

The Expert System as a Proposal for Creating Innovative Strategy

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Abstract

The process of creating an innovation strategy is a complex one. The formulation of innovation strategy requires a more intensive calculation that makes it possible to select the optimal variant of innovation strategy for enterprises. Similarly, the creation of different innovation strategies requires the use of information technology. A place has to be allocated to hold intermediate results. Also, work with larger amounts of data and knowledge must be stored in transparent database, to avoid loss, confusion and difficulty in searching for information. This paper examines the use of an expert system as an appropriate means of meeting the requirements of creating an innovation strategy. The paper examines in detail the various modules of the proposed expert system, as well as the preconditions for a successful performance.

Key words: innovation strategy, expert system, innovation, knowledge, expert, management

1 INTRODUCTION

The current period is marked by many changes. Competition is constantly sharpening, businesses feel effects of global economic crisis, constantly developing new products, customers, primarily through the Internet have a lot of information on which the decision to buy. Customer focus has become part of a corporate approach of many companies (Strišš et al., 2009). Efforts to identify customer requirements and transferred to the new product is the task of today's marketers.

Businesses are trying to exploit these changes and turn them into their own competitive advantage. Innovation activities are essential to the survival and growth of the company. They significantly affect to its performance, market position and market power. They are a key business process, because through these companies are trying to achieve some competitive advantage. The basic precondition for the creation and use of innovation in the enterprise is well worded innovation strategy.

2 INNOVATION STRATEGY AND ITS MAKING PROCEDURE

Innovation strategy is understood as innovative business approach to the choice of objectives, methods and ways to fully utilize and develop the innovative potential of the company (Lendel, Varmus, 2010, p. 49). This is the direction of its boundary, which determines the potential of innovative strategies. Innovation strategy is closely linked with corporate strategy, therefore, must reflect the basic features of this strategy. Corporate strategy defines the scope of the enterprise within the meaning of the industry and markets in which the enterprise operates (Kislingerová, Nový, 2005, p. 106).

Innovative potential of the strategy can be defined as a measure of innovation strategy, which would have been achieved in the optimal utilization of all sources of innovation strategy (Lendel, Varmus, 2010, p. 49). The level of innovation potential of the strategy depends on the level and quality of the components of the innovative resources strategy.

Innovation strategy, we understand the sources of innovative opportunities, skills, knowledge, experience, invention and innovation, the firm available, or is unable to obtain in time. Innovative resources of strategy consist of four basic, interrelated modules, namely: (Lendel, Varmus, 2010, p. 49)

- Bank of inventions,
- Bank of innovative opportunities,
- Knowledge base,
- Bank of innovation.

The process of innovation strategy is a complex process that contains six main parts. This is a defining vision and mission of the company, identifying strategic objectives, detailed analysis of the enterprise environment (internal and external), strategy formulation itself, its implementation and subsequent evaluation associated with the control.

The most important process of creating an innovation strategy we considered the formulation of strategy. The process to generate the different variants of innovation strategy, its analysis and evaluation according to established rules and criteria specified. Based on past performance of activities may be to select an appropriate solution to an optimal variant innovation strategy for the company. Strategy formulation process is marked by more intensive computations occurring mainly in the selection of appropriate solutions. Even generating different options strategies requires innovative use of information technology. For subsequent evaluation of the various options it is necessary to interim results be imposed in an area for the purpose of subsequent confrontation and comparison with current outputs. It should also be based on more data and knowledge, which must be stored in transparent database. This will avoid the emergence of common situations where they are being confused, searching, lost and resting mainly due to absence of awareness of their existence within the enterprise. All of these prerequisites and requirements for successful development of innovative strategies can be achieved by introducing an expert system which will provide to senior managers detailed information necessary for decision-making.

For these reasons, we consider for purposes of creating a successful innovation strategy for the introduction of appropriate expert system that will ensure effective work with knowledge and innovation-related data. Knowledge-based systems using artificial intelligence solution allows arbitrarily complex problems. Used knowledge is considered crucial for high-efficiency innovation strategy. These systems are used in solving the problem of expert knowledge.

3 PROPOSAL OF EXPERT SYSTEM FOR WORK WITH INNOVATION AND CREATION INNOVATION STRATEGY

Expert systems can be understood as a knowledge system in which expert knowledge is used in a very specific problem area. The main objective of the proposed expert system will achieve the best response to the real data on innovation, thereby ensuring high quality decision-making

innovation strategy. Creating an expert system is a complex process as the project site, as well as for programming.

