



## The use of decision support systems: a case study in a capital goods company

Rafael Henrique Palma Lima (EESC-USP) [rhlima@sc.usp.br](mailto:rhlima@sc.usp.br)

Claiton de Oliveira (EESC-USP) [claiton@sc.usp.br](mailto:claiton@sc.usp.br)

Heráclito Lopes Jaguaribe Pontes (EESC-USP) [hjpontes@sc.usp.br](mailto:hjpontes@sc.usp.br)

Arthur José Vieira Porto (EESC-USP) [ajvporto@sc.usp.br](mailto:ajvporto@sc.usp.br)

*Abstract: Since the decisions made by company administrators are demanding more and more information and analysis of large amounts of data to avoid some risks regarding decision-making mistakes, the Decision Support Systems (DSS) have been of great importance to allow dealing with problems that could not be decided just through the human cognitive power. Due to the great possibilities offered by the DSS to find answers to problems and trends for the future, they have become more and more popular in the corporative world to assist both higher and middle levels of management in decision-making. Thus, this paper aims to review the existing DSS definitions found in the literature and report the use of a DSS by a large capital goods company, ranging from the system characteristics to its user profiles.*

*Key-words: Decision Support Systems; Information System; Business Intelligence.*

### 1. Introduction

The decisions made by company administrators are demanding more and more information and analysis of large amounts of data to avoid some risks regarding decision-making mistakes. Such strategic decisions are essential for the continuity of the corporation in the market and an error can mean irreparable losses.

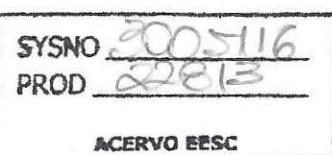
Information as the performance indicators, by itself, cannot do much for the organizations. However, according to Amaralunga and Baldry (2002) the use of such information for decision-making and the creation of improvement initiatives may raise the company's performance, causing positive changes in organizational culture, systems and processes.

Since executives need operational information to make decisions, it is highly interesting the study of systems which make use of the computational power to analyze large amounts of operational data and find answers to problems and trends for the future. In this context, the Decision Support Systems (DSS) have been of great importance for allowing dealing with problems that could not be decided just through the human cognitive power.

Due to the great possibilities offered by the DSS, they have become more and more popular in the corporative world to assist both higher and middle levels of management in decision-making. Thus, this article aims to review the existing DSS definitions currently found in the literature and report the use of a DSS by a large capital goods company, ranging from the system characteristics to its user profiles.

### 2. Decision support systems

The concepts of decision support systems were first articulated by Gorry and Morton (1971) in the early 1970s, which were defined as "interactive computational systems which





help the decision makers to use data and models to solve non-structured problems". After more than three decades, this definition is still considered valid and the term DSS has become more and more popular within the academic and entrepreneurial environment.

According to Sprague and Watson (1991), these concepts were developed in the following decades and started to define the DSS in a broader way, including any system that contributes with the decision process. To be considered a DSS according to these authors, the system must have the following characteristics:

- a) To be aimed at less structured and less specified problems than those which managers face;
- b) To combine the use of models or analytical techniques with traditional functions of information access and retrieval;
- c) To focus specifically on resources that facilitates its use by non-specialized personnel in computing;
- d) To emphasize the flexibility and adaptability to accommodate changes in the environment and in the decision process approach.

In its minimum form, a decision support system must provide support for the decision makers, especially in non-structured or semi-structured problems. Such systems must be user-oriented, easy to use and based on data models, which would be the formal representations of the problems. A system which possesses these characteristics might create a synergy with its user to improve the decision-making quality significantly (CASSIE, 1997).

The basic architecture of a DSS is composed of three elements: data, models and users (SAGE, 1991; NETO, 2000; SPRAGUE AND WATSON, 1991). As shown in Figure 1, these elements can be seen as vertices of a triangle whose edges represent the interfaces between them.

