

## : *What influences supply and demand for information goods?*

Mary Daly, Cork University Business School

and Daniel J. Power, DSSResources.com and University of Northern Iowa

Organisational decision making environments are complex and decision makers must deal with uncertainty and ambiguity on a continuous basis. Information is a valuable input for resolving ambiguity and uncertainty, but providing decision support information has a cost that must be considered. Assessing information needs, managing and assessing decision problems, and implementing a solution require an understanding of the specific decision domain. Managers must have sufficient information so that the decision problem and its complexity are well understood. In many situations, information requirements and availability for supporting decision-makers must also be assessed and understood. This column examines the influences that alter and balance information supply and demand in organizations and in specific decision situations.

Information, as a discrete entity like a report, analysis, or query, can be considered as a commodity or good, and hence supply and demand theory is relevant to information, cf., Bates, 1990. Data-driven and model-driven decision support can facilitate a better decision making environment and improve decision making quality, **BUT** decision support and organisational decision making have **not** reached the level of maturity where decision makers can operate with perfect information and automated decision making tools. Business Intelligence (BI), business analytics (BA), and data-driven decision support are perceived by some managers as having a narrow functional purpose, rather than a broader enterprise-wide scope, and often with limited returns, cf., Kohavi, Rothleder and Simoudis (2002), Carte, Schwarzkopf, Shaft and Zmud (2005), and Piccoli and Watson (2008).

A number of frameworks can help explore perceptions of managerial decision makers about information. For example, Humphreys and Berkeley (1985) proposed a framework related to a decision maker's demand for information. Their framework presents a cognitive representation of managers' thinking condensed into multiple levels, which correspond to understanding of a decision problem and how managers can gain additional insights during the problem solving and decision making process. Also, Earl and Hopwood's (1980) recommendations for implementing information systems for decision making support help understand the information supply available to decision makers.

For many years, theorists have recognized that decision making information supply is incongruent or inconsistent with economic theories that posit that individuals and organisations select the alternative that leads to an outcome that maximizes utility or profit (Von Neumann and Morgenstern, 1944). Simon (1957) proposed a decision making model of 'bounded rationality' to explain situations involving decision making under uncertainty and imperfect competition. The influence of bounded rationality on a decision maker's thinking, and the levels of uncertainty inherent in all but the most

## : *What influences supply and demand for information goods?*

structured of decision making, has meant that decision makers continue to use strategies that attempt to 'bring order' into their information processing activities when confronted with excess information or the lack of sufficient information (Simon, 1981; Payne, 1982; Taylor, 1984). These strategies include: reducing the uncertainty by delaying action and gathering more thorough information; reducing the decision into sub-decisions; suppressing the uncertainty by ignoring it and acting on intuition; or assessing the consequences and associated probabilities based on similar previous experience (Tversky and Kahneman, 1974; Mintzberg et al., 1976; Janis and Mann, 1977; Lipshitz and Strauss, 1997).

### **Influence of Decision Situation and Decision Mode**

Thompson and Tuden (1959) studied the relationship between information and decision making. They distinguished between situations with uncertainty about the objectives and preferences of an organisation and uncertainty about the cause-and-effect relationships embodied in particular organisational actions. Their framework identifies four different types of decision modes for a 2X2 matrix of these conditions and situations. The decision modes include: 1) computation, 2) bargaining/compromise, 3) judgement, and 4) inspiration. Computation or a rational decision mode using an "answer machine" is most appropriate when there is low uncertainty about preferences and cause-and-effect. When either of the two dimensions of uncertainty are in the 'high' zone, the decisions are unstructured or semi-structured decision problems. Moreover, 'decision by compromise' indicate a satisficing (Simon, 1957) scenario, or a solution is achieved through bargaining (Nutt & Wilson, 2010) or trade-off. Decision making in a judgemental mode occurs when the uncertainty pertains to the consequences of the manager's actions, even though the objectives are relatively clearly understood and judgment is relied upon to achieve the optimal outcome (Speier, 2006). In this situation, the uncertainty is considered threatening and it tends to be masked rather than exploited to present a possible learning experience. Each of the four decision modes requires different information goods, indicating that the information processing capability of an organisation directly influences the effectiveness of the decision making capabilities in each decision mode.

