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THE BUSINESS INTELLIGENCE SYSTEMS

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Abstract:
The category of computer systems that support decision-making can be defined by the term "business intelligence". It concerns the whole of the Information Technology (IT) tools that add extra "intelligence" to the business process. Integration of traditional, operational applications with a wide range of data analysis programs or expert system categories provides an effective basis for assisting decision-making.
Adopting the decision is the process by which an intelligent system determines the pertinence of a certain change in its behavior and develops possible alternatives in this respect, selecting one of these as a course of action to achieve the intended purpose, and its rationality is conditioned by the availability of the information necessary, sufficient and timely to adopt solutions to the problems of choice for a course of action in the given situation and, respectively, to control and regulate the functioning of the lead organization.

Key words: business intelligence, expert systems, knowledge, information society, databases,

JEL classification: M10, M15

1. LITERATURE REVIEW

Information society is defined as a society of organizations and, at the same time, a knowledge-based society (Drucker, 1992), at whose confluence the knowledge-based organization paradigm is situated (Moigne, 1993). The knowledge-based organization is increasingly accepted as a viable alternative to present and perspective to the traditional paradigm of the organization based on control and authority (Dragomirescu and Neagu, 2000).

IT assists with the professionalism of managers to ensure the quality of the decisions and, implicitly, to increase the performance of the organizations. This assistance may, according to Sheridon (1992), embody a variety of forms (Alter, 1980):

- providing input for decision-making;
- "What if ...?" analysis of the decision alternatives proposed directly by the decision-maker (simulation of consequences and comparison);
- generating, on a computerized basis, decision-making solutions that can be validated or modified by the authorized organizational actors;
- generating, in computerized form, normative decision-making solutions, which can not be amended, but only admitted or rejected (the decision-maker appears as a ratification).

To what extent the management problems can benefit from the benefits of computer assistance results from the degree of structure of the problems (Iancu, 2016). If a problem is completely structured, it could be solved by an automatic tool without any human intervention; instead, if a problem has no structure, it can only count on the help of hazard (Iancu and Burciu, 2015).

For a system to combine the efficiency and capabilities of storing databases with the flexibility and functionality specific to AI applications, it must be designed based on a common definition basis. This basis consists of methods of representing knowledge (concept specific to artificial intelligence) and methods of semantic modeling of data (specific concept of databases).

The characteristics of the different categories of computer tools with applications supporting decision making are presented in Table 1:

Table 1. The characteristics of computer systems that support decision-making

Computer tools	Subject of decision support	Users	Results provided	Types of operations	Orientation in relation to time
Traditional IT systems for driving	Data processing	Deciding at all hierarchical levels	Reports	Numerical calculations, edits and data retrieval	Retrospection
Decision support systems	Assisting the decision on semi-structured issues	Officials and decision-makers	Decisional alternatives and assessments of human decisions	"On-line" analyzes, simulations, optimizations, assisting communication	Real-time or prospective
Systems with artificial intelligence for driving	Assisting in solving complex, poorly structured problems	Professionals with general training but who may not have expert knowledge in the field of applications	Recommendations diagnoses, plans, projects	Inferences	Predominantly prospective

If a definition of the system were to be drawn, it would mark that a system is made up of a group of components between which relationships are established and which work together for a common purpose by accepting inputs and producing outputs through a process (transformation) (Pascu et al., 2016). As shown in Figure 1, inputs are elements that enter the system to be processed; process is the process of transforming inputs into outputs, and outputs are the elements that have resulted from the transformation process.

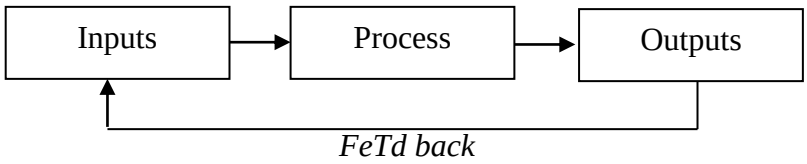

Figure 1. The components of a system

According to Nobel Prize Laureate Herbert Simon, there are three phases of the decision-making process (Simon, 1989):

a) gathering and assimilation of information by exploring and analyzing the context for the purpose of identifying decision-making issues;

b) designing the formulation of the decision-making problem, as well as developing and evaluating alternatives to possible solutions to this problem;

c) the choice, which consists in selecting a possible alternative to be implemented.

I. Stăncioiu and G. Militaru (1998) consider that, in a general sense, decisions themselves can be considered information.

In accordance with the diversity of the personalized manifestations of the subjects in the role of decision-makers, the following information-cognitive models of decisional behavior are structured (Dahl, 1984),(Nicolescu, 2001):

a) The economic model according to which the decision-maker is fully informed, has all the possible decisional alternatives and pursues a rational optimization of one or more performance

parameters; after defining the problem, it establishes the criteria for assessing the decisional alternatives, generates all these alternatives with their related consequences and selects, by comparative analysis, the most convenient, which will be the optimal solution of the decisional problem;

b) The limited rationality model applicable to both individual and group decision, whereby the decision maker considers the different decisional alternatives sequentially and not as a whole, uses heuristic (torture) methods to identify alternatives and opts for a satisfactory solution in following a moderately laborious search; this means recognizing the inherent limitation of the duration and mental search effort, which varies from one decision to another;

c) The default default model whereby the decision maker identifies from the outset a preferred action plan based on the evaluation of some variables and relies on the subsequent confirmation of the plan. This model involves a highly personalized, non-process decision model that appeals to the decision-maker's intuition, experience and thinking.

