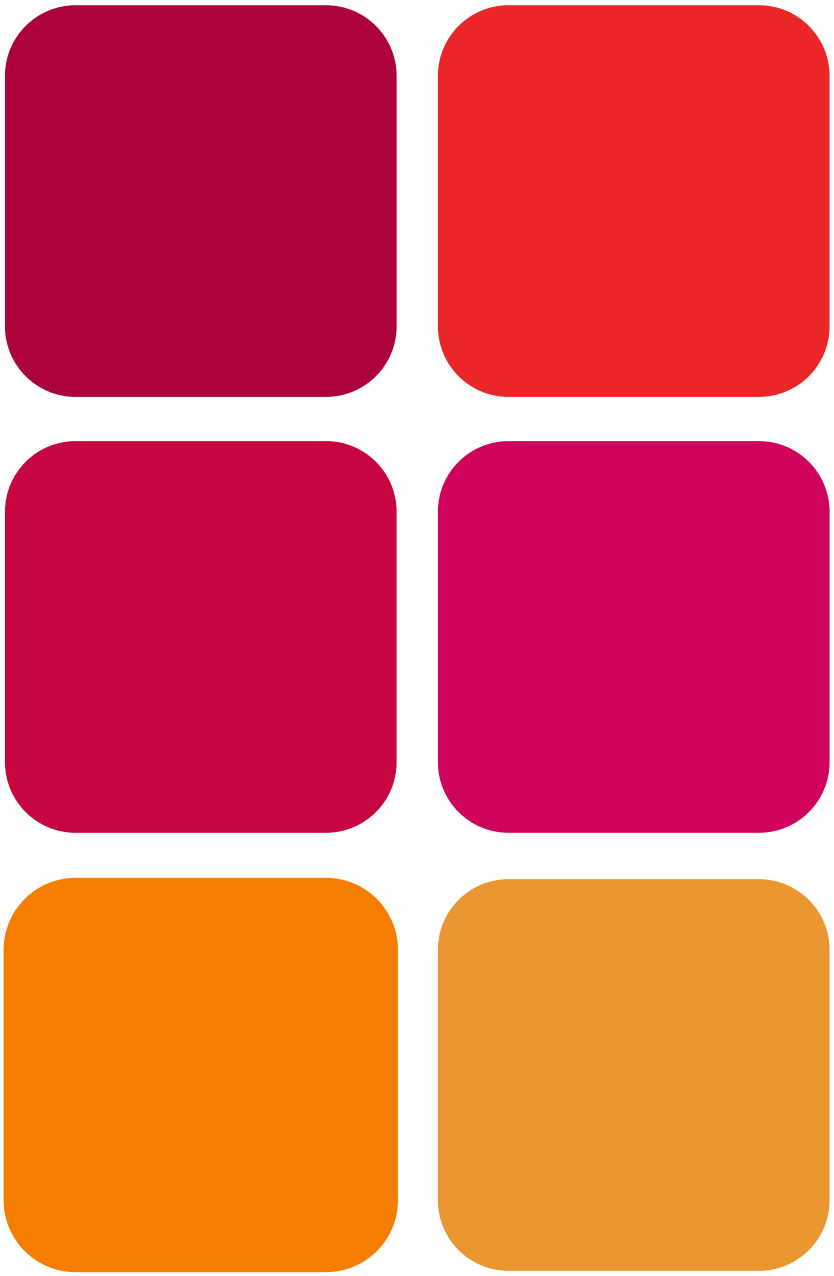

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UNIVERSITAT JAUME·I

Introduction to Management Information Systems

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Chapter 1. Information in the company

1.1. The concept of *information*

All individuals, companies and, in general, all organisations are continuously capturing data, many of which are of no significance to them at all. However, other data are available that would afford them a better understanding of their own environment and of themselves. These data – what we know as *information* – enable them to make more accurate decisions. For this reason, the right amount of information at the right time is a key factor for every organisation.

Company managers take decisions, prepare plans and control their company's activities using information that they can obtain either from formal sources or through informal channels such as face-to-face conversations, telephone calls, social contacts, etc. Managers are challenged by an increasingly complex and uncertain environment. In these circumstances, managers should theoretically be able to define and obtain the type of information they require. However, this is not what happens in practice; rather, the way managers perform their work depends on the available information that they have access to. Most decisions are therefore made in the absence of absolute knowledge, either because the information is not available or because access to it would be very costly.

Despite the difficulties in obtaining information, managers need relevant information on which to base their planning, control and decision-making functions.

Although the terms *data* and *information* are sometimes used indiscriminately, they do have different meanings. Data are non-random symbols that represent the values of attributes or events. Hence, data are facts, events and transactions stored according to an agreed code. Data are facts obtained through reading, observation, calculation, measurement, etc. The amounts and other details on an organisation's invoices, cheques or pay slips, etc, are referred to as *data*, for example. Data are obtained automatically, the result of a routine procedure such as invoicing or measurement processes.

Fig. 1.1. Transformation of data into information

Information is a set of data transformed in such a way that it helps to reduce future uncertainty and, therefore, contributes to the decision-making process. Information is data transformed in a way that makes sense to the person who receives it; in

other words, it has a real or perceived value for that person when he or she acts or takes decisions. Information, moreover, is data that have been interpreted and understood by the recipient of the message. The relationship between data and information is similar to that of raw materials and the finished product.

Information will be meaningful insofar as it provides useful raw material for taking a specific decision.

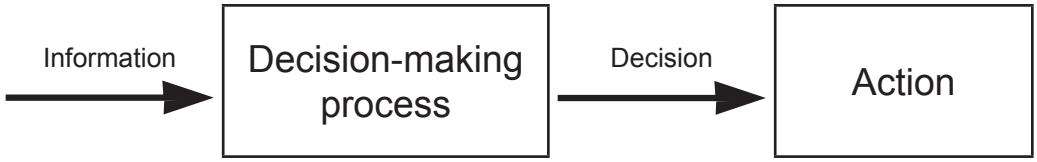

Fig. 1.2. Decision making: transformation of information into action

The process of reflecting on and understanding information is what allows the message to have different meanings for different people. This process also implies that the data analysed, summarised or processed to produce messages will only become information if its recipient understands its meaning. For data to be transformed into information, there must be an awareness of what the person receiving the message will use it for, his or her training, position in the organisation and familiarity with the language and calculations used in the message.

While all managers need information, they do not all need the same type of information. The kind of information required will depend on a range of factors: their level in the hierarchy, the work they are carrying out, confidentiality, urgency, etc. Indeed, the usefulness of information is a debatable point, and what for one person is information, for another is data. In an organisation, for example, when information is transferred from one organisational level to another its meaning may change significantly, such that at one hierarchical level it is regarded as significant information, whereas at another level it is simply data (Menguzzato and Renau, 1991).

Information is the recipient's knowledge and comprehension of data. Information reduces uncertainty and affords the recipient something he or she did not know previously.

Information is one of many company resources, alongside capital, raw materials and labour, since no company is viable without information. Regarding information as a scarce resource obliges us to consider the issue of information economics, in other words, how to establish the necessary relationship between the value of information and its cost.

According to Menguzzato and Renau (1991), information costs can be estimated by taking the following into account:

– The information content required.
– How urgently the information is needed.

– The amount of information needed.
– How accessible the information is.

In contrast, information value is more difficult to determine. The concept of *expected value of perfect information* (EVPI) can be used to estimate information value. This concept may be defined as the difference between the average expected result with perfect information and the average expected result with the available information. The cost and the value of the information must be compared in order to find out how to use this scarce resource, in what amount, and what benefits might be expected from using it.

Information is an essential factor for the company in that the possession or otherwise of opportune information will be a determining factor in the quality of the decisions it adopts, and as a result, of the strategy that it might design and put into practice at any given moment.

Well-prepared information can go a long way to avoid problems stemming from environmental uncertainty, either because of lack of clarity in certain aspects, or due to the huge amount of accumulated data when a decision has to be taken urgently.

1.2. Characteristics of information

Good information provides value. Experience shows that good information should present the following qualities:

1.2.1. Relevance

Relevance is a decisive quality. Relevant information is what increases knowledge and reduces uncertainty surrounding the problem under consideration. Reports and messages frequently contain irrelevant sections that lead to difficulties and cause frustration. Many erroneous managerial decisions are a result of data overload. The right information is not taken from an excessive accumulation of data, which tends to cause a general feeling of impotence vis-à-vis the problem, but rather it depends on getting hold of the relevant data. This characteristic is heavily influenced by the qualities explained below.

1.2.2. Accuracy

Information must be sufficiently accurate for managers' purposes. No information is totally accurate, and spending more on information in pursuit of greater accuracy does not always result in more valuable information.

The degree of accuracy should be coherent with the importance of the decision to be taken and will vary according to the decision-maker's level in the hierarchy. The degree of information accuracy required will depend on the hierarchical level in question.

1.2.3. Completeness

In an ideal world, all the information required to take a decision would be available; however in reality this is not possible. Information is considered to be completed if it informs us on the key points of the problem we are analysing.