In this architecture, the user must have knowledge of the problem in question to be able to use the system. Through the models, which are the formal representation of the problems, the user can analyze the stored operational data in several data bases of the company. The results obtained with these analyses must be evaluated by the user, who uses his knowledge of the problem to make the correct decision.

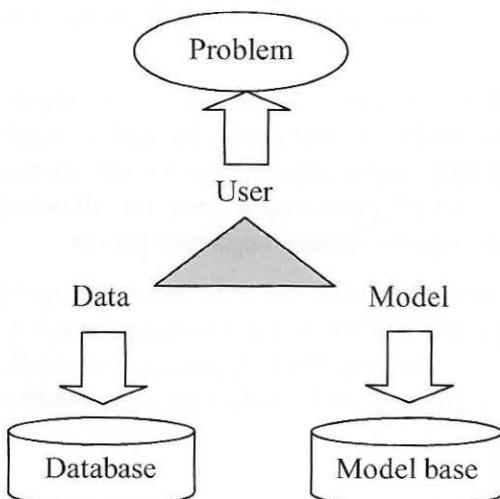


FIGURA 1 – Basic architecture of a DSS. Fonte: Sprague and Watson (1991).



Hence, it can be perceived the importance of the user role in the decision-making process. The computational systems are not made to make decisions by themselves, but to supply safe information where the decision maker can base his decisions avoiding as many risks as possible.

From the technological point of view, the architecture of a DSS encompasses all the company. All the operational data bases must be integrated forming a single date warehouse containing the necessary data for the decision-making. These data can be analyzed through data mining tools or OLAP (On-Line Analytic Processing) for non-trivial information retrieval, that is, which could not be identified only through human analysis. To perform such analyses, the problem at issue must have been modeled and formalized so that the results obtained are valid and trustworthy. At the end of this process is the system user, who is the responsible for making inferences from the results obtained by the analysis and making decisions based on the presented facts. The process just described here can be seen in the Figure 2.

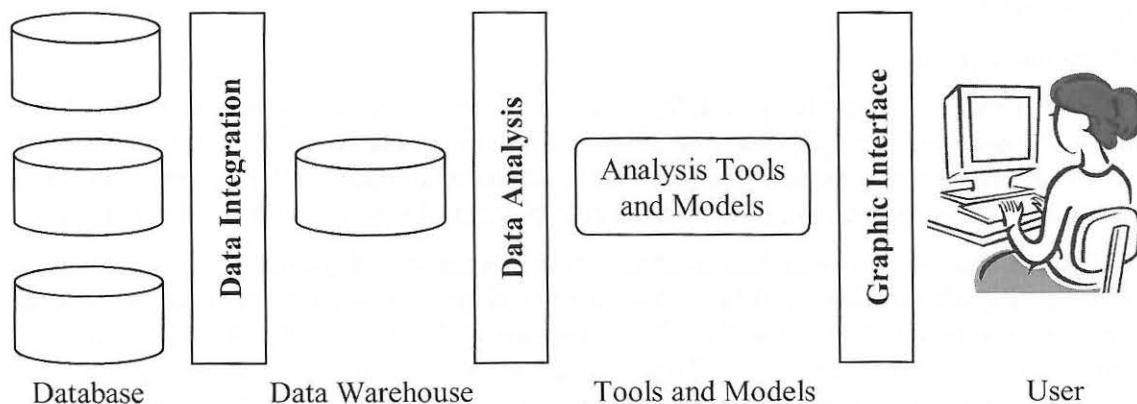


FIGURA 2 – Architecture of a DSS from the technological point of view.

The use of decision support systems can bring several benefits for the companies. Through a theoretical and practical analysis of the DSS, Keen (1981) elicited a list of benefits that can be reached by the companies which use such systems. Such benefits are:

- a) Greater number of alternatives evaluated before the decision-making;
- b) Better understanding of the company business;
- c) Fast reply to unexpected situations;
- d) Ability to perform ad-hoc analyses;
- e) Learning and reflections on the business;
- f) Better communication of the decisions;
- g) Greater control and standardization;
- h) Cost reduction;
- i) Better decisions;
- j) More effective team work;
- k) Time saving;
- l) Better use of the data resources.



