Is there a Gap between Information Technology and Decision Makers?

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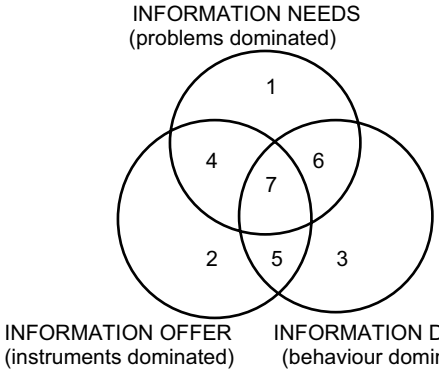
Abstract. *A study was conducted to determine ways of decision making in Croatia. The study shows that in decision making process of Croatian managers dominates operational and programmed decision-making instead of strategic decision-making. The usage of information technology for decision-making support is limited to static reporting instead of dynamic reporting and more complex data analysis.*

Keywords. Management, decision-making, information technology.

1. Introduction

Controlling is in a modern economy an important function and also a business philosophy. It is a support to management in a process of adaptation to internal and external changes. The information-oriented controlling concept, along with accounting and management, represents one of several controlling concepts; it underlines the information goals of controlling [1] within a company's goal system. The general task of such a controlling system is coordination of data gathering and usage, that is, coordination of information needs, demand and offer. In this aspect, controlling coordinates, develops and implements a management information system. The following figure depicts the relationship between information offer, demand and needs [8].

Information needs depend on the company's set of values: its vision, mission and goals, as well as on its individual business problems. Information needs arise from previously defined priorities within the organization: what the organization aspires to (vision), whom it serves (mission) and what is wants to achieve in a specific period of time (goals). The priorities to which the company aims determine the information needs, and are a differentiation criterion for distinguishing important information from unimportant one.



1 Information that is not offered and for which there is no demand, but which is needed
2 Information that is offered but has no demand, neither is needed
3 Information for which there is demand but is not offered, neither is needed
4 Information for which there are both needs and offer, but no demand
5 Information that is offered and for which there is demand, but which is not needed
6 Information that is needed and for which there is demand, but which is not offered
7 Information that is needed, for which there is demand, and which is offered

Figure 1. The relation between information offer, demand and needs

Information demand depends on the manager as a user: if the goals and tasks of each individual manager are clearly defined, then information demand will be transparent. Rational management will require one kind of information, while intuitive management will need another. It is a well-known fact that decision-makers take into account primarily those variables that they themselves can control. Moreover, they are more apt to go on with their current behaviour rather than put an effort into innovative decision-making processes. Hence, adapting information offer (reports) to information demand, i.e. to managers, is of utmost importance.

Information offer depends to a large extent on data and usage of data collection tools, data processing and aggregation, and their conversion into information that enhances users' knowledge.

The optimum information system should offer information that is needed and in demand. In that respect, an efficient information system set-up means that field 7 expands into field 6 in Fig.1. Beside the basic economics instruments, information technology provides a wide range of modern tools for information preparation and processing, as well as special applications for the management requirements, as described in parts 3, 4 and 5.

There is an overlap in the relation between information offer, demand and needs; the larger the common area, the bigger the information system and the reporting system likewise. As a result, since the reporting system is an important part of the information system, it fulfils its role to a better extent. The role of information controlling concept is to enlarge the common overlap of these three information sets; controlling is considered to be successful when the information offered is indeed important (needed) and required by the managers for management and decision-making.

2. The Management as an Information Demander

The basic management function is to lead an organization towards goals fulfilment. Each organization exists in order to fulfil a certain purpose or goal, whereas managers take the responsibility to achieve these goals. Managers motivate activities that lead to achievements of goals and purposes, while preventing activities that do not contribute to attaining those goals. Management is thus a process of guidance towards achievement of organization's goals working in cooperation with people and making use of people and other resources.

2.1. Management and Controlling

Managers define in agreement with the organization's owners the company's vision (what the organization aspires to) and mission (whom the company serves) as well as its strategic goals. Managers take the responsibility of the organization's success or failure, of achieving agreed upon goals, and hence they also define information demand and its priorities. Controlling is an expert aid to management on the way to business success: the role of controlling varied with time – it served as a registrator in a static environment, as a navigator in a limited dynamic environment, while in an extremely dynamic environment it is an innovator helping managers in management and decision-making processes with new methods and tools. A controller is responsible for information transparency, a good controller can answer the following questions from an operational point of view: Where is business success generated (from which customers, with which products, on which markets, at which times, etc?) What reduces that success? What enhances it? Moreover, a controller answers the following questions viewed from a strategical aspect: Where are the possible future success sources (from which customers, with which products, on which markets, at which times, etc?) What could diminish that future success? What could enhance it?

