other in the framework provided to guide analysis and in the issues they emphasize.

While a requirements analysis can be aided by employing an appropriate analysis approach, success ultimately depends on the contributions of the human participants. So, the quality of the resulting specifications depends largely on participants' intents and commitment.

System design is the predominantly technical task of configuring hard ware, software, and human (procedural and human-machine interaction) components to meet stated requirements, given economic, technical, and behavioral realities. Primary concern should be directed toward establishing appropriate linkages among the IS product's components and between these components and those of other applications, of systems software, and of other organizations that interface with the IS product. All information processing tasks associated with the IS product must be addressed: data capture, entry, processing, storage, and dissemination.

Once a system design has been completed and software acquisition or development commences the costs of significant IS product changes substantially increase. It is thus desirable for users to review and evaluate a system design on its completion. Users need to visualize whether or not requirements will be met by the design and assess requirements-costs trade-offs.

System acquisition refers to efforts to prepare proposals, solicit and evaluate bids, and negotiate contracts with hardware and software vendors. Given effective requirements analysis and system design tasks, proposal preparation should be relatively straightforward.

The user role is again that of reviewing and critiquing. Users must ensure that proposals represent organizational needs that criteria used to evaluate bids are consistent with organizational objectives, and that contracts include adequate organizational protection.

Most efforts to improve the IS implementation process have involved *system development* tasks - software design (structuring a software product as a collection of programs), program design (structuring a program as a collection of modules), module coding, and program testing.

Software development tasks are by far the most technical tasks associated with IS implementation. In few instances is intensive user involvement beneficial. Interestingly, much of the current activity associated with «application

development» software is aimed at bypassing these purely technical tasks through automated design or development.

System testing refers to efforts by system developers to increase the likelihood that a IS product will perform as specified when introduced into the organization. The intent is to exercise the entire requirements domain of a IS product: the complete range of inputs and outputs, every possible condition or situation that might arise, peak processing loads, all manual procedures, linkages with other systems, etc. Such an objective, however, is unreasonable, given the enormous number of circumstances to be tested with most IS.

The key to effective system testing, thus, is to compile a relatively small set of test data that accounts for much of the IS product's domain. Test data are an important organizational resource, a resource worthy of considerable investment in design and preparation. Generally included in such collections of test data are the most common values expected, common errors, and boundary values. Some test data are «artificial» - that is, created solely for test purposes. Progress is being achieved in developing software that automatically generates artificial test data after analyzing a piece of software. The remainder of the test data would be «live» - that is, extracted from an organization's data and transaction files. It is here that an important user role emerges - working with system developers to compile the test data.

The act of testing itself often requires considerable effort and time. Testing often uses up half or more of the time devoted to software development. Compiling a quality set of test data thus results in a number of benefits: development time should be shortened, fewer errors should appear when the IS product is introduced, and maintenance expense should be reduced.

Testing shows only the presence of errors, not their absence. Only through *design* can efforts be directed toward producing error-free IS products.

Consider *conversion.* If a IS fails to perform as expected on its organizational introduction, a number of harmful consequences are likely to arise. For example

- Inability to perform specific organizational functions with the introduced IS may prevent those functions from being performed at all;
- Even if partial operation is realized, organizational disruptions may be severe;
- Failure is usually accompanied by negative psychological impacts that may impede future IS activities;
- Additional development costs will be incurred as IS staff members work to resolve the situation.

The probability that some failure will occur with any IS implementation is fairly high. Not only is it unlikely that all errors will be caught through system testing, but the original requirements specification may have been faulty and the time lag between when these specifications were derived and when the IS product was introduced might be long enough for naturally occurring organizational changes to invalidate certain requirements. The larger, more

sophisticated, or more innovative the IS product is, the higher is the probability of failure. The aim in selecting a conversion strategy is to reduce the risk of a disastrous failure occurring but to do so at an acceptable cost.

The parallel strategy has the greatest potential for reducing the risk of failure. Both the IS being replaced («old») and that being introduced («new») run simultaneously for a time. In addition to having the old IS performing the function in case the new fails, one can compare the outputs of the old and new IS. The expense and the organizational confusion of operating parallel systems, however, can be great. The least costly strategy is to perform a direct conversion - i.e., at a certain point the old IS is replaced by the new. The risk inherent in such a strategy, however, should be clear. Two other strategies represent compromises between the parallel and direct conversion extremes. With a phased strategy, the new IS is incrementally introduced by dividing it (by subfunctions, complexity layers, organizational subunits into which it is introduced, etc.) and introducing each segment only after experience is gained with its predecessor. With a pilot study strategy, one segment of the new system is introduced and experienced, after which the remainder of the system is introduced. The objective with both the phased and pilot study strategies is to uncover problems early in the conversion effort so later introductions have lower risks of failure.

The following characteristics of IS products are typically assessed in selecting a conversion approach: their urgency, importance, and extent of organizational dependence, organizational impact, and required human interaction (input and output). Assessing such factors and planning a conversion effort clearly require user involvement. When the IS product being introduced is large or complex, it is common to find mixed conversion strategies in which particular segments of the system are introduced according to their unique attributes. The final IS product may often appear quite different from the original design as a result of two change processes: organizational members' being exposed to the IS product, and the IS product's «experiencing» the organizational context in which it has been inserted.

Consider *training.* Implementation efforts usually require that a variety of organizational members (top management, managers of the operating units sponsoring the IS product, users of the IS product, IS management, system analysts, and programmers) perform a wide range of tasks. For these tasks to be carried out effectively, participants must have certain knowledge, skills, and background information. Table 11.2 summarizes representative requirements. A training effort must consequently be carried out that provides implementation participants with the knowledge and skills each requires. This training should not be a one-time event, rather, an organization-wide IS training program should exist on an ongoing basis that is supplemented as needed for any IS implementation project.