### 3. Case study

In this section is presented a case study about the use of a DSS by a large company. The information presented here has been obtained through interviews realized with some system users, including the representative user and the systems department chief. The study has addressed the following aspects of the company: company description, analysis of the systems department, system description, user profiles, functionalities implemented and plans for the future related to the system.

#### 3.1 Company description

The case study was performed in a company which produces capital goods. Its main products are machine-tools, CNC lathes, conventional lathes, plastic injection machines, machining centers, parts of grey cast iron and high-precision hole-machining systems. The researched company is currently a national reference in the production and commercialization of these products and possesses branches in the United States and Europe for its commercialization.

#### 3.2 Systems department

As mentioned previously, a DSS is a computerized system which involves all the company. Therefore, to be possible to maintain such a system functioning it is necessary that the company possesses a department responsible for maintaining, developing and supporting all the information systems, ranging from the entrepreneurial systems to the office software.

In the case of the researched company there is a systems department whose mission is to maintain the physical and software structure functioning. The physical structure includes computers, communication networks, data terminals and servers. On the other hand, the software structure includes all software used in the company, enclosing since the entrepreneurial systems and engineering and project systems (CAE, CAD) to office software as email managers, text editors and electronic spreadsheets besides software to exchange messages among the employees.

The work of the systems department also includes the particular software development, which occurs when there isn't a solution in the market which meets the needs of the company. Moreover, system users may request to the department modifications and improvements in the existing systems. In addition, it is also responsibility of this department to research new solutions and suggest, when necessary, the deployment of new technologies and systems.

In the systems department are located the servers which store all the company data. However, the employees of the department have no authorization to manipulate the data directly once their mission is only to maintain the systems functioning. The insertion, deletion and update operations are responsibilities of the system users.

Regarding the personnel, the department currently possesses 41 employees divided among four primary activities such as: leadership, development, assistance and project. Amongst these employees 14 are programmers, 2 are data base administrators (DBA)) and other 4 employees are responsible for giving emergency support 24 hours a day.

#### 3.3 Description of the DSS used

The used information system to support the decision in the researched company is developed by one of the leader companies in the national market of entrepreneurial intelligence software. This software has been developed since 1995, while its first version was



released in 1998. The deployment of this software in the company occurred in the year of 2001, where it was installed the version of the same year. Throughout this work this software will be called by the fictitious name DSSsoft.

With the DSSsoft is possible to perform analyses related to several aspects of the company, as finances, marketing, sales and human resources, among others. Inside the software, these analyses are divided among five views, which are:

- a) Financial View: in this view it is possible to perform analyses related to the company finances, ranging from invoicing to receiving and paying bills;
- b) Corporative View: it includes analyses related to the internal aspects of the company which are not directly related to the finances. Such analyses involve subjects as human resources, production and inventory;
- c) Sales and Marketing View: it involves analyses related to sales which supply means to evaluate how the goals and the backlogs are. Furthermore, it is possible to cross sale data and customer data to verify future sale trends;
- d) Performance Indicators: it possesses diverse sorts of performance indicators which can be customized. Such indicators can be from financial to quality or production perspectives;
- e) Market Competitive Information: in this view are some reports which are based on information fed by external sources related to the market.

This software is not restricted to the high management, being able to be also useful to the managers of the diverse areas of the company. To this end, the software allows the creation of users who have access only to some parts of the system. As example, for an employee of the invoicing area can be created a user account which has access only to the financial and sales view.