When decision making by 'computation' is possible, information systems serve as 'answer machines' in programmable (Simon, 1977) or well structured (Gorry and Scott-Morton, 1971) decision situations. The information demand is high in this situation. When the uncertainty is related to disagreement regarding causation, the information system may be a 'learning machine' providing a range of ad-hoc or, 'what-if' analysis. However, Earl and Hopwood (1980) note that the use of computational information systems are extended into this area, resulting in the use of 'answer machines', "which mask the uncertainty... and very often assume the very certainties that cannot be found" (Earl and Hopwood, 1980, p. 9). When uncertainty and disagreement relate to the organisational objectives, decision making assumes a 'political' flavour, where values, expectations and preferences conflict. The opportunity exists to use 'dialogue machines', which would facilitate consultative and participative processes when exploring possible solutions. However, information systems are used as 'ammunition machines' which facilitate the promotion and articulation of a particular preference position, which is then used to influence the outcome by shaping what is

## *: What influences supply and demand for information goods?*

regarded as problematic and by emphasizing a credible solution. When uncertainty over causation further complicates the decision problem and inspired decision making is required, an 'ideas machine' would generate opportunities for brainstorming and for creative thought.

### **Influence of the Decision Maker**

Generally, a decision maker makes the final judgement, based on the output from a DSS or using inspiration. In structured situations a decision maker provides the preferences. Hence, in these situations the main role of the decision maker is to "complete the model, i.e., to tell the system what to do when there is a gap in the program" (Levine and Pomerol, 1995, p.42); otherwise the DSS has automated the process, and no further decision is required by a person. Automated decision technologies effect organisational performance by facilitating routine tasks, (Tushman and Nadler, 1978; Davenport et al., 2010), while simultaneously the automation of routine and often tedious tasks allows a decision maker to explore a problem more thoroughly than would be possible without computer support (Pick, 2008). Automated decision technologies may introduce a variety of managerial challenges because, ultimately, managers have the responsibility for defining the context and the limits for the automated decision.

The relationship between information processing theory and decision making is based on the assumption that individual decision makers have the ability to acquire, to interpret, and to analyse information, and to have memories to store information on a long and short term basis. Decision support does not only relate to tools per se, but rather it is concerned with enabling and facilitating better decisions within organisations (Alter, 2004). Decision support in an organisation allows the incorporation of wider elements under consideration when supporting decision making that focuses on the decision makers' specific problem solving tasks, and ensures the output is packaged in a way that makes it easy for managers to use (Silver, 1991).

Decision makers operate with different levels of constraint, which manifests itself as levels of discretion and levels of autonomy on the part of the decision maker. While constraints determine the nature of the activities that managers engage in, the nature of information availability is also impacted. The ideal of a complete portfolio of integrated and consistent information that captures all operational activity and is made available to experienced organisational actors who have analytics capability remains an ideal and is not yet a reality. Some would argue that ideal is unrealistic.

### **Conclusions**

The challenge facing providers of decision support information goods is to understand the

## *: What influences supply and demand for information goods?*

fundamental requirements for decision support for the various decision situations and decision modes. Providers must understand the models and the applications which will provide decision makers with information that is reliable and consistently accurate. Research should focus on understanding decision maker information requirements at all levels of an organisation.

As noted by Mason and Mitroff (1973, p. 480), a manager uses information as the “evidence upon which his decisions will be based”. The supply of information comes from many sources and is used as evidence. Different sources have different costs and provide information that varies in quality. The decision situation, the decision mode, and the decision maker determine the demand for information. In all decision modes, the quantity of information goods demanded is greater than the quantity available and supplied. Decision makers often seem to have an unlimited appetite for information. The quality of the information good supplied is also often of concern and the quality of prior information impacts future demand.

### **References**

Adam, F. and J.C. Pomerol (2008). Developing Practical Decision Support Tools Using Dashboards of Information. Handbook on Decision Support Systems. F. Burstein and C. W. Holsapple, Springer. 2: 151 - 173.

Alter, S. (2004). "A work system view of DSS in its fourth decade." *Decision Support Systems* 38(3): 319-327.

Bates, Benjamin J. "Information as an Economic Good: A ReEvaluation of Theoretical Approaches." In B. D. Ruben & L. A. Lievrouw (Eds.), *Mediation, Information, and Communication. Information and Behavior. Volume 3* (pp. 379-394). New Brunswick, NJ: Transaction, 1990.