Table 11.2 Implementation Knowledge Requirements

General Areas of Required Knowledge	Specific Areas
Organizational overview	Objectives, purpose, opportunities, constraints, internal and external functioning
General IS	Hardware and software concepts, IS potential, organizational IS policies and plans, existing IS applications
Technical skills	Methods and techniques required to perform implementation tasks
Organizational skills	Interpersonal behavior, group dynamics, project management
Target organizational unit IS product	Objectives, purpose, functions resources, links with other internal and external units, problems. Purpose, design, required procedures, impacts on individuals

Documentation is an integral element of a IS product, as it provides users with both product visibility and product understanding. Additionally, documentation can become the medium by which implementation participants obtain a common view of the IS product and through which individual contributions are conveyed.

Historically, IS implementation efforts have been deficient in documentation. Documentation has generally been viewed as a secondary work obligation to be undertaken on completion of software development (often by a junior staff member, not the actual developer). That such a situation exists is not surprising, given the existence of reward systems focused on delivery of a software product by a given date. Software development activities not directly associated with program design, coding, or testing are naturally seen as unproductive.

When reward systems begin to stress the provision of easily maintained software products, this perception of documentation should change. The growing concern with documentation can be seen in the fact that many modem software practices provide documentation as a byproduct. At least three documentation packages should be provided: a user's manual, operator's manual and project manual.

The user's manual tells how to use a IS product and informs potential users about the capabilities of the product. It consequently must contain general information (a narrative description of purpose, environment, basic structure, benefits, limitations, individuals to contact for more information, etc.), specific information (on hardware, basic system flow, inputs, outputs, processing mechanisms and conditions, data files, etc.), and detailed operating procedures (manual procedures, input formats, output layouts, error conditions, recovery

procedures, etc.). The importance of producing a clear, correct, and complete user's manual cannot be overemphasized, as it is through this document that IS use occurs. It has been recommended that preparation and approval of the user's manual is the first «product» of an implementation effort. The operator's manual gives computer operators all the information they need to schedule, prepare, and execute a run and to distribute output from the IS product. So, it should describe the system flow, inputs, outputs, data files, processes, errors, recovery procedures, hardware, setup, data entry procedures, output distribution, normal run cycle, etc. The importance of a comprehensive operator's guide increases as the organization's IS portfolio grows and operators can no longer maintain a complete understanding of each IS product in their minds.

The project manual provides, at any point in the life of a IS product, a description of what has transpired, what the product's current state is, and what is expected to occur in the future. It should reflect not only all key decisions (objectives, plans, designs, evaluations, etc.), but also the reasons behind these decisions. A project manual provides a guide for the product's developers, evaluators, or maintainers, and also reduces the vulnerability of a project to personnel turnover. Essentially, the project manual should provide summary and detailed descriptions of the efforts, decisions, and outcomes associated with each implementation activity.

Alternative development approaches

There are next approaches to system development:

- Traditional approach (structured) that includes three techniques: structured analysis, structured design, structured programming;
- Object Oriented approach (views IS as a collection of interacting objects that work together to accomplish tasks, where IS consists of objects).

Figure 11.1 shows the object oriented development model.

