



Expert Systems and Artificial Intelligence Capabilities Empower Strategic Decisions: A Case study

Reza Khodaie Mahmoodi¹, Sedigheh Sarabi Nejad² and Mehdi Ershadi sis^{2*}

¹Department of Management, Marand Branch, Islamic Azad University, Marand, IRAN

²Department of Management, Tabriz Branch, Islamic Azad University, Tabriz, IRAN

Available online at: www.isca.in, www.isca.me

Received 2nd July 2013, revised 17th August 2013, accepted 11th September 2013

Abstract

This article tries to investigate the capabilities of expert and artificial intelligence systems in organization strategic decision. An expert system is a knowledge-based computer program that achieves human expertise in a limited domain. The expert system or knowledge based systems (KBS) are originated in the study of artificial intelligence (AI). Expert systems owes their existence to the artificial intelligence and answer to inferential questions on specific issues such as the implications of the knowledge of the experts. Expert systems must be able to explain their process of reasoning and conclusion to the end user. This research indicates that expert system leads to promotion of strategic decision making quality accompanied by speed and accuracy in the principle behaviors and the root of the expert system is artificial intelligence that the computer activities like human activities are based on knowledge, accuracy, education and perception

Keywords: Expert systems, artificial intelligence, fuzzy logic, strategic decisions, empowerment.

Introduction

Information technology in the field of management is a key decision-making tool that effects on the value and quality of decision making as a product in a dynamic and complex national and international competition environment. By comprehension of the close relationships in technology decision making management the importance of the support systems in decision making is clarified as a management tool. Knowledge based system as the reliable system facilities the interaction with external environment and ability of the decision making under resource limitation situations and possibility of galas and elimination of the barriers. Application of such system began since 1970 by research on artificial intelligence and it was progressed in 1980 by development of information and empowerment of search engines¹. The ultimate goal of these systems is support of policy making activities and planning and decision making. The origin of these systems backs to artificial intelligence studies. Artificial intelligence is a capability to fulfill duties and task of computer that like human being needs to knowledge, accuracy, inference, education and perception of the affairs². It seems that artificial intelligence is symbol of Meta industrial period and next century. Nowadays, the artificial intelligence is common challenge among computer expert and other experts and decision maker. An ad hoc system is a computer program that imitates thinking process of a skilled person³. It is tried to help experts and specialist and replace the main limited specialist scope. These systems are the primary and simple developed knowledge systems that save data as rules and entity in data base called knowledge base in structured way and then the results are obtained by using special methods of inference⁴. This article considers empowering capabilities in ad

hoc system in order to increase decision making quality and deciding bases on knowledge in least time. Determination of empowering capabilities in interacting with strategic decision making can be considered as the primary goal. So unknown statement aspects can be introduced as the research problem.

Theoretical Principles

Expert systems: In description of expert system it should be pointed that these systems ate programs and applications that could infer about particular problem like human being. These systems use special rational paradigms that they are similar to tools used by human for solving problems. As human being thinks about a problem these systems use methods and patterns defined by humans, so, they use human logic. It can be said that they think like human being. So there are other words equivalent to expert system in literature related to artificial intelligence that they are called knowledge based systems. Indeed this naming was done because of similar information used by these systems in solving problems. Although, both term are synonym in the artificial intelligence texts but accompaniment of these terms leads to expanded application in the artificial intelligence world. Expert systems are the main branch of artificial intelligence due to capability of solving and inferential of the problems. Task domain is another major term that an expert system acts in this domain like medicine, astronomy and architecture that they are considered as domains with tasks of diagnosis of disease, scheduling of flights and designing of a building⁵.

In a definition it can be said that expert systems are computer applications that simulate manner of thinking of an expert in a

particular domain. Indeed, these applications recognize the logical patterns used for decision making and then they deiced like human being accordingly⁶. By development of artificial intelligence by the aim of simulation of human characteristics by a computer system, the ad hoc system was introduced as system used in decision making in late 1990. The first automatic ad hocsystem was designed in Stanford University called DENDRAL in 1965 that it was employed in chemistry for searching organic structure by calculation on chemical formulas⁷. One of the goals of artificial intelligence is perception of human intelligence with simulation by a computer application. It is obvious that intelligence can be generalized into many skills based onperception like capability to decision making ,learning and understanding of a language so it is a general term. Most of the achievements of artificial intelligence relate to decision making and solving problem as the major subjects of the expert systems⁸.

