DECISION SUPPORT SYSTEMS FOR NEW PROJECT DEVELOPMENT IN FAST MOVING CONSUMER GOODS INDUSTRIES

DR. NINKO KOSTOVSKI
PROFESSOR, UNIVERSITY AMERICAN COLLEGE SKOPJE, REPUBLIC OF MACEDONIA
e-mail: kostovski@uacs.edu.mk

DR. MARJAN BOJADJIEV
PROFESSOR, UNIVERSITY AMERICAN COLLEGE SKOPJE, REPUBLIC OF MACEDONIA
e-mail: provost@uacs.edu.mk

DR. HARI LOKVENEC
LECTURER, UNIVERSITY AMERICAN COLLEGE SKOPJE, REPUBLIC OF MACEDONIA
e-mail: harilokvenec@yahoo.com

Abstract

In any contemporary business, decision makers are confronted with increasing amount of information, not necessarily incorporated properly into decision making process. Moreover, decision makers show several cognitive limitations and biases. Managerial decision support systems are intended to assist decision makers in taking advantage of available information. Research proved that these systems could compensate for the relative weaknesses of the managers as decision makers. They prevent common biases of human decision-making and foster objective and reliable information.

With number of variables that must be taken into consideration, internal and external, technological, financial and market related, the new product development and the specifics of that process in fast moving consumer goods industries is perfect for application of computerized decision support system. The results of implementation of such system based on Exsys Corvid in processed food industry are presented with review of overall impressions for the usefulness of the new software, provided by the managers involved in the process. They found that the system consistently offers realistic decisions, that the system is convenient for capturing the institutional knowledge of the process, but also that the system not always follows the standard procedure. They think that the system is user-friendly. However, the implemented system will be useful and consistently outperform expectations only if the company is ready to continuously upgrade the embedded tacit institutional knowledge and experience. However, doing so, the company should never neglect the consumers changing preferences as the most important environmental domain of information critical for new product development.

Keywords: Decision Support Systems, New product Development, Fast-Moving Consumer Goods Specifics

Classification JEL: M10, M14, M15, M16

1. Introduction

Historically, the main goal of the Decision Support Systems was to provide analytical and information-based experience to improve the decision-making process. Ever since their earliest releases, during the 1950s, these systems were set up in different ways, using different types of information and models. Managers, as human beings were demonstrating limitations in their capabilities to process all available information (Simon, 1957). The decision makers were confronted with increasing amount of information that was rarely properly incorporated into the decision process (Blattberg and Hoch, 1990). Moreover, Lucas and Nielsen (1980) noted that the amount of information beyond a given threshold starts to hinder the performance of the decision makers. Provided with extensive amounts of information that only distracts and diverts their attention from the key variables, they spend more time on systematizing the information instead on solving the problem, noticed Glazer et al. (1992). Managerial decision support systems are standalone software or modules of complex Enterprise Resource Planning or Management Information Systems intended to assist decision makers in taking advantage of the available information (Little, 1979). Even the earliest releases of these systems contained models that “allowed various “what-if” analyses” (Wierenga et al., 1994). Others stated that the combination of embedded model(s) and the managers’ acumen outperforms either of
these two alone (Blattberg and Hoch, 1990). The power of these systems and the embedded models compensate for the relative weaknesses of the managers, as human beings Hoch (1994). Contemporary releases of decision support systems contain complex decision-making models that allow various simulations and "what-if" analyses to provide the decision makers with the opportunity to integrate information and to simulate the outcomes of different perceived actions. Using some decision support system makes the managers less susceptible to anchoring bias and stimulates decision-making based on objective and statistically founded process (Hogarth and Makridakis, 1981). Since the 1950 - 60s, when the development of these systems began, several different concepts or paradigms were set and, depending on the manner of their acceptance, several transformations of the decision-making systems have been made. Historically, this type of software went through four paradigms: 1960 – Structured Reports, 1970 - Management Decision Support Systems, 1980 – Expert Systems, 1990 – Data Mining Systems, 2010 - Big Data Paradigm. The further development of decision support systems shows their industry specific specialization, like decision support systems for food processing, for example, or for some complex cross-functional functions like development and market roll-out of new products. In food and in other Fast Moving Consumer Goods (fast moving consumer goods) industries, computers are everywhere: from factories to supermarkets, generating more and more data An intelligent system able to deal with the challenges imposed by the specifics of the Fast Moving Consumer Goods has to possess flexibility, speed, learning ability, adaptability, ability to handle complex things and ability to provide explanations (Corney, 2002).