Based on the analysis of the literature on the creation of knowledge and expert systems (Návrát et al. (2007); Spalek et al. (2005); Kelemen & Liday (1996)) and after careful examination of the issue of innovative strategies (Horňáková & Zaušková (2008); Dupař & Molnár (2002); Kováč (2007); Tidd et al. (2007); Dupař et al. (1997); Zaušková (2006); Zaušková & Loučanová (2008)) proposes that we an expert system to work with the knowledge needed to create an innovation strategy consisted of the following basic parts:

- The core system (knowledge base, data base, working memory, and stack mechanism inference appropriate solutions),
- Input / output module,
- Explanatory module,
- Protocol,
- Other components of the system (knowledge base editor, editor of the database module learning outcomes generator module external sources).

Proposal of an expert system for work with innovation creation and innovation strategy (Fig. 1) was, in addition to learning foreign and domestic literature, created (processed) on the basis of previous research. The purpose of the research was to identify readiness of selected Slovak companies for the deployment and use of innovative marketing strategies on the base of the identification of key elements, work with innovative ideas, opportunities, innovation and application of lateral thinking. Research was conducted on the sample 236 senior managers of medium and large enterprises operating in the Slovak Republic. Most managers were contacted through an electronic questionnaire (93.2%). 6.3% of top managers have personally reached out through semi-structured interview.

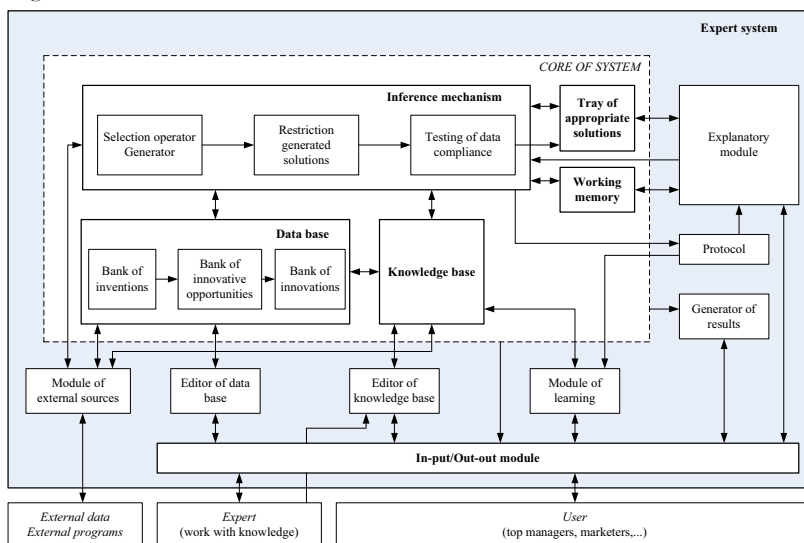


Fig. 1 – Proposal of expert system architecture to work with innovations. Source: own elaboration

The results obtained from research formed the basis for the development content of the various elements of the proposed system. In particular, interviews with top managers helped to gain a more comprehensive view of the implementation of innovation strategy in the company. Figure 1 shows the architecture of the proposed expert system for dealing with innovation in the development of innovative strategies. This is a complex system whose components must interact with each other and provide the necessary knowledge in real time.

The basic precondition for the successful operation of the proposed expert system is the existence of actual knowledge base module and the module data base. Kelemen and Liday (1996) emphasize the need to strictly distinguish the data structure representing generally applicable and accepted evidence from the data structure. This is due to the different requirements of access and manipulation.

The proposed expert system will perform two basic actors: the user and the expert. User is a person who, in practice the expert system uses the capabilities of working with innovation and creation of innovative strategies. These are the top managers and marketers. Expert knowledge is a source of innovation and innovation strategies.

4 CHARACTERISTICS OF FUNDAMENTAL ELEMENTS OF THE PROPOSED EXPERT SYSTEM

The proposed expert system consists of modules, which provide its functionality. Each module performs a specific task. Outputs from one module are inputs to the second module. The successful performance of the proposed expert system is essential to ensure coherence and seamless communication between modules.

4.1 Knowledge Base

Knowledge Base focused on expert knowledge gained. It provides a space for the collection of all knowledge that can be used in the innovation process. Tidd (2007) points out that innovation is closely linked with knowledge. It states that “the issue is to create new opportunities by combining different sets of knowledge” (Tidd, 2007, p. 16). These are the knowledge of technological possibilities and the appropriate configurations to meet the needs of business and customers. This knowledge may take the form of experience accumulated by the company during its existence or be the result of the review process (technology, market competition ...). The main purpose of knowledge base is to provide space for an appropriate mix of skills into a successful innovation.