1.2.4. Source trustworthiness

Trust in the information source increases when it has a proven track record. To increase the trustworthiness of the message, managers use reports from various sources, particularly where strategic decisions are concerned.

1.2.5. Communication with the right person

Each manager in the company is assigned a specific area of activity and responsibility and must receive information to undertake the tasks he or she is responsible for. However, this process does not always function as well as it should, and information may not reach the right level in the organisation. For instance, a superior might not provide all the information to the person who needs it, and vice versa; a subordinate may hold back information in an attempt to make him or herself indispensable. Information providers must be aware of information needs in order to ensure it goes straight to where it is required.

1.2.6. Punctuality

Good information is that which is delivered just when it is needed. To a certain extent, the need to obtain information quickly can jeopardise its accuracy, although today's data processing methods can produce accurate information very rapidly. Vital information for the company may become worthless if it takes too long to obtain, or delays occur in processing and communicating the information.

Although the punctuality of regularly produced information is important, how often information is produced should be related to the type of decision or activity it is required for. Often, companies routinely produce reports at fairly arbitrary intervals (daily, weekly or monthly) following traditions or calendar conventions without taking into account the time cycle of the activity involved.

1.2.7. Detail

Information should contain the minimum number of details for effective decision making. Every superfluous character or data entails extra storage efforts, more processing, more assimilation of difficulties and probably inferior decisions. The level of detail should vary with the level in the organisation: the higher the level in an organisation, the greater the degree of aggregation and synthesis. At times, particularly as lower levels, information must necessarily contain a lot of detail if it is to be useful, although the general rule of minimum possible detail for coherence with efficient information use should be followed. Given the need to be concise and to direct attention to where it is required, reports often purposely highlight items whose performance deviates significantly from a fixed standard or budget. An example of this type of report is seen in the accounting technique of budgetary control in which actual expenditure, measured item by item, is compared with the budgeted or desired expenditure. Small variations in these reports may be accepted, but differences exceeding tolerance levels are highlighted. These exceptions are presented to managers, thus enabling them to carry out their control function more quickly.

1.2.8. Comprehension

Comprehension is what transforms data into information. If the information is not understood it cannot be used and therefore it cannot add value. Many factors intervene in understanding information:

- User preferences. Some people prefer information in graphs or charts, while others prefer a narrative description. Some prefer presentations with statistics and figures, while others do not understand them. Research has shown that some people assimilate specific facts in detail, whereas others evaluate the overall picture without paying attention to the finer points. Inevitably, these variations mean that the same message can be interpreted in different ways.
- Previous knowledge. Comprehension is the result of memory in association with the received message.
- Environmental factors. Group pressure, available time and trust in the information system all influence comprehension.
- Language. Information is codified in signs or messages.

1.3. Information needs

We live in a world of information. Every day potential readers are presented with a multitude of books, journals and newspapers. However, human capacity is limited and we can absorb only a tiny amount of all this information. There are no clear procedures to help us to identify all information of interest quickly.

Information needs refer to the information required to take decisions correctly and to carry out the tasks deriving from them.

Three large sets of information needs are associated with the three stages in the strategic management process:

– A strategic diagnosis should be undertaken when a strategy is drawn up; in other words, an internal analysis and an environmental analysis – both general and specific – must be carried out. Information is an essential element in this strategic diagnosis stage.

  Information is needed on the main strategic environmental factors: cultural, financial, political, competition, technological. This information should attend to the evolution of these factors, as well as their present state.

  An internal analysis requires information generated by the company itself as a result of its activity. This information can be classified according to the *company's functions, namely*, *marketing*, *production, finance, human resources, R&D and management*.

– Each member of the company involved in implementing the strategy must be aware of his or her particular responsibility, and must receive information on the tasks he or she has to perform – and how to perform them – in order for the strategy and its component plans to be effectuated. In other words, those responsible for accomplishing these actions need information about what they have to do and how to do it. This information is usually passed down from higher to lower levels.

– Strategy control; efficient control requires knowledge on the outcomes of the actions undertaken to effectuate the plans, and how the different environmental components are evolving, in order to verify whether the strategy is developing appropriately and whether any changes are influencing its viability.

Some of the information used to draw up the strategy will also be required in the control stage in order to compare the strategy targets with the results being obtained. Information on the results of implementing the plans will also be needed at this stage. This information must be delivered at the right time so that when any deviations are detected in the control, opportune measures can be taken to correct them and achieve the target sets.

We can therefore consider three sets of information needs in the management process, each one of which will require different information and will be obtained in different ways.

It is extremely important to restrict the information to what is actually needed, as there is a risk of information excess, and everything that goes beyond the strictly necessity impoverishes rather than enriches the system, since it affects the cost of obtaining information. Information economics aims to determine the optimum amount of information for a specific problem, based on comparing the marginal cost of the information and the value of the sample or additional information. We

know what type of information we want to obtain; we now examine the sources of information that can be used to obtain it.

1.4. Sources of information

Information is an essential, strategic resource that can be obtained from numerous sources. In this section, we distinguish between internal information relating to the environment within the company, and information about its external environment. Many of the data captured by information systems refer to the functioning of the organisation and are used to produce internal information. This internal information provides management with knowledge about how the company is functioning and whether or not it is achieving its objectives. Most internal information comes from the accounting system and statistical analyses (sales, production, etc.). Other internal information sources such as surveys and interviews with company members provide quantitative information on, for instance, workers' motivation levels or other indicators that are not easily quantified.

Company managers also need information on the environment: sales volume of their most direct competitors, potential client segments for the company's product lines, geographical distribution of its shareholders, etc. A company can only be successful if it adapts to the demands of its external environment. The environment is represented by a number of groups that vary in their capacity to influence the company's fulfilment of its objectives. Below, we identify these interest groups and the different types of information about them that the company requires:

- Customers: marketing, sales, levels of satisfaction.
- Distributors: marketing and logistics (distribution).
- Competitors: market penetration, innovations, product quality.
- Suppliers: transaction conditions.
- Trade unions: salaries and employment stability.
- Shareholders: company performance.
- Financial institutions: financial conditions and investment opportunities.
- Government: legal and political developments.

The company must be informed constantly about each of these external groups and, at the same time, some of these groups (e.g., shareholders and the government) must also receive information from the company.

Information on the environment can be obtained from the following sources:

- Personal information sources, which provide information through contact with sales staff, customers, suppliers, distributors, bankers, etc.
- Impersonal information sources, which range from general publications (e.g., reports on the current situation, bank and official entity reports, specialised journals) to specific studies (e.g., market research, opinion studies, consultants' reports).

Chapter 2. Essential aspects of information systems in the company

2.1. The concept of the information system

All systems can be divided into subsystems. Because the company behaves as a system, its different elements can be broken down into subsystems. According to the organisation theory literature, the company can be divided into the following systems: commercial, operations, financial, personnel, and information. The information system is related to all the other systems and the environment. The purpose of the company's information system is to gather the information it needs and, following necessary transformations, ensure that it reaches the members of the company who require it, whether for decision making, strategic control, or for implementing decisions adopted by the company (Menguzzato and Renau, 1991). A manager's performance therefore depends on his or her skills in exploiting the information system's capacities in order to obtain positive business outcomes.

For the purposes of this chapter we adopt the definition of an *information system* given by Andreu, Ricart and Valor (1991). According to these authors the information system is a formal set of processes that, working from a collection of data structured depending to the company's needs, gathers, processes and distributes the information necessary for the company's operations and for its corresponding management and control activities, thereby supporting, at least in part, the decision-making processes necessary for the company to perform its business functions in line with its strategy.

This definition, therefore, only includes the formal information system, which is the part of the information system that all the company's members are familiar with and know how to use. This does not mean that informal information systems are not important, but simply recognises the limitation that they are, by their very nature, more difficult to study, plan and manage, at least from a cohesive and holistic point of view. Informal information systems are not the result of a designed process; rather they provide chance information. We must not, however, ignore the existence of informal information channels, and the speed and efficiency with which they can operate, on occasions spreading rumours through the organisation more quickly than information that follows the standard channels.

The above definition refers to the functions and strategies of the company; by this, we aim to transmit the idea that a company's information system must serve its business approach. In the end, the information system is only one of the many elements that the company designs and uses to achieve its objectives, and as such, it must be explicitly coordinated in line with these objectives.

To complete this definition of an *information system*, we now attempt to clear up any confusion between information system and *computer system*. The computer system consists of a complex interconnection of numerous *hardware* and *software* components, which are essentially determinist, formal systems in that specific *input* always gives the same *output*. Information systems are social systems whose behaviour is largely influenced by the objectives, values and beliefs of individuals and groups and by the performance of technology. The way an information system behaves is not determinist and does not follow the representation of any formal algorithmic model.