This paper shows how, working together with the management and with the new product development cross-functional team of one of the biggest Macedonian food processing industry, we managed, in a short time, to develop an expert system based on Exsys Corvid program suit. It is a powerful tool for building and fielding interactive expert system applications. It is designed to be easy to learn and aimed at non-IT experts. It enables the decision-making logic and process of the domain expert to be converted into a structured form that can be used to provide fast advice to product development people. However, despite its easy-to-lean nature, Exsys Corvid has been used to build highly complex systems. The testing of the effectiveness of the developed decision support system shows great level of satisfaction with its performances and the company continues to use it and improving its internal knowledge.

2. The Problems with the Decision Making

Decision makers in the contemporary business are confronted with increasing amounts of information (Blattberg et al., 1994). However, that increased amount of information not necessary is incorporated properly into their decision process (Blattberg and Hoch, 1990). On the contrary, in processing information, decision makers show several cognitive limitations (Simon 1957, Hogarth and Makridakis, 1981, Weber and Coskunoglu, 1990). Managerial decision support systems are intended to assist decision makers in taking advantage of available information (Little, 1979). These systems contain models that make it possible to perform so-called "what-if" analyses (Wierenga et al., 1994). Blattberg and Hoch (1990) noticed that the combination of the software and the manager often outperforms either of these two alone. Latter, Hoch (1994) stressed that the power of these systems and the embedded models simply compensate for the relative weaknesses of the managers as decision makers. However, it would be quite straightforward to claim that such systems and the models inevitably increase the effectiveness of the managers as decision makers (Sharda et al., 1988).

Managers are bad at integrating information from diverse sources (Dawes, 1979). On the other hand, decision support systems are able to integrate evidence from one occasion to another and to identify useful empirical regularities in massive databases (Hoch, 1994). These systems contain decision-making models that allow various simulations and "what-if" analyses to provide decision makers with the opportunity to probe the outcomes of different perceived actions. Moreover, in time
the decision makers who use the systems are able to read the nature and the strength of the relationships between the key variables. These systems provide cognitive feedback that enhances the ability of decision makers (Sengupta, 1995). In time they become good in their own discovering of cues that are appropriate to the decision, and finding these cues is the key to performing well in the volatile environments (Klayman, 1988). In fact, managers as decision makers suffer from several information-processing limitations (Weber and Coskunoglu, 1990). The concept of bounded rationality states that human beings as processors of information show limitations in their computational capabilities and use of memory (Simon, 1957). Moreover, Lucas and Nielsen (1980) reported that the amount of information provided beyond a given threshold starts to reduce their performance as decision makers. Vast information forces them to spend more of their time on processing the information instead on the solving of the problem. They are provided with extensive amounts of irrelevant information that distracts their attention from the key variables (Glazer et al., 1992).

Cognitive limitations of the managers lead to non-rational decision-making. Instead for optimal they start looking for sufficiently good options or use simple rules of thumb (Bazerman, 1994). The procedures based on heuristics lead to decision bias and systematic error (Tversky and Kahneman, 1974, Glazer et al., 1992). Typical mistake is so called anchoring on some previous decision and then “adjusting” it by a certain degree to the new situation (Tversky and Kahneman, 1974). Obviously, such decisions are biased towards the initial decision (Slovic and Lichtenstein 1971), which might prove totally inapplicable for the new market situation (Mowen and Gaeth, 1992). However, Weber and Coskunoglu (1990) noted that the heuristic is omnipresent and automatic even in situations where its use leads to obvious bias. Other problem is the time pressure. Pressed by the urgency, managers use selected and reduced information search and practice superficial processing (Hogarth and Makridakis, 1981). The time pressure also leads to a tendency towards "locking in on a strategy" (Edland and Svenson, 1993), use of oversimplified strategies (Wright, 1974), or conformist behavior of the managers (Hwang, 1994). Decision support systems make managers less susceptible to anchoring and stimulate decision-making according to objective data. They help offering of decisions that are really different from previous and fully reflecting the information about the current market conditions (Hogarth and Makridakis, 1981). This is an important capability of decision support systems especially in less predictable environments (Hoch and Schkade, 1996). Samuelson and Zeckhauser (1988) argued that even the heuristic error is widely recognized, there is still lack of obvious ways to avoid it. Moreover, a series of decision making experiments show that people disproportionally tend to Status Quo. Decision support system is useful in preventing the anchoring and heuristic and also prevents decisions based on avoiding the risk, they concluded. Others, like Van Bruggen at al., (1998) stressed that the decision makers are confronted with an increasing amount of information. This leads to a complex decision environment that may cause decision makers to lapse into using mental-effort-reducing heuristics such as anchoring and adjustment. They researched how the cognitive style of the decision maker affects the way how he can take advantage from use of a decision support system and found that high-analytical managers outperform and are better in identifying the key decision variables than their low-analytical counterparts. Moreover, the former showed more variation in their decisions. Van Bruggen at al. supported the earlier Chakravarti et al. (1979) findings that the good decision support system builds on the strengths of the managers and compensate for their weaknesses. They also found that decision support system when designed user-friendly lowers the overall task complexity of the managers. Their findings are consistent with previous evidence of the existence of biases in human judgment.
3. Managing New Product Development