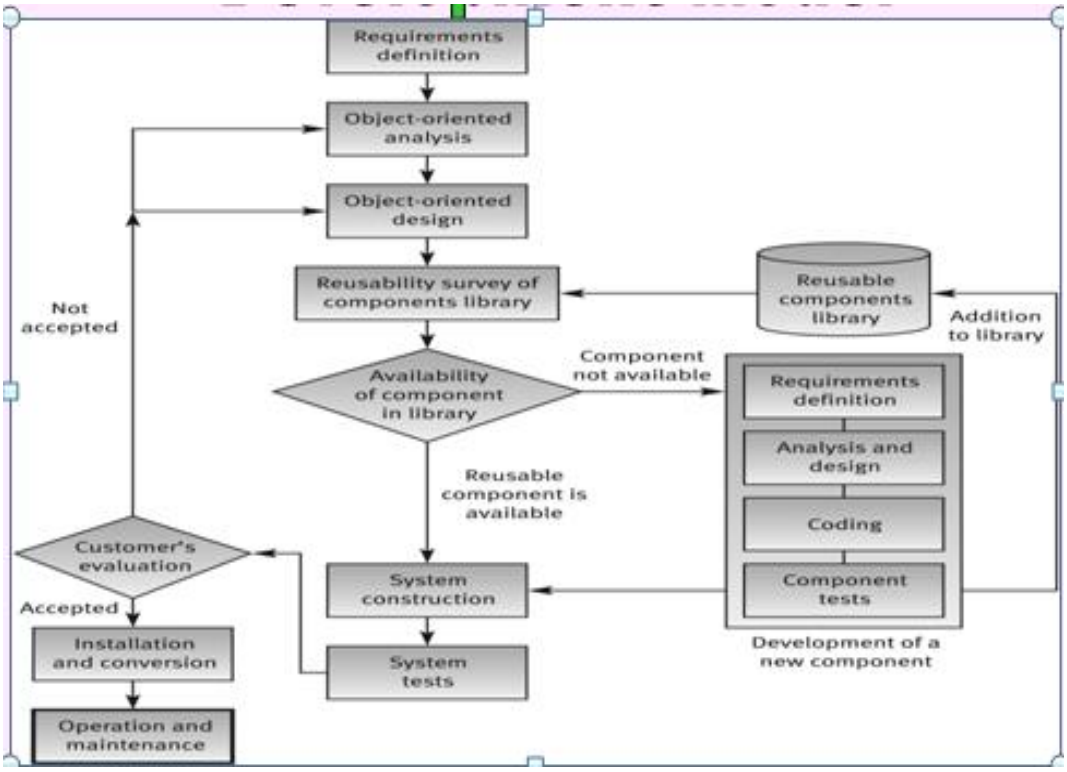


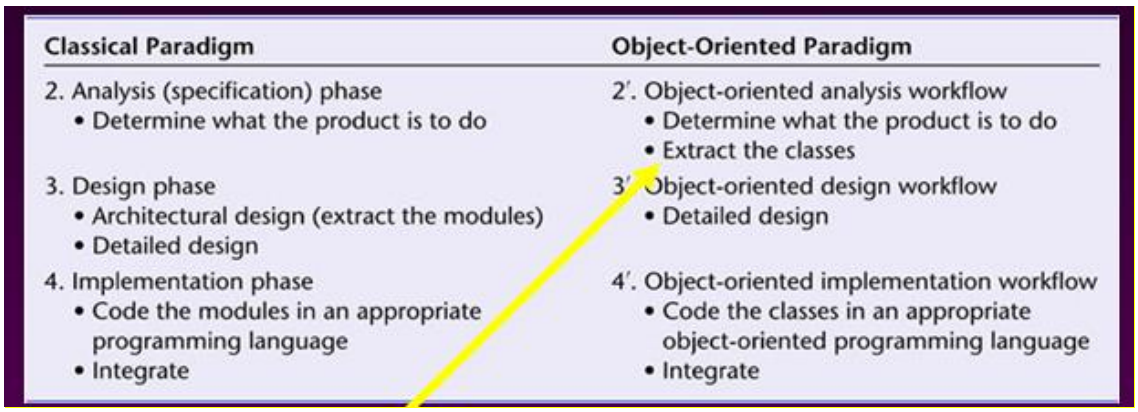
Figure 11.1 Object Oriented Development Model

Object Oriented approach includes three techniques: Object-Oriented Analysis (OOA) (defines all of the types of objects and shows what user interactions are required); Object-Oriented Design (OOD) (defines all of the additional types of objects necessary to communicate with people and devices in the system, also shows how the objects interact to complete the tasks and refines the definition of each type of object); Object-Oriented Programming (OOP) (includes writing of statements using a programming language). Table 11.3 shows the composition of structured and object-oriented approach.

Table 11.3 Classical phases and Object- Oriented workflows

Classical Paradigm	Object-Oriented Paradigm
1. Requirements phase	1. Requirements workflow
2. Analysis (specification) phase	2′. Object-oriented analysis workflow
3. Design phase	3′. Object-oriented design workflow
4. Implementation phase	4′. Object-oriented implementation workflow
5. Postdelivery maintenance	5. Postdelivery maintenance
6. Retirement	6. Retirement

In more detail



Objects enter here

There are following ***models to system development***:

1) *waterfall* model (describes a development method that is linear and sequential (consist of the requirements ,design, implementation, verification, maintenance) and based on the metaphor that when one phase was finished, the development proceeds to the next phase and there is no going back, so does not accept the expected changes and revisions that become necessary with most projects, also some alternatives include joint application development (JAD), rapid application development (RAD), and spiral model;

2) prototype model (systems development methodology in which a prototype is built, tested, and then reworked as necessary until an acceptable prototype is finally achieved from which the complete system or product can now be developed and also an iterative, trial-and-error process that takes place between developers and end users);

3) spiral model (consist of the general steps: a) the new system requirements are defined in details; b) an initial design is created for the new system; c) a first prototype of the new system is constructed from the initial design; d) a second prototype is evolved by a fourfold procedure: evaluating the first prototype in terms of its strengths, weaknesses, and risks; defining the requirements of the second prototype; planning and designing the second prototype; constructing and testing the second prototype; e) at the customer's option, the entire project can be aborted if the risk is deemed too great.

In the figure 11.2 the waterfall model is shown.

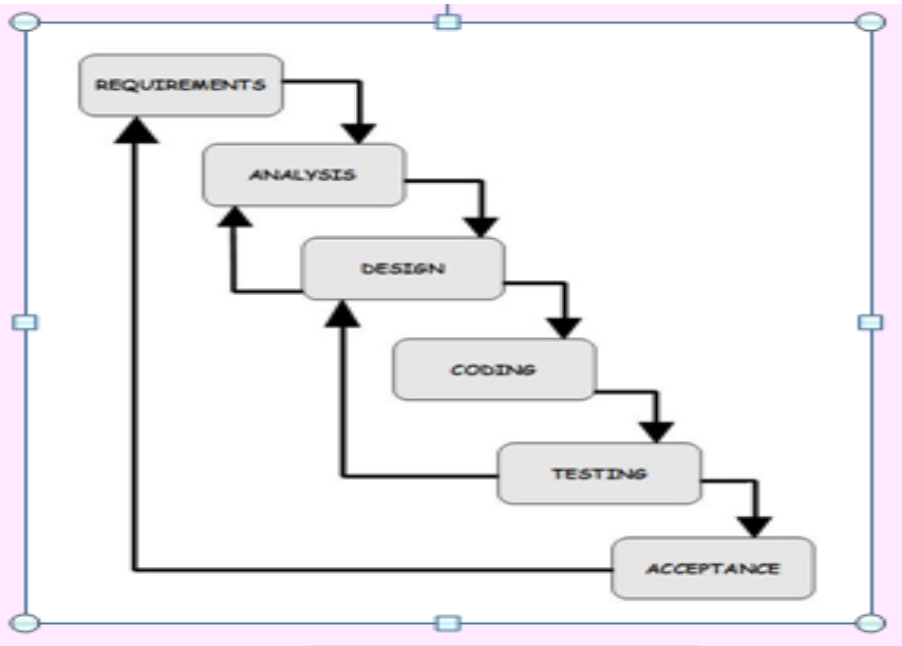


Figure 11.2 Waterfall model

Extreme Programming (EP) - discipline of system development that follows a specific structure that is designed to simplify and expedite the process of developing new software, developed by Kent Beck to be used with small teams of developers who need to develop software quickly in an environment of rapidly-changing requirements.

Unified Process (UP) - object-oriented system development methodology offered by rational software that uses UML (develop iteratively, define and manage system requirements, use component architectures, create visual models, verify quality, control changes).

Rapid application development (RAD) - emphasizes speed of development through extensive user involvement in the rapid, iterative, and incremental construction of a series of functioning prototypes of a system that eventually evolves into the final system (or a version).