Daly, M. (2016). "Decision support: a matter of information supply and demand." *Journal of Decision Systems, WG 8.3 Proceedings*, Published online: 16 Jun 2016, Pages 216-227 at DOI <https://doi.org/10.1080/12460125.2016.1187423>

Davenport, T. H., J. G. Harris and R. Morison (2010). *Analytics at work: smarter decisions, better results*, Harvard Business School Press.

## *: What influences supply and demand for information goods?*

Earl, M. J. and A. G. Hopwood, Eds. (1980). From management information to information management. The Information Systems Environment. North-Holland.

Gorry, G. A. and M. S. Scott-Morton (1971). "A framework for management information systems." Sloan Management Review (pre-1986) 13(1): 55.

Humphreys, P. and D. Berkeley (1985). Handling Uncertainty: Levels of Analysis of Decision Problems. Behavioral Decision Making. G. Wright. New York, Plenum Press.

Janis, I. L. and L. Mann (1977). Decision making: A Psychological analysis of conflict, choice and commitment. New York, Free Press.

Kohavi, R., N. J. Rothleder and E. Simoudis (2002). "Emerging trends in business analytics." Communications of the ACM 45(8): 45-48.

Levine, P. and J. Pomeroy (1995). The role of the decision Maker in DSSs and Representation Levels Proceedings of the 29th Hawaii International Conference on System Sciences.

Lipshitz, R. and O. Strauss (1997). "Coping with Uncertainty: A Naturalistic Decision-Making Analysis." Organizational Behavior and Human Decision Processes 69(2): 149-163.

Mason, R. O. and I. I. Mitroff (1973). "A program for research on management information systems." Management Science 19(5): 475-487.

Mintzberg, H., D. Raisinghani and A. Theoret (1976). "The Structure of 'Unstructured' Decision Processes." Administrative Science Quarterly 21(2): 246-275.

## : *What influences supply and demand for information goods?*

Nutt, P. and D. Wilson (2010). "Discussion and Implications: Toward Creating a Unified Theory of Decision Making." in Paul C. Nutt and David C. Wilson, Eds. "Handbook Of Decision Making", Wiley: 645-677.

Payne, J. W. (1982). "Contingent decision behavior." *Psychological Bulletin* 92(2): 382.

Phillips, L. D. (1984). "A theory of requisite decision models." *Acta psychologica* 56(1): 29-48.

Piccoli, G. and R. T. Watson (2008). "Profit from customer data by identifying strategic opportunities and adopting the "born digital" approach." *MIS Quarterly Executive* 7(3): 113-122.

Pick, R. A. (2008). "Benefits of Decision Support Systems." *Handbook on Decision Support Systems* 1: 719-730.

Pomerol, J.-C. (1997). "Artificial intelligence and human decision making." *European Journal of Operational Research* 99(1): 3-25.

Sage, A. P. (1981). "Behavioral and organizational considerations in the design of information systems and processes for planning and decision support." *Systems, Man and Cybernetics, IEEE Transactions on* 11(9): 640-678.

Silver, M. S. (1991). "Decisional guidance for computer-based decision support." *MIS Quarterly*: 105-122.

Simon, H. A. (1946, 1957). *Administrative behavior a study of decision-making process in administrative organization* New York Macmillan.

Simon, H. A. (1960, 1977). *The New Science of Management Decision*. Englewood Cliffs, NJ, Prentice Hall.

## *: What influences supply and demand for information goods?*

Simon, H. A. (1979). "Rational decision making in business organizations." *The American Economic Review* 69(4): 493-513.

Simon, H. A. (1981). "Information-Processing Models of Cognition." *Journal of the American Society for Information Science* (pre-1986) 32(5): 364.

Speier, C. (2006). "The influence of information presentation formats on complex task decision-making performance." *International Journal of Human-Computer Studies* 64(11): 1115-1131.

Taylor, R. N. (1984). *Behavioral decision making*. Glenview, IL,, Scott, Foresman.

Thompson, J. D. and A. Tuden (1959). "Strategies in Decision Making." *Comparative Studies in Administration*.

Tushman, M. L. and D. A. Nadler (1978). "Information processing as an integrating concept in organizational design." *Academy of Management Review*: 613-624.

Tversky, A. and D. Kahneman (1974). "Judgment under uncertainty: Heuristics and biases." *Science* 185(4157): 1124-1131.

Von Neumann, J. and O. Morgenstern (1944). *Game theory and economic behavior*, Princeton, Princeton University Press.

Author: Daniel Power

Last update: 2019-06-22 10:31