Many companies are focusing on how to stay innovative and how to nurture innovation climate. New Product Development is important facet in this regard. Companies believe that new product development can help them be more competitive. However, the new product development is complicated, time-consuming and crosses–functional process, a cumbersome transformation of a market opportunity into a product based on juggling the assumptions about the market with the given technological possibilities (Krishnan and Ulrich, 2001, Griffm and Hauser, 1996). Researches (Song and Montoya-Weiss, 1998, Cooper and Kleinschmidt, 1997) were focused on the critical factors of the new product development, trying to find ways to enhance the success rate of the new products launching. They all agree that the way how a company manages the process is one of the key factors of its competitiveness, sustained competitive advantage and financial benefits (Enright, 2001). Laforet and Tann (2006) explored the characteristics of innovative companies in terms of the new product development. While they point out on the people, organizational values and culture of innovation and experiment, same time, they stressed the importance of extensive investment in advanced systems and technology. According to Poolton and Barclay (1998) believe that the better effectiveness of new product development boosts the profitability of the manufacturing companies. It is one of the areas left with the greatest potential for improvement, they stated. Moreover, the new product development is vital in determining the ongoing economic success of manufacturing companies (Jensen and Harmsen, 2001). Minot and Wood (2003) worked on the challenges and failures of new product development and found that while failures can ruin the business, there is no guarantee that the system will always be successful. They concluded that the reasons for failure can be attributed to a variety of factors including inability to make creative and imaginative strategic decisions. Verona (1999) listed the lack of a structured new product development system as one of the main factors of failure. Minot and Wood (2003) similarly list the poor project management, the inadequate organizational infrastructure and the underestimating of the technical challenges among the most common reasons for failure. Gerwin (1993) added the environmental uncertainty and disregarding the emerging technologies. Craig and Hart (1992) identified the degree of sophistication of the new product development process and the quality of the related market information among the key factors of success or failure of any new product launching. The goal is to bring the product to market on time; simultaneously optimizing the financial bottom-line by reducing the costs and skimming the market.

The new product development is particularly important for companies operating in the fast-moving consumer goods industries where the consumer preferences change quickly (Van Trijp and Steenkamp 2005). Consequently, the fast moving consumer goods companies are constantly seeking new ideas to feed their product development processes, resulting in various in-house idea generation systems and external idea contests (Andriopoulos and Gotsi 2006; Bilgram 2013). However, many of these idea generation activities gradually tend to become fairly conventional. Thus, most of the fast moving consumer goods companies suffer various cognitive limitations or biases of those engaged in the idea generation (Lilien et al. 2002; Franke, von Hippel, and Schreier, 2006). Also, resistance to externally generated ideas is often present, even when they are solicited by the users, particularly in established companies with strong corporate culture (Katz and Allen, 1982; Lichtenthaler and Ernst 2006).

4. The Dangers of the Process

New product development is largely accepted as critical success factor of the manufacturing companies. For example, March-Chorda et al. (2002) proposed a conceptual model for critical success factors with the product development process as the key factor. The problem is that the manufacturing
companies, especially in fast moving consumer goods, are often over-concerned with the internal capabilities. According to Anderson (2008) these companies use very simplified new product development management framework based on the technology they possess. Barclay (1992) summarizing the key elements required in achieving new product development success lists the proficiency in technological activities as one of the main, if not the critical factor. Attempts, such that of Petrick and Echols (2004) to integrate supplier information in the technology planning process are nothing but backward extension of the same manufacturing tunnel vision, now backward along the supply chain.