Alternative development approaches

Challenges to the traditional IS implementation approach center around the notion of adaption. As IS are often subject to constant and dynamic changes, the desirability of creating and managing implementation processes that facilitate change, improve communication flows, provide for quick feedback, and span implementation activities seems clear. For example, even with the sequential approach to IS implementation, considerable *iteration* (backtracking to previously performed activities) is often encountered as early assumptions or design decisions prove inappropriate or infeasible. As implementation proceeds, organizational learning always transpires, resulting in a more accurate understanding of the opportunities, problems, constraints, benefits, and costs associated with the IS product. So, even when a traditional approach to IS implementation is adopted, mechanisms should exist (in the form of checkpoints allowing reviews,

reevaluations, and re-planning) that permit management of an iterative, rather than sequential, series of activities.

Two *approaches* to the IS implementation process, both of which involve a succession of iterations through partial IS products, are presented: *evolutionary and prototyping*. Each solves a particular set of problems that may arise when a IS product is implemented. After each approach is discussed, an overall framework for selecting an implementation approach is suggested.

Consider *evolutionary development*. Large, complex IS typically are characterized by a long interval between the specification of requirements and the conversion activity. During this development period, changes are likely to occur that invalidate some of the stated requirements. Furthermore, during these primarily technical tasks, users are frozen out of the implementation effort. With a lengthy development period, valuable feedback from those using a IS product is absent.

The evolutionary approach to IS implementation strives to address these difficulties. With this approach, the IS product is broken into predefined versions that are successively developed and introduced into the organization. If each version has a relatively short development period (a few months at most), a portion of the IS product will probably be introduced before significant organizational changes occur, and user feedback on these early versions can be incorporated into later versions. Typically the initial version is a skeleton of the full IS product, and succeeding versions add refinements until a complete product is configured.

Consider *prototyping.* When the organizational functions to be supported by a IS product arc poorly understood, it is difficult to state a valid requirements specification. Such situations are most quickly recognized with decision support systems applications, as much of the anticipated use of the IS product remains to be shaped through user experiences. Difficulties in stating requirements arise with many applications as well. With the prototyping approach, a «quick and dirty» version of the IS product is developed in a very short time (a few weeks at most) and provided to users. After experience with this prototype, users are more likely to recognize how the IS can help them perform their organizational responsibilities. Feedback from users is then incorporated into successive versions of the IS product. The IS product is thus designed and developed through a process of continual user learning and product adaptation.

While many factors interact to determine which approach is most appropriate for an implementation effort, three factors are generally considered:

- Ease of determining IS requirements,
- Presence of relevant prior experiences of implementation participants,
- Length of time anticipated for IS design and development.

External acquisition

External technology acquisition has been viewed as an important method used by firms to update and extend their technological knowledge base and to achieve higher economic returns. However, not all studies have evaluated the

contribution of external technology acquisition to firm performance. Although external technology acquisition has some advantages, it should be considered as a double-edged sword as it also has some inherent negative aspects.

As show on a sample of corporations in different countries, external acquisition of technology through various strategies increases in importance in general. Product case studies further show that external acquisition of technology is associated with technology diversification into increasingly costly new technologies. Today corporations become multi-technological. Besides quasi-integrated corporate systems of innovation arise in which in-house research and development is managed together with a mix of strategies for external acquisition of technology, using various contractual forms, that presents new challenges to traditional in-house research and development management. Technology diversification is moreover shown to be associated with growth of sales as well as with growth of research and development expenditures. A high level of external technology acquisition presents risks that ought to lead companies to consider technology based product diversification.

However, external technology acquisition provides several advantages to firms. For example, it helps them to overcome limitations of their internal resources and capabilities. By sourcing technology externally, firms can overcome internal knowledge deficiencies and resolve problems of insufficient internal resources and capabilities. It allows firms to acquire industry standard technologies and complements for existing products, and to unlock existing technology and innovations and so helps firms catch up with competitive moves or fill market gaps.

By outsourcing non-core technological activities, external technology acquisition allows firms to focus their resources and capabilities on developing their core technological competencies. External technology acquisition allows firms to specialize deeper in their core competences while relying on outside firms that are specialized in other fields, for complementary expertise and skills.

Also, external technology acquisition provides flexibility in strategic decision-making for technology development. Besides it may be difficult for firms to adapt to unfamiliar technological areas due to comfort in using previous technological paths, firms can readily acquire background knowledge on new technological areas through external technology acquisition, thereby increasing the speed of adapting to new technologies. Moreover, if external technology acquisition is effectively pursued, firms can benefit from a larger range of technological solutions and hence take advantage of new business opportunities, although heavy reliance on external technology acquisition may have disadvantageous consequences. However the most critical risk of external technology acquisition is the trade-off between external technology acquisition and internal research and development in terms of obtaining necessary technological knowledge and capabilities.

Outsourcing

Outsourcing is currently going through a stage of unstoppable growth. Also gives the organizations the opportunity to have better IS services and the possibility to achieve technological improvements and, although cost savings in staff and technology are generally seen as very important, they do not emerge as priority reasons for outsourcing in the present study. There are risks, but they are mainly associated with providers, also with great concern being expressed about the lack of qualification among their providers' staff, the potential lack of compliance with contracts, and the inability to adapt to the new technologies.

IS outsourcing - is the commissioning of part or all of the IS activities an organization needs, and (or) transferring the associated human and other IS resources, to one or more external IS suppliers.

Outsourcing is prescribed for everything from back office services like information technology development, human resource transactions and indirect procurement to core services such as innovation, research and development, marketing and customer care.

IS outsourcing has experienced a remarkable growth in recent years. Driven at first by the firms' attempts to reduce or control costs and to focus on their core business, and then seen as a way to improve IS services, outsourcing is now a widespread phenomenon.

There are four types of outsourcing relationships: support, reliance, alignment, alliance.

Outsourcing information systems brings together the papers that combined contribute a detailed understanding of how outsourcing of IS and back office functions has developed, and is likely to develop, the theories that can be applied to this field of study, the mistakes committed and learning achieved, and insights into what really does work.

