

International Conference on Communication, Management and Information Technology (ICCMIT 2015)

## Decision support system and knowledge-based strategic management

Bader.A.Alyoubi, Ph.D <sup>a</sup>

<sup>a</sup> Department of Management Information Systems, College of Business of Jeddah, University of Jeddah, Jeddah, Saudi Arabia

\* Corresponding author. Tel.;; fax.:  
E-mail address: [balyoubi@hotmail.com](mailto:balyoubi@hotmail.com)

---

### Abstract

Decision Support Systems (DSS) are popular tools that assist decision-making in an organisation. The importance of Knowledge Management (KM) is also recognised due to its contributions in decision-making in organisations. DSS have been synergised with knowledge management systems and have evolved from earlier concepts of “data processing” and Management Information Systems (MIS) to their current form as indispensable IS aid for decision-making. The most common application of the synergy of DSS and KM can be found in Group Support Systems (GSS). GSS support group functions like brainstorming, idea evaluation, and communication facilities. Links between Knowledge Management (KM) and Strategic Management of business are also discussed. KM has the potential of enabling businesses to gain competitive advantage through a detailed study of the environmental factors. This way, DSS are automatically viewed as key support functions, as they enable knowledge operatives and decision-makers to make well informed decisions through effective study of semi- and ill-structured variables in the external environmental factors.

*Key Words: Decision-making, Decision Support Systems (DSS), Knowledge Management (KM), Group Support System (GSS), Strategic management, Strategy*

### Introduction

A Decision Support Systems (DSS) is a popular tool of Information Systems that supports decision-making processes. A DSS has been defined as an interactive and adaptable computer-based Information System that supports non-structured management problems too (Turban and Aronson 2000). Through the use of DSS, decision-makers were able to find solutions to various problems. These include semi- to ill-structured problems that involved multiple attributes, goals, or objectives (Nemati, Steiger, Iyer and Herschel 2002). Information systems have been frequently linked with Knowledge Management (KM) to enable businesses to arrive at a more informed and scientific decision. Knowledge Management can be described as the practice of capturing tacit knowledge and converting it to explicit knowledge. This is achieved through processing the existing explicit knowledge by filtering, storing, retrieving, and disseminating it. This adds actionable value to the knowledge. Actionable value can also be added by creating and testing new knowledge (Nemati, Steiger, Iyer and Herschel 2002). Uses of Decision Support Systems (DSS) enhanced by the concept of knowledge management (KM) have also been found in successfully managing the strategy of organisations in business. This section reviews literature on the historic development of Decision Support Systems (DSS) and the applications of the concept of Knowledge Management (KM) and looks at how the combined concept is applied in the field of strategic management.