Through this software the executive can make analyses and print them as reports to be taken to meetings and discuss the decisions to be made. Besides, it is possible to export the results to electronic spreadsheets format, making possible the accomplishment of simulations through data alterations. The interface focuses on the easiness of use and with only a few clicks the user can cross a lot of variables and generate an analysis combining, for instance, sales of a vendor in one determined region in recent years. At this type of analysis it is possible to perform the drill-down, also known as information detailing. This drill-down is made through the increase of information detailing in several levels. For instance, in a sales report it can be held several levels of information such as country, region, city, customer, orders and the like. In the DSSsoft most of the analyses can be customized by the user. Nonetheless, some more complex analyses are static and only function as reports. For this reason, it is possible to classify the analyses in the following way:

- a) Dynamic analyses: in these analyses the variables to be presented and the levels and order of drill-down can be configured by the user;
- b) Static analyses: in these analyses the users cannot modify the information that is presented. Even so, the drill-down option exists, but without the information level customization.

### 3.4 System deployment

The deployment of the DSSsoft system occurred during the year of 2001, where the version of the same year was installed. The complete process of installation took four months and was composed of the following phases:

- a) Elicitation of the necessities in all levels of management to identify the types of necessary analyses, the performance indicators to be used and the necessary variables for the analyses;
- b) Study of the operational databases of the company with the objective to verify which functionalities of the system can be implemented with the existing data;
- c) Customization of the system, where the alterations, reports and analyses necessary to attend the necessities of the company were implemented;
- d) Installation and configuration of the DSSsoft database and the software installation in the computers of the end users;
- e) User training and software use release.

As it can be seen in the Figure 3, the deployment of such a system involves all the company. The operational databases store data deriving from all the company sectors, forming a large set of tables and registers that must be studied before projecting the DSSsoft database. In the other extremity there are the users, who are spread around the company and possess diverse necessities and expectations in relation to the system.

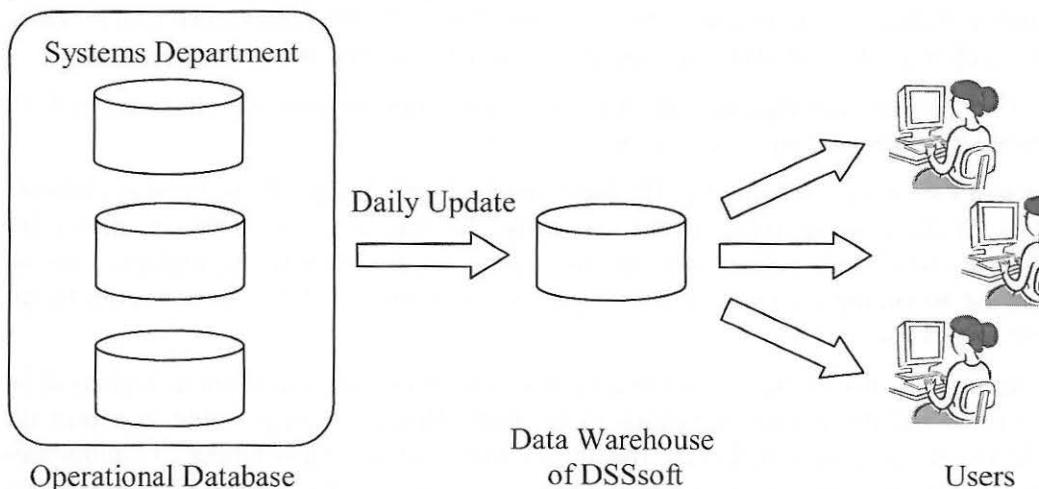


FIGURA 3 – Physical structure of the system.

As shown in the Figure 3, the database is not updated in real time, what is common in the case of data warehouses. However, the daily update is sufficient for the presented data to have a good precision. Therefore, the users must have in mind that the operational data registered in one day will be available in the DSSsoft only in the following day.

