

# Professional Practices: Use of Expert System in Providing Consulting Services

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## ABSTRACT

In the past, consultancy was limited to human experts and once the expert dies or disappears all the expertise they have vanishes as well. With today's high technology, IT has been involved in all life's aspects, which made life easy and fast. This paper discusses how IT can increase the effectiveness of giving an expert advice within a particular field. It shows how IT expert systems become as alternative of human experts providing high quality and accurate information to achieve maximum potentials.

**Index Terms**— *consultant, expert system, knowledge base, Expert-consulting systems, artificial intelligence*

## 1. INTRODUCTION

Artificial intelligence started to appear before a long time with legends and stories that spread in that time. Within the 40s and 50s a few scientists from different fields started to search whether artificial Intelligence is possible to happen or not [1]. AI usually relies on group of hypothesizes that operate in a human intellect which will be mechanized [2]. Generally it refers to computer programs that considered as intelligent for the reason of human brain simulation includes learning, reasoning and self-correction. It uses sort of rules and information to reach certain conclusions. One of the most popular applications of the AI is expert system [3].

Expert system is computerized based, which imitates the human behaviors particularly expert knowledge and experience in a specific domain. It includes set of rules that perform solutions for problems faced in the related domains such as diagnostic and medical applications, financial planning decisions, computer configurations, chess games etc [4]. Expert system distinguishes from other traditional systems is that it investigates methods and techniques for constructing man-machine systems with specific problem-solving expertise [5]. It can combine various experiences from several experts in a specific domain to introduce better and optimum solutions.

Regarding to consultancy an expert system may perform as a human consultant if it covers various aspects of the same domain. It can be trained to analyze and advice the user giving him best possible choices to be applied.

## 2. LITERATURE REVIEW

Early in the 80s, Buckner and Juell state that expert system can be used to provide information to wide range of people with limited number of consultants. They proposed an expert system as a solution to the shortage issues in faculty, staff, and students user services at North Dakota State University (NDSU). The system offers consulting

assistance in making personal computer buying decisions and in computer hardware configuration [13].

According to Nunamaker, Konsynskit, Chen, Vinze, Chen & Heltne, an Information Center Expert system (ICE) have been developed to provide knowledge-based support for Information Centers (ICs). The system has been applied in three different ICs. The ICE system has three sections: consultation, distribution, and help-Service, i.e., ICE/C, ICE/D, and ICE/H, for the three areas of the information centers. ICE/C built by knowledge from multiple experts system that provides the users with consultation to assist them with the operation of software selection [14].

Moreover, Johnson and Wehrs suggested in their article "Consulting Without Consultant: Expert System Application in User Services", an expert systems solution in providing consulting services at Academic Computing Services (ACS) at University of Wisconsin. The system called: the Shareware Consulting System SCSI, which helps users in determining and their shareware needs [15].

With the power of modern ICT, medical information became more obtainable to people. A knowledge sharing system has been developed to allow any person to get a medical consultant from more than one medical professional opinion. The system is two-module web application based on Internet, one for PDAs and the other for PCs. The application helps users to get answers for their medical issues either by gathering valuable knowledge through searching the archive, or by choosing an expert to sent the questions to [16].

KISAN is rule-based expert system in agriculture field for soil nutrients management. The system gives consultation by discovering the deficiency or excess of nutrients in the soil and then counsels the name of convenient fertilizer taking into consideration some chemical characteristics of the soil [17].

According to Nopparatkiat, Nagara & Chansa-ngavej, a rule-

based expert system has been developed for skin issue consulting in the zone of acne, wrinkle, freckle, melasma and uneven skin tone, with bespoke therapies from Thai traditional medicine background. The system gives treatment consultation based on 416 rules from primary and secondary sources Thai traditional medicine knowledge [18].

Financial Management Consultation Expert System with Constraint Satisfaction and Knowledge Refinement is an expert system that evaluates a company financial health condition. The system integrates various kinds of expertise and enterprise management policies represented by knowledge production rules for financial management consultation [19].

### WHAT IS A CONSULTANT?

A consultant is an expert that has a wide knowledge of a subject matter, who offers a professional advises to solve a specific issue in a particular field such as management, security, law, finance, human resources, etc. Consultant is a problem solver that a company usually demands when it does not have the inside house employees with the required expertise to solve the problem [10] [11].

To become a consultant special characteristics and responsibilities a person should meet. Consultant should bring the following to the table: clarity and perspective, recognition and expertise, knowledge networking, confirmation, know when to say "no." [10].

Consultants help companies that hire them to achieve its goals through: Consulting, advising, and designing programs to fill the gaps between the actual situation and the desired one. Developing management and supervisory skills and know-how. Defining the company's mission, goals, and objectives. Coaching, guiding, training (different levels). Assessing the actual situation. Improving work performance. Identifying training and operational needs. Improving organizational communications. Enlarging the company's customer base and market segment. Achieving Customer satisfaction and customer loyalty. Increasing employee motivation. Raising the levels of organizational performance and achievements [12].

### EXPERT SYSTEM COMPONENTS

Expert system structure has different components interact together to provide best possible solutions for users. It consists of three levels, which are user level, engine level and storage level. Generally the user level is the nearest one to the user, the user gives the system some facts about a problem may face in a specific domain using a graphical user interface and then at the end through the same interface, the user takes results, which are advices and solution.

Engine level is the core of the system using reasoning engine,

which derives recommendations needed. It diagnoses questions asked by users and search for suitable solutions. It is either rule based, case based reasoning or other methods such as neural networks, genetic algorithms, and data mining. Reasoning engine is also connected with the storage level as a reference to it.

Storage level consists of knowledge base for storing rules, analyzed cases and objects of a domain expert expertise and database for storing the facts of the domain problems. Knowledge base usually stored IF-THEN rules to solve the problems according to a specific expertise of either an individual expert or multiple experts.