Application of expert systems: Expert systems are used in commercial planning, security systems, oil extraction and mines, genetic engineering, designing and manufacturing automobiles and designing camera lens and scheduling airline flights.

Designing and scheduling: The systems are used in these scopes search on several complex and interactional goals in order to clarify the work and achieve to the goals and propose the best option.

Financial decision making: Financial services industry is one of the main users of the expertsystems. The proposed software is expert systems that act like banking consultants⁹.

Expert systems structure: Expert systems have five layers: show as figure 1. i. User interface; ii. Working memory; iii. Knowledge base; iv. Inference engine; v. Explanation system.

Working memory and knowledge base are data structure used by the system and inference engine is the primary program. Explanation system explains the user questions⁴.

Fuzzy logic: The main challenge related to expert systems is relationship with other branches of artificial intelligence. In other hand, some expert systems use fuzzy logic¹⁰. In Non fuzzy logic there are only true or false options. Such logic cannot be completed; since perception and process of decision making of human is not absolute in most of cases and it is true or false depended on time and place¹¹. During 1920-1930 Jan Lukasiewicz proposed logic that in it the value of a relation could be more than 0 or 1 and they can be true or false. Lukasiewicz can be expressed as “accuracy grade”. So instead of saying this logic is true or false we can say that: "how this logic is true or false?" Fuzzy logic is used when that concepts like “heaviness”, “cold” and “length” gain importance⁸. Our model is a tree (L) that most qualitative and quantitative variables are considered .Since these variables choose the real value of strategies they are called value drivers. The determined strategy selection value involves delay (selection for waiting) expansion of selection (selection by the aim of expansion of the project scale) without implementation of the project(selection by the aim of management of the project). We assume that the investor chooses combination of these strategies as the best strategy and waits to next steps¹². Some factors are waiting of the investor and the others contain practice for waiting for real strategy. So, the selected strategy by the competitors is implemented besides cost of implementation and the input barriers are increased so that the decision maker could invest. In the case of selection, competition is increased and liquidity is reduced to the predicted amount and finally, the appropriate solution is chosen. What element is evaluated? The answer depends on variables (EXV) is a value between (0 and 1). The highest value of EXV is the highest tendency toward instant investment. If EXV equals to zero waiting is proposed and if EXV equals 1 investment is proposed instantly. Each average value indicates grade of tendency toward investment in an interval. According to this grade the investor chooses following strategy: for example if EXV=0.05 two investors could follow opposite courses. One of them can be considered as proposition for investment and the other is proposed for waiting of option¹³.