It is not possible to give a reply to all of the previous questions without the use of modern information technology and tools that it provides. A controller is always a person with an economic background and is a collocutor with information personnel in order to define information offers. The controller's task is to define information demands and to define information offers that fulfil them, that is, what the demands on the information system are. The information staff's task is to implement these demands with the information system.

2.2. Management Profile: Results of Empirical Research in Croatia

Recognising information demand depends largely on managers since they are one of the most important groups of information demanders. A result of a detailed, extensive comparative survey on management functions in Croatian companies is the profile of a typical manager, from which we single out the following features:

Table 1. Profile of a typical manager in the survey

Criterion	Feature	%
Gender	Male	74%
Age	41-45 years	41%
Academic degree	Bachelor	90%
Academic major/profile	Economy	49%
Manager level	Higher mid-level	50%
First employment	Current company	43%
Work period in current company	Over 15 years	45%
Previous working position	Management, lower level	56%
Managed unit	Over 10 employees	51%

From the above-mentioned manager characteristics, the academic major or profile should be singled out; survey results show that

51% of managers come from non-economics technical background. This implies that during preparation of the information offer this should be taken into account – the economic information preparation and processing have to be clear and comprehensible to non-economists.

Since managers are the main information demanders, a consideration of the manager's time structure is recommended (Table 2).

Table 2. Average time spent by function

Management function	Average time spent
Organizing	22%
Leadership	21%
Planning	20%
Controlling	19%
Human resources management	18%

It should be stressed that there is a difference in the time spent by managers of different managerial levels on individual management functions (Table 3).

Table 4. Programmed and non-programmed decisions [4]

Decision type	Management level		
	Senior	Higher mid-level	Mid-level
Programmed decisions	49%	44%	47%
Non-programmed decisions	51%	56%	53%

Although this survey does not prove the expected notion that with the rise of management level, the significance of non-programmed decisions increases as well, a nearly stable proportionality is observed between programmed and non-programmed decisions, irrespective of management levels. Such a result influences the choice and processing of information required for decision-making.

Table 5. Decision methods used by managers

Decision-making method	Percent.
Rational decision-making	46%
Decisions based on judgement (and experience)	36%
Intuitive decision-making	18%

Table 3. Management level and time spent in preparation and decision making [4]

Average time spent in preparation and decision making	Management level											
	Senior				Higher mid-level				Mid-level			
	Up to 25%	30-50%	More than 50%	Total	Up to 25%	30-50%	More than 50%	Total	Up to 25%	30-50%	More than 50%	Total
Strategic	46	35	20	33%	49	42	9	28%	82	13	4	20%
Tactic	37	61	2	30%	24	69	7	32%	40	58	2	29%
Operational	13	29	29	37%	48	31	31	40%	18	31	51	51%

Senior management spends much more time in planning and controlling when compared to lower-level management. It can be deduced that planning and controlling are vitally important functions, not only by managers' theoretical standards, but also by practical survey results. The implications for the information offer are that information should be prepared and processed that is pertinent to planning and control, as well as information needed for business processes of the organization. This data arises from the business process itself, it is relatively objective and is less prone to be under the influence of the manager's subjective characteristics. Preparation and processing of information for leadership and human resources management systems is more generally influenced by the manager's subjective preferences.

Distinguishing individual management levels and decision types facilitates the definition of the information offer: according to the results of this research, operational decisions seem to have the major influence, while the time spent for strategic decisions is represented to a lesser degree.

Rational decision-making concerns a clear, well-known decision algorithm, generally being a programmed decision. Intuitive decision-making is used in the case of new unknown situations whose results are not certain. These results show that the information offer should assign equal importance to rational (programmed) and experience-driven and intuitive (non- programmed) decisions.

Table 6. Factors effecting decision-making [4]

Factors	Total %
A good and expert preparation for a decision	24%
A good and objective pre-knowledge	22%
Decision-making responsibility	18%
Education (generally), decision-making education (specifically)	13%
Motivation for decision-making	12%
A right distribution of power and influence in the organization	11%

Results of the study show evidently that a good and professional preparation of decisions; and a good information and education of managers make 59% of good (or bad) decisions. Therefore, information offer must be responsible for adequate data preparation and processing, and

managers are obliged to demand adequate information.