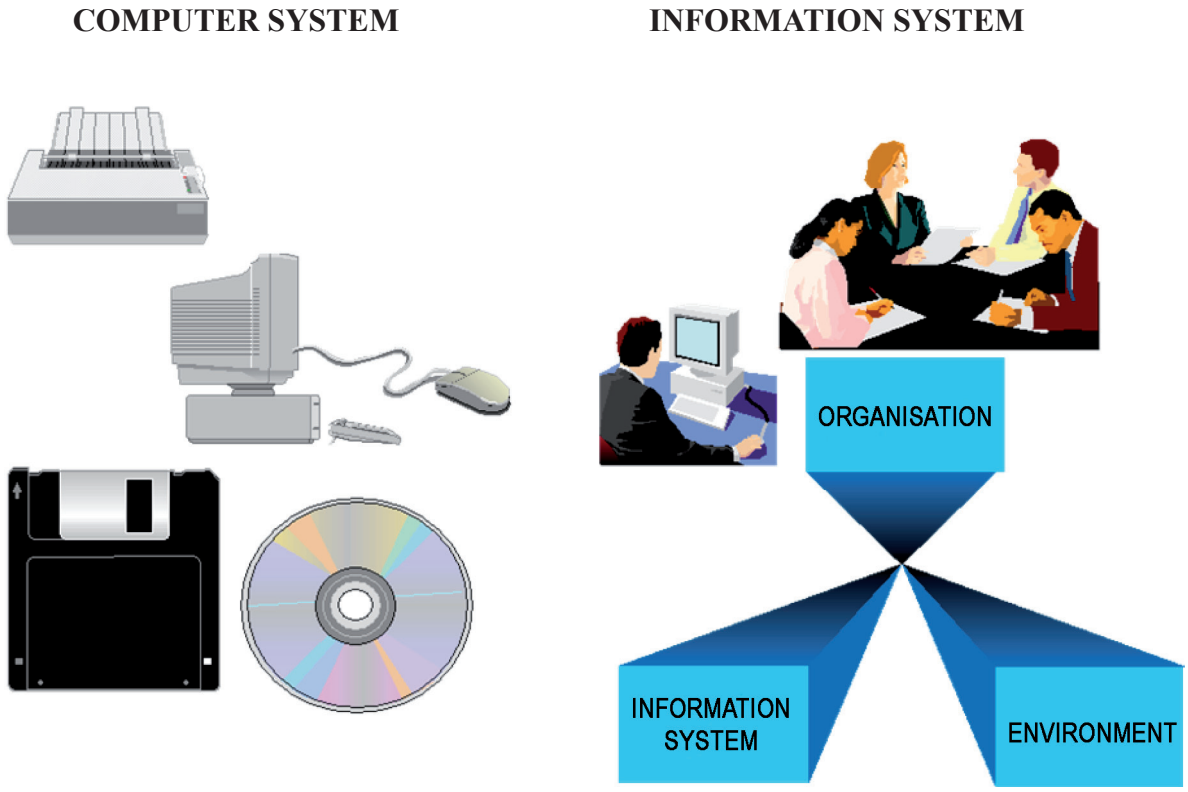

Fig. 2.1. Computer system-information system

Today's company information systems have to deal with a huge quantity of data and provide information structured in different ways to multiple decision-makers in the company. The role of the computer system is therefore vital to the company's information system. Given the major role of information systems, we believe that today's organisations cannot be efficiently and effectively managed without information systems that incorporate a series of information technologies. Information technology has therefore become a fundamental aspect in managing both small and large companies and enables them to seek out competitive advantages.

But an information system is more than just a computer system. It is inseparable from the organisation-environment system, and in the decision-making process we

cannot expect that all the necessary information will be predetermined, formalised and computerised. Information circulates throughout the whole organisation like a current flowing through formal and informal channels and both horizontally and vertically. The information system is the organisational structure that has to manage these information flows with the maximum efficiency and effectiveness in order for the company to carry out its functions in accordance with its business plan or strategy.

The essence of every information system is that it provides the means by which the necessary information is delivered at the right moment and with the right structure to the members of the company who require it, whether for taking decisions, for strategic control or for implementing decisions that have been adopted.

Most of the problems that arise within business information systems are related to organisational, social or human factors rather than technical problems, which are quite scarce. Managers should therefore focus on the appropriate strategic and tactical application of their information systems.

2.2. Information system components

Information systems comprise hardware and software, telecommunications, databases, human resources and procedures (García Bravo, 2000).

2.2.1. Hardware

Nowadays all companies use computers, usually personal computers (PCS). Large organisations employ diverse computer systems including *mainframes*, *minicomputers and most commonly*, *PCS*. However, recent advances in the technical specifications of PCS now means that they perform many of the tasks initially done by minicomputers, and the difference between these two categories is becoming increasingly blurred.

The three computer types have a similar arrangement. The component controlling all the system's units is the central processor, which carries out the instructions given by a program. Other devices are used to introduce data (keyboard and mouse) and produce the system's *output* (printers).

2.2.2. Software

There are two types of computer programs: system software and application software. System software programs are used to manage the computer system's resources and simplify programming. Applications, like spreadsheets or word processors, directly help the user to do his or her work.

2.2.3. Databases

Many company information systems are used as a vehicle for delivering databases. A database is a collection of interrelated data, such as an organisation's human resource or product databases.

The customer database is extremely valuable to the company since it can be used to inform clients of new products or to develop new products that meet their needs. A database must be organised so it can be accessed according to its content; for example an order may be given to retrieve the names and addresses of customers that were invoiced for totals in excess of one million in the previous year. Databases are managed by software systems known as *database management systems* (DBMS).

2.2.4. Telecommunications

Telecommunications are the means by which information is transmitted electronically over long distances. Nowadays, computer systems are generally connected by telecommunications networks. Various network connections are available to suit the needs of different companies. In a small company, PCs are connected by local area networks (LAN), enabling their users to communicate and share data, tasks and equipment. Wide area networks (WAN) are used to connect computers at greater distances, either within the company or in a different location. Internet, the 'network of networks', links up an immense variety of networks from diverse fields worldwide.

These connections enable PC users to access the company's databases and other computerised resources.

2.2.5. Human resources

Two types of human resources can be distinguished: information systems specialists and end users. Information systems specialists include systems analysts, programmers and operators. End users are the people who use the information system or the output they generate, in other words, the large majority of an organisation's members.

2.2.6. Procedures

Procedures are the policies and methods that must be followed when using, operating and maintaining an information system. Procedures must be used, for example, to establish when to run the company's payroll program, to determine how many times it should be run, who is authorised to do so and who has access to the reports it produces.

2.3. Functions of the information system

Companies or organisations develop information systems to help to perform the tasks they are specifically designed to do. For instance, a hospital will have a medical records system, police departments will hold criminal records, all companies will have a payroll system, supermarkets will use inventory systems, offices will have office automation systems, etc.

All information systems carry out a series of functions that may be classified as follows:

- Data capture and collection.
- Storage.
- Information processing.
- Distribution or dissemination of information.

2.3.1. Data capture and collection

This function consists of capturing both external (related to the environment) and internal (generated within the company) information and sending it through the communication system to the entities within the information system responsible for organising it to avoid duplication and useless information (noise). The person or people who capture the information will depend on what type of company they work for. Sales staff, purchasers, managers at different levels in the hierarchy or members of the company in direct contact with organisations in the environment can all act as information gatherers. The data capture and collection process should be more intense in the areas or sectors of the environment and the company that are subject to the greatest changes.

Once the information has been collected and filtered, and redundant information removed, it is stored.

2.3.2. Storage

The following questions require an answer:

1. How should information be stored?
   By classifying it according to a particular criterion or at different points.

2. What type of system should be used to store information?
   The system can vary from the traditional filing system to a computer processed database. The use of one system or another will depend on the amount of data to be stored, how frequently it will be used, the number of users and whether or not access is restricted.

3. How should the user access to the stored information be managed?
   The information may be stored in different services and departments, or in a single location to which all users have access. The company will decide which of these two options is most appropriate, depending on how specific the information is. Access to or retrieval of the information can take many forms; for example passwords may be used to access a database, enabling only authorised personnel to access the information when required.

2.3.3. Information processing

The purpose of information processing is to transform the stored information into useful information that will be meaningful to the person who requires it. This is a key function of all information systems. Information processing is essentially carried out by the computer subsystem. The spectacular development of computers has meant that on the one hand, the volume of stored and processed data is constantly increasing, and on the other hand, the falling cost of hardware has led to a generalised use of computers.

2.3.4. Distribution and dissemination of information

Not only must the information system provide the information each user requires, but it must also disseminate information to other people within the company. Different members of the company need to be aware of certain information about the company and the environment in order to respond more quickly and efficiently to everyday situations that require problems to be solved or decisions to be taken.

2.4. The information system and the value chain

In this section we contextualise and analyse the role of information systems within the value chain model. The value chain covers all the activities a company undertakes in order to offer a product or service. Value chain activities fall into two main categories: primary and support activities. Primary activities are more closely related to creating value. Support activities allow primary activities to take place by providing the necessary inputs and infrastructure. These activities link together to form the value chain.