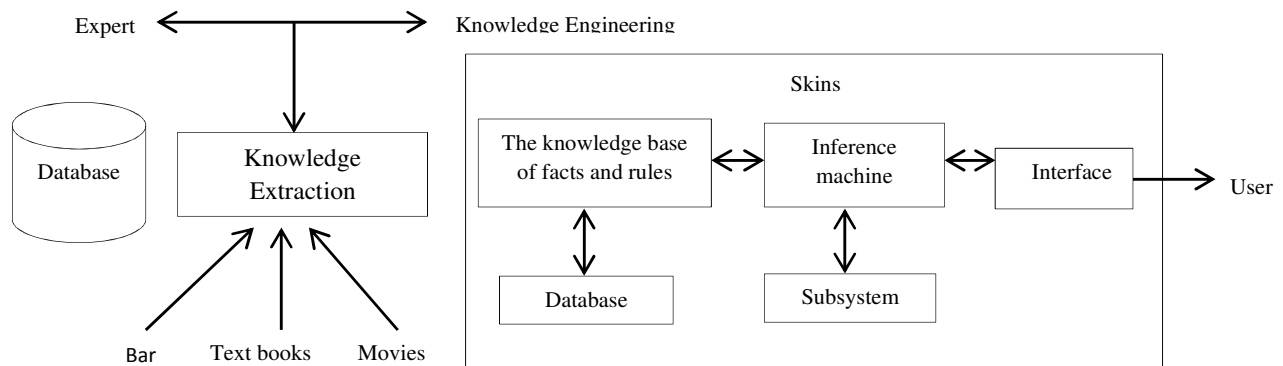


Figure-1
 Components of Expert Systems⁷

Artificial intelligence and its relationship with expert systems: Effort to possessing capabilities of recognition and imitation of human intelligence aspects was begun since 1950. In 1956 some scientists particularly Marin Minosky (at technical university of Massachusetts, Cluode Shanana (at Bell laboratory) and John Maccarty at Darmuth university held a conference in Canada in this regard. John Maccarti the associate professor of Mathematics called this conference artificial intelligence. Since that time artificial intelligence has been considered by the scientists¹⁴. Artificial intelligence defines efforts to building computer disciplines (software and hardware) by human behavior. Such disciplines have capabilities of learning natural languages, doing human task as robot and competition with experts and decision making. An artificial intelligence system is not merely artificial and merely intelligence but it is target based system that solves problem as artificial way. These systems are knowledge, experience and inferential reasoning based. Artificial intelligence stems are like books and other intellectual worksand they have information whenever they are written and they could produce something new after preparation. Intelligence systems have increase expert capabilities and they never constitute their position. These systems lack common sense. Artificial intelligence is divided into secondary scopes and it tries to establish systems and methods in imitative way as intelligent systems and decision making logic. The three branches of artificial intelligence are: experts system, robots and natural language processing, NLP.

Empowerment capabilities: Knowledge management: Peter Darker emphasizes on the organization knowledge by this point that other economic resources (production tool) are capital, natural resources and work force but the economic resource knowledge is fundamental. This knowledge is asset of an organization that empowers organization to achieve significant competitive benefits. Organizational knowledge is intangible competitive resource that it is in depth of organization since the competitors could not imitate this trend. This intellectual capital is accumulated gradually in the organization. There is considerable difference between implicit and explicit knowledge, implicit knowledge even could not be compiled by experts and it is transferrable and long lasting process. Ramprased defines knowledge as follows¹⁵.

$k = f(I.C.S)$ Knowledge = function (information, culture and skills)

Table -1

Dimensions and components of knowledge-based expert system²

Type features	components
Storage and knowledge creation	being permanent expertise - stability - to maintain and create new knowledge
Distribution and transfer of knowledge	the transfer of expertise with computers - rather than knowledge of data processing - stop
The ability of an issue	the ability to work with incomplete information
reduce costs and work in hazardous environments	reducing costs - increased productivity - providing competition- Increased speed and accuracy - being innocent of human error

Strategic decision making: Although decision making for identification of the goal or strategy is main step in achieving goals but decision is the selection of the decision makers in order to reach to the goal. Occupational decisions are those decisions that are adopted in the process of implementation of a project by the defined goal. Every plan is conducted by decision making. For optimal decision making in concurrent and succeeding form the decision making involves compilation of the strategies, goals and measuring expected results, identification and classification of problems, identification and offering solutions, assessment of the strategies and selection and implementation of the plans and decisions and control and evaluation. The results should be compared with obtained results (goals) in order to conduct required actions².

Strategies: Knowledge is infrastructure of learning and dynamic organizations. Knowledge is organization asset and that the studied organization rank is shaped by establishing this asset in appropriate cycle. The knowledge data base of expert system manages saving, distribution and creation of knowledge in order to extract knowledge in minds of the experts and form a source for achieving strategic goals. It is expected that decision making is made for different levels managers by management strategic. The expert system smart terminals provides capabilities for appropriate and rapid decision making by using two knowledge data base and research motor.

