

NARROWING ORGANIZATIONAL INFORMATION COMPLEXITY

L. Sabini¹ - A. Valentino²

Abstract The aim of this work is to provide a new view of Information Technology as an instrument of reducing wrong environmental interpretation in decision process. Uncertainty is an aspect of organizational decision making with which organizations must live and that influences firm performance. In fact the presence of uncertainty, that environmental complexity brings on management decision, affects decision process and underlines the problem of getting and analyzing environmental information. To solve this problem, that's to control environmental complexity, we see DSS, as an help managers to synthesize internal and external information and to reduce their information needs. Comparing firms that implement Decision Support System we believe that they can give a strong help in reducing perceived complexity in decision process, thus enabling firm reduce variance of expected results of a decision. At this stage of the work, we focus only on the preliminary steps explaining our model but this is not tested yet, for this reason this work is configured as a working-paper.

1 - INTRODUCTION

According to common sense, technology within an organization is a resource under the disposition of managers, and a tool to assist the organizational processes. Parallel to the “traditional” functions in which technology is placed, we would introduce a different perspective of analyzing information technology. Particularly we would focus on the systems that help managers to take strategic decision and planning.

These processes have a great importance and also the path through which managers take these decisions is quite important. According to the idea of bounded rationality [1], humans are not able to understand and synthesize all information necessary to take a “full-rational” strategic decision. The way in which managers interpret the environmental requirement and need is very important. We believe that Information Technology “Decision Support Systems” have a certain impor-

¹Luiss Guido Carli, CeRSI (Centro Ricerca Sistemi Informativi), Roma, Italy, lsabini@luiss.it.

²Luiss Guido Carli, Luiss Business School, Roma, Italy, valentino@luiss.it.

tance because they can positively influence the way of analyzing environment by synthesizing information in a way analysable by humans. Without opening the “black box” of the DSS we avoid to solve the problem that current DSS have, remaining at theory level. There are no practical solution on how a DSS improve a particular decision or a particular output.

In this work we present a very essential model that takes into account and attempt to analyze the effect that complexity brings in managerial decision. Particularly we focus our attention on the ambiguity brought by the environmental complexity in managers decisions and we introduce Information System Technology Decision Support System (DSS) as an help in support decision to reduce managers perceived complexity.

The main idea of this work is to analyze the compared effect of process decision in IT managed complexity (with strong use of DSS) respect to process decision in which there aren't DSS in helping synthesizing information.

“How IT-DSSs help decision process to reduce perceived complexity and help managers to take decisions that enhance firm performance? ”.

We believe that an organization that implements powerful mechanism to analyze and synthesize information has a good chance to handle his complexity and match that one of external environment.

We initially review, very briefly, organization and IT literature on this topic, then we define our simple model and the method to conduct our analysis.

2 - REVIEW OF LITERATURE

Managers have to take decisions and decide how to exploit firm resources. So the activity of planning is considered the central function of management because it sets the pattern for other activities to follow. "Planning means defining goals for future organizational performance and deciding on the tasks and use of resources needed to attain them" (R. Daft) [2]. Some elements of planning consist of: evaluating environmental forces and organizational resources, establishing a set of organizational goals, developing strategies and plans to achieve the stated goals and formulating a decision-making process. To produce a strategic plan has been developed a number of essentially similar models of systematic planning by authors as Argenti [3], Coehn and Cyert [4] and Glueck and Jauch [5]. Simon [6] describes the decision making process as consisting of three phases: intelligence, design and choice. Intelligence means to scan environment to identify some political, social, economic and market problems that could impact on the organization. Design involves the development of alternative ways of solving the problems and choice consists of analyzing the alternatives and choosing one for implementation. According to these points, environmental needs are met through a strategic planning process, involving the formulation of missions, goals, and objectives.

According to March [7], decision process is a tricky issue, because it can be easily influenced by different factors, both internal and external to firm. In fact, manag-

ers have to find a way to balance the requirements and needs imposed by external and internal forces and to integrate the overall functioning of the organization so as to allocate resources in a manner best designed to meet goals and objectives [8]. The way to scan and process the information gathered in the environment is explained in the literature by different models [9]. The course of a decision taken by decision maker within an organization, therefore, is also strongly influenced on “how” and by “who” process the information. According to traditional view people simplify information processing in order to generate an adequate (not optimal) behaviour [10], [11], using a model of “limited capacity”[9].

The introduction of automatic systems (DSS) will shift the issue of processing information from the “limited capacity model” to the “cybernetic information-processing model” that is [12] a way to better optimize in the long run. As some researches argue [13] the power of heuristic procedure (DSS applies rules that are already defined) iterated over time can well approximate the rational choice.

In this scenario the knowledge of process through which these decisions are taken will improve the output provided by managers to an organization.

In fact, the importance of decision making is underlined by Sirmon [14]. He states that the decision process is fundamental to achieve competitive advantage, because managers must effectively bundle and deploy resources. The incorrect analysis of the environment decreases the output of decision process and even if the organization owns valuable and rare resource will not necessary reach the competitive advantage.

