

## Chapter 2

# Fields of Application, Methods of and Current Trends in Information Management

Topics of information management are coming up not only in the literature of the subject [1–4] but also in everyday life. Aspects of these topics are particularly worthy of attention as this process increasingly expands beyond the boundaries of a specific business organisation – an enterprise – and is becoming widespread in politics, culture, science and, obviously, in business. This is because information management processes encompass not just simple information processing and analysis, but primarily its acquisition, collecting and transmission.

Today, information management processes are found in all types of organizations which run various operating processes and management functions. This is because data acquisition and collection processes depend on, and are strongly correlated with, the constant development of information technology, serving inter alia to collect, analyse and transmit the processed information.

Before discussing information management processes, it is useful to refresh the concept of information as well as the functions it has played in recent years.

### 2.1 Concept of Information: Development

The concept information has developed very rapidly and taken many turns since it was introduced by Claude E. Shannon.

Claude E. Shannon created the basis of the quantitative information theory [5, 6], for which subsequent researchers tried to create theories explaining the value of information. In 1970s there were developed an original theory describing both the quantity and the quality of information. In it, he distinguished between descriptive information and identifying information and proved that only the quantity of identifying information is the same as the information quantity defined by Shannon.

Shannon was among the first to point out the huge utility of binary code and stated that text, image as well as sound can be described with strings of zeroes and ones. Claude E. Shannon is now considered one of the authors of the information theory, or actually the father of this theory, originating from mathematics and straddling the border between statistics and informatics. However, it now turns out that information theory is also of great importance in contemporary economics, telecommunication, engineering and cybernetics. It covers the areas of information processing, transmission, compression, analysis and security.

Since the days of Claude Shannon, the concept of information has evolved extremely rapidly, as every field of science tried to assimilate this concept to its problems. Even though the concept of information was initially identified strictly with mathematics, it is now defined in almost every scientific field and can fulfil completely different function in each one.

The information theory introduced by Shannon mathematically characterised the recording, transmission and retrieval of information, aiming to reconcile two opposite objectives, namely recording messages in the shortest form (optimal coding) and also securing a message from being corrupted during transmission. Research on brevity of information recording was done by Bertrand Russell, who, as a result of his work brought to light the so-called Berry's paradox concerning natural numbers, resulting from the obvious contradiction, namely that the phrase "unanimously defined" cannot be used in the language of mathematics. This is because first, a distinction has to be drawn between the language examined and the meta language in which the examination is being conducted.

Precisely because the concept of information in the past could have and probably still has various associations and definitions, it makes sense to refer to the definition of information coming from Latin (*informatio*), which means a certain image and concept. Information is a concept basically originating from two sources. Firstly, the concept of information can be treated as objective, which is the view coming from physics and mathematics, where information means a certain physical or structural property of objects. Secondly, the concept of information can be understood as subjective (cognitive), which means that information is what the mind can process and use for its own purposes [7–9].

Both the objective and the subjective approaches present information as a certain property or an image, as a set of notions used for various and completely different purposes.

Selected definitions of information and the main functions it can fulfil may be following (Table 2.1).

The variety of definitions formulated for the concept of information justifies an unambiguous statement that this concept applies to very many fields of knowledge and areas of applications. From the point of view of management science, the concept of information should be considered in relation to an enterprise or an economic organisation. Such an approach implies the need to start analysing the problem due to the existence of the information management process.

**Table 2.1** Definition of the concept of information and its assigned function

Information definition	Functions fulfilled by information
Information is the contents taken from the outside world	Information:
It is acquired during the process of our adjustment to that external world and the process of our senses accommodating to it	maps the past, present and future forms and changes the reality (e.g. Norbert Wiener)
The message is acquired by a human through observation or an intellectual action which is transmitted in the sender-receiver constellation	
Information is the property of a signal or a message consisting in reducing the indeterminacy of a situation or its further development	
Information consists in contents taken from the outside world, which expand knowledge or reduce the ignorance of the decision maker, as well as the uncertainty and indeterminacy of the decision-making situation	
Information consists in contents having specific meaning of something, for somebody and due to something	Information:
It is expressed using linguistic and/or non-linguistic signs	presents events, the condition of things, objects etc. from the perspective of the present, the past or the future (e.g. J. Lyons)
Information is a reflection of what exists in the tangible sense (so-called reflection relation)	Information:
It is a factor that to some extent identifies the form (shape) of future objects and phenomena (the so-called realisation relation)	identifies and anticipates reduces the degree of indeterminacy defines the degree to which systems are organised
Information is data about economic processes and phenomena	Information: identifies and solves problems
It is used in the decision-making process	

## 2.2 Information Management Process in a Commercial Organisation

Today, information management is a process operating at all levels of an organisation. The variety and multitude of information management definitions means that this concept may be perceived and understood in very many ways. A few of them are presented below.