After the ending of the deployment, neither of all the existing functionalities in the system could be implemented. Next, there is a list of the analyses and reports that were implemented and are currently in use in the company in each one of the five views of the system:

- a) Financial View: Invoicing Analysis, Budget, Receiving and Paying Bills, Countable Demonstrations;
- b) Corporative View: Payroll, Personnel, Cost Analysis, Production Analysis, Purchases and Inventory Analysis;
- c) Sales and Marketing View: Monitoring of Goals, Input of Orders registered daily, Backlogs, Customers versus Product Line;
- d) Performance Indicators: in this view only financial indicators were implemented. The



quality and productivity indicators were not implemented in the system;

- e) Market Competitive Information: this vision was not implemented because the company does not possess data sources for this information. Moreover, many of these information are sensitive, being preferable the use of paper to send them only to the people who can have access.

The SADSoft offers several options of analyses and reports which were not implemented in the company. Next, there is a list of reasons to explain the non-implementation of some of these functionalities:

- a) Some of the functionalities needed data that did not exist in the corporative system of the company or in the operational databases;
- b) Some of the analyses were not implemented because it was not identified the need for use of these functionalities by the users;
- c) The company possesses several information sources which are not necessary to be implemented in the DSSsoft again. For instance, some information about the market and the competition are provided by external consultants and are not recorded in the system once they are considered confidential information.

### 3.5 System users

At the beginning of the use of the system, the number of users was small because the DSSsoft was still operating in test phase and there was no culture of use of the system. Nevertheless, bit by bit the managers and directors were trained and started perceiving the power of the system which they had in their hands. This way, the number of users started growing and the system effectiveness could be perceived by its users. Currently the DSSsoft is used in the following departments of the company:

- a) Financial;
- b) Comptroller;
- c) High Administration composed of seven directors;
- d) Commercialization composed of five sales managers;
- e) Systems Department;
- f) Human Resources Department;
- g) Purchases;
- h) Production.

The high administration is the main focus of the system, and these possess access to all its functionalities. Currently, the most operating user of the DSSsoft is the president of the company, opposing the tradition in which high directors do not have culture of software use. The software can be used every day to consult basic information as the cash flow, receiving bills and backlogs. Besides the directors, the systems department also possesses access to all the functionalities of the system, being able to perform tests and validations, but not to decision support use. The other departments which use the DSSsoft possess access only to the functionalities that are of their interest.

Since the beginning of the installation an employee of the company was elect to be the delegate user of the DSSsoft. This user was chosen by having a general knowledge of all the company and by being familiar with this type of systems. The role of this user is to work as an



intermediary between the systems department and the other users. When a necessity is identified by the common users, he is the responsible for verifying and communicating them to the systems department if necessary. In addition, he is responsible for training new users and solving small doubts. To be able to perform his role, the delegate user possesses access to all the functionalities of the system.

#### 4. Conclusion

Confirming the power of the decision support systems, this article presented a deployment case study of a DSS in a large company which has been using for about six years. After this time, the software became an essential work tool for its users.

Currently, there is a culture in the company for the use and maintenance of this software in all levels, from data collection to its use for decision support. To illustrate this, one of the perceived benefits was the improvement in the quality of operational data registering. Before the deployment of the DSSsoft, many operational data were registered incorrectly, causing inconsistencies in the reports and impairing the quality of the analyses. This was surpassed through a work in the front line of the company, orienting the employees towards the importance of registering data correctly. Nowadays, this problem practically does not exist.

The DSSsoft has shown efficient and its use became a common practice among the managers, assisting decision making through fast and easy analyses. In spite of the perception that the system is sufficiently used in the company, there is no tool able to count the access number and the analyses performed by the users. Therefore, it is not possible to accurately know the way that the system is used or even who uses it.

The searched company has interest in updating the version of its system. As mentioned previously, the used version is of 2001 and is currently discontinued, that is, it is not being developed by the software supplier anymore. Although this version satisfies almost all the necessities of the company, the most current version possesses new functionalities that can be very useful to the company. Moreover, many analyses which are static in the version of 2001 became dynamic in the most current version. Despite the advantages of the new version, the update was not done yet due to the updating work be practically the same as installing the DSSsoft in a company which does not possess it, once many changes occurred in the software and the database since its deployment.

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