### **The History of Decision Support Systems**

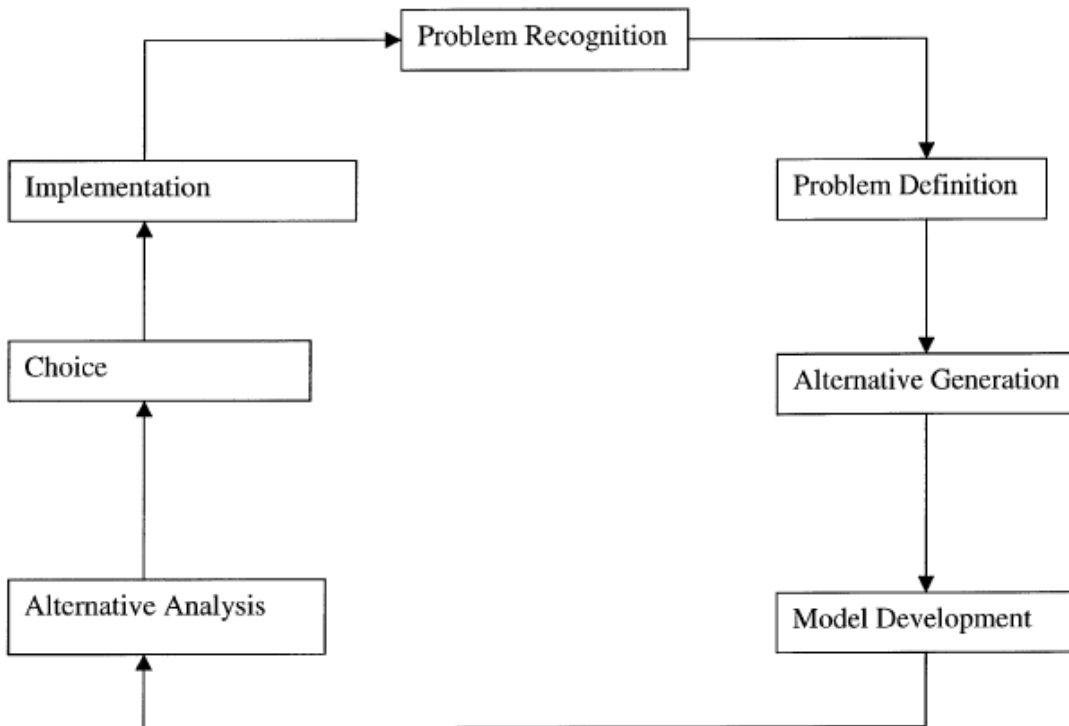
Information Systems were developed in the 1960s with the aim of facilitating business functions like billing, payroll, inventory control, and accounts payable (Kautish and Thapiyal 2012). Such organisations and processes were simply referred as ‘data processing’ up until the 1970s, when they became known as Management Information Systems (MIS) (Berson and Smith, 1997). The primary aim of MIS was to assist organisations in decision-making processes by making information available in transaction processing systems (Kautish and Thapiyal 2012). The early application of MIS in businesses was viewed as a cumbersome and confusing process, and very few such implementations were successful. It is consistent with the view of Marchand and Peppard (2012) that Information Technology (IT) often fumbles analytics resulting in failure of projects. However, Kautish and Thapiyal (2012) argue that it is largely due to misunderstanding of IT professionals of the nature of managerial work.

The birth of DSS can be traced back to the efforts of Gorry and Scott Morton (1971) when they tried to improve MIS by combining Anthony’s categories of managerial activities (Anthony, 1965) and Simon’s decision types (Simon, 1977). The table representing the framework for DSS is presented below.

	Strategic Planning	Management Control	Operational Control
Unstructured	E-commerce	Career paths	Grievances
Semi-structured	Forecasting	Budgeting	Assignments
Structured	Dividends	Purchasing	Billing

**Fig: 1. Examples of Gorry and Scott Morton decision types (Courtney, 2001)**

While MIS was dealing with processes like billing, inventory control and accounts and relied on accurate data that was obtained primarily from sources internal to the organisation, DSS on the other hand depended on external data as many of its applications were strategic in nature (Fig 1). This meant that the data was often ill-defined and required a different approaches. Courtney (2001) defines a more developed model of decision-making in a DSS environment in Fig. 2.



**Fig. 2. Conventional DSS decision-making process (Courtney 2001)**

Here, the emphasis is shifted to the model development and problem analysis. Once the problem is recognised, mathematical models are built on the basis of the problem that facilitate the creation of alternate solutions, and models are then developed to analyse the various alternatives. The choice of the most suitable alternative is made and implemented as per Simon's (1977) description. While no decision within this structure is clear-cut and the phases in the above process often overlap and blend together (Courtney 2001).

With time, DSS has further evolved to even include additional concepts and views and facilitate support of decision-making in team problem-solving. The evolved concept is referred to as Group Decision Support System (GDSS) or just Group Support System (GSS). The GSS includes brainstorming, idea evaluation and communication facilities into its mix to provide a well-rounded support to group decisions. GSS provides for a wider application of the tools in DSS in the areas of group planning (Rathwell and Burns 1985). Applications include engineering projects, development projects, scientific communities, company planning, crisis management and conflict resolution (Rathwell and Burns 1985).