Most large organizations use IT outsourcing for functions ranging from infrastructure to software development, maintenance and support. Example, an organization might outsource its IT management because it is cheaper to contract a third party to do so than it would be to build its own in-house IT management team. Also an organization might outsource all of its data storage needs because it does not want to buy and maintain its own data storage devices.

If you're looking to save money on IT and software development, offshore outsourcing is a great way to take advantage of the best and most innovative solutions available at a low cost. And while you're cutting costs and getting better services, you'll find that your company has much more time and resources to dedicate to improving its core functions, building its core competencies and becoming more competitive. Companies in software development and website development are increasingly recognizing the benefits of offshore outsourcing.

Currently the e-business revolution has forced a transformation of the traditional outsourcing structures into new forms of outsourcing such as internet service outsourcing, Applications service outsourcing and business process outsourcing. IS outsourcing has benefited both from the economic globalization and from the potential of IT, and additionally represents the response of firms to

the pressures exerted by the business environment - generated by greater competition, rapid technological changes and shorter development cycles - seeking to maintain their competitive advantages.

End-user development

The ease of use of information technologies has steadily increased while their cost has declined dramatically over the years. End-user-developed systems range from spreadsheet models, to personal or departmental databases, to full-fledged software programs built with user-friendly computer languages (for example, Visual Basic for Applications) or development tools such as fourth-generation languages. These systems are now prevalent in modern organizations.

End-user - user, who use functions within the application to automate programming tasks and also when the end-user is the primary developer.

End-user development - systems development and programming undertaken by non-IS staff. End-user development is the development and support of computer systems by users with little or no help from technology specialists. End-user development of applications represents a major trend in the use of information technology in organizations. User-developed applications are computer based applications for which non-information systems professionals assume primary development responsibility. They support decision making and organizational processes in the majority of organizations. Some end-user applications:

- Reports from a corporate database using standard enquiries defined by the IS function;
- Simple ad hoc queries to databases defined by the user;
- Analysis using tools such as spreadsheet models or more specialized tools such as risk or financial management packages or business intelligence software, used for monitoring sales and marketing performance of information stored in a data warehouse;
- Writing company information for a company intranet;
- Development of applications such as a job costing tool or production scheduling system, using easy-to-use, high-level tools such as application generators, PC database management systems such as Microsoft Access or Borland or visual programming environments such as Microsoft Visual Basic.

Who are the end-users: non programming (enters data, use application), command level (access data, print reports), end-user programmers (develop applications for personal use), functional support personnel (develop applications for others to use), end-user computing support personnel (training, hotline, develop applications), programmers (work on a contract basis).

Consider some *stages* of development end-user development:

First is *isolation* - a few scattered pioneers of end-user development developing small-scale business tools within their area. Initially, little support from central IS.

Second is *standalone* - larger-scale applications that may be of importance to a department are developed. At this stage, an information centre may be developed to support an increase in demand for user computing services.
Third is *manual integration* - different end-user applications need to exchange data. That happens through manual intervention, with files being transferred by floppy disk or across the network or even with rekeying of information. Information centre development has continued to support the needs of these larger-scale applications by providing training and skills and specifying standards for hardware, software and the development process.
Fourth is *automated integration* - users start to link into corporate applications to gain seamless access to information.
Fifth is *distributed integration* - here there is a good level of integration between different end-user applications and corporate systems. Very good standards of metadata (data describing data) are required to help achieve this.
The figure 11.3 shows end-user development approaches, where complexity - technical knowledge, which is required to apply the principle and adaptation power - level or extend of adaptations that can be realized.

EUD Approaches				**Supportive EUD Approaches**
Complexity / **Adaptation Power**	**Customisation**	**Integration**	**Extension**	
Programmers			Programming	**Testing:** Question-based testing; WYSIWYT; Integrity checks; Exploration environments **Community aspects:** Configuration files **Appropriation support**
Local Developers		Component swapping at runtime; Separated tailoring interfaces	Natural Programming; Scripting	
Non-Programmers	Interface customisation; Parameterisation	Programming by demonstration (PBD); Accountants paradigm; Integrated tailoring interfaces		

Figure 11.3 End-user development approaches

At present, end-user development disabilities lack of documentation system, which may lead to be short-lived and, when users design their own systems, they have forgotten the documentation more about how the system works, and do not understand what they can expect little or no support by technicians. Inadequate expertise leads to underdeveloped systems; many end user development systems are never completed so users lack the real expertise to utilize the most appropriate IT tools. Also, lack of organizational focus creates «privatized» system and when you develop a system for yourself, you must ensure that it interacts with other organizational systems. If you don't, you may create a «privatized» system that includes redundant information or performs redundant processes. Yet insufficient analysis and design leads to subpar systems and some users jump to conclusions

about the hardware and software they should use without carefully analyzing all the alternatives. If this happens, your system may work but not as efficiently as it could.

End-user development can help to increase the flexibility of software. IS developers should think how they can address the different end-user developers of their system.

Thus end-user development is the development of IS by end users with little or no formal assistance from technical specialists what made possible by the 4th-generation software tools. Now users can access data, create reports, create web pages without professional help and therefore systems can be created very rapidly.

Review questions

1. What is a software development life cycle?
2. What is software development life cycle model? What are the most well known models you know?
3. Explain the difference between a structured and object-oriented approach.
4. In which case the acquisition process can be a problem?
5. What are the benefits of IT outsourcing?
6. Describe the approaches to development for end-users.

Chapter 12. Information systems ethics and crime

Information system ethics and crime include next issues surrounding professional codes of ethics, file sharing, and infringement of intellectual property, security risk assessment, Internet crime, identity theft, employee surveillance, privacy, compliance, social networking, and the ethics of IT corporations.

An information system is a powerful tool, which are used in organizational goals, support sustainable development.

Information technology has also made it easier to engage in ethical or unethical business practices electronically anywhere in the world. Thus the technology is deployed in organizations depends on our decisions as managers, computing professionals, and users of information systems. Therefore, we should make these decisions guided not only by the technological and organizational aspects of information systems, but in consideration of their effects on individuals.