By information management, Smith and Medley understood recording, processing, storing and providing information using computers in order to identify events that determine the operations of an enterprise [4]. Ward, Griffiths and Whitmore relate this concept to information resource handling jobs which fulfil the functions of acquiring, securing, using, disseminating and promoting information [10].

Schwarze indicates that the concept of information management may be identified with managing data or information stored on traditional media, such as documents or forms [11]. This term is sometimes also used as identical to the concept of data bank management, thus highlighting the roles of special IT systems for information storage, processing, provision and securing. Information management is also understood as the management of IT resources [12, 13]. What is more, the notion of information management is also understood as the function within an enterprise which includes all activities related to determining information requirements as well as processing, storing, transmitting and elaborating information.

Schwarze also proposes that information management be treated as fulfilling the functions of planning, directing, coordination and control within the scope of information requirements, of elaborating, transmitting, storing and preparing information to support the achievement of enterprise goals [11].

Sometimes researchers are introducing yet another perspective of information management. Some of them points out that managing information consists in planning, organising, coordinating and controlling elementary information functions which occur on the operational and strategic levels and cover all areas of enterprise activity [1]. Another approach defines information management as all the activities aimed at recognising events that determine enterprise operations and providing users with information according to their needs [14].

Information management is now presented as a set of rules, techniques, systems and devices which represent the information/communication structure of an enterprise. Key information management tasks within an enterprise include [2, 15]:

- Planning, developing and implementing the information strategy of an enterprise, subordinated to its information policy;
- Controlling information flows through the enterprise communication network;
- Planning capital expenses for developing information systems;
- Ensuring the effective operation of information systems like:
  - Field systems;
  - Management information systems;
  - Decision-support systems;
  - Expert systems;
  - Systems for clerical work automation;
  - Telecom systems;
- Information quality management;
- Creating conditions to keep the information collected within the enterprise secure (defining rights to access information);
- Providing effective forms of training and development for the IT staff and system users;
- Creating conditions for the enterprise to have effective links to the information market;
- Integrating information systems used at various levels.

It is worth noting that in any management system, information requirements can be identified. Satisfying them conditions and improves management effectiveness. This is why such areas offer some room which can be served by information management technologies, whose place is mainly where the organisation needs to intelligently use, acquire or transmit information [15].

Areas of information management in a given business organisation depend on the internality and externality of streams of information collected by this organisation. The internality of information streams applies mainly to processing, transmitting and analysing information inside the organization, whereas the term 'externality' is used if information originating inside the organization is exchanged with its environment, or, conversely, if information originating from the environment is exchanged for information originating within the organization. If this is the process of information management, the type of information determined by its character should be defined. In general, for the purposes of managing information within a commercial organization, two types of information are distinguished [16]:

- Information for operations – informing;
- Information for cooperating – communicating.

Both informing and communicating relate directly to the main streams of information flow within the organisation. This is why, within information management areas in a business organisation, we talk of:

- Managing internal information;
- Managing external information;
- Managing internal communications;
- Managing external communications.

Based on the above split of areas in which information is used within a commercial organisation, the following characteristic features of information management tasks within business organisations are distinguished [16]:

#### 1. Characteristic features of information management in the informing process:

- Acquiring or transferring information;
- Information belong to operations;
- Internal information source;
- Information plays the role of ensuring that the organisation operates correctly;
- Good and unlimited access to information;
- Easily programmable information;
- Information is structured;
- Quantitative data;
- Tangible information storage media;
- Indirect method of information transfer (frequently textual);
- Information may be highly repeatable;
- High frequency of information use;
- High susceptibility to planning and control;
- Formalised and restricted information circulation.

## 2. Characteristic features of information management in the communication process:

- Interactive information exchange;
- Information for cooperation;
- External information source;
- Information plays the role of influencing the organisation and making it evolve;
- Poor and limited access to information;
- Information is difficult to program;
- Information is unstructured;
- Quantitative-type data;
- Intangible information storage media;
- Direct method of information transfer (frequently verbal);
- Information may be slightly repeatable;
- Low frequency of information use;
- Poor susceptibility to planning and control;
- Partly formalised and unrestricted information circulation.