### **Knowledge Management and the DSS**

As discussed above, the inclusion of knowledge management and its principles is what truly enables DSS to provide support for semi- and ill-structured problems. In this section, we review the literature on Knowledge Management and investigate its connection with DSS. As defined above, Knowledge Management is essentially the process of capturing tacit knowledge and converting it into explicit knowledge. Tacit knowledge may be defined as a collection of person's beliefs, perspectives, and mental modes that are often taken for granted. Insights, intuition, and subjective knowledge of an individual that the individual develops while being in an activity or profession are also considered tacit knowledge (Nonaka and Takeuchi 1995). Explicit knowledge, on the other hand, is formal knowledge that can be expressed through language, symbols or rules etc. It is quantifiable data that can be weighted through mathematical models or universal principles (Nonaka and Takeuchi 1995). New knowledge can be created through synergising the conversion of tacit knowledge into explicit knowledge. According to Nemati, Steiger, Iyer and Herschel (2002), this conversion is

a four step process that includes **socialisation, articulation, integration, and understanding/ internalisation** (Fig. 3).

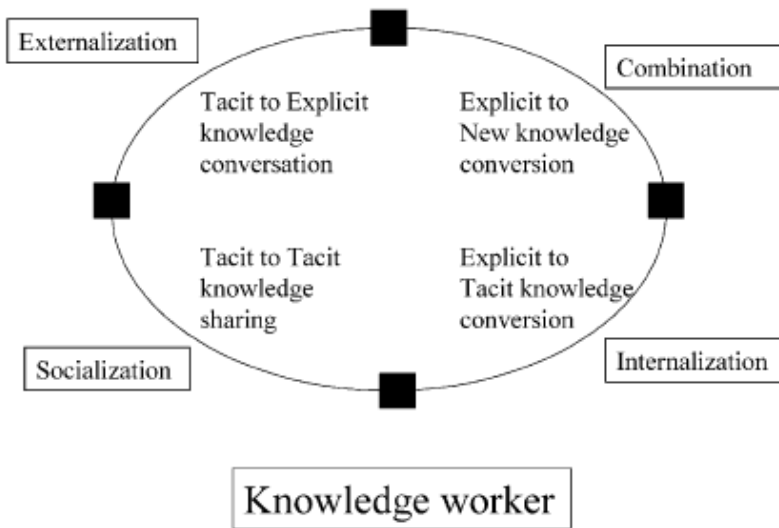


Fig. 3. The process of knowledge management (Nemati, Steiger, Iyer and Herschel 2002)

**Socialisation** is the sharing of tacit knowledge. It occurs through workers exchanging with others the experiences, technical skills, mental models, and other forms of tacit knowledge. Knowledge sharing in the workplace is often implemented with the assistance of IT, through digitised filming of the physical demonstration of a process. For example, a process might be recorded as a video and uploaded on the internet for anyone interested in learning the process to access. Such demonstration or how-to videos can facilitate the sharing of the knowledge. Artificial Intelligence (AI) has also been used as an innovative method that facilitates sharing of tacit knowledge (Nemati, Steiger, Iyer and Herschel 2002).

**Externalisation** or Articulation is the conversion of the tacit knowledge to explicit knowledge. It occurs through and is largely facilitated by the DSS systems that an organisation utilises. One such example is the brainstorming of GSS. GSS brainstorming sessions enable the participants to formally state a problem and provide ideas as solutions. The ideas are then anonymously relayed (without evaluative comments) to the other participants. They then provide their own enhancements and modifications and facilitate a stream of related and meaningful ideas that are directed toward solving the stated problem. After the generation of ideas, evaluation of the specific ideas usually takes place. The evaluations typically include a concise list of things the participants like and dislike about a particular idea, along with the reason why the participants think so. The group then addresses these concerns and works towards a valid and universally agreed solution to the stated problem that might be implemented. The information collected from the ideas is stored formally in form of text or other data for future use.