The second survey was carried out with the aim of understanding the level of controlling development representing a support to managers in Croatian companies. According to survey results on controlling practices in Croatian organizations [5], it is evident that controlling is the most important environment for planning and business analysis, and is the most important information source. In order to get acquainted with the procedural dimensions of controlling, the information flow was researched: from where information arrives into controlling and where it is goes to. According to survey results, information comes into the controlling department from accounting, sales or finance departments, and most frequently it is sent to senior and lower management. Hence, the accounting, sales or finance departments are responsible for the information offer, while the management of all levels represent information demand. The results of this survey provide valuable direction for information offer and demand, and offer the possibility for a better harmony among information offer, demand and need.

3. Information and decision making

Information needed in decision-making process and offered by information system may be prepared in various ways shown in Table 7.

3.1. Information preparation based on rules

Reporting and monitoring are examples of data usage based on rules. Reporting technology is intended for information distribution in the context of operative decision-making process. These are tasks of operative analysis where rational and programmed decision-making prevail. Both predefined and ad-hoc reports are addressed at information delivery, publishing and distribution. This is the technology of static reporting.

The transactional or operational part of the information system is responsible for executing the transactions of the enterprise's business processes. A part of it is the management reporting subsystem consisting of a set of predefined and standardized reports based on transactional data. The important factor of the quality of reporting subsystem is the degree of data integration across enterprise's functional areas. The successfully integrated enterprise's data is the main factor of the success of integrated enterprise information systems (Enterprise Resource Planning – ERP, Enterprise Application Integration – EAI, Enterprise System – ES).

Table 7. Information and decision-making

Purpose of information	Type of information preparation	Decision-making type
Reporting (static reporting)	*Based on rules*: execution of a standard predefined report at a specific period of time	*Operative decision-making*: business monitoring / reporting Example: product inventory
Simple (elementary) data analysis (dynamic reporting)	*Based on skill*: generating analysis / report the most often in interactive manner Example: multidimensional data analysis in data warehouse	*Tactical decision-making*: tactical analysis of business, problem diagnosis Example: sales analysis products by markets, insight into reasons why sales decrease
Complex data analysis (knowledge discovery)	*Based on knowledge*: problem modelling, use of model / method, interpretation of results Example: data mining, simulation, optimization	*Strategic decision-making*: strategic analysis of business, problem insight Example: product basket analysis, buyers' behaviour analysis

Although decision-makers are provided with a set predefined standardized and parameterized reports with no access to deeper information. They often experience not to have the exact information needed at the moment of decision-making. This is the main cause for decision-makers' frustrations with the level of information support in the decision-making process. The situation is described as "data rich but knowledge poor".

3.2. Information preparation based on skills

Preparation of information based on skills uses methods of simple data analysis done in the most cases in interactive manner where the analyst sets query, analyses results, repeats these steps until he/she obtains insight in the nature of considered business problem. These are tasks of tactical analysis with a mix of programmed and nonprogrammed decisions.

The part of information system enabling

corporate decision-makers to supply information and thus navigate the complex business environment is the analytical or decision support subsystem. Today it is often referred to as business intelligence.

Dimensional analysis of data, such as On-line Analytical Processing (OLAP) in data warehouses, is a good example of analytics. People intuitively look at the business through dimensions or perspectives. The managerial question "What are the sales data on products, time and markets" implies three business dimensions: product, time and market.

The multidimensional (analytical) data structure is in many aspects more visual than table structure used in operational (transactional) information subsystem. The reason is that the dimensional structure is capable of showing interesting interrelationships between dimensional attributes, such as product, time and market, which are not seen in classical table structure. These interrelationships among the dimensional attributes may result in valuable business information. For business decision-makers they are the most important because they may uncover hidden business information.

3.3. Information preparation based on knowledge

Preparation of information needed for decision-making based on knowledge uses various methods of modelling business problem and utilizing some method of complex data analysis. This is the main difference to previous types of information preparation where models and methods are not used and where information is get by using queries. These tasks are fulfilled in strategic analysis where nonprogrammed decision-making prevail.

The typical models/methods used are optimization methods, simulation methods, expert systems etc. Data mining [7] is the best example of data usage based on knowledge. This is an analytic process of exploring large amounts of business data in search of consistent patterns and/or systematic relationships between variables, i.e. this is an information extraction activity whose goal is to discover hidden facts contained in data sets. The goal of data mining is prediction. Predictive data mining is the most common type of data mining. It has the most direct business applications. Typical applications include market segmentation, customer profiling, fraud detection, evaluation of retail promotions, and credit risk analysis.

