Decision Support Systems in Business

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INTRODUCTION

Decision support systems (DSSs) are a sub-set of information systems that support human decision-making through computerized systems that provide contextual information. DSSs allow decision-makers to improve their strategic planning and management control; from a business standpoint these systems have a wide-range of application (Yong & Taib, 2009). DSSs can be applied in a variety of areas to assist decision-makers as in controlling inventory, assessing consumer behavior, scheduling, forecasting, safety, planning, and risk assessment (Turban, et al., 2008). DSSs also see wide-ranging application in other fields, such as political analysis (Berg & Rietz, 2003), investigating social implications (Turoff, et al., 2002), developing educational programs (Tatnall, 2007), medical applications (Mainous, et al., 2013), understanding consumer behaviors (Koufaris, et al., 2001), evaluating military decisions (Klimack, 2002), assessing environmental policies (Poch, et al., 2004), forecasting demand (Efendigil, et al., 2009), predicting stock performance (Kuo, et al., 2001), and understanding power system loads (Santana, et al., 2012).

Perspective of Chapter

DSS usage, design and development have expanded to near ubiquity with the emergence of business analytics; an example of near ubiquity includes Internet listservs, Web directories, and Google searches (Lankton, et al., 2012). Though there are many types of DSS, it is likely that more and more DSS will be based on business analytics and optimization strategies (i.e. model-driven DSS). This is due to several factors, including rapidly collected data needing speedy analysis, continual increases in computing power, and modern software packages which reduce expertise required to developing robust mathematical models. The objective of this chapter is to provide readers who are less familiar with a general background of DSSs, considerations, and their business applications; the intended target audience being those unfamiliar with DSSs. To provide a starting point for readers, the authors begin this chapter by describing foundational concepts that relate to DSS. The primary focus of this chapter is an overview of the importance and applications of DSSs, model-driven testing practices in the form of verifying and validating DSSs, and evaluation methods. The review of these topics is paramount

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because they are often misunderstood or misused, which ultimately reduce DSS utility. Finally, the authors list and describe various applications of DSS to specific business related endeavors for further reading.

BACKGROUND

Development of DSS

The primary goal for DSSs is assisting decision-making through an integration of expert knowledge and mathematical models (Trefil, 2001). The basic framework of a DSS starts with a data or knowledge base, a mathematical model, user interface, and the users themselves (Marakas, 1999). One of the key subsystems of a DSS includes mathematical models that find non-obvious trends in data; in this process, the users themselves are vital in creating a DSS, through their expert knowledge and interaction with the DSS. Modern DSSs often utilize a combination of classical to advanced machine learning methodologies (Kuo, et al., 2001).

DSS development is typically iterative with models used to support decisions continuously or progressively refined until the decision-maker is confident that its components, structure, and values represent a system accurately (McGovern, et al., 1994). From a mathematical standpoint, these systems are often developed with specific metrics in mind in order to increase the overall accuracy of the DSS; therefore, understanding evaluation metrics is critical. However, Likert-surveys are useful for DSSs concerned with dichotomous categories, 'go' or 'no-go,' and even categorical outcomes, i.e. success, inconclusive, or failure states (Thieme, et al., 2000).

Problem Types

DSS problems are termed either: unstructured, ill-structured, semi-structured, or structured (Trefil, 2001), these are defined in Table 1 along a continuum of from structured to unstructured.

Taxonomies

DSSs are very broad in practice and can vary in design. Two primary taxonomies exist for DSSs (Alves, da Silva, & Varela, 2013); first, a simple DSS taxonomy created by Haettenschwiler (2001) relating to human interaction and described in *Table 2*; second, a taxonomy developed by (Power, 2002) describing DSSs based on use and described in *Table 3*.

UNDERSTANDING AND EVALUATING A DSS

Limitations and Uncertainties

Although DSSs have some application limitations, many DSS practitioners state that DSSs positively influence or augment their decision-

Table 1. DSS problem types (Trefil, 2001)

Type	Description
Structured	• Known system relationships. • Lack system ambiguity. • Not generally a focus of DSSs.
Semi-Structured	• Most common area of DSS application. • More known and agreed upon than in ill-structured or unstructured. • General agreements on either system representative data or system evaluation. • Require human knowledge for final decisions.
Ill-Structured	• Complexity of problems being solved is high. • Less is known about the problem domain. • Does not result in a solution with a certain answer. • Disputes about appropriate assumptions occur often. • Alternative strategies in deriving a solution is common.
Unstructured	• No consensus on information interpretation. • Experts needed to evaluate and implement a solution. • Typically involves groups of varying talent and expertise to evaluate candidate solutions. • Interactive approaches usually implemented. • Solutions are continuously monitored and documented for future use.