In addressing the knowledge seeking knowledge manager needs to proceed further in solving the problem. The knowledge base must be designed to allow efficient access to required knowledge, while allowing the largest store of knowledge. It must correspond to the choice of implementing data structures.

4.2 Data Base

Data Base contains all the unique information relating to innovation. It consists of Bank of inventions, the Bank of innovative opportunities and the Bank of innovations.

Bank of inventions is the search space, creation, evaluation and storage of inventions that may

participate in the next phase in creating an innovation strategy. Invention is new knowledge that results in a change in the structure and level of knowledge and this is a new idea of possible change, respectively new approach (Zaušková, 2006, p. 37). It is about suggestions, ideas and thoughts of a solution. The process of inventions is a complex process that requires a large number of variants. Innovative ideas are the product of information coming from the surroundings and the business system itself. This information is identified to the needs and concept solutions. Important processes are the recognition of status and choice of appropriate means. The result of this process is an innovative idea (invention), which is ready for their review and decision on its need and value for the purposes of innovation strategy.

Bank of innovative opportunities is a space to store and work with the identified innovation opportunities. An innovative idea (invention) is a necessary but insufficient condition. The idea must be feasible and satisfy the conditions for potential success. We are talking about find of opportunities - the process of change an idea into an opportunity. Review inventions opportunity for innovation is a complex process that requires some assessment of up to 100 ideas for one successful product (Zaušková, Loučanová, 2008, p. 40). Here, the enterprise can create its own rating system. During evaluating, the managers must reckon with feedback in the form of corrections and improvement ideas, combining them, and breaking down under (Zaušková, Loučanová, 2008, p. 40). The Bank also serves innovative opportunities for the conservation of innovative opportunities for the company are not immediate importance. Bank to gradually accumulating innovation opportunities for peer evaluation can create the necessary synergies. Bank keeps all the innovation created by innovation and creates the environment for their effective management and their translation into successful innovation strategy. Innovation is understood the practical transfer of new ideas into people's products, services, processes, systems and social relations.

4.3 Working memory

Working memory provides space for the solution of the problem. It will include three components: a solution, plan and agenda. Solution provides to the space in working memory, which requires the solution to the problem created. It is about hypothesis, proposed structure and so on. The plan contains a sequence of actions to be taken to solve the problem. The plan may, for example a sequence of such steps: design the scheme-specific variants of innovation strategy and then optimize. The priorities of each decision module plans - scheduler, which selects the plan and the work to be carried out within the plan developed. Agenda in the form of data structure stores a sequence of actions to be taken to implement the selected activities planner. The priorities assigned to interpret these actions to maintain and ensure the activation of broken shares in the event that other actions have higher priority. Working memory can be seen as a place where solutions are stored intermediate data and arrange the activities of the solutions.

4.4 Input-Output Module

The main task of I / O module is to create an interface between knowledge-based system and its surroundings, which is represented by end-users. These are the senior managers and staff involved in the process of creating an innovation strategy. Other end users are business mar-

eters who use the knowledge gained in the evaluation of inventions and innovative opportunities in the implementation analysis to create an innovation strategy. Through this module, the user sees an expert system. The main objective in this area is to create user interfaces that allow communication affordable for solving the problem, i.e. while creating an innovative business strategy and interpretation of appropriate solutions found.

4.5 Explanatory module

The basic module is a function of clarifying clarification, explanation and justification of the decision, which is the output of an expert system. Managers and marketers obtain the necessary justification for the final solution in the form of the chosen innovation strategy. Explanatory module offers managers and marketers the opportunity to browse the knowledge base, view and modify working memory. They get invaluable help when debugging a knowledge base to guide the course of the solution. The importance of clarifying the module and see the possibilities of development of various innovative options strategies. Managers would be able to choose alternatives to develop innovative strategies that expert system still has not been examined. Explanatory module would allow examining the impact of certain decisions on innovation located by the innovation strategy. History of the solution is charged in a protocol module then uses to explain.

4.6 Inference mechanism

It allows finding the required knowledge in knowledge base, data base and using them to develop innovative strategies. It can derive from these bases for further information and knowledge. Its work is based on a knowledge base and data base on which influences the choice available to operators, limiting the number of tested solutions proposed generator and controls compliance testing solutions generated with the actual data. One of the important outcomes of inference mechanism is *tray of appropriate solutions*. This module contains the appropriate solutions, which are rated according to their fitness level. They then enter into explanatory module, through input / output module which gives to user (the senior manager or marketers).