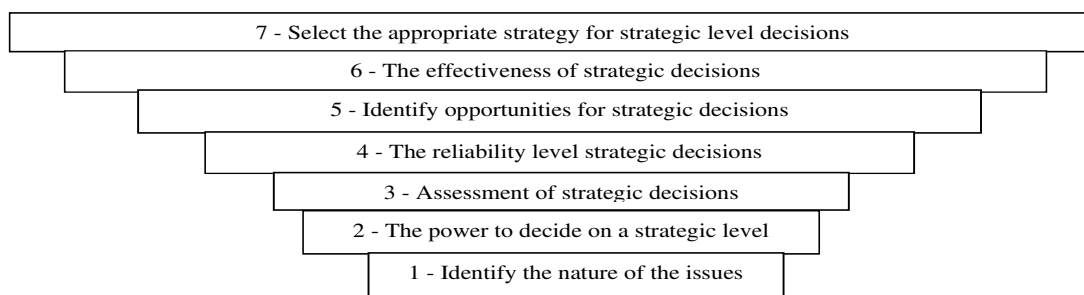


Figure-2

Structure Interaction strategic level of management decisions based on expert system capabilities

Review of Literature

By development of artificial intelligence by the aim of simulation of human characteristics by a computer system, the ad hoc system was introduced as system used in decision making in late 1990. Different researches have been conducted on fuzzy ad hoc systems and artificial intelligence: Stella and Choks in an article by the title of ad hoc systems alternative for educational development in Nigeria showed the important role of ad hoc systems in facilitation of learning and education¹⁶. Hakim Pour and et al in article of “practical application of neural networks in management” discovered effective solution and tools for neural networks in management that artificial neural network are fundamental element in business¹⁷. Magni et al in article by the title of “an alternative method for evaluation of the firms by using fuzzy and fuzzy logic” used IF-THEN¹⁸. Baluei et al analyzed capabilities of fuzzy package by using confidence level as new method¹⁹. Masterlo and et al medeled the real fuzzy ad hoc system¹⁰. Bafandeh in article by the title of “offering a fuzzy ad hoc system for designing organizational structure” offered five stages model based on fuzzy mathematics for determination of optimal organizational structure that a fuzzy system is introduced in first stage by four organizational conceptual aspects as inputs and different organizational forms as output introduced by Mentezburge. In the second step the inputs and outputs are converted into fuzzy numbers. The inference engine laws are determined in third step .In the fourth step fuzzy is eliminated and finally the model is tested in step five⁶. Tagi zadeh and Solutani in article of evaluation of learning level of an organization by fuzzy system evaluated level of learning Tabriz Islamic Azad University. The results showed that the score of learning in university by membership grade of 0.996 is fair²⁰. Zavareh and Kochaki zadeh in article by the title of introduction on ad hoc system and its application” introduced an ad hoc system and its role as the system for helping elites and decision makers in future that it is considered as a counseling system in decision-making⁴.

Methodology

The primary goal of a research can be considered as determination of the expert systems and artificial intelligence

that shape expert systems capabilities by strategic decisions nature and effect on other decisions .The research method is survey and applied in this research. The population of the research involves chief mangers of the central organization and firms related to the studied organization about 68 mangers. Twenty eight mangers worked in the research center, fifteen persons worked in the organization and twenty five persons worked in the dependent firms. Although this research is applied but the correlation method was employed and the data were collected by the questionnaire. The questioners were distributed among experts for measurement of validity experimentally and then they were reviewed by the academicians .In order to measure reliability of the questionnaire, Cronbach alpha was used and alpha coefficient of %95 resulted from SPSS indicates high reliability.

Analytical Model: This research explains the effect of expert systems empowerment on the studied organization strategic decisions objectively and operationally and it investigates the relationship between variables of application of knowledge based expert system and artificial intelligence (independent variable) and empowerment of strategic decisions show as figure 3.

Research Hypotheses: The main hypothesis: Application of expert systems and artificial intelligence is useful in empowerment of the organization strategic decisions.