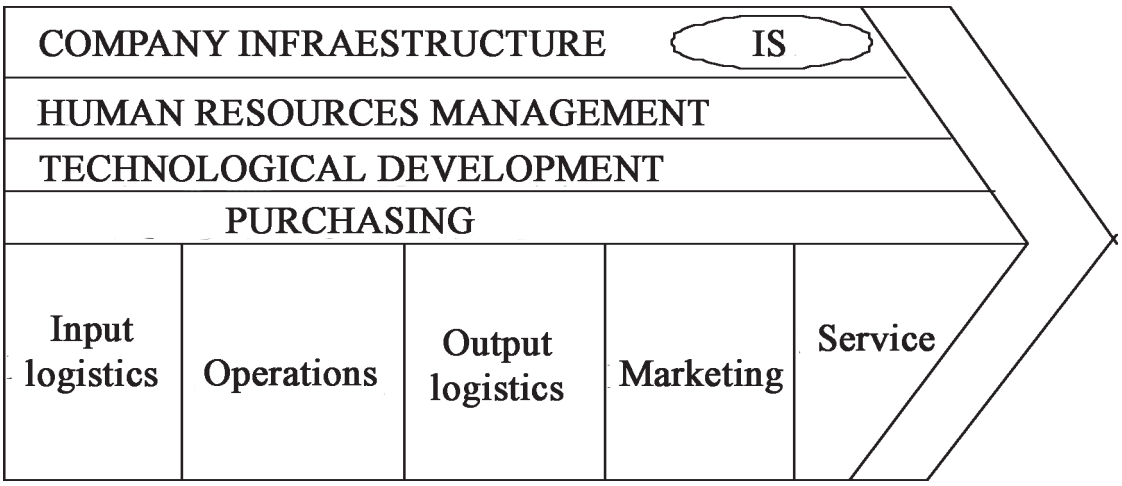

Figure 2.2. Value chain model

The primary activities are shown in the bottom part of figure 2.2 and include:

- Input logistics: the procurement of raw materials and supplies from suppliers.
- Operations: the transformation of raw materials into finished products with the appropriate quality, time and cost conditions.
- Output logistics: the transport of products to customers.
- Marketing: to detect customers' needs and procure orders.
- Service: activities designed to maintain the conditions of use for the sold product.

Support activities are presented at the top of figure 2.2 and include:

- Company infrastructure: the organisational framework that impacts all primary activities in a generalised way. These include all managerial activities, such as drawing up strategies, planning and control.
- Human resource management: all activities related to the selection, training and motivation of the company's staff.
- Technological development: all activities designed to procure and subsequently manage technologies.
- Purchasing: procurement of the elements needed to carry out the production process.

According to Andreu et al's definition, the information system forms part of the support activity known as company infrastructure. This tells us that all the value chain activities need support based on the information system. Because all the support activities sustain each other, the information system's role is to interact with all the company's activities, whether basic or support.

We now explore how information technologies can have a profound effect on each one of these activities, sometimes by simply improving efficiency, and at other times by changing the activity in a fundamental way:

Supply logistics
Information technology can have major repercussions on the supply of materials to manufacturing points. Some large chain stores are directly linked to several of their suppliers, particularly in the clothing industry. This link improves deliveries and reduces stock volumes, and affords greater flexibility to respond to changing demand almost immediately.

Operations
Many Spanish banks offer what is known as household or family accounts. Essentially, these accounts are traditional savings accounts with an added service: a regular summary of the account's transactions arranged by concept (outgoings such as rent, electricity, telephone, school fees, courses and so on, and income, usually the monthly salary). The client receives the equivalent of a balance sheet for a given period. The more transactions the client makes through the bank, the greater the value of the service; if all transactions are made through the same account, the summary will give the client a thorough analysis of his or her income and expenditure. Preparing these reports is a relatively simple task for the bank: the only information needed is reliable data on the type of transactions made.

Another example is that of cashpoint machines or ATMs, which have changed radically in recent years. A cashpoint service was previously considered to give competitive advantage, but now it has become necessary in order to compete and remain in the sector and all banks offer the same type of service.

Information technologies can also affect operations; one case is that of a cable news company which now offers a new line of financial services including instant financial information (foreign exchange rates, for example).

Dispatch logistics
Information technology has a major impact on the way in which products and services are delivered to customers, for example, connections to travel agency booking systems.

Marketing and sales
One agrochemical company has designed an on-line crop planning service for its main customers. With just a standard telephone line and their PC, farmers can consult agricultural databases with information on crop prices, the conditions necessary to grow the crop and the prices of fertilizers, pesticides, etc. They are then helped to reach a decision by a range of models and systems, which they can experiment with and adapt to their own growing conditions (climate, soil, etc.,) to study the implications of different crop rotations and planting programmes. The model helps the farmers to choose fertilisers, insecticides and other chemicals, and also to maximise discounts by grouping their purchases.

Marketing and sales activity, somewhat forgotten during the initial decades of the IT revolution, is now the area where these technologies are having the greatest repercussions.

After sales service
One lift manufacturer has installed black boxes similar to those used in aviation in its new line of products. This is a response to the numerous occasions when customers call the company's technical service without explaining how the breakdown in the lift has occurred. The maintenance engineer can now connect the device to the company's computer, find out the cause of the breakdown and then repair the lift *in situ*, thereby reducing repair costs and increasing customer satisfaction by solving the problem on the first visit.

Company infrastructure
Management control: a financial services company used to pay its sales team a commission for each product they sold. The result of this policy was that the sales team were highly motivated to make the initial sale but had no incentive to make sure that clients were satisfied and kept their money in the same place (extremely important for the managers of a financial services company). With a new integrated client database, the company has reduced the commission on the initial sale, and now pays a new commission if clients remain with the company and increase the assets they hold with it. This new approach (only possible with new technology) has brought the company's strategy and the sales team's incentives into line much more effectively.

Some airlines use a network to monitor the situation of each of their planes in any given moment. Information on the plane's position and passenger list, and the passengers' connection times, enables airlines to take better decisions by speeding up delayed flights or delaying takeoff where connections have to be made with other flights. The company therefore avoids income losses due to passengers continuing their journey on their competitors' flights if they miss their own connections.

Human resources
An oil company has installed desktop terminals for all the members of its management board, to give complete on-line access to all personnel records of the top four hundred employees in the company. These records provide data such as performance over the last five years and a list of positions that each person has held. The company claims that this capacity has facilitated its most important personnel decisions.

The systematic examination of a company's added value chain is an effective way of finding advantageous IT applications.

All the value chain activities, whether basic or support activities, need and generate information. The information system compiles information generated by different activities that is later needed for other activities to function. The information system distributes this information to each activity (see fig. 2.1). From this perspective, the information system plays an important role in coordinating the various value chain activities. This role involves coordinating:

– between basic activities (e.g., ensuring that orders reach the production department);

– between basic activities and support activities (e.g., any control activity);
– between support activities (e.g., monitoring personnel involved in support activities).

The information system therefore plays a central role in ensuring the smooth working of interactions among value chain activities.

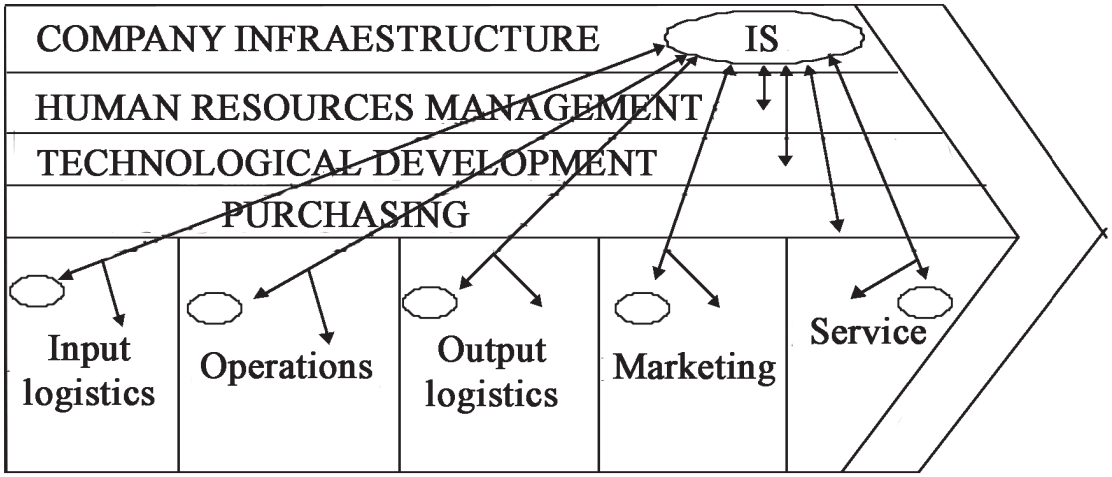

Figure 2.3. Model of the value chain with the information system

The information system is also highly relevant to the links between the value chain activities. For example, the systematic compilation of customer complaints by the information system can help to guide quality control procedures during the manufacturing process. The links between activities in the value chain can be improved through the information system. Exploitation of the links between activities can, in some cases, bring about a reconfiguration of the value chain, leading to new approaches to the same business and even to notable competitive advantages. Thus, the information system influences the design of the organisation's structure.