Ethics and Codes of Ethics include answer the questions, such as:

1. Is an ethical breach punishable by law?
2. How do ethical issues relate to legal ones?
3. If there is no law that penalizes a certain conduct, does it mean that you are always right behaving in that way?

Ethics is a study of the principles of right and wrong that ought to guide human conduct, where it is behavior and decision making use into three domains of:

1. Ethical issues
2. Legal issues
3. Discretionary domain

As we develop and use information systems to solve organizational problems or to respond to opportunities, we need to make sure that our solutions is proper with respect to each of these domains.

Ethical issues - is governed by the general rules of conduct and specific codes of ethics. Ethical considerations are outside the scope of legal liability.

Legal Domain - regulates a number of relatively well-documented forms of behavior prescribed by law and shall be enforceable in the courts of the country or within the local jurisdiction.

Discretionary Domain - only if the action is both legal and ethical falls into this domain, where we act properly entirely according to our preferences. In this area, we can apply such criteria as organizational desirability or cost-benefit analysis.

Because knowledge of ethics it applies to the issues arising from the development and use of information systems, it is helps us make decisions in our professional life. Professional knowledge, as a rule, expected to make a special responsibility within the area. That is why the in this area professionals have developed codes of ethics, that is, a set of principles designed to guide the behavior of members of the profession.

Codes of ethics provide guidelines for ethical conduct in the development and use of information technology. End users and information systems professionals would live up to their ethical responsibilities by voluntarily following such guidelines. Example, you may be responsible for the end-user:

- increase the professional competence,
- acting integrity,
- setting the highest standards of personal performance,
- promotions of health, privacy and well-being of the general population,
- taking responsibility for their work.

There are two fundamental approaches to ethical reasoning:

1) *consequentialist* theories that tells us to choose the action with the best possible consequences. Thus, the utilitarian theory that represents this approach holds that our chosen action should produce the greatest overall good for the greatest number of people affected by our decision. This approach is often difficult to apply, since it is not easy to decide what is the good is and how to measure and compare the resulting.

2) *obligational* theories that argues that it is our duty to do what is right. Your actions should be such that they could serve as a model of behavior for others and, you should act as you would want others to act toward you. Our basic duty is to treat others with respect, and not to treat them solely as a means to our own purposes.

Information privacy, accuracy, property and accessibility

Ethical issue in the development and use of information systems include following (PAPA):

1. Privacy
2. Accuracy
3. Property
4. Accessibility

We recall the next concepts:

Accessibility - it is an opportunity for a reasonable time to obtain the required information service. By integrity is meant the relevance and consistency of information, its protection from destruction and unauthorized changes. Privacy - a protection against unauthorized access to information. Information privacy is also known as data privacy.

Information privacy is the aspect of information technology, that deals with the ability an organization or individual has to determine what data in a computer system can be shared other parties.

1. Privacy is the right of individuals to retain certain information about themselves without disclosure and to have any information collected about them with their consent protected against unauthorized access.

Information privacy is the privacy of personal information and usually relates to personal data stored on computer systems.

Information privacy is considered an important aspect of information sharing. With the advancement of the digital age, personal information vulnerabilities have increased.

The Privacy Act serves as a guideline for a number of ethics codes adopted by various organizations. The Act specifies the limitations on the data records that

can be kept about individuals. Invasion of privacy is a potent threat in an information society. Individuals can be deprived of opportunities to form desired professional and personal relationships, or can even be politically neutralized through surveillance and gathering of data from the myriad databases that provide information about them.

The following are the principal privacy safeguards specified:

1. no use can be made of the records for other than the original purposes without the individuals consent;
2. no secret records should be maintained about individuals;
3. the collecting agency is responsible for the integrity of the record-keeping system;
4. the individual has the right of inspection and correction of records pertaining to him or her.

The power of information technology to store and retrieve information can have a negative effect on the right to privacy of every individual. Information systems and related technologies enable the creation of massive databases containing minute details of our lives which can be assembled at a reasonable cost and can be made accessible anywhere and at any time over telecommunications network throughout the world.

Information systems are created (are purchased) for certain information services. Information privacy may be applied in numerous ways, such as encryption, authentication and data masking - each attempting to ensure that information is available only to those with authorized access. These protective measures are geared toward preventing data mining and the unauthorized use of personal information, which are illegal in all parts of the world. If for one reason or another to provide these services to users becomes impossible, this is obviously detrimental to all subjects of information relations. So, without opposing the accessibility of other aspects, we identify it as an essential element of information security. Vividly leading role accessibility is manifested in various control systems - production, transport, etc. Externally, the less dramatic, but also very unpleasant consequences - both material and moral - can have long-term unavailability of information services used by large numbers of people (sale of rail and air tickets, banking services, etc.).

Information privacy is:

- internet privacy (all personal data shared over the Internet is subject to privacy issues where most websites publish a privacy policy that details the website's intended use of collected online and/or offline collected data);
- financial privacy (financial information is particularly sensitive, as it may easily used to commit online and/or offline fraud);
- medical privacy (all medical records are subject to stringent laws that address user access privileges, and also by law, security and authentication systems are often required for individuals that process and store medical records.

The need to support information privacy is applicable to personal information, such as financial data, medical records, political records, business related information and website data.

Two database facts create specific dangers:

Database matching, which makes it possible to merge separate facts collected about an individual in several databases. If minute facts about a person are put together in this fashion in a context unrelated to the purpose of the data collection and without the individual's consent or ability to rectify inaccuracies, serious damage to the rights of the individual may result.

Statistical databases, which contain large numbers of personal records, but are intended to supply only statistical information. A snooper, however, may deduce personal information by constructing and asking a series of statistical queries that would gradually narrow the field down to a specific individual.

All countries offer particularly extensive legal safeguards of privacy. In the environment of business globalization, this creates difficulties in the area of international data flow, or transfer of data across national boundaries.

Privacy protection relies on the technical security measures and other controls that limit access to databases and other information stored in information systems memories or transmitted over the telecommunication networks.