4.7 Other components of the proposed expert system

Other important components of the proposed expert system are:

- Editor of knowledge base,
- Editor of data base,
- Module of learning,
- Generator of results,
- Module of external sources.

Editor of knowledge base provides a constant update, completion and dissemination of knowledge base. This change occurs not only during its development, but often also during operation. The reasons leading to these changes may be different. The most common is the acquisition of new knowledge that may help in the process of innovation strategy of company. Second, the manager can identify errors that must be removed (such as rules for generating variants of an innovation strategy, importance of amending the innovation process ...). The same principle is based on the *editor of data base*, which, unlike the editor working from knowledge base informa-

tion relating to inventions, innovative opportunities and innovations themselves. There may be reason for changes such as incorrect identification of ideas and their subsequent translation into innovative opportunities...

An important part of the proposed expert system is a *module of learning*. Its main objective is to promote acquisition of knowledge. It ensures that is always based on the current situation. The obtained knowledge is stored back into a knowledge base and used for future proposal innovative business strategy.

Generator summarizes the results of partial results in a reasonably integrated whole, without extra information requested in the form of a comprehensible form. His contribution is in providing effective, efficient, differentiated, comprehensive, current, serving mainly commercial information for decision-making in innovation. Communicates with input / output module to provide senior managers with the required information and understandable.

Module of external sources provides communication of the expert system with their environment. The main activity of this model is to work with external data and work with external programs. Inference mechanism in case of request certain data will search in the data base. If there in not find the required information, the management is submitted to module external sources. He begins to search external data source. In case of found of required fact it is allowed insert it into the data base and send back the management to inference mechanism. Likewise it does even in case of necessary expertise. As inference mechanism doesn't appear requisite knowledge in the knowledge base, submit the management to module of external sources. It begins to search external data source. If successful, will embed the acquired knowledge into a knowledge base, if fail then it turns through the input / output module for expert, who knowledge supplemented by the necessary knowledge base editor. Then handed back control to inference mechanism.

5 CONDITIONS FOR SUCCESSFUL WORK OF THE PROPOSED EXPERT SYSTEM

That the proposed expert system to work effectively, it is necessary to ensure that the following conditions:

- Efficient data acquisition,
- Implementation of quality input / output module,
- A detailed and careful analysis of the enterprise environment.

The quality of the implementation of input / output module can substantially multiply the performance generated by the system (Návrát et al., 2007, p. 259). These are the creation of executive comfort interactions with expert systems. The aim should be to create an acceptable user interface allowing the creation of innovative communication strategies and appropriate business located as a result the interpretation of the innovation strategy.

The most important prerequisite for the successful operation of an expert system we consider *a detailed and thorough analysis of the enterprise environment*. In a first step, the undertaking must determine its innovation capacity. It consists of the sum of knowledge, experience, resources, assets and managerial capabilities and skills in business available, or is unable to obtain in time.

This is the basis for creating an innovation strategy. Then there is a *mapping of innovation potential*, the rate of innovation means business, it can reach the optimal utilization of all components of innovative capacity. The next step, the enterprise must assess and *identify the current level* of use of innovative capacity. This analysis will provide a realistic picture of the possibilities of innovation, which in turn translate into *specification of innovative requirements*. These are the *selection of the main operators*, i.e. areas in which are interesting for the enterprise in terms of its vision and mission and will form the essence of innovation strategy. It can be the innovative area in which a company makes in terms of innovative capacity using the best results. Another area that needs to be addressed is the establishment of *rules making* innovation strategy. The rules will operate the proposed expert system. An important part of innovation is to define requirements, *system of evaluation*. The company must have clear criteria by which consider innovation strategy chosen, respectively according to which attributes to monitor its implementation over time. These attributes will form the basis for continuous evaluation of innovative strategies that will indicate the timeliness of an innovation strategy and the measures for its upgrade.

6 FUTURE WORK – REAL APPLICATIONS OF EXPERT SYSTEM FOR STRATEGIC PLANNING IN PRACTICE

Expert systems are now using modern technology such as *fuzzy logic, neural networks or genetic algorithms*. Have their advantage in the field of strategic management, knowledge management, marketing, quality management and logistics. Are developed and used for quality assessment of the supplier (Kwong et al., 2002), to develop and formulation of marketing strategies (Davies et al., 2002). Liebowitz (1998) emphasizes that expert systems must be an integral part of knowledge management. Only then can the senior management to obtain the necessary output for its decisions.

