

DECISION SUPPORT SYSTEMS TO CREATE A COMPETITIVE ADVANTAGE

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Abstract: *This paper presents the evolution of Decision Support System (DSS) technologies and issues related to DSS definition, application and limitations. A modern DSS is capable to measure all relevant parameters, carry out an in-depth analysis, and suggest possible courses of action and future trend in a given area. Offering useful insights to businesses, the DSS can help in building and maintaining competitive advantages. The advancements in computer, mobile and internet technologies have had a strong impact on the design of a DSS and its capabilities.*

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1. Introduction

Decision making at different levels of management is becoming increasingly difficult given the complexity of social and economic environment and the rapid evolution of science and technology.

The increasing complexity and volume of information to be processed in decision-making systems require the use of modern and confidence tools.

Computerized Decision Support tools are increasingly used as decision-makers are convinced of their usefulness and possibilities for improvement and development of these tools.

Artificial intelligence development and its applications in various fields come to help increase the effectiveness of management processes as well as knowledge in general.

Human decision-maker may be faced with a number of limitations that affect the outcome of the decision-such as cognitive limits (due to limited human capacity to store and process data, information and knowledge), within the time (many decisions must be adopted within a very short time or insufficient to substantiate their correct and complete) and economic limits (about the cost of acquiring, storing, processing, transmission and dissemination of data, information and knowledge used in decision making).

2. What is a Decision Support System (DSS)?

Decision support Systems (DSS) are developed to support decision makers in their semi-structured tasks and appeared towards the end of 60s (Ackoff, 1968). A decision support system (DSS) is an interactive software-based system that collects, organizes and analyzes business data to support an executives' skills at all stages of decision making.

DSS are generally based upon interactive computer networks which can help the manager to identify and solve problems, and to take the efficient, effective and economic decisions.

Decision Support Systems (DSS) have transformed from automated systems for simplifying calculations into an important tool that combining hardware, software and human intelligence, capable of visualizing future trends in a given area, offering useful insights to businesses.

Decision support systems developed in recent years have been designed as a support for managers in making decisions, providing them with assistance in this process, but not replace them.

Man has control over decision-making, and these systems only provide alternatives decision based using modeling tools and data analysis.

Main features of Decision Support System are:

- designed to help support decisions that are formulated as semi structured, complex problem;
- serve to assist decision-makers at the individual or group in all stages of decision making;
- solutions are obtained by manipulation of data, search for information, models, and calculations;
- the response time to achieve an acceptable solution is limited;
- is typically designed for either a particular decision-maker or a group of decision-makers.

In the early 1970s, the architecture of the first DSS was composed by a model- base management system, a database management system and a human-computer interface (Sprague and Carlsson 1982).

In the 1990s, into the architecture previously described was added a knowledge-base, so as to give the system the capacity for reasoning in the taking of the decision. This approach leads to develop Intelligent DSS or also called knowledge-based DSS.

According to Marakas (2003) the components of a DSS are:

- a database management system and the associated database;
- a model-base management system and the associated model-base;
- the inference engine and the knowledge-base;
- a user interface;
- a user: who forms an integral part of the process of problem solving.

The major applications for DSS emphasized manipulating quantitative models, accessing and analyzing large data bases, and supporting group decision making. The Decision Support Systems can be divided into following categories (Power 2007):

a. Model-driven DSS

A model-driven DSS was based on simple quantitative models. It used limited data and parameters and emphasized manipulation of financial, optimization and/or simulation models. It provided the most elementary functionality to manufacturing concerns.

b. Data-driven DSS

Data-driven DSS emphasized the access and manipulation of a time-series of internal company data and sometimes external and real-time data tailored to specific tasks using general tools. Relational databases accessed by query and retrieval tools provide an elementary level of functionality.

Data warehousing and On-Line Analytical Processing (OLAP) provide the highest level of functionality and decision support.

c. Communications-driven DSS

Communications-driven DSS use network and communications technologies to facilitate decision making. Collaboration and communication in the decision-making process can be achieved through various instruments such as groupware, video conferencing and computer-based bulletin boards, voice and video delivered using the Internet protocol.

d. Document-driven DSS

A document-driven DSS processes large volumes of unstructured data existing in a large document databases (may include scanned documents, hypertext documents, images, sounds and video documents).

e. Knowledge-driven DSS or Expert Systems

Knowledge-based DSS combines artificial intelligence with human expertise in solving problems in a particular area. Decision making is a process that in addition to technical support needs cognitive support provided by the human. The cognitive support includes knowledge about a particular domain and experience of the decision maker and its reasoning ability.

f. Web-based DSS

The World-wide Web and global Internet provided a technology platform for extending the capabilities and deployment of computerized decision support. Many DSS have Web interfaces to take advantages of graphics displays, interactivity, and ease of use.

3. Decision Support Systems to Create a Competitive Advantage

The complexity of management problems require intelligent technologies to support and in some cases even replace the human factor in decisions. DSS supporting human decision maker in solving complex decision, semistructured and unstructured.

General benefits of DSS are to assist in improving managerial strategic decision-making. Using DSS enables quick responses to market changes and implementing proactive strategies. DSS allows for faster decision-making and reduces the time taken to solve problems.