Integrity can be divided into static (understood as the immutability of data objects) and dynamic (related to the correct implementation of complex actions (transactions)). Means for control of dynamic integrity are applied, particularly in the analysis of the flow of financial messages to identify stolen, reordering, or duplication of certain messages.

Integrity is the most important aspect of information security in cases where the information is "a guide to action." Formulation of drugs prescribed medical procedures, a set and characteristics of components, the course of the technology process - all examples of information that may be a violation of the integrity of the literally deadly. Unpleasant and distortion of official information, whether the text of the law, or the Web page, the server of any government organization.

Privacy - the most researched in our country aspect of information security. Unfortunately, the practical implementation of measures to ensure the confidentiality of modern information systems encounters serious difficulties. First, information on technical channels of information leakage are closed, so that the majority of people are deprived of the opportunity to make representation about the potential risks. Secondly, in the way of custom cryptography as the primary means of ensuring confidentiality are many legislative obstacles and technical problems.

Almost all subjects of information relations, who actually uses the IS, the first place is accessibility. Almost is not inferior to her the importance of integrity - what is the point in the information service, if it contains distorted information? Finally, there is also privacy for many organizations and individuals (such as passwords).

2. Accuracy

Pervasive use of information in our societal affairs means that we have become more vulnerable to misinformation. ***Accurate information*** is error-free, complete, and relevant to the decisions that are to be based on it.

Professional integrity is one of the guarantors of information accuracy. An ethical approach to information accuracy calls for the following:

- a professional should not misrepresent his or her qualifications to perform a task;
- system safeguards, for example control audits are necessary to maintain information accuracy and where regular audits of data quality should be performed and acted upon;
- a professional should indicate to his or her employer the consequences to be expected if his or her judgment is overruled;
- individuals should be given an opportunity to correct inaccurate information held about them in databases;
- contents of databases containing data about individuals should be reviewed at frequent intervals, with obsolete data discarded.

3. Property

The right to property is largely secured in the legal domain. But, intangibility of information is at the source of dilemmas which take clarity away from the laws, moving many problems into the ethical domain. At issue primarily are the rights to intellectual property: the intangible property that results from an individual's or a corporation's creative activity.

Intellectual property is protected by following mechanisms:

- *Patent* - is a method of protecting intellectual property that protects a non-obvious discovery falling within the subject matter of the Patent Act.
- *Copyright* - is a method of protecting intellectual property that protects the form of expression (for example, a given program) rather than the idea itself (for example, an algorithm).
- *Trade secret* - when intellectual property protected by a license or a non-disclosure agreement.

There are computer programs with valuable property and therefore are the subjects of theft from computer systems. Unauthorized copying of software (software piracy) is a major form of software theft because software is intellectual property which is protected by copyright law and user licensing agreements.

4. Accessibility is the hallmark of an information society that most of its workforce is employed in the handling of information and most of the goods and services available for consumption are information-related.

There are next necessities for accesses to the benefits of an information society include:

1. Access to information
2. The intellective skills to deal with information
3. Access to information technology

One should strive to broaden the access of individuals to the benefits of information society. This implies broadening access to skills needed to deal with

information by further enabling literacy, access to information technology, and the appropriate access to information itself.

Intensive work is being done on developing assistive technologies - specialized technologies than enhance access of the handicapped to the information technology and, in many cases, to the world at large.

Impacts of information technology have positive and negative potential. The Code of Ethics and Professional Conduct commit computer professionals to a design and build information systems that enhance the quality of working life.

Some of the positive effects of information technology include:

- Access to individuals with disabilities
- Computer-assisted instruction (learning aids)
- Environmental quality control
- The ability to work from remote locations.
- Law enforcement
- Medical diagnosis

Some of the negative effects of information technology include:

- Computer crime is a growing threat (money theft, service theft, software theft, data alteration or theft, computer viruses, malicious access, crime on the internet).
- Use of computers has displaced workers in middle management (whose primary purpose was to gather and transfer information) and in clerical jobs.
- May create a permanent underclass who will not be able to compete in the job market
- Some categories of work have virtually disappeared which has created unemployment for a number of workers
- Societal issues (privacy, accuracy, property, and access)
- Health issues

There is computer based work monitoring and, related to it, telephone call accounting and service monitoring is practiced to ensure the quality of customer service and to provide objective evaluation of employee performance. The aggregate information gained from these information systems is necessary for management as a means of planning and control. However, when used improperly, these systems can not only raise ethical concerns but actually be counterproductive.

Invasive use may result in increased employee stress and a sense of lack of autonomy. When the gather information is inappropriately applied to individual employees, such usage raises questions about privacy and quality of working life.

It should be a primary goal of managers and computing professionals to lower the invasiveness of monitoring. The emerging new technologies keeping offering opportunities to improve the effectiveness and efficiency of people's work and present new threats to their rights.

Health issues - the use of technology in the workplace raises a variety of health issues. Heavy use of computers is reportedly causing health problems, for

example: damaged arm and neck muscles, job stress, eye strain, radiation exposure and may be death by computer-caused accidents.

Therefore, for solutions to some health problems there are ergonomics - based on the science of ergonomics that sometimes called human factors engineering. The goal is to design health work environments that are safe, comfortable, and pleasant for people to work in, thus increasing employee morale and productivity.

Ergonomics stresses the healthy design of the workplace, workstations, computers and other machines, and even software packages. Other health issues may require ergonomic solutions emphasizing job design, rather than workplace design.

Ethical behavior of employees is highly dependent on the corporate values and norms - on the corporate culture as a whole. Open debate of ethical issues in the workplace and continuing self-analysis help keep ethical issues in focus. Many corporations have codes of ethics and enforce them as part of a general posture of social responsibility.