Azadeh et al. (2009) deal with the creation of an *expert system for strategic planning*. Their proposed expert system allows the assessment of strengths, weaknesses, opportunities and threats. It is based on information inputs consisting of external and internal factors. The output of system is the proposal of strategies to eliminate bottlenecks and improve the system itself.

Han (2003) dealt with a *neural expert system approach to designing an intelligent strategic planning system*. The proposed neural expert system could Providence 'goal-seeking' functions, which prove to be very useful for unstructured decision-making problems, specifically in strategic planning. He created a prototype of this system called *StratPlanner*, which was experimentally tested on data from the Korean automobile industry. The results confirmed that the neural expert systems approach is useful for performing competitive analyzes. Neural expert system prototype was designed to diagnose strategic problems and design appropriate strategic alternatives for the current competitive situation. Han (2003) dealt with using neural networks and expert systems techniques.

In practice, it may meet with several applications of expert systems, which are designed to support strategic planning. In most cases, however, they are focused solely on creating a marketing strategy. For example, *Quick Insight* is an expert system for the assessment of market opportunities and business ideas. It evaluates the product (service) in comparison with its competitors and sets the probability of success of the product on the market. In evaluating and assessing us-

ing the expertise on which a decision can be made in relation to the product (innovation, withdrawal, replacement ...). Quick Insight is used by more than 500 companies such as 3M, AT & T, Caterpillar, Equitable Life, General Electric, IBM, Pillsbury and many others [13]. The main benefit of this expert system is the possibility of rapid and accurate analysis of market potential for products and services of the company. The basic objects of analysis include product, service, price, market, competition and environment. Quick Insight helps measure the company's ability to achieve its goals and plans. It allowed make the experiment when entering different input values, which result is in the generation of alternative strategies. As an output the system provides arguments. Each claim contains a list of key factors to be considered in the analysis. Expert system interprets the results in terms of good business models, including the Boston Consulting Group Matrix, GE Business Screen, Competitive Advantage, and over 30 more in a comprehensive evaluation report [13].

Business Insight is an expert system designed to assess and develop marketing and development of marketing strategies for larger businesses. It provides a unique insight into complex relationships between multiple business concepts. It examines individual allowable strategies that can be modified and improved before making a decision. An important part of expert system is knowledge base for product and services. Business Insight offers cooperation with experts in areas of strategic planning. It also allows comparison of alternative strategies based on their strengths and weaknesses, explore market opportunities and critical assessment of key success factors. It uses several methods such as strategic management (Michael Porter's Five Competitive Forces, GE Business Strategy Matrix, Boston Consulting Group Matrix, SWOT Analysis, Product Life Cycle Analysis, Pricing Strategy and dozens of other models) [14]. The results are compared with a knowledge base of best business strategies and evaluated several marketing and business concepts relating to the problem. The results are reflected in the form of analysis to include a statement about the problems of the proposed marketing strategy. Business Insight generates a comprehensive report based on which managers can plan and justify their strategic choices [14].

Those cases mapped develop problems using expert systems in terms of strategic planning. Most applications are focuses exclusively on issues of competition, marketing and product portfolio. Innovation and innovative strategies has not yet been charted in detail. Therefore, our design expert system for creating an innovation strategy can be considered as a first step towards the use of expert systems in this area. The proposed expert system includes several new features which will allow the necessary information for policy-making.

Our aim was to develop a proposal for a comprehensive expert system for creating an innovation strategy. Show a comprehensive proposal to site the elemental and relational. Name and define the basic building blocks of this system in detail and describe relationships outputs of the system. In the next steps in our future research, we want to focus on the compilation of this prototype system using appropriate programming language in collaboration with our colleagues at the Faculty of Management and Informatics, Faculty of Electrical Engineering and the University of Žilina. We plan to set up a prototype to test in real conditions of medium or large company operating in the region of Žilina.

7 CONCLUSION

Innovations are currently a prerequisite for competitiveness. The economic crisis forced most businesses to savings in all business areas. On the other hand, it should be noted that the economic crisis for some time gone and come again to revive the economy if re-distribution markets. Successful companies are the ones that have implemented an innovative strategy to invest in R & D and innovation. The proposed expert system is currently focused on facilitating the process of making innovation strategy. It provides senior managers with a tool to obtain information necessary for decision making.

The proposed expert system is an extended architecture for a complete solution of innovative strategies. However, there is scope for its further expansion as well as its reduction. It depends on the type of business, entering the quantity of data and knowledge, number of possible scenarios for the innovation strategy. Each firm is characterized by specific processes and areas. The author seeks to create a relatively universal expert system for creating an innovation strategy, which it is possible to modify (adding or reducing) the individual modules.

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