Decision Support Systems

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INTRODUCTION

Over the four decades of its history, decision support systems (DSSs) have moved from a radical movement that changed the way information systems were perceived in business, to a mainstream commercial information technology movement that all organizations engage. This interactive, flexible, and adaptable computer-based information system derives from two main areas of research: the theoretical studies of organizational decision making done at the Carnegie Institute in the 1950's and early 1960's as well as the technical work on interactive computer systems which was mainly performed by the Massachusetts Institute of Technology (Keen & Morton, 1978).

DSSs began due to the importance of formalizing a record of ideas, people, systems, and technologies implicated in this sector of applied information technology. But the history of this system is not precise due to the many individuals involved in different stages of DSSs and various industries while claiming to be pioneers of the system (Arnott & Pervan, 2005; Power, 2003). DSSs have become very sophisticated and stylish since these pioneers began their research. Many new systems have expanded the frontiers established by these pioneers yet the core and basis of the system remains the same. Today, DSSs are used in the finance, accounting, marketing, medical, as well as several other fields.

BACKGROUND

The basic ingredients of a DSS can be stated as follows: the data management system, the model management system, the knowledge engine, the user interface, and the users (Donciulescu, Filip, & Filip, 2002). The database is a collection of current or historical data from a number of application groups. Databases can range in size from storing it in a PC that contains corporate data that has been downloaded, to a massive data warehouse that is continuously updated by major organizational transaction processing systems (TPSs). When referring to the model management system, it's primarily a standalone system that uses some type of model to perform "what if" and other kinds of analysis. This model must be easy to use, and therefore the design of such model is based on a strong theory or model combined with a good user interface.

A major component of a DSS is the knowledge engine. To develop an expert system requires input from one or more experts, this is where the knowledge engineers go to work, who can translate the knowledge as described by the expert into a set of rules. A knowledge engineer acts like a system analyst but has special expertise in eliciting information and expertise from other professionals (Lauden & Lauden, 2005).

The user interface is the part of the information system through which the end user interacts with the system—type of hardware and the series of on-screen commands and responses required for a user to work with the system. An information system will be considered a failure if its design is not compatible with the structure, culture, and goals of the organization. Research must be conducted to design a close organizational fit, to create comfort and reliability between the system and user. In a DSS, the user is as much a part of the system as the hardware and software. The user can also take many roles such as decision maker, intermediary, maintainer, operator, and feeder. A DSS may be the best one in its industry but it still requires a user to make the final decision.

Power (2003) introduced a conceptual level of DSSs, which contains five different categories. These categories include model-driven DSS, communication-driven DSS, data-driven DSS, document-driven DSS, and knowledge-driven DSS. Defining DSS is not always an easy task due to the many definitions avail-

able. Much of this problem is attributed to the different ways a DSS can be classified. At the user level, a DSS can be classified as passive, active, or cooperative.

Essentially, DSS is a computer-based system that provides help in the decision-making process. However, this is a broad way of defining the subject. A better way of describing DSS is to say it is a flexible and interactive computer-based system that is developed for solving non-structured management problems. Basically, the system uses information inputted from the decision maker (data and parameters) to produce an output from the model that ultimately assists the decision maker in analyzing a situation. In the following sections, we first discuss design and analysis methods/techniques/issues related to DSSs. Then, the three possible ways to enhance DSSs will be explored.

DESIGN AND ANALYSIS METHODS/TECHNIQUES/ISSUES RELATED TO DSSS

Design Methods

Today, DSSs hold a primary position in an organization's decision making by providing timely and relevant information to decision makers. It has become a key to the success or survival of many organizations. However, there is a high tally of failure in information systems development projects, even though they are a focal point of industrial concern (Goepp, Kiefer, & Geiskopf, 2006). Designing methods have become an important component that assures a successful information system design. This issue is in relevance to the design of a DSS.

There have been many different strategies employed for the design of a DSS. Current research on DSS design has witnessed the rapid expanding of object-oriented (OO), knowledge management (KM), structured modeling (SM), and design science (DS) approaches.

Object-Oriented Approach

The characteristic of OO approach is to use object-oriented software engineering with unified modeling language (UML) in the design and implementation of a DSS. OO approach involves basically three major steps (Tian, Ma, Liang, Kwok, & Liu, 2005). The user's requirements are first captured by using a set of use case diagrams. These diagrams indicate all the functionalities of the system from the user's point of view. Then classes and their relationships are identified and described in class diagrams. Finally, sequence diagrams or collaboration diagrams are developed, which describe the interaction between objects (instances of classes). Tian et al. (2005) designed a DSS with the OO approach for an organization, which was implemented successfully.

Knowledge Management Approach

In some environment (non-preprogrammed applications), end users, especially the less experienced end users, need to have certain knowledge guiding them how to use the system. The KM design approach supports end users by embedding declarative and/or procedural knowledge in software agents. This approach provides better assistance to inexperienced users of spatial DSS, which requires a design approach that will prioritize knowledge support of the end users' decision-making activities (West & Hess, 2002).

Structured Modeling Approach

SM approach "uses a hierarchically organized, partitioned, and attributed acyclic graph to represent models" (Srinivasan & Sundaram, 2000, p. 598). It consists of three levels: elemental structure, generic structure, and modular structure. The elemental structure intends to capture the details of a specific model instance. The generic structure targets at capturing the natural familial groupings of elements. The modular structure seeks to organize generic structure hierarchically according to commonality or semantic relatedness. The leveled structures allow the complexity of a model to be managed and ranked according to its hierarchies. The graph feature allows modelers and decision makers to understand the model better. A key advantage of SM is the ease with which structured models can be visualized (Srinivansan & Sundaram, 2000).

Design Science Approach

The functionality of a DSS evolves over a series of development cycles where both the end users and the systems analyst are active contributors to the shape, nature, and logic of the system (Arnott, 2004). Yet system developers have little guidance about how