“Online privacy fears stoked by Google, Twitter, Facebook Data Collection Arms Race”, “Your E-Book is reading you”, "Instant personalization" brings more privacy issues to Facebook. These are only a few recent examples of media headlines dealing with the issue of online privacy and personalization. Scholars and managers have repeatedly stated the benefits of personalization, which is targeting products and services to individual customers and constitutes a key element of an interactive marketing strategy. To be able to accurately estimate the needs and wants of customers, it is necessary to gather a significant amount of information. Privacy concerns may arise when personal information about customers is gathered. If this arises, personalization can backfire by making clients reluctant to use the service or - even worse - developing a negative attitude towards the company. A survey by Opera Software found, that Americans fear online privacy violations more than job losses or declaring personal bankruptcy. This had induced politicians to introduce regulations and laws that address online privacy that safeguard consumers against online monitoring and intrusion into confidential user information. However, privacy online remains a complicated issue for both, managers and politicians, because new personalization technology emerges at a much faster pace than political regulations and guidelines. Online users can only perceive privacy, if they are able to control their personal data. Over the last two decades, the effect of privacy concerns has been investigated comprehensively. Although insights in the social psychology perspective of customer’s information privacy concerns may be interesting for managers, most of the previous research focuses on general privacy concerns in-stead on information privacy. A deeper under-standing of the dimensions of control and their consequences is essential to fully under-stand the process online personalization. Especially if markets intend to deliver the best online personalization experience to their customers, these settings are of vital interest. Therefore, the goal of information privacy is to provide answers to the following questions: What are the

effects of different data collection methods (overt/covert) regarding private customer data on privacy concerns? How do different purposes of data usage (primary/ unauthorized secondary) influence concerns for information privacy and is this relationship influenced by trust that users have in the online merchant? Do users perform a risk-value analysis when personalization is applied by the online merchant? Do increased privacy concerns impact the evaluation of personalization and as a consequence users' willingness to transact? These insights will provide marketers and advertising strategists with practical advice in order to implement an optimal personalization application for customers.

Currently, a common fallacy for security people is to think 'any and all' information security risks will turn into severe risks for the organization. This is profoundly untrue. Although every incident has an impact, the nature of said impact requires scrutiny to find whether there is a danger. A risk materializes if a threat, such as a virus, meets a corresponding vulnerability, for example a lack of virus protection, and can therefore lead to a corruption of the system. In short, an information security risk will, by definition, reduce your systems/information/data confidentiality, availability or integrity. This reduction can be harmless, for example when a power supply fails and the secondary power supply takes over, or severe, for example if you are a payment services provider and someone steals the credit card records you store or process for your clients.

Computer crime

Computer crime or Cyber crime is a serious issue. It may be a lesser danger to organizations than the effects of what is called 'cyber war': cyber war is even less discriminate than criminal activity, but potentially more devastating. Every organization has a role to play in securing cyber space against terrorist attacks.
Cyber-capabilities: In 2009, the US President announced that, 'America's economic prosperity in the 21st Century will depend on cyber security.' This statement was supported by the US General Accounting Office in a report on cyber security in February 2013, stating, 'The evolving array of cyber-based threats facing the nation pose threats to national security, commerce and intellectual property, and individuals.' The UK's 2012 National Security Strategy identified cyber attack as one of the four highest-priority risks faced by the UK. Now we see the severity of threat in a series of highly advanced attacks. An advanced persistent threat posed by organized crime and state-level entities, with attacks against enterprises such as Google, Coca-Cola, NASA and Lockheed Martin; Operation Aurora was in 2007, there were attacks on Estonia's critical national infrastructure; malware such as Stuxnet, Duqu and Flame all demonstrate that an international military crisis is also likely to be accompanied by a cyber attack. Any response to a major national incident also depends on information stored in electronic information systems. This makes the threat of cyber attacks doubly dangerous.

Cyber war / cyber terrorism

Every significant terrorist or criminal organization is believed to have cyber-capabilities and to have become very sophisticated in its ability to plan and execute attacks, using the most recent technology.

In the same way that health and safety and compliance have become part of the business agenda, so should a broad understanding of security, and considering it should be an integral and permanent part of your planning and Statements of Internal Control; do not allow it to be left to specialists. Ask them to report to you what they are doing to identify and protect your key assets, including your people. 'More than 900 million computers are linked to the Internet; many of them are vulnerable to indiscriminate cyber attack. The critical infrastructure of the first world is subject to the threat of cyber assaults, ranging from defacing websites to undermining critical national computer systems. In February 2003, the White House published the National Strategy to Secure Cyberspace2, in which the President recognized that securing cyber space would be an extraordinarily difficult task, requiring the combined and coordinated effort of the whole of society and that, without such an effort, an infrastructure that is 'essential to our economy, security and way of life' could be disrupted to the 'extent that society would be debilitated'. The keyword list in table 12.1 was developed after reviewing web sites devoted to cyber terrorism.

Table 12.1 Cyber terrorism categories and keywords

Intent (Cyber terrorism)	**Intent (Hacking)**
• Cyber/computer terrorism • Information warfare • Cyber/computer warfare • Cyber/computer spies • Cyber/computer saboteurs • Cyber/computer espionage • Cyber/computer defense • Critical system/infrastructure disruptions	• Hacktivism • Cyberactivist • Computer network disruptions • Service disruptions • Internet-wide disruptions • Communications disruption
Infrastructure	**Techniques**
• Telecommunications • Banking and finance • Electrical power • Oil and gas distribution/storage • Water supply • Transportation • Emergency service (911) • Government services	• Malicious Code (Malware) • Network attacks • Viruses • Worms • Trojan horse • DDOS/DDOS attacks • Email viruses

The standard ISO27001 is written that every organization has a role to play in society's survival of a terrorist attack, which is to take its own precautions to ensure that it has a reasonable prospect of survival. The Standard provides guidelines that, when deployed, reduce the organization's level of exposure to the

impacts of terrorist attacks while improving its own business continuity arrangements.

Review questions

1. What kinds of ethical issues are missed by Mason's Four Ethical Issues of the information age (PAPA)?
2. What are some ethical issues found in politics, marketing and society?
3. What ethical issues lead to the firing of an employee?
4. Explain the difference between a computer virus, a worm, and a trojan horse.
5. What the potential threats cyber terrorism represents?

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