The storage of information is the catalyst to converting explicit knowledge into new knowledge. This process is called **integration** or leveraging. In the example of brainstorming, similar problems in the future could be directly addressed through earlier cases of successful implementations derived from the brainstorming discussions, thus generating new knowledge. AI is often used at this stage too. GSS brainstorming sessions that are stored as text streams can be accessed and analysed through text mining software. This can enable data mining and searches based on provided keywords, related concepts, clusters of similar ideas, etc.

The last stage of the Knowledge Management process is **internalisation**: converting explicit knowledge to implicit knowledge; here too DSS can help. One method is by modifying the internal mental model of the knowledge worker. Such mental models are often used by knowledge workers as a performance guide in specified situations. DSS can bring about the desired change in this mental model. DSS can help in the modification of a knowledge worker method of acknowledgment of new relationships between key factors that facilitate a new discovery, thus building a model for logic where such new information is automatically internalised.

Apart from the Group support systems (GSSs) that are developed through the implementation of DSS concepts and Knowledge Management, other examples of even more developed forms of the DSS- KM synergies include Negotiation Support Systems (NSS) and Intelligent Support Systems (ISS). NSS are often considered a branch of GSS that involves use of computer technologies for facilitating negotiations. Rathwell and Burns (1985) define conflict resolution as one of the functions of GSS. The NSS is a system that formally addresses conflicts and provides decision-making support for negotiations. ISS is often referred to by systems which heavily utilise Artificial Intelligence (AI) in their practices. Kautish and Thapiyal (2012) classify ISS into two generations – the first one uses rule-based expert systems and the other utilises futuristic technologies like fuzzy logic, neural networks, and genetic algorithms.

### **DSS, KM, and Strategic Management**

The relationship between DSS and KM in the context of businesses is firmly established from the previous discussions. The link between KM and Strategic Management is also another heavily researched among academics. In the highly competitive and global environment of modern organisations, (Huang 2009) argues Knowledge to be a key asset through which competitive advantage is gained and maintained. Strategy has been often defined as the comprehensive, unified, and integrated plan that is developed to ensure the objectives of the organisation are achieved (Glueck, 1980). This plan is impossible to be developed without the right information available to the strategic planners. Strategic Planning is therefore an information-intensive process. Data regarding the internal and external factors, which are related to the organisation and the environment, and the processing of such data, are therefore vital for making strategic decisions. This means that the organisation must know what data to collect, something that is often referred to as strategic knowledge acquisition (Pietrzak, Paliszkievicz, Jalosinski and Brzozowski 2015). Pietrzak, Paliszkievicz, Jalosinski and Brzozowski (2015) in a diagram have represented how strategic knowledge acquisition as a key element of creating superior performance (Fig. 4).



**Fig: 4.** Strategic knowledge acquisition as a key element of creating superior performance

The link between knowledge management and strategy is therefore considered to be very important for building an effective strategic plan. According to Pietrzak, Paliszkievicz, Jalosinski and Brzozowski (2015), the external environment is a key driver to the strategy. There is a general agreement that companies should be gathering as much information as they can about their competitive environment. This would help them in making choices that are profitable. Note that the data collected from external environments would be rarely well-structured. This is where the advantages of informed decision-making enabled by DSS come into action. Thus, DSS has a major role to play in the way organisations acquire and assimilate the strategic data that is the key to their profitability.

For a successful integration of DSS with strategic decision-making, Goul, Shane and Tonge (1986) point out that assistance in representation, operations, memory aids, and control are essential. Representations can be in the form of theoretical advice to the decision-makers. Operations typically lay down the structure in which data is collected. It can be through sessions that require the decision-makers to answer questions, which are evaluated through the use of IT.