Secondary hypotheses: H₁:Application of knowledge based expert systems influences on organization strategic levels decision making power. H₂:Application of knowledge based expert systems influences on organization strategic levels decision making evaluation. H₃:Application of knowledge based expert systems influences on organization strategic levels decision making validity. H₄:Application of knowledge based expert systems influences on organization strategic levels opportunities identification. H₅:Application of knowledge based expert systems influences on organization strategic levels decision making efficiency. H₆:Application of knowledge based expert systems influences on organization strategic levels appropriate strategy selection.

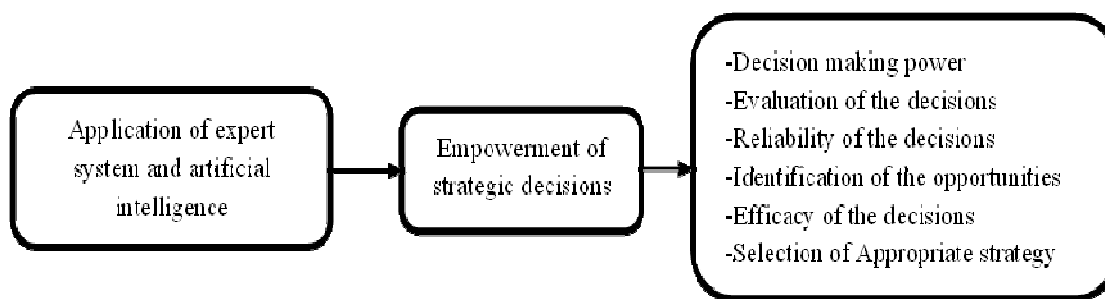


Figure – 3
 Model used in the research

Analysis of Data: The chief managers of the studied organization offered their opinions about different aspects of decision making in the organization. The statistical population involved 68 individuals containing 28 managers of the research center (%41.3), 15 center managers (%22.1) and 25 managers of dependent firms (%36.7). In order to analysis of data, dependent and independent variables colorations coefficient analysis was used and the data were collected by questionnaire and the data were analyzed by SPSS and Excel.

It should be pointed that since the critical value of α is 0.233 and the research hypotheses are confirmed in this level. In comparison between two alpha levels the α has higher overlay relative to 0.05 for subjects.

Test of homogeneity of the data: This test is a simple non parametric method for determination of homogeneity of the experiential data and selected statistical distribution. In this test the conformance test hypothesis and alignment of distribution of observation and theoretical distribution was assumed hypothetical. So, the primary hypothesis of this test indicates uniform distribution of frequency of observations in the hypotheses. The critical value of the statistics and its measured value are shown in the table 2. According to the output of SPSS, the Colomogrove-Smearnov test value is according to table 3. Thus the data homogeneity is not the same in all hypotheses.

The results of this test show that the experts have not offered the same response to statements and hypotheses and they have their technical opinion. This difference indicates natural and balanced distribution in respond to the questions.

Conclusion

Revolution in the organization decision making requires to considerable shift in tendency toward knowledge management and its different dimensions in the organization and utilization of the latest technology of support and expert systems. Native knowledge is the foundation of knowledge management in expert system. This knowledge has been shaped by reliance on inferential approaches, logical processes and similarities in manner of thinking and inference to the expert and managers. The output of this system is promotion of strategic decisions accompanied by speed, accuracy and feasibility. When an organization encounters with problems it uses experts for counseling. This expert has own knowledge. Indeed, expert system tries to imitate human specialists. The root of expert systems or knowledge based system backs to artificial intelligence. Artificial intelligence is capable to do computer affairs that these affairs are based on knowledge, accuracy, inference and perception.

Table- 2
Results of hypothesis testing research

Hypothesis	Test	Test Results statistic	Significant	Critical value	Test
First	average	are accepted	5%	1/645	10/803
Second	average	are accepted	5%	1/645	8/374
Third	average	are accepted	5%	1/645	6/698
Fourth	average	are accepted	5%	1/645	5/076
Fifth	average	are accepted	5%	1/645	7/648
Sixth	average	are accepted	5%	1/645	6/720
Seventh	average	are accepted	5%	1/645	6/145