Also, DSS provides more evidence in support of a decision. Internet technologies change substantially business models and contribute to the development of innovative web-based Decision Support Systems.

In a hyperconnected economy no sector of the economy will be untouched by technology such as Internet of Things (IoT), Artificial Intelligence (AI), and blockchain. Although there are many advantages in relatively large number of organizations still are registered resistance to using Decision Support System

Among the factors that cause resistance in using DSS emphasizes the lack of knowledge in the use of new technologies and the fear of learning new things. The manager's problem-solving style is sometimes intuitive rather than analytical.

Limitations and disadvantages of Decision Support Systems

DSS unlimited trust and dependence is not desirable since they may have a number of limitations Such as:

- The impossibility of quantifying and collecting all data;
- System design failure due to ignorance of the specific needs of decision-makers;
- A DSS is structured for a specific purpose and the data and models limit how it can be used;
- Lack of technological knowledge for many decision makers;
- Unaware of Assumptions: Human decision-maker must realize that a computerized DSS is only a supporting tool and must use his own judgment when making the final decision. A decision maker must analyze the limitations and assumptions that a DSS has considered when analyzing data for an unstructured or partially structured situation;
- Information overload is a major problem for managers, and many DSS increase the overload.

4. Evolution of Decision Support Systems

DSS decisive evolution was marked by innovations that have occurred in the last 50 years. Beginning in the early 1990s, four powerful tools emerged for building DSS: Data warehouses, on-line analytical processing OLAP, data mining, and web-based DSS.

A data warehouse is a subject-oriented, integrated, time-variant, nonvolatile collection of data (Inmon, 1992). A data warehouse is a solution for integrating data from diverse operational databases to support management decision making.

A data warehouse is built to store large quantities of historical data and enable fast, complex queries across all the data. The data warehouses are using relational or multidimensional database technologies for on-line analytical processing (OLAP).

OLAP (n.d) is software for manipulating multidimensional data from a variety of sources that has been stored in a data warehouse. The software can create various views and representations of the data. OLAP software provides fast, consistent, interactive access to shared, multidimensional data.

These systems are used to discover trends, analyze critical factors and perform statistical analysis. Data Mining is a set of artificial intelligence and statistical tools used in analyzing data from various dimensions and perspectives, finding patterns, classifying and grouping the data and summarizing the identified relationships.

The emergence and development of The World-Wide Web technologies and e-commerce allowed to rapid increase in the volume of data in real time and developing new data mining tools. The universal TCP/IP protocol or Web platform leads to widespread use and adoption of decision support systems in organizations.

Development of computer networks and the trend of replacing individual decisions taken by the group of individuals have also opened wide the doors for development of various tools to support collaboration and group processes.

Group support systems (GSS) and computer-mediated communication systems (CMCS) facilitate more effective group interaction, leading to greater decision-making effectiveness in modern distributed organizations.

A standard Web browser can be used as the user interface/dialog means that companies can introduce new DSS technologies at their sites at relatively low cost when compared to client-based DSS.

5. Conclusions

Decision Support Systems are constantly evolving under the influence of the new technologies, new approaches and ever-changing business needs. Experts identify key developments or trends in DSS in near future. These include:

- Mobile tools, mobile e-services, and wireless Internet protocols will mark the next major sets of development in DSS.
- DSS will be capable of handling much “softer” information and much broader concerns than the mathematical models and knowledge-based systems have been capable of handling in the case in the past.
- DSS will take into account in the formulation stage of the problem of multiple perspectives, developed from organizational, personal and technical positions. All relevant variables for all stakeholders must be included in models, or taken into account during the analysis, if they cannot be quantified.

- Greater collaboration functions will be enabled, facilitating more interactive decision processes.
- The use of artificial intelligence (AI) is being replaced with intelligent systems and soft computing, which are emerging new technological platforms.
- A future DSS may be able to utilize cognitive features, intensively using visualization, memory, reasoning, attention and comprehension.

References

- Ackoff, R.L. (1968). Management misinformation systems. *Management Science*, Vol. 14, (4), pp.147–156.
- Inmon, W.H. (1992). *Building the Data Warehouse*, QED Information, Sciences, Wellesley, MA.
- Marakas, G.M. (2003). *Decision Support Systems*, 2nd Edition, Prentice-Hall.
- OLAP Council, (n.d). *On-line Analytical Processing Definitions*, Available at <http://dssresources.com/glossary/142.php>.
- Olson, D. L. (2007). *Data mining in business services*. https://www.researchgate.net/publication/227209803_Data_mining_in_business_services.
- Power, D. (2004). Decision Support systems: from the past to the future. In *Proceedings of the Americans Conference on Information Systems*, New York, August 2004, pag. 2015/2031.
- Power, D.J. (2007). A Brief History of Decision Support Systems. *DSSResources.COM*, (online). Available at <http://DSSResources.COM/history/dsshistory.html>, version 4.0, March 10, 2007.
- Sprague, R.H. and Carlson, E.D. (1982). *Building Effective Decision Support Systems*. Englewood Cliffs, NJ; PrenticeHall.