The information system compiles and distributes the information necessary for taking decisions or implementing initiatives throughout the whole value chain when this information is generated in other activities of the chain. For example, sales information may be relevant in taking decisions on after sales service; it may also be useful in designing the most appropriate service actions for a given set of circumstances.

By considering the information system as an integral part of the company's infrastructure, the information that it manages – although it is generated or used by specific activities – does not belong to any activity in particular but rather to the company as a whole. However, it is possible that some value chain activities need to produce, process and use considerable volumes of information that are not required in other areas of the company.

To provide for these circumstances, there are information systems or subsystems that are limited to specific activities; these are not part of the basic information system that is integral to the company's infrastructure. These information system or subsystem processes may also use or generate relevant information for other activities, so long as the quantity of this information is relatively small.

Some applications belonging to specific functional subsystems of the organisation are:

- Marketing: sales forecasts, sales planning, customer and sales analysis and evolution, campaign effectiveness...
- Manufacturing: production and schedule planning, cost control and analysis...
- Logistics: planning and control of purchasing, distribution, inventories, transport routes...
- Personnel: staff vacancies, evaluation (performance analysis), personnel administration (payroll...)
- Accounting and finances: accounting, costs, financial analysis...
- General management: strategic planning, resource allocation...

2.5. The information system and the company infrastructure

Every person in the company needs or generates information, and therefore no person in an organisation can be totally detached from its information system. The company's information system cannot be associated with any one of its activities in particular. It is not a new department, nor is it accountable to any one of the traditional functional departments. An information system project must have the commitment of all the representatives of the company's hierarchical structure. It is not a data processing centre, a misconception often held by some members of the company, including managers; a data processing centre is just one information resource, one area of information activities.

A broad vision of the organisation must be taken when designing a company's information system. If the system is to work properly managers must actively guide the process, since they are the ones with a global vision of their company. The company's management must take responsibility for adapting their organisation, structure and personnel to changes in the environment. If these changes involve a shift towards technological development, the responsibility for adopting new technologies in the company lies with its management, who must match the information technology to the company's needs. The impact of information technology on business is so vital that managers must always take full responsibility for guiding the company's information technologies and information system. However, many managers have traditionally been somewhat ill disposed to technological changes and have shunned their responsibilities in this area. This reticence is due to the fact that many top-level managers began their

professional careers before the wide scale introduction of computer technology. As a consequence, they are not comfortable dealing with IT issues, and have frequently delegated this area of responsibility to technical personnel, who although they are experts in their field, do not generally have much interest in the company's business activities.

In order to manage information technology and the information system, management must learn and advance in the organisational learning process, which entails incorporating, assimilating and exploiting information technology and the information system as a strategic tool. They must understand the role of the company's information system and how it works in harmony with other management systems. The information system is one of many elements in the company's infrastructure and must be consistent with other systems such as planning, control, incentives or the organisational structure.

The information system must be coherent with other systems that make up the company's infrastructure, all of which must work in a coordinated manner with each other. The company's infrastructure is designed in accordance with its target objectives.

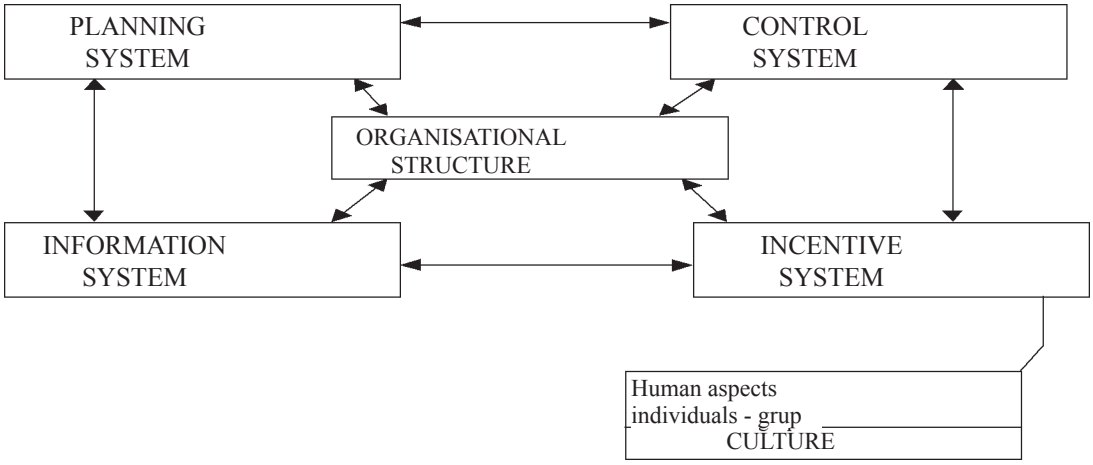

Fig. 2.4. Internal structure of the company's infrastructure

The figure represents the internal structure of the company's infrastructure. Information systems are an integral part of the whole infrastructure in the company. There is a complete, direct interdependence among all the systems; in other words, it would be a mistake to think that the information system and the control system are only interdependent through the organisational structure. They are, in fact, directly interdependent, in the same way that the information system and the planning system are. It is important to remember that the information system comprises a set of elements that must be coherent and coordinated with all the other systems within the company's infrastructure.

The set of systems should be coherent both internally, and with the company's objectives, which it must expressly contribute to achieving. This dual coherence has various implications:

On the one hand, internal coherence implies that a balance must be established in order to respect the interdependencies between the systems. This balance is not easy to achieve, but it can often be reached by making subsequent adjustments through compromises among the objectives of all the systems involved. On the other hand, coherence between the various systems and the company's objectives can only be achieved if the systems' design thoroughly and explicitly takes these objectives into account.

This concept of *balance between systems* is crucial and has a number of consequences. When any changes are to be introduced into any element of the whole, an imbalance will occur which, at the same time, will set off a 'balance recovery' process with potential implications for the other systems involved. In sum, it is difficult to successfully introduce changes in one element (e.g., the information system) if the implications of these changes for other systems – in other words the company's infrastructure – are not taken into account. Consequently, any changes made must be highly balanced to minimise the resulting imbalances and spread them out over time, thus allowing the rebalancing tendency of the whole to solve the problem of its own accord. The best strategy for introducing changes will depend on each company and on the corresponding balance at any given moment, although human aspects, both group and individual, also have a part to play.

Managers with responsibilities for changes in the company's information system should take the following aspects into account:

– Resistance to change. There is generally a natural resistance to change within organisations. Because changes in the information system can entail modifications to the structure, culture and policies of the organisation, there is frequently considerable resistance to changes in the development of information systems. However, the company's managers must drive and lead these changes even though the process may be more complicated and slower than initially envisaged.

– Adapt technology to the organisation. The information system is there to serve the company and its objectives and, therefore, the technology the system uses must be adapted to the organisation. The information system must provide the necessary information to perform all the business functions in the company and to that end, the most appropriate technologies should be chosen.

– Understand the limits of information technology. We generally use technology to solve organisational and human problems, but we should always remember that correct, beneficial computer use depends on the user's intelligence and know-how.

Experience shows that the companies that derive the greatest benefit from their information systems are not always those with the most technologically sophisticated systems; rather they have understood how to integrate the information system into the company's strategy so as to achieve its objectives, and have good communication channels between managers and IT technicians. The information system is interdependent with the other systems in the company. The harmonious balance established among all these systems does not only depend on the information system.

Chapter 3. Information system categories

3.1. Introduction

Given the complexity of information processing and the varying degrees or levels into which data and processes can be structured, depending on the problem or issue, several categories of information systems are required to deal with all the organisation's information needs.

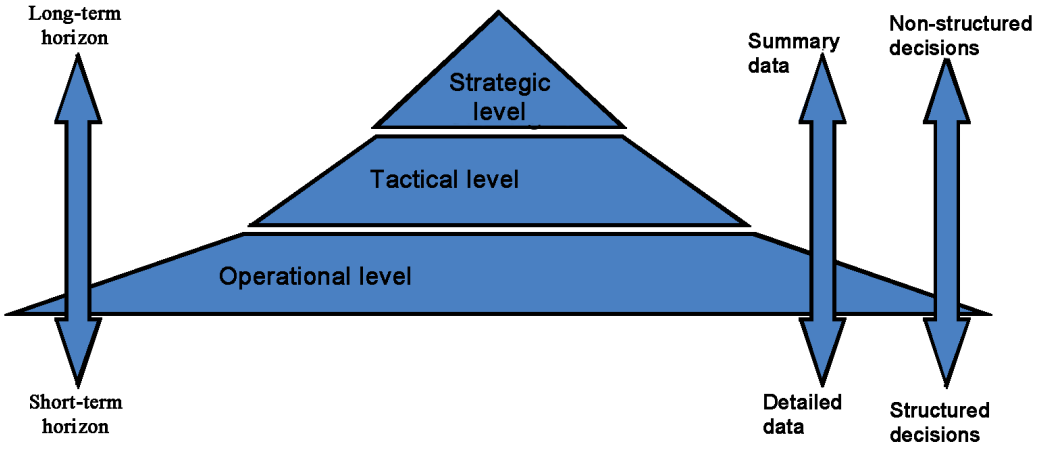

Fig 3.1. Levels of management

Different types of information systems must be developed to meet the whole gamut of information needs in a company: systems for processing transactions, management information systems and decision support systems (Arjonilla and Medina, 2007). The various information system categories remain coherent through their integration in a common data architecture.