The above characteristics of the information management process justify an unambiguous statement that information management within commercial organisations applies equally to the informing and the communication processes. These processes seem to inseparably harmonize with and complement each another and also constitute processes of overall information management.

## 2.3 Role of the Organisational Structure in the Information Management Process Within a Business Organisation

As commercial organisations are constantly evolving, information management processes increasingly frequently deal with problems of correct information sharing and retrieval. This subject should undoubtedly be considered in the context of various organisational structures, so when undertaking the topics of information sharing and transfer within commercial organisations one cannot ignore the type of organisational structure determining not only the distribution of decision-making authorities or organisational levels, but also the possible (more or less centralised) methods of splitting shared information [17–22].

The organisational structure is treated as the basic tool for managing and developing desirable organisational behaviours, and it is through it that the activities of members of this organisation are planned, organised, incentivised and controlled [4].

The basic functions of the organisational structure include the regulatory function, whereby the freedom and indeterminacy of organisational behaviours is minimised through:

- Reducing the complexity, splitting participants into different groups and determining the place of every participant in the division of power, work, responsibilities and duties – structuring the elements;

- Laying down the general framework of behaviour in the organisation, the mutual structuring of standards of conduct of individuals and teams occupying different positions and fulfilling different organisational roles – structuring organisational activities.

Basic types of organisational structures include:

- Lean and flat structures – depending on the management span;
- Line, functional, line-and-staff structures – depending on the dominant type of organisational ties;
- Functional, divisional, project, matrix, tensor structures – depending on the dominant criterion for grouping basic units;
- Holdings and groups – depending on the capital ties.

The above types of organisational structures are characterised by different information needs and it is with reference to the differences in those needs that each such structure is characterised below [4, 23, 24].

Lean structures are characterised by a long route and duration of information flow and the possibility of errors appearing in information/decision-making processes as a result of information being deformed and delayed, which constitutes their major drawback. On the contrary, the strength of flat structures comes from short routes and durations of information flow.

If the organisational structures result from the dominant type of organisational ties, their following characteristics can be identified as below. One of the disadvantages of line structures comes from the long information flow routes as well as the risk of a disruption to the official route and information flow. In the case of a functional structure, one can speak of shorter information flow routes and a complex communication network, including the network of information flow. In the case of a line-and-staff structure, in turn, the presence of a long route of information flow and processing within the organisation should be emphasised.

If we divide organisational structures due to the dominant criterion for grouping and distinguishing basic organisational units, then in the case of a single-dimensional structure – the functional structure – there are problems with information flow between e.g. functional divisions. In a project structure, there are short communication routes, decisions are made quickly and information flow is improved within problem areas covered by projects. In turn, in a multi-dimensional (matrix) structure, the route of information flow is significantly shortened, thus improving information flow by accelerating it and raising its credibility, particularly as employees act as a link (bridge) between the functional unit and the team. This type of a structure is also characterised by a rather complex communication network within the organisation. In the case of a tensor structure, one can observe the presence of complex and long information flow routes.

When analysing various types of organisational structures, modern structural solutions must be mentioned. These include: the process structure, the network structure and the virtual organisation structure [4]. When discussing information requirements, it is worth noting that in an organisation with a process structure,

the routes of information flow and decision-making are shortened. In a network structure, in turn, the flow of information streams is shortened.

This book proposes possible models of information splitting [25–29] and attempts to identify their operation based on each organisational structure. However, it is already possible to make some observations that information splitting tasks can, in general, be independent of functional ties. This is why in the case of hierarchical structures, the main area in which information splitting schemes are applied are line structures as well as line-and-staff structures. In the former, the power centralisation conditions mean that all methods of information splitting can be used. They require all components to be possessed (and they are held by units at the same management level) in order to reconstruct the split information, which naturally corresponds to this type of an organisational structure. The situation is slightly different in the line-and-staff model, in which functional relations may allow the type of authority for information retrieval to be assigned. In practice, this means that it is possible to establish an entitled decision-making group in which every person has separate rights to reconstruct information but only from among a certain subordinate group. Hence this model is more universal, as it allows secret sharing schemes to be applied [30–33]. However, when analysing the broad opportunities to create the parts of split information and the technique for managing them using secret sharing algorithms, another type of structures in which these techniques can be broadly utilised becomes obvious. These are divisional structures in which certain independent segments (subgroups) of people can be distinguished, who share or reconstruct certain secrets independently of the remaining units or employees. This is quite an important feature which makes these methods extremely universal. Thus secret splitting techniques will be designed for being used in particular types of organisational structures while the possibility of applying them to models combining the features of divisional structures with staff structures will be indicated at the same time.

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