2. DECISION-MAKING STEPS WHEN USING BUSINESS INTELLIGENCE SOLUTIONS

Regarding the process of decision-making based on business intelligence solutions, we identify the following fundamental steps:

• *Analysis* - Filtering from the multitude of data useful information in accordance with the business model and identifying the performance indicators. Analysis of information in various contexts to identify trends. Business Intelligence means making information available to all departments of the company so that each manager can perform their own analyzes and be able to track the evolution of *performance indicators on the segment of interest;*

• *Finding causes* - Explaining the causes of certain phenomena that do not match the business model;

• *Action - Making* decisions based on the information analyzed. These decisions are based on the future projection of the effects that an action will have (eg increasing sales of a particular product as a result of a promotion). Again, the human component has an important role: it appreciates which of the variants of action will lead to the expected result. Business Intelligence assists the decision-making process by simulating effects (What If ...? What happens if ...?);

• Measurement of results - In this last step, we can see if the decisions taken were correct or if the results are not the exact ones, it indicates the direction in which we must act to improve them.

3. DESINGNING BUSINESS INTELLIGENCE SOLUTIONS

When we want to implement a Business Intelligence solution, we need to start from the requirements of the users who will use it. We do not have to consider only the management team, but any type of user who will need - in some form or another - information from this system to carry out their work.

We can divide users of a Business Intelligence system into:

• Information users - They only need reports or performance metrics. They use standard reports rather than information analysis capabilities;

• Information Consumers - They need the possibilities of information analysis in various contexts and require functions for dynamic data queries;

• Analysts and experts - Are those to whom multidimensional analysis is needed to identify trends and make major decisions. They need ad hoc analysis and free access to any kind of information in the system.

In order to have a fair picture of the categories of system users and to meet their requirements, the design of the solution must take into account the following two fundamental elements:

a. Location of the information on which the analysis is based. These data will typically be in

various existing operational systems: Line of Business (LOB) applications, Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Human Resource Management (HR), Distribution Network Management supply chain). All of these systems have some common features, among which the most important are transactional systems. Another aspect, which typically prevents the use of data for analysis, is that systems are isolated and communicate too little with other systems, and data is not correlated. When we want to make an analysis of information we need to find a way to integrate the data from all these systems.

b. System users and types of information required. Users' profiles will be created to later design the system and plan its capability based on these requirements.

4. ARTIFICIAL INTELLIGENCE IN SUPORT OF DECISION MAKING

Intelligent systems have techniques specific to artificial intelligence such as neural networks, evolutionary calculation, expert systems, fuzzy systems, hybrid systems, and smart agents. With the help of these, they effectively inform the activities, business processes and the fields of management, in which a considerable amount of human expertise is involved (Iancu, 2011).

Specialist research has shown the efficiency of intelligent systems for the economic field in applications such as banking, portfolio investment, banking supervision, planning, insurance, financial diagnosis, human resources management, accounting and auditing, tax and other types of weak or poorly structured, diagnostics, planning, design, control and monitoring (Iancu and Buta, 2012).

Expert systems are defined as "intelligent software programs that use knowledge and inferential procedures to solve problems that are difficult enough to require human expertise to be resolved." (Iancu, 2011). Inference is a logical move from one statement to another, and the last statement is deduced from the first. Expert systems have a fundamental structure that consists of the knowledge base, the inference engine, the explanation facilities, the facts base, the user interface, and the facilities for acquiring new knowledge.

Fuzzy systems are expert systems based on fuzzy logic, they have a great flexibility and performance in a variety of applications. Unlike classical logic, working with two exact numerical values, fuzzy logic operates with multiple values on the [0,1] range and with degrees of belonging or degrees of truth.

Artificial neural networks, also referred to as connection systems, appear to be an intelligent, ultimate solution, if the other methods of computer assistance are inapplicable due to the weak structure of decisional problems.

Artificial neural networks can acquire knowledge through direct learning on specific examples, using specific learning algorithms, having the ability to learn from incomplete data, hence generating network capability.

5. CONCLUSIONS

The computer assistance of managerial activity has emerged as a necessity with the complication of management problems and the accentuation of the time pressure in solving these problems; at the same time, it is known that man is by nature not an optimal decision-maker, acting under incomplete information and being exposed to cognitive dissonance states that can lead to errors of managerial conception and action.

The succession of generations of concepts and solutions for IT support in the managerial field shows the following trends in this approach:

- from the substitution of the decision subject through the automation of some activities, to the complementarity of the human factor with the intelligent artifacts;
- from simply informing the decision-maker, facilitating his understanding of the problems and increasing his ability to find appropriate solutions;

- from data processing to knowledge processing;
- from routine-focused assisting to facilitating creative approaches;
- from a limited assistance to individual activities, to the inclusion of group activities;
- from assisting an impersonal user to personalization according to the style, temperament, level of experience and competence of each user;
- from assisted retrospective (control) to prospective (decisions, strategies, scenarios).

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