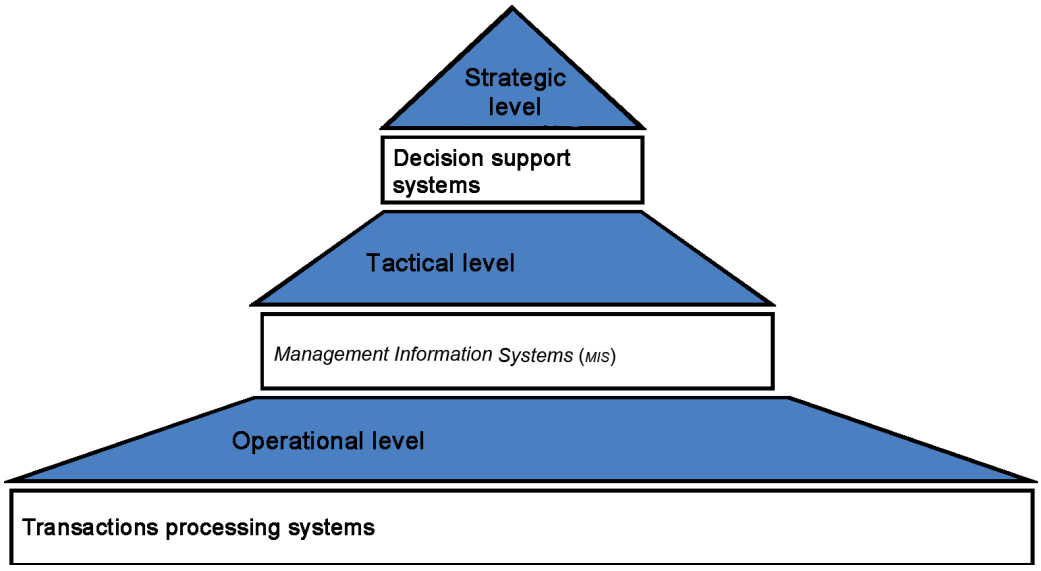

Fig. 3.2. Information system categories

3.2. Transaction Processing Systems (TPS)

Transaction processing systems are the cornerstones of a company's information system and compile their daily business operations. Many companies cannot operate without this type of system. As operations are carried out in the company, transaction processing systems gather, process and store data and reflect business transactions such as sales, purchases, payments, etc.

Transaction processing systems are the most defined or structured information processes in the organisation, automating the central core of its operations. Their purpose is to improve the company's routine activities. The most common transactions include invoicing, payrolls, production and reception of orders. Companies aim to carry out these activities quickly, systematically and efficiently. All these activities are carried out at the operative level in any organisation and have similar common characteristics:

- These operations are repeated many times in companies.
- The way these transactions are carried out is very similar in all companies.
- The activities can be separated into well understood stages (procedures) that can be described in detail.
- There are very few exceptions to the standard procedures.

The above characteristics allow routines to be established for managing transactions. The large volume of transactions at an organisation's operational level leads many companies to try and develop more efficient and effective ways of processing the data generated through this type of activity.

Transaction processing systems are faster and more accurate than the manual procedures used to perform the same routine activities. A transaction processing system replaces manual procedures with computer-based procedures to perform well structured routine tasks.

Transaction processing system output may take the form of transaction documents or database queries.

a) Transaction documents

Many transaction processing systems produce transaction documents, such as invoices, purchase orders or payroll lists. These documents may be classified as action documents or information documents.

a-1. Action documents

Action documents imply that some kind of action is taken. For example, an airline ticket guarantees that a seat on an aeroplane is reserved, or a bank has to pay out money when a cheque is presented.

a-2. Information documents

Information documents confirm that a transaction has taken place or informs about one or various transactions. For example, a bank transfer slip with details of the transfer, or a breakdown of credit card payments that accompanies the credit card bill.

b) Database queries

A wide variety of information can be extracted from a database using a database management system and user-oriented fourth generation languages. These queries can provide lists of all transactions processed during a specific time period, or error reports with a list of erroneously processed transactions.

3.3. Management Information Systems (MIS)

These can be defined as information systems that provide information for users with similar needs. The main purpose of Management Information Systems is to provide managers with the information they need to take decisions and solve problems. Management Information Systems are supported by corporate databases, which include data generated by transaction processing.

Every organisation has to take decisions on many issues that arise on a regular basis, whether weekly, monthly, or quarterly, for which certain information is required. One example is the monthly breakdown of sales figures on a client by client basis. Because the decision-making processes are clearly defined, the information needed to take decisions can easily be identified. An administrative information system can therefore prepare regular reports on which to base these decisions; these reports are prepared and presented in a previously designed format. Thus, these systems provide support for structured decisions, since administrators know beforehand which factors should be taken into account in the decision-making process and the Management Information System provides clearly structured reports with all the necessary information to take these structured decisions.

The content of these reports can be enhanced by including the concept of management by exception. In this case, the information processor compares real performance with previously established standards, and when performance falls outside acceptable limits, the manager's attention is drawn to the fact. Management by exception can be incorporated into Management Information System reports in four ways:

1. by preparing a report only when exceptions occur

2. by using the report's sequence function to highlight exceptions. The report's entries can be arranged in ascending or descending order, according to one or more key areas, such that entries requiring greater attention appear at the top of the list. For example, a sales report could be arranged in descending order of sales for each

client during a specific time period; clients purchasing the largest volumes would therefore appear first. Another example would be sales volumes per item, in which an ascending order would place the products with the lowest sales volumes in a given period at the top of the list, thereby alerting the user to least successful items.

3. by grouping exceptions together. In this case, the reports are prepared so the user can find exceptions in certain areas according to a particular criterion. For example, a report could present clients' outstanding invoices in columns arranged by due date, either within one month, over 30 days, over 60 days or over 90 days. This makes it easy for managers to identify outstanding invoices for specific periods in a single column.

4. by showing deviation from the norm. Results of actions are compared with forecast actions and any difference is presented as a deviation. For example, a report could compare data on real product sales by geographical area with sales forecasts and present the difference in the deviations column.

In the 1960s attempts were made to develop an information system that would automatically meet all the company's information needs by means of an administrative information system known as the MIS (Management Information System). The MIS represented a formal commitment by executives to make IT available to all managers. The idea of the MIS was to maintain a continuous flow of information to managers.

Figure 3.1 illustrates the relationship between the MIS, the company's management and the environment in which it operates.

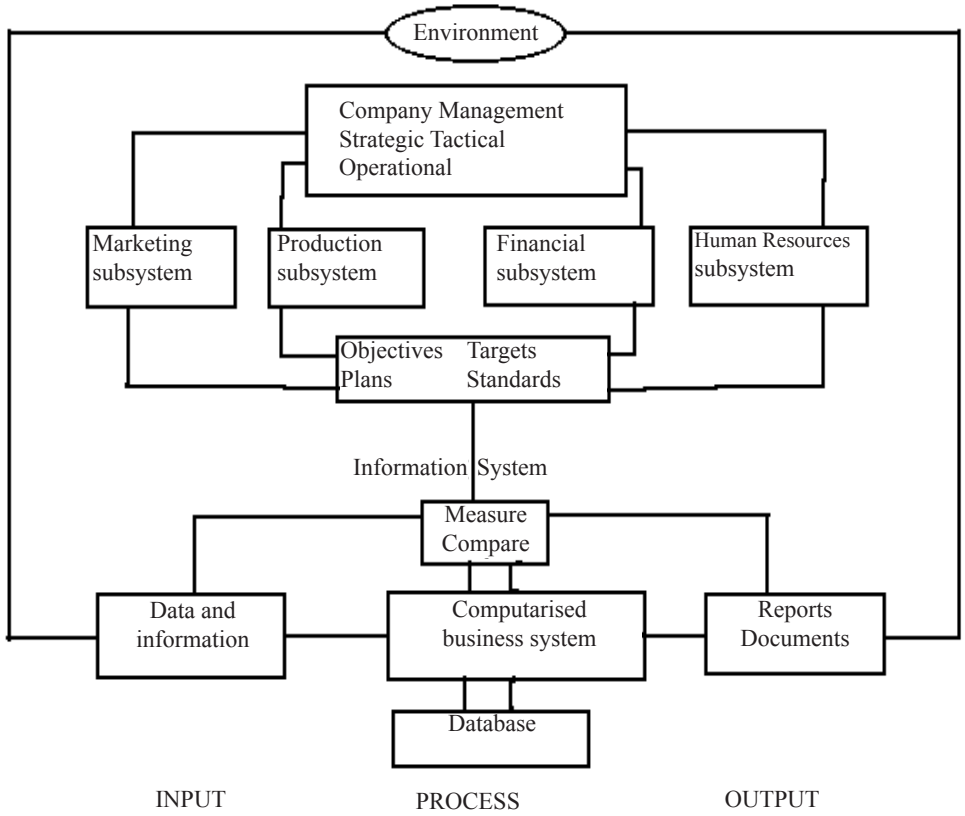

Figure 3.3. The MIS-company management relationship.