Leonard-Barton (1992) noticed that the core capabilities made of the knowledge and skills, technology and systems, applied management practices and company values, if too strong, can hinder and restrict instead to foster the process of new product development. However, the new products are likely to be more successful if they are designed to satisfy a perceived need of the consumers rather than simply to take advantage of the existing technology (Ortt and Schoormans, 1993). Indeed, the danger that many companies wish to avoid is the development of products without sufficient consideration of the market. If such a product passes early stages of the development, management is reluctant to raise the question about it once money has been spent (Sunk costs and Escalating Commitment, fallacies). The problem then spirals out of control, taking the company with it. Supplier or material bias is similar example of such escalating commitment fallacy. The management often insists on suppliers or inventory stocks with suboptimal quality (Leonard-Barton, 1992).

Over-formalized structures, rules, codes and instructions, together with a centralized decision-making, can significantly mask the role of the market in the new product development processes (Jaworski and Kohli, 1993). Clark and Fujimoto (1991) and Khurana and Rosenthal (1997) believe that the main contributor to the new product development failure is the environmental (market) uncertainty. This means that any good product development decision support system needs to put forward the strategy how to deal with the identified market and the overall environmental (political, social, economic, technology) uncertainties. Henkel and von Hippel (2005) believe that timely and reliable knowledge about the customer preferences and their requirements is the single most important area of information necessary for good product development. Afuah (2001) examining the reasons for 50 percent or higher failure rates on new products in fast moving consumer goods industries pointed out on the failure to “understand” the customer needs.

5. Exsys Corvid Based Expert System for New Product Development

Exsys CORVID is powerful web-based platform for building knowledge automation decision support systems with embedded expert logic. The software allows capturing the logical rules and procedural steps used by experts in their conventional decision making, to be described in a way that the underlying Runtime Inference Engine can process trams to emulate the questions, and create recommendations in an interactive user-system session. The users interact with the system as if they were talking to the expert. The system returns situation-specific recommendations and advice on a wide range of issues. One of the main advantages of the Exsys Corvid software is that it uses syntax rules that are easily understandable and close to the human language. The software allows the user to build own system without special knowledge of computer technology. The construction of own decision support system with Exsys Corvid starts with identification of the distinct steps of the decision-making process and expressing them in one or more sets of if/then/else statements. This must be done for all “hard” rules and for the heuristics of the given situation, in order to create the logic of the expert system that covers the all aspects of a particular task. These rules are embedded in the part of the system called Inference Engine. Rules represent independent facts and do not have direct links to each other. This allows their independent change and adjustments based on the current
needs and preferences. Acting upon these rules, the decision-making software determines: what rule or rules to be used, what information to be processed by those rules, how to extract the necessary information from other rules, questions to ask the user, and what actual user interface to be used. If there is sufficient information to make the decision, system decides how to format and present the output. The entire knowledge base of the expert system is built step by step by careful systematizing these rules in so called logical blocks. One logical block contains sufficient logic for performing one particular task. Exsys Corvid uses very simple command blocks with only a few commands. This is due to the fact that its decision-making engine is powerful tool. Usually, only a few commands are required for assigning a task that will then be linked with the corresponding resolution rules.

Our new product development decision support system is intended to support top management decision-making in one large food processing company in the Republic of Macedonia. Food processing is one of the biggest fast moving consumer goods industries, characterized with many new products or variants of existing products launched in a very fast pace. The decision process requires many parameters to be checked in a relatively short time frame. Possible mistakes in form of neglected requirements, confronted product features and similar are very frequent and can be costly if detected late in the process. Since, the Company uses Microsoft Dynamics NAV as its Enterprise Resource Planning System and its business processes are controlled according the ISO9001:2000 it was a convenient case to check the Exsys Corvid platform. We established a joint development team that created the set of initial questions to define the new product development process and the key variables, limitations and the starting assumptions of their current decision-making. The application we developed contained 37 questions that were linked with 31 logical if-then-else blocks, similar to those depicted in Figure 1.