Today competition is faced with an accelerating rate of change in technical, social, political, and economic forces. As a result of these changing forces, the decision process has become more difficult, requiring greater skills in planning, analysis, and control [8].

The uncertainty, that environmental complexity brings on management decision, affects decision process and underlines the problem of getting and analyzing environmental information. Those information are not clear and simply understandable without a process of synthesis.

The main issue is the complexity. According to Rullani, [15] complexity means the degree of variance expressed by a phenomenon, so the number of different possible states that a system can express. These states manifest different outcomes that can either match the expected results or diverge (upward or downward) from them.

In this way the problem of complexity affects the difficulty to organize and synthesize information together in a way understandable by humans (managers).

The need of information is well explained by Information Processing View, IPV [16] [17]. This theory underlines that within organization there is a difference between information needs and information disposal that decision makers (managers) have. This difference between the information, necessary to take a “rational” strategic decision and the information that managers effectively detain, is called “informative gap”.

Galbraith [16] explains different strategies for obtaining the needed information processing capabilities. One of these concerns with the investment in vertical in-

formation systems. The processing of information can be increased with computers and mechanisms that can efficiently plan for uncertainties, and distribute the information upwards without overloading the top of the organization (decision makers). The easier information is transmitted to who take decisions, the better the capability of handling information will become.

By using this strategy, organizations can work with balancing the information processing needs and capabilities, so that the company can make efficient and viable decisions when encountering uncertainties and organizational problems.

Reducing this gap will allow managers to reduce the variance in management misunderstanding of environmental needs.

3 - MODEL

First of all is important to underline that because of this is a working paper all the reasoning stays at quite “high” level, this means that some elements are not enough developed yet. In effect in this work we provide a very simple model that analyzes the relationship between decision process (DP) – performance (P) and the influence of environmental complexity (EC) on this relationship.

According to Teece [18] there is a direct relationship between DP and P: organization can obtain good performance through a good decision process that have to understand, identify, get, synthesize environmental information.

We believe that this relation can be influenced, positively or negatively, by the presence of EC. This effect is well explained by Rullani [15] definition of complexity underlined above.

Given this situation the EC persistently breaks the relation between DP and P bringing uncertainty in the output. This happens because, in doing strategic plans managers have to evaluate external forces and scan the environment; doing these activities managers are influenced by complexity and so they more probably could make mistakes in evaluating such environmental needs and requirements.

Following this idea the influence of EC can increase or decrease the effects, managers decisions have on firm performance. In this scenario we provide the idea of DSS as a tool to control over these effects.

According to Gorry [19], DSS can be defined as interactive computer based systems which help decision makers using databases and models to solve ill structured problems. According to Sol & Rakkenbrg [20], DSSs provide systems using suitable and available technology to improve effectiveness of managerial and professional activities.

However we want to stress that the aim of this work is not to introduce the concept of IT-DSS, that is already quite known and explored [21], but to consider the influence on organizational performance that different levels of perceived information complexity have.

The idea is not to explore the dynamics on which the implementation of IT as a mechanism of coordination will work, in this step we would focus only on the

presence of DSS. For this reason this is a static model to compare the expected differential output on different DSS level implemented within an organization. These systems, defined above, are seen particularly as a tool to reduce perceived complexity to managers and so, more direct, to reduce the variance of manager misunderstanding of environmental needs.

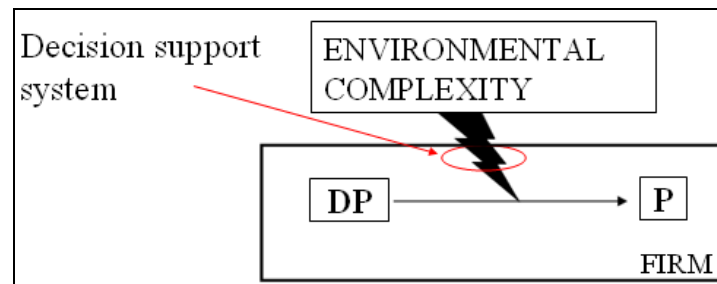


Fig.1 Model based on RBV, with consideration of Environmental Complexity

The reason why DSS can reduce perceived complexity is well explained, as stated above, by IPV [16]. Uncertainty, that is the expression of complexity, is seen as function of the difference between information needs (I_n) and information disposal (I_d). This difference between the information that are necessary to take a “rational” strategic decision and the information that managers effective detain is called “informative gap” [$\Delta I = I_n - I_d$].

This informative gap brings uncertainty in the output of a decisions, so the uncertainty can be seen as $U = f(\Delta I)$.

Reducing this gap will allow managers to reduce the variance in management misunderstanding of environmental needs. We believe that DSSs will increase [I_d], so reducing the informative gap. In our view DSSs increase the level of information disposal because they improve quality, providing a synthesis of all environmental information and throw a rationalization of them. This means that decision makers have a better chance to avoid mistakes in taking decisions.