Table-3
Results of Test of homogeneity of the data

Hypothesis	Test statistic	Test Results	Critical value	Test
First	Colomogrove-Smearnov	are accepted	0/486	2/186
Second	Colomogrove-Smearnov	are accepted	0/375	2/202
Third	Colomogrove-Smearnov	are accepted	0/361	2/260
Fourth	Colomogrove-Smearnov	are accepted	0/486	2/026
Fifth	Colomogrove-Smearnov	are accepted	0/521	2/117
Sixth	Colomogrove-Smearnov	are accepted	0/624	2/338
Seventh	Colomogrove-Smearnov	are accepted	0/624	2/121

References

1. Ward J. and Peppard Y., Strategic Planning for Information Systems, London: John Wiley & Sons Ltd. (2002)
2. Hamidi Zadeh M., Jafari M., Behjati M., *Strategic Management Studies*, **1(5)**, 45-27(2010)
3. Davis S., David C. Yen., the information system consultant's handbook: System analysis and design, **5(11)** 7001-8493 (1998)
4. Zavareh A. and Kuchaki A., Introduction to expert systems and applications, new approaches to regional conference on Computer Engineering and Information Technology, ROUDSAR (2011)
5. Elahi S. and Rajab Zadeh A., Expert systems, intelligent decision-making model, Frist Printing, Tehran, Publications Printing Co., publisher of Business (2006)
6. Bafandeh zendeh A., developed a fuzzy expert system for design of the organizational structure, *Space Management*, **13(3)**, 41-46 (2009)
7. Sageb Tehrani, M., Tadayon, shabnam., Information Technology Management, Tehran, kind of publishing, Frist printing, **6(12)** 507-508 (2005)
8. Mishra Aswini Kumar, G. Sri Harsha, Shivi Anand and NeilRajesh Dhruva, Analyzing Soundness in Indian Banking: ACAMEL Approach, *Research Journal of Recent Sciences*, **1(3)**, 9-14 (2012)
9. Hosseini, A., pass on Expert Systems, Network Magazine, December (2006)
10. Aggarwal Vijender, Aggarwal Rachna and Khanna Parul, Micro Finance and Risk Management for Poor in India, *Research Journal of Recent Sciences*, **1(2)**, 104-107 (2012)
11. Droudi Homa and Dindar Farkoosh Firouz, An Investigationon the Relation between Human Resources Management and Organizational Developments, *Research Journal of Recent Sciences*, **2(2)**, 50-53 (2013)
12. Yasir Arafat Elahi and Mishra Apoorva, A detail study onLength of Service and Role Stress of Banking Sector inLucknow Region, *Research Journal of Recent Sciences*, **1(5)**,15-18 (2012)
13. Mastrobeo G., facchinetti G.,magni G.A., A proposal for modeling real option through fазzy expert system, management perspective, *Journal of Product & Brand Management*,**3(4)**1472-964(2011)
14. Kelley, D., Loyman, S., "Introduction to Rabaties," New Jersey(1986)
15. Radieng, A.," Knowledge management, translated by Mohammad Hossein Latifi, first published, Tehran, the publisher (2004)
16. Stella, N., Chuks, A., Expert System: A Catalyst in Educational Development in Nigeria, Proceedings of the 1st International Technology, Education and Environment Conference (c) *African Society for Scientific Research (ASSR)* (2008)
17. Hakim poor, H., Huam Hon Tat, N., Rahmandoust, M., Artificial Neural Networks' Applications in Management, *World Applied Sciences Journal*, **14(7)** 1008-1019, ISSN 1818-495(2011)
18. Magni, C., Malagoli, St., Mastroleo, G., an alternative approach to firms' evaluation: expert systems and fuzzy logic, Electronic version of an article published as, *International Journal of Information Technology*,**1(5)** 195-225(2006)
19. Baloui Jamkhaneh, E., Nozari, A., Nadi Ghara, A., Analyzing Fuzzy System Reliability Using Confidence Interval, *World Applied Sciences Journal*,**10 (13)**, 2191-2197(2011)
20. Taghizadeh H., Soltani Fesandig, G., Assessment of the learners using fuzzy expert system, *Journal of Management Tomorrow*, (2010)