The environment is represented at the top of the figure, the central section represents the company management and the company's various subsystems, and MIS appears in the bottom section. Information and data flow from the environment to company management and to the MIS. In addition, management sends information and data to the MIS (MIS inputs), which are processed by information processors specially designed to provide output in the form of documents and reports to management groups at strategic, tactical and operational levels, as well as to the environment. The database contains data from the accounts information system and also incorporates data from the environment.

Managers define the company's objectives, and set targets, plans and standards (centre of Figure 3.1). These plans and standards provide another type of input to the MIS, establishing the bases on which control and feedback can operate.

The software uses the database to produce its regular reports. The MIS output should be relevant information sent in the right way to the right person at the right moment. This information must be carefully selected to help the decision-making processes at strategic, technical and operational levels (management). This output is used by those responsible for resolving the company's problems.

This information is normally compiled in:

1. Strategic level reports to provide managers with the information they need to plan activities such as defining and reviewing the company's objectives, setting long-term targets (more than three years) and establishing company policies.

2. Tactical (and status) situation reports to enable management to draw up new or revised short-term plans (from 1 to 3 years) on a continual basis, and to perform their planning and control functions efficiently so that the subsystems can be properly coordinated.

3. Operational reports with daily information to keep managers fully informed of the company's current situation, thus enabling them to carry out their control functions. In addition, much of the information the company sends to the environment is provided by the MIS in the form of invoices to clients, and salary and tax payments.

Because the MIS hosts an information system structured in accordance with certain previously determined decisions, it cannot be used to make decisions when an unexpected problem arises. The idea behind the MIS is to help interpret the information needed to take previously defined decisions, and particularly at the strategic level, information needs are not easily identified.

Given the limitations of an information system like the MIS in supporting non-programmed decisions, information system designers needed to look at the problem from a completely different angle (Menguzzato and Renau, 1991). Rather than being structured from the perspective of the person who interprets

predetermined information needs, the information system should be conceived to give the greatest possible flexibility to the decision maker. In this way, instead of previously establishing what type of decisions are to be taken, information should be arranged according to its origin and type, based on decision-makers' general knowledge, so the necessary information is available to them when they have to take a decision. The design of the company's database is therefore crucial: it must enable information to be used rationally, and must allow the information system to be properly integrated. The company database must be flexible enough to be structured according to the particular needs of different decision-makers. This reveals the need for more interactive systems that help the decision maker to take non-structured or only slightly structured decisions.

3.4. Decision Support Systems (DSS)

Not all company decisions are recurrent, and some have to be taken infrequently or perhaps only once. Decision support systems provide a tool to deal with less precisely structured or defined problems that arise sporadically. DSS help managers who have to take non-structured decisions. A decision is understood to be non-structured if there are no clear procedures in place to take the decision, and it is not possible to identify beforehand all the factors that need to be considered in the decision.

It must be said that all information systems support decision making, even if only indirectly. DSS have been expressly developed to support the decision-making process. These systems facilitate dialogue with the user when he or she is considering alternative solutions to a problem, and the system provides database access and models constructed to present information.

Decision support systems are interactive, and aim to expand human reasoning capacity to resolve specific non-structured decision-making problems (Gil, 1997). This type of system focuses on the decision-making processes and must provide relevant facts relating to the decision easily, quickly and accurately It must also offer interactive access to processing media that can be used creatively and that allow the user to explore a range of alternatives, and provide the information necessary to respond to the problem. When managers use a DSS, they consider a number of possible scenarios by asking "What would happen if...?" For example, a manager who is deciding what price to set for a new product can use the marketing area of the decision support system. The system will have a model that combines various factors such as product price, the cost of materials, advertising costs, all of which affect profit forecasts for product sales over a five-year period. By varying the price of the product in the model, the manager can compare forecast results and select a price accordingly.

Unlike administrative information systems, decision support systems can help to make decisions for which a procedure cannot be fully programmed in a computer. To this end, some of the dependent relations between factors and their consequences

are shown by computer models, and value judgements are introduced when the manager interacts with the system. Spreadsheets, which can help to manage data by representing them in columns and rows in a table, are frequently used to construct simple decision support systems.

The main purpose of decision support systems is to help the decision maker in the decision-making process. Unlike transaction processing systems and administrative information systems, DSS are not structured or formalised, since they are generally used for *ad hoc* processes and therefore they need to be flexible and adaptable. The key aspect of a DSS is that it supports decision making in situations where computer data processing capacity is needed in conjunction with the criteria or rationale of the decision maker.

The main emphasis of DSS lies in its support function, and not the automation of decisions. The computer's task is to provide access to data and offer the chance to test alternative solutions, but it must not replace the manager's criteria. In other words it does not attempt to offer responses or impose a sequence of predefined analyses; rather it is the user who chooses how to tackle the problem and in the final instance, takes the decision.

A DSS uses data from the organisation's transaction processing system and administrative information system as well as data from external sources. In fact, the data required to generate information can come from a range of sources, not only the database as in the case of the transaction processing system and the administrative information system. Moreover, a DSS can store and later reprocess previously obtained data. The user interacts with the system by making requests, creating or modifying models to adapt them to variations and to help understand the problem, managing data and designing the format and content of reports, which may include text, structured information or figures.

In using these systems it is essential to determine what information is necessary. In well structured situations this information can be identified beforehand, but this becomes complicated in non- structured environments. Once the manager has certain information, he or she may realise that more information is necessary; in other words certain information reveals a need for further information.

In these cases neither the format nor the content of the system's reports can be designed previously. Decision support systems must therefore be more flexible than transaction processing systems or administrative information systems. The user must be able to define the content of each report he or she wants. The manager's own criteria therefore play an important role in taking decisions on non-structured problems. While DSS help managers, they are no substitute for the manager's own criteria.

One example of a non-structured decision is the decision banks had to take over whether or not to install ATMS. They had to calculate the cost of both manual and automatic services, the degree of customer acceptance, their competitors' response, etc.

3.4.1. Problem resolution with DSS

DSS are interactive information systems that help the decision maker deal with fairly unstructured problems by offering analytical models and access to databases. These systems are designed to help in the decision-making process. One of the main features of these systems is their flexibility. Personal DSS should be easy to use: the tools should be oriented to the final user for this purpose. On the other hand, an organisation's DSS, used widely by different members of a company, should be the result of a well planned process. All DSS should be easy to use. Within its area of application, a DSS should offer the user a way to apply models and databases interactively that enhances the support it gives to deal with the problem the user faces.

So, what is the essence of DSS? In what type of business situations should the DSS approach be considered?

The way people in an organisation tackle a problem will vary according to how structured the problem is; in other words, it will depend on the extent to which predefined procedures are in place to take decisions on the matter in hand.

Principally, DSS help to take decisions on semi-structured problems, where some phases in the decision process often require considerable computer support. This is because a model, which can contain hundreds of relationships, is applied to a database that frequently contains a large amount of data; the decision maker intervenes in the selection of this data. DSS can also be used to take decisions on non-structured problems. These decisions can also be taken with the support of expert systems, although with a very limited field, such as the decision to approve a loan application.

The main tasks facing managers involve a high level of ambiguity; in other words they generally have to deal with non-structured or semi-structured problems.

3.4.2. Possibilities of Decision Support Systems

A model is a representation of something, designed for a specific purpose. It is usually an abstraction or a simplification of a phenomenon. A model represents the relationships between the aspects resulting from the phenomenon. A model is constructed by adopting a series of suppositions or assuming a series of premises about the dependence between variables. Various alternatives can then be analysed by changing some variables and seeing what would happen if the premises were modified and then comparing the results (What would happen if...?"). For example, what would happen if we changed a product's sale price? What value would a variable need to have to achieve a certain result? What volume of sales would we need to obtain a given net profit?

3.4.3. Using a spreadsheet as a decision-making support system

The spreadsheet program is widely used in the work environment and is now the standard software used to manage information in the business world. Despite this widespread use, we believe that a low percentage of users take full advantage of the spreadsheet's potential. The spreadsheet could be better exploited by applying the logic used to construct models with different scenarios. In many cases, poor use of the spreadsheet leads to considerable loss of time and on occasions, the program cannot be used to carry out some types of analysis.

The purpose of the spreadsheet is not to perform complicated mathematical operations; a calculator is sufficient for that. The spreadsheet comes into its own precisely when the result of the first calculation appears, which should lead on to an analysis of this result. The spreadsheet can also help achieve greater productivity when it is used to perform regular repetitive operations. The spreadsheet also includes logical functions and search functions that allow the user to delegate more mechanical decisions to the computer such as, for example "if this value is lower than that one, then multiply by x".