4 - METHOD

The aim of our work is to test the effective and real effect of DSS on decision process to reduce the environmental complexity. Therefore we want to conduct a comparative analysis to underline if the presence of DSS can affect the output of a decision process. To achieve this aim, we decide to realize a qualitative analysis, based on the realization of multiple case studies. To do the test, we would construct two samples: one characterized by firms that use DSSs systems and other characterized by firms that haven't implemented them yet. We would control for the size and the industry in which they play.

The reason of controlling for size is linked with the necessity to take only medium and large organization because only they have the possibility to implement a DSS system. Also, industry sector is another important issue to check, because it avoids biased observations depending on different industry trends.

So, stated that the method used to test our model is qualitative research we want to explain that this choice is driven by the difficulty faced in clearly identify variables that are involved in our theory. While the presence of DSS within an organization is very easy to detect, the decision making process, in different organizations, is composed by a lot of heterogeneous factors that make it very difficult to tests it in a quantitative way.

5 – Limitations & Future Research

There are different limitations to our work. One of them attains to the range of problems that a DSS system can be applied. To simplify our model we assume that DSS can reduce environmental complexity, but in the reality this effect is linked with the type of problem. If the “big” problem cannot be decomposed in a subset of them, and then analyzed in detail, the chance that a DSSs would solve the “big” problem is very low. This is due to the impossibility to synthesize information in which there is not complete understanding of all the variables, or interaction among them. In those case human decisions are necessary.

For future research we highlight the lack of consideration of middle state in between the presence of DSS and absence of them. In the “real word” there can be a lot of intermediate state in which there is a various level of DSSs integration. For this reason future research should take into account the different levels of integration that DSSs could have.

We would like to thank the anonymous reviewers for their judicious comments and useful suggestions.

BIBLIOGRAPHY

1. Simon, Herbert, A. (1964). On the Concept of Organizational Goal. *Administrative Science Quarterly*, 9(1), 1.
2. Daft, R.L. (2004). *Organizzazione aziendale*. Apogeo, Milano
3. Argenti, J. (1980). How to solve the mismanagement crisis I. *Adizes*, Dow Jones & Irwin, Homewood, Illinois and Transatlantic Book Service, London, 13(4), 106-107.
4. Cohen, K.J., Cyert, R.M. (1973). Strategy: Formulation, Implementation, and Monitoring. *The Journal of Business*, Vol. 46, No.3.
5. Jauch, L.R., Glueck, W.F. (1988). *Business Policy and Strategic Management*, McGraw-Hill
6. Simon, Herbert, A. (1977). *The New Science of Management Decision*.
7. March, J. (1994). *A primer on decision making: How decisions happen*.
8. Martinez, M. (2004). *Organizzazione, informazioni e tecnologie*. il Mulino, Bologna
9. Lord RG, Maher KJ. Alternative Information-Processing Models and Their Implications for Theory, Research, and Practice. *The Academy of Management Review*. 1990 ;15(1)
10. Cyert, R., & March, J. (1963). A behavioral theory of the firm.
11. March, J., Simon, Herbert, A., & Guetzkow, H. (1958). *Organizations*. John Wiley & Sons Inc
12. Hogarth, R. (1981). Beyond discrete biases: Functional and dysfunctional aspects of judgmental heuristics. *Psychological Bulletin*.
13. Kleinmuntz, D., & Thomas, J. (1987). The value of action and inference in dynamic decision making. *Organizational Behavior and Human Decision Processes*, 39(3), 341-364.
14. Sirmon, D.G., S. Gove and M. A. Hitt. (2008). Resource Management in Dyadic Competitive Rivalry: The Effects of Resource Bundling and Deployment. *The Academy of Management Journal*, 51(5): 919 – 935.
15. Rullani, E. (1984). Teoria ed evoluzione dell'impresa industriale, in *L'impresa industriale*, M. Rispoli, Il Mulino.
16. Galbraith, J.R. (1973). *Designing Complex Organization*. Addison Wesley.
17. Galbraith, J.R. (1977). *Organizational Design*. Addison Wesley.
18. Teece, D. J. (2007). Explicating Dynamic Capabilities : The Nature And Microfoundations Of (Sustainable) Enterprise Performance. *Strategic Management Journal*, 1350(August), 1319-1350. doi: 10.1002/smj.
19. Gorry, A., & Scott Morton, M. (1989). A framework for management Information system. *Sloan Management Review*, 49-61.
20. Sol, H., & Takkenberg, C. (1987). *Expert Systems and Artificial Intelligence in Decision Support Systems*.
21. Shim, J., Merrill, W., Courtney, J., Power, D., Sharda, R., Carlsson, C., et al. (2002). Past, present and future of Decision Support System. *Elsevier Science B.V.*, 931, 1-16.