4. Business analytics

Although business users are experts in their business domains, they are unlikely to be experts in data analysis [9]. Usually business users rely on a data analyst who employs analysis applications to extract information from data. Business users have to impart their domain knowledge to the analyst, and then wait until the analyst organizes data, analyzes it, and returns the results. Since there are usually open questions regarding the results, several iterations are necessary before business users can act on the results of the analysis.

Analytical applications, which incorporate a variety of data analysis techniques, must therefore provide recommendations to business users of how to best analyze data and present the extracted information for the specific business problems. From the business users' standpoint business analytics must rely on solving specific business problems, i.e. it must incorporate task-specific knowledge, and must not rely exclusively on data analysis techniques. This is the reason why this type of analysis is called business analytics. The most known are:

- Business Performance Management (BPM) / Enterprise Performance Management (EPM) Analytic Applications,
- Customer Relationship Management Analytic Applications (CRM)
- Supply Chain and Operations Analytic Applications (SCM)

5. Information system in decision-making

Probably the most information used in business decision-making process can be found in the organization's information system. The information system is a complex system that has to cover all informational tasks needed to service operational, management and decision-making activities of the enterprise.

Regarding decision-making process Fig. 2 shows information system's layers. Data is generated within business domain, settled and structured in data layer. Various aspects of data processing are done on integrated data in data analytics layer. Data analytics layer summarizes static reporting, dynamic reporting and complex analysis. Unfortunately business users are not satisfies with pure data analytics. They are experts in their business domains and they are

unlikely to be experts in data analysis. Business analytics, which incorporates a variety of data analysis techniques, must also provide recommendations to business users of how to best analyze data and present the extracted information for the specific business problems. From the business users' standpoint business analytics must rely on solving specific business problems, i.e. it must incorporate task-specific knowledge, and must not rely exclusively on data analysis techniques.

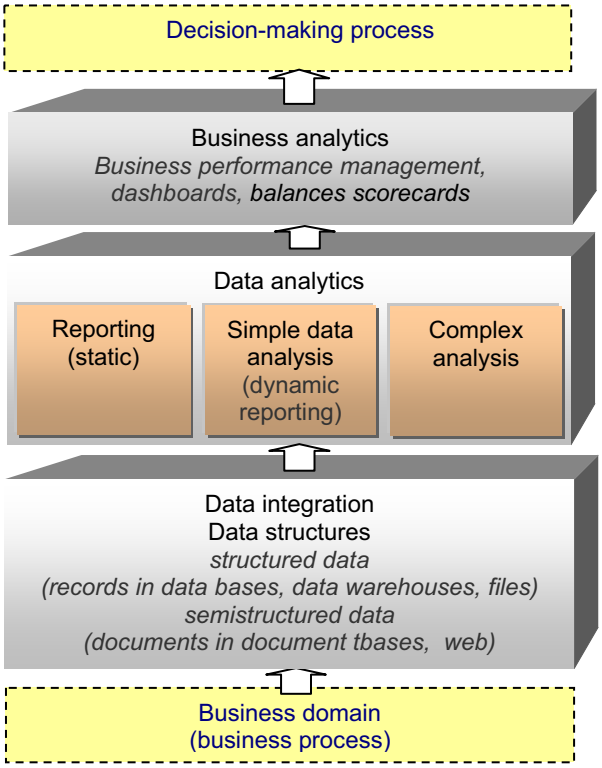


Figure 2. Information system's layers

All kinds of information can be gathered and aggregated in information systems, but if there is no context of it and if business has no advantage to generate a good business strategy, then information is worthless. Information system's data must be integrated vertically and horizontally, users must know the data stored in the information system and the data must be documented. Not only internal data has to be integrated, this must be true for both interior and exterior data.

6. Conclusion

The paper shows the results of a study conducted to examine the Croatian manager's decision-making process. Although the preparation of information needed in decision-making process was not in the focus of the study, we may conclude that there is a gap between managers and their usage of information technology.

Middle managers spend 51% of their time on operative decisions, 29% on tactical and 20% on strategic decisions. Top managers spend 37% of time on operative, 30% on tactical and 33% on strategic decisions. Operative decisions are most time consuming even at the top level of management. It is reasonably to assume that the preparation of information for decision-making is based on rules using the most often static reporting from information system and occasionally dynamic reporting or complex data analysis. Even the 50% of decisions of top managers are programmed which supports the previous statement that decision-making is based on rules using static reporting.

Results of the study makes evident that good and professional preparation of decisions; and good information and education of manager makes 59% of good (or bad) decision. Therefore, information offer must be responsible for adequate data preparation and processing, and managers are obliged to demand adequate information. Clear definition of information offer, demand and need makes the gap between information technology and management easy to overcome.

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