Hence, when we are about to start a task with the spreadsheet, we can have two aims:

– to construct a model for decision-making support, in which case our target should be to achieve maximum possible flexibility.
– to mechanise a repetitive process that we have to do on a regular basis, repeating the same calculations, which should aim to be both convenient and secure.

When constructing a spreadsheet, it is essential to know exactly what our objectives are; this will help us take the right approach to achieve our objectives.

3.4.4. Using a DSS in the decision-making process

The general, the decision-making process has four stages. During the first stage, known as the intelligence stage, the environment is explored in order to find or define the problem. During the second stage, the design stage, various alternatives are drawn up for comparison during the selection stage. The solution is then applied and improved where necessary. Each one of these stages can provide feedback to a previous stage in order to redefine the problem or select a better solution, for example.

DSS can help at different stages of the decision-making process.

Spreadsheets are usually used to construct simple decision-making models. They do, however, have limitations. Their data-handling capacity is limited and they cannot work with very large databases.

3.5. Executive Information Systems (EIS)

DSS mainly support planning tasks, whereas the essential feature of the powerful EIS tool is their support for control activities. An executive who uses an EIS has a greater capacity to analyse all aspects of the company's operations and to seek out problems and opportunities.

Since companies timidly began to adopt Information Technologies (IT), there has been a growing conviction that IT cannot easily be applied to managerial tasks: the more complex and ambiguous the activity is, the less useful computer-based tools prove to be.

This conviction can easily be verified in the real business context. Computers are now widely used by administrative staff and increasingly by middle management. However, the image of a general manager of a large company busily working in front of a computer screen does not easily spring to mind. A top-level executive's daily routine is inevitably assumed to be a round of meetings, telephone calls, conferences, conversations, business lunches, etc. Research shows that the executive's activity is more oriented to verbal communication, and highly analytical reports and documents are relatively unimportant (Rockart and Treacy, 1982). However, there is a widespread interest in linking up high-level management with computer tools.

3.5.1. The evolution of information systems

Since its beginnings, IT has clearly been conceived as a source of solutions for business management. The stages described below show the path of its development:

– First to appear were the Transaction Processing Systems (TPS), which replaced manual procedures for clearly structured routine tasks with faster and more accurate computer-based procedures. Some of the most common transactions now performed by TPS are invoicing, accounting and payroll management.

– At the end of the 70s, the concept of the MIS (Management Information System) attempted to meet all the company's information needs at the strategic, tactical and operative levels, structured according to specific predefined decisions. However, in practice these systems have not been useful to top-level managers, because they generally have to deal with new situations that require non-structured decisions for which information needs are not previously established. For this reason, MIS are particularly suitable to cover the information needs of lower-level managers.

– Once it had become clear that comprehensive strategic information system models were not viable, Decision Support Systems (DSS) were introduced.

These provided solutions for particular decision-making contexts, and in the end have proved to be more suitable for certain company staff areas.

The idea of providing regular and relevant information to high-level managers has attracted the attention of information system researchers since IT was first introduced into organisations (Applegate, Cash and Mills, 1988). Different types of computerised information systems have pursued this ambitious goal. Both MIS and DSS were first offered as systems to fulfil these needs. However, many researchers have found that both MIS and DSS, while useful for other levels in the firm's hierarchy, fail to satisfy the information needs of top-level management.

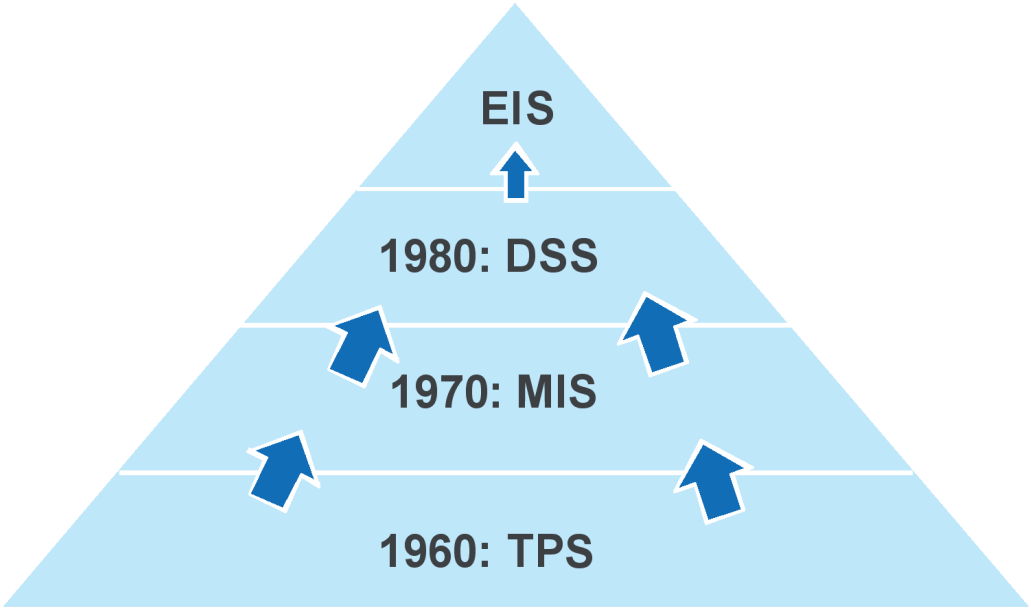

Fig. 3.4. Evolution of company information systems.

Given that the undertakings and responsibilities of management differ substantially from those of other people in the company, their tasks clearly cannot be seen as a mere extension or intensification of the work done at lower levels in the company hierarchy, for whom as we have seen, suitable computer based solutions are available. As a result, executives need specific computer support, which differs from the support provided for other members of the organisation.

It is in this context that Executive Information Systems (EIS) appeared as the next candidate to provide top-level managers with the information they need. These systems have been designed to offer reliable information to executives about key indicators of the workings and operations of their organisations.

3.5.2. Executive Information Systems (EIS): concept and characteristics

An EIS can be understood as a computer-based information system designed specifically for use by top-level company managers, providing internal and external information that they can use as a support in performing their work.

Although definitions of EIS vary, there is a general consensus on the characteristics they all share, which we now detail below:

a) Capacity to access and manage information

EIS must gather the internal and external information that is relevant to the executive, and must therefore be able to access and manage information from a range of sources and in different formats, and handle quantitative and qualitative, structured and non-structured information.

An EIS provides direct access to information without the need for intermediaries.

b) Presentation of information

The information must be presented to the user in a meaningful and manageable way, which involves combining data from different sources in the same report or on the same screen, and filtering and condensing a wide range of information. As well as its capacity to aggregate information, an EIS must also allow the executive to explore more deeply and obtain additional more detailed information on a specific aspect if he or she considers it necessary.

The presentation of information must be adapted to the user's personal preferences, for example by offering choices on how the system can alert the executive to deviations in any variable.

c) Orientation to Critical Success Factors (CSF)

The EIS must provide information on key business variables, and must be flexible enough to adapt to possible changes occurring in the business, guaranteeing that the system remains oriented to critical success factors. For this reason, the design of the EIS must allow for constant evolution. The EIS must be able to accurately determine the user's information needs in order for it to have the right orientation; to a large extent, its success or failure depends on this capacity.

d) Capacity for communication and time organisation

An EIS must also act as a support for communication, through electronic mail, and in organising the executive's work in the diary or calendar that usually comes with the system.

e) Ease of use

These systems must match the user's profile, in this case, people who do not usually have any IT training and moreover do not have the time to acquire it. This means that they must be easy to use and allow direct, intuitive access to their features. The EIS learning curve should be no longer than a few minutes.

EIS are one of the most promising tools that technology has made available to companies. They allow an executive to understand and analyse the forces acting in the company and in the market without moving from his or her own desk. Executives can use EIS in two ways: to read information about the current situation and forecasted trends, and as a tool to perform personalised analysis.

Executives use EIS in two completely different ways: *a*) to access information on the current situation and on foreseeable business trends; and *b*) to perform personalised analyses of available data. We now turn briefly to these two usages.

a) Access to information

When executives have "read-only" access to the latest data or reports on the situation of key variables, they can examine the information but do little, or perhaps nothing, in terms of processing the data. This type of access may be widely used in sectors where market conditions change quickly, where executives have to keep up with a lot of reports, or where hour-by-hour monitoring of operations is important.

b) Personalised analysis

Naturally, executives can use the computer not only to gain exclusive access to information, but also as an analytical tool. The type of analysis will vary from one executive to another. Some will simply calculate new ratios or extrapolate current trends for application to future scenarios. Others will highlight trends of particular interest on figures or graphs to gain an additional visual perspective. Some work with simulated models to determine where capital investments will be most productive. What is important is that the EIS allows the executive to consider, change, extend and operate data according to procedures that are meaningful to him or her at a personal level. For this method to be efficient, executives will inevitably spend a lot of their own time and effort in defining the data they need and learning what the computer can do. Users will need at least some initial training and assistance with the computer languages involved.