![Figure 1 –Logic Block in Exsys Corvid](http://www.exsys.com/pdf/CaseStudies.pdf)

To illustrate the operations of the system, we will refer to one of the questions. A decision block similar to the presented in Figure 1, directs the decision makers in our model to choose the main product market differentiator. If they choose **Healthy diet**, then the system will lead them towards the potential market estimation block, the potential design (packaging, price) and similar features of the proposed product. **Healthy diet** is the company’s planned main marketing differentiator in Europe and UK for the next year. In that case the package should not weight less than one pound and the list of the ingredients should be free of common artificial flavors and low in allergens. The idea to stop children to buy small packages without control of the parents while meeting the strict EU and UK requirements will be heavily exploited in the marketing campaigns in order to mirror the raising sensibility of the consumers in EU and UK regarding these issues. The idea is consistent with the new corporate social
responsibility policy and all promotional activities should reflect and capitalize it. However, if the intended market for the proposed product is US than it should weigh less than 120 grams to match the requirements of the US distributor who sales through vending machines. The user answers the questions and in each of the logical blocks, the system tests the proposal and directs the decision maker to other relevant check points. The number of the questions and the blocks grows in time and if-then-else blocks are refined automatically with the use of the system. The logical links between the blocks can be viewed in decision-three view (Figure 2).

Figure 2 – Decision Three in Exsys Corvid

However, this is a mock situation. The disclosure of actual decision logic we used will expose the marketing strategy of our host Company. This explains why, practically all cases of Exsys Corvid based applied software are based on real cases, but in fact, are fictitious. However, we can still present the end results without jeopardizing the embedded corporate policies and strategies, behind. To test the system, we defined a simple task: "To introduce salted crispy sticks as new product or not" We made the starting decision model, and after the running, the software was able to present the course of action: accept the proposed new product. The offered decision was then cheeked using a questionnaire distributed to the panel of the most relevant people in the organization in relation with the new product development processes.

Four of them answered that the decision offered by the system is very realistic and six that it is realistic. Eight of the interviewed answered that the system is very convenient for capturing and storing the institutional knowledge. Four of the interviewed answered that the recommendations from the system are fully internally consistent and six that are consistent in most of the tested situations. Interesting, but three of the interviewed people answered that the system not always followed the accepted ISO 2000 based procedure. And finally, seven of them think that the system is very user-friendly and easy and three that it is user-friendly.
6. Conclusions

Working together with the management and with the new product development cross-functional team of one of the biggest Macedonian food processing industry we managed in a short time to develop an expert system based on Exsys Corvid program suit. Working together with the engineers and sales and marketing people we developed a relatively robust decision support system that can be used repeatedly by the company in its future project development proposals.

The results from the fast screening of the experience of the key people show that the Exsys Corvid is a powerful software tool that can significantly improve user’s decision making system. The product helps manager to checks all the relevant facts and critical data in relation with the new product decisions. In addition, due to the speed at which it operates, it allows considering a number of anticipated (and unexpected) situations that could arise by changing the input parameters in a relatively short time.

Our findings are consistent with many similar presented in white pages by Corvid. The main advantages listed by the other users are: ability to deliver situation specific recommendations, regulatory and policy compliance, automates the routine, saving time of the key people, capturing the corporate knowledge and don’t letting the expertise to get away with retirement or fluctuation of staff members, easier reaching of consensus between parts of the company, consistency in the decision making, looking smart to the customers with an ability to cast individualized, focused questions and to provide customized recommendations and bringing the knowledge in the interaction with the customers on the web page and the social media (http://www.exsys.com/pdf/CaseStudies.pdf).

One of the biggest benefits of the proposed decision support system for the top management is that it allows testing of proposals without involving many people and prevents the possible leak of the ideas or recipes. Once the rules for assessing the viability of the ideas for new products are defined it allows testing of unlimited number of variants, modifications, changed conditions and so on, in short time and with neatly reports and without any human bias, anchoring, stereotyping, or simple neglecting of some key factor(s) of the decision model.

Of course, the system will be useful and will consistently outperform the expectations only if the company is ready to continuously upgrade the embedded expert knowledge and tacit experience. Furthermore, the company should always put forward not the technological issues, but the customers and their needs and tastes, same time not forgetting its corporate social responsibility about the healthy diet of the population.

Exsys Corvid version we used was trial, since it is fairly expensive product suit. However, based on the level of the satisfaction with the features of the product expressed by the users we suggested the management of the company to buy several licenses for Exsys Corvid and to continue to develop this application independently. Also a viable alternative is to use a free light version Exsys Corvid or cheaper yet similar program suits from other vendors.

7. Bibliography


Boston, MA.


sustainable new product development decisions”. Technological Forecasting and Social Change. 71. pp. 81-100