The resulting advice relates to theoretical outcomes that will result in or have resulted in, an increase in entry barriers for the organisation under examination in terms of a particular product/market element. Memory aids enable decision-makers to review their decisions based on the answers they provided to questions asked in a specific operation. The memory aids also typically record the suggestions provided by the DSS. The memory aids should also provide a succinct summary of advice offered in every general category and stored neatly in different folders for easy access. The DSS should also provide sufficient control to the decision-maker during the whole operation of acquiring strategic data.

### **Conclusion**

The link between decision-making systems (DSS) and Knowledge management (KM) is an area of intense academic research. The history of the evolution of DSS informs us about how 'data processing' developed into Management Information Systems (MIS) and how it later transformed into DSS of today through synergy with knowledge management. The most important and frequent application of the concepts of KM and DMM is evident in Group Support Systems (GSS). It is important to note that DSS, and more specifically GSS facilitate more efficient Knowledge Management (KM) in each of the four steps in the KM cycle. The link between KM and strategy is also another topic of rigorous study and scrutiny. Knowledge is a key factor for an organisation towards building a sustainable and successful strategy. Having the right information, together with the knowledge of using it the appropriate way is one of the keys to success. This means that the concept of KM is as crucial to strategic management as any other activity. DSS, through its enhancement of KM has also found use towards enabling decision-makers to take more informed strategic decisions.

### **References**

- Anthony, R.N. 1965. "Planning and Control Systems: A Framework for Analysis". *Harvard University Graduate School of Business Administration, Boston*.
- Berson, A. and S. Smith. 1997. *Data Warehouse, Data Mining, and OLAP*. New York: McGraw-Hill.
- Courtney, James F. 2001. "Decision making and knowledge management in inquiring organizations: toward a new decision-making paradigm for DSS". *Decision Support Systems* 31: 17–38.
- Glueck, W.F. 1980. *Business Policy and Strategic Management*. New York, NY: McGraw-Hill. p. 9.
- Gorry, G.A., and M.S. Scott Morton. 1971. "A framework for management information systems". *Sloan Management Review* 13, no.1.
- Goul, Michael, Barry Shane, and Fred M. Tonge. 1986. "Using a Knowledge-Based Decision Support System in Strategic Planning Decisions: An Empirical Study." *Journal Of Management Information Systems* 2, no. 4: 70-84.
- Huang, J.J. 2009. "The Evolutionary Perspective of Knowledge Creation—A Mathematical Representation," *Knowledge- Based Systems* 22, no.6: 430–438.
- Kautish, Sandeep, and M.P. Thapliyal. 2012. "Concept of Decision Support Systems in relation with Knowledge Management – Fundamentals, theories, frameworks and practices". *International Journal of Application or Innovation in Engineering & Management* 1, no. 2: 1-9.
- Marchand, Donald A., and Joe Peppard. 2013. "Why IT Fumbles Analytics." *Harvard Business Review* 91, no. 1/2: 104-112.
- Nemati, Hamid R., David M. Steiger, Lakshmi S. Iyer and Richard T. Herschel. 2000. "Knowledge warehouse: an architectural integration of knowledge management, decision support, artificial intelligence and data warehousing". *Decision Support Systems* 33: 143– 161.

- Nonaka, H. Takeuchi. 1995. *The Knowledge-Creating Company*. , New York: Oxford Univ. Press.
- Pietrzak, Michal, Joanna Paliszkievicz, Krzysztof Jalousinski, and Andrzej Brzozowski. 2015. "A case study of strategic group map application used as a tool for knowledge management." *Journal Of Computer Information Systems* 55, no. 2: 68-77.
- Rathwell, Margaret A., and Alan Burns. 1985. "Information Systems Support for Group Planning and Decision-Making Activities." *MIS Quarterly* 9, no. 3: 255-271.
- Simon, H.A. 1977. *The New Science of Management Decision*. New York: Harper Brothers.
- Turban, E., and J. Aronson. 2000. *Decision Support Systems and Intelligent Systems, 6th edn*. Upper Saddle River, NJ: Prentice-Hall.