Measurement Issues in Decision Support Systems

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INTRODUCTION

The past decade has seen tremendous progress in systems for information support–flexible and adaptable systems to support decision makers and to accommodate individual needs and preferences. These model- or data-driven or hybrid decision support systems (DSS), now often called business intelligence (BI) systems, incorporate diverse data drawn from many different internal and external sources. Increasingly, these sources include sophisticated enterprise resource planning (ERP) systems, customer relationship management (CRM) systems, data warehouses and other enterprise-wide systems that contain vast amounts of data and permit relatively easy access to that data by a wide variety of users at many different levels of the organization. Decision support, DSS and BI have entered our lexicon and are now common topics of discussion and development in large, and even in medium-sized, enterprises. Now that DSS is well established, attention is turning to measurement and the metrics that populate such systems.

BACKGROUND

Decision-making as we know it today, supported by computers and vast information systems, is a relatively recent phenomenon. But the concept has been around long enough to permit the methods and theories of decision-making to blossom into "a plethora of paradigms, research schools, and competing theories and methods actively argued by thousands of scientists and decision makers worldwide" (Robins, 2003).

Early computer systems focused primarily on accounting and financial data. It is said that information systems are about transforming data. We could say that early systems transformed data into aggregated or summarized data – for example, wage rates, hours worked, benefits and tax data, and so forth transformed into departmental or corporate payroll reports.

In the mid-1960's, the development of the IBM System 360 and rapidly proliferating competitive systems from other vendors ushered in the era of Management Information Systems (MIS). Applications quickly moved beyond finance and accounting data and into operations. Transaction processing systems began to generate order, usage, and customer data that could be analyzed with (what quickly became quite sophisticated) models. The transformation of data into information became commonplace. For example, data on sales and usage, costs, supplier lead times and associated uncertainties were transformed into reorder points, safety stocks, and comprehensive inventory management and production scheduling systems.

Despite the broader reach of MIS, such systems are characterized by highly structured, infrequent reports, often with standard formatting. Frequently, because it was "easier" (for the IT staff), each manager in a given function, for example, marketing, received the same voluminous report – even though a manager of activities in Japan could not careless about data relating to New Jersey. Despite the tremendous advance of MIS over previous-generation systems, contemporary MIS systems draw most of their data from enterprise resource planning (ERP) systems that contain mostly internal data on transactions, and therefore suffer from many of the same problems as older systems (an internal, historical, and financial focus).

Decision support systems "evolved from the theoretical studies of organizational decision making done at the Carnegie Institute of Technology during the late 1950s and early '60s and the technical work on interactive computer systems, mainly carried out at the Massachusetts Institute of Technology in the 1960s" (Keen & Scott Morton, 1978; Power, 2003). By the end of the 1970's, it was clear that model-based decision support had become a practical, useful tool for managers.

A 1970 article by John Little of MIT clarified the concept of decision support. In a 1979 paper he provided a definition that is paraphrased here:

A coordinated collection of data, systems, tools, and techniques along with requisite software and hardware, by which an organization gathers and interprets relevant information from the business and environment and turns it into a basis for action.

Another useful definition of a DSS is:

Interactive computer-based systems designed to couple the intellectual resources of individuals with the capabilities of the computer to utilize data and models to identify and solve semi-structured (or unstructured) problems and improve the quality of decisions (paraphrased from Gorry & Scott Morton, 1989)

In these two definitions, we see some important concepts–gathering and interpreting relevant information (related to the decision at hand, not just to transactions), using the intellectual resources of managers, and providing information that can be used as the basis for action. The "new idea" here was that managers need more than information, they need decision support. If provided with good data, and models and tools to transform the data into useful information, their effectiveness will improve.

As the field has evolved, the term *Business Intelligence* has come to be used for the types of systems that were previously referred to as DSS. A simple definition of business intelligence fits well with the DSS definitions given earlier: "Technologies that help companies make better business decisions" (www.orafaq.com/glossary).

METRICS OF BUSINESS AND MANAGEMENT PERFORMANCE

The definition of decision support, or the capturing of business intelligence, is supporting managers who are running the business. Increasingly, it refers to supporting middle-level managers who rely on a mix of internal and external data that is steadily tilting towards external data on customers, markets, competitors, and the political, regulatory and economic environment. If we define the process of *control* as tasks undertaken by middle- and lower-level managers to *ensure that plans come true*, we see clearly the role of data and information in decision support: managers use data and convert it into information to *monitor* the implementation of plans to ensure that strategic goals are met. If the monitoring indicates that plans will not be fulfilled, corrective *action* must be taken *in time* to ensure that the plan is in fact met. If the information from a decision support system cannot serve as the basis for action (i.e., cannot first help the decision-maker to decide to do something, and then help to decide what to do) the information will not be used and the system will therefore be useless.

The keywords in the previous paragraph that lead to action are *monitoring* and *in time*. Monitoring is the management function that is the primary target for DSS implementation. Timeliness is crucial; advance warning without enough time to steer around the iceberg, or to make the necessary changes to ensure that strategic plans are successful, is not the kind of decision support that managers seek.

In recent years, we have seen the emergence of *operational business intelligence*, the same concept as the older BI and DSS, but focused on shorter-term, operational decision-making.

Operational BI most differs from BI for management and control purposes in both the level of detail required and in the timeliness of the data. Operational BI may involve accessing a transaction system directly or through a data warehouse that is updated in near real-time multiple times throughout the day. Business intelligence for management and control purposes may also be in near real time, but can also be based on weekly or monthly data (Howson, 2008).

As we think about supporting management decision-making, we must think of how managers work at decision-making. What they do is easy to describe (despite the fact that it is fiendishly difficult to do it): managers abhor irregularities and plans that do not come true, yet they thrive on exceptions. They look for things that do not fit, that look funny, and that are out of line. Then they ask why. Much of their time is spent trying to answer that simple question and searching for actions that will make perceived problems disappear and bring things back to "normal expectations".

Examples of the "whys" that plague managers of large companies include:

- Why is it that Cadillac does not attract younger buyers?
- Why did the PC manufacturers who dominated the market in the 1990's lose so much share to Dell Computer?

Shorter-term examples include:

- Why did that ad campaign not work? (Think of Infiniti's ad campaign when the brand was introduced in 1989-90 – the ads never showed the car and while considered creative, it started the brand on an also-ran trajectory that to this day, has not caught up with its Japanese and European luxury-car rivals.)
- Where are the bottlenecks in our supply chain?
- What can we do to fix a supplier who is behind on delivery of a critical component? (Think of the current problems of the Airbus A380 and the Boeing 797).

For each of these questions, one can imagine a manager who is conjuring the question as a response to a perceived exception that needs to be "fixed".

- Which Cadillac sales manager thinks that the product is not attractive to young buyers?