Moreover, there are four actors involved in the system, users who consult the system in a specific domain, system & knowledge engineers who develop and translate expertise into a system and domain expert or group of domain experts who currently are experts and consultants solving the problems that the system is intended to solve [6]. Figure one illustrates the expert system structure.

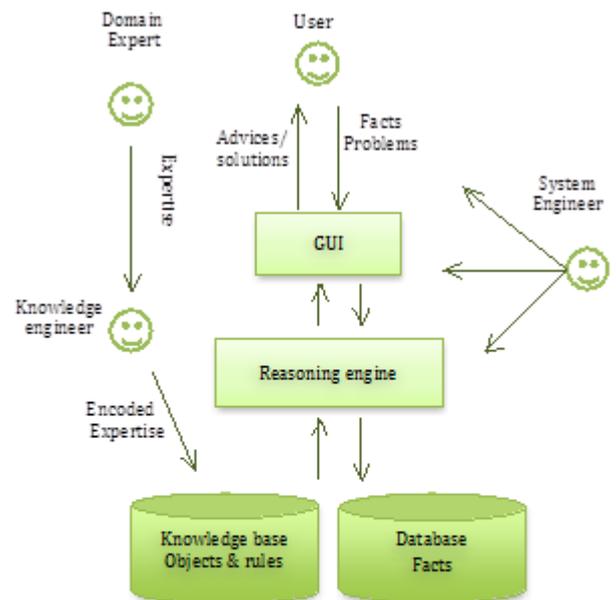


Fig (1): Expert system structure

### EXPERT SYSTEM CHARACTERISTICS / FEATURES

Successful expert systems will be those that combine facts and heuristics and thus merge human knowledge with computer power in solving problems [7]. To be effective, an expert system must focus on a particular problem domain.



The features, which commonly exist in expert systems, are:

- a) Goal driven reasoning or backward chaining
  - An inference technique, which uses rules to repetitively break a goal into smaller sub-goals, which are easier to prove.
- b) Coping with uncertainty
  - The ability of the system to reason with rules and data, which are not precisely known.
- c) Data driven reasoning or forward chaining
  - An inference technique which uses rules to deduce a problem solution from initial data.
- d) Data representation
  - The way in which the problem specific data in the system is stored and accessed.
- e) User interface explanations
  - That portion of the code, which creates an easy to use system, and the ability of the system to explain the reasoning process that it used to reach a recommendation.

### Benefits Of Expert System

There are many benefits of using expert system in different field.

- a) Increase the probability, frequency, and consistency of making good decision.
- b) Help distribute human expertise.
- c) Facilitate real time, low cost expert level decisions by the non-expert.
- d) Enhance the utilization of most of the available data.
- e) Permit objectivity by weighing evidence without bias and without regard for the user's personal and emotional reactions.
- f) Permit dynamism through modularity of structure.
- g) Free up the mind and the time of the human expert to enable him or her concentrate on more creative activities.
- h) Encourage investigations into the subtle areas of a problem.

### CASE STUDY: INVEX (INVESTMENT ADVISORY)

INVEX is one of an expert system in the field of investment management advisory. Capital investment deciding which product or business to support is a very important business issue because it is largely irreversible, usually involves long-

term decisions and affects the nature and the structure of the business [9].

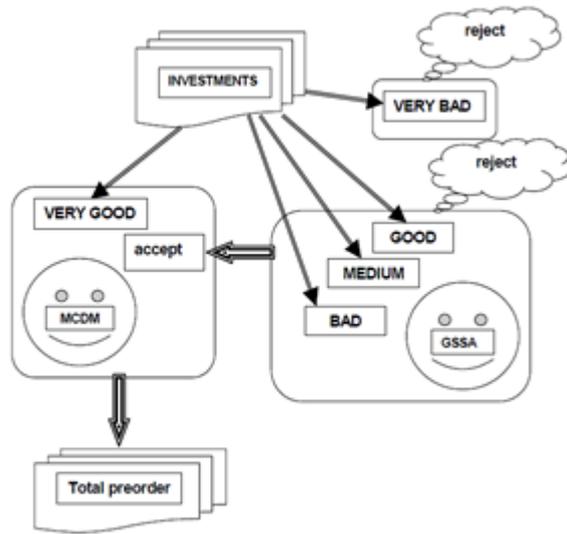
The INVEX expert system will help the project analyst and investment decision-maker to determine whether a project is acceptable or not. Whether it is the best alternative and can calculate the extent of the decision sensitivity to certain critical assumptions.

During a consultation, firstly INVEX will ask about a customer's preferences and intentions. After that it builds up a customer profile where the information asked from customers depends heavily on their intentions and the course of the consultation. These preference and intentions are translated using production rules into the weights assigned to the different objectives in the multi-criteria analysis knowledge source [9]. INVEX is fed with data through the spreadsheet.

INVEX performs the next steps when all the input data are ready. It will divide the investments into five groups according to the values of parameters. Investments from the group VERY GOOD are accepted for the multi-criteria decision-making (MCDM), while investments from the group VERY BAD are rejected [9]. A group-specific sensitivity analysis (GSSA) is performed for the investments from the group GOOD, MEDIUM and BAD, and then a user is asked whether to accept or reject each of these investments. The first step decreases the number of investments that will take part in MCDM, by rejecting the bad choices [9]. If specified, a risk analysis is performed on the accepted investments. The MCDM gives the optimal combination of investments for the given resources. Total preorder used in MCDM gives the best investments from the set of accepted investments [9]. In the cases when have only BAD and VERY BAD investments, the optimal combination would include the investments that may not be acceptable for the investor if the first step is skipped although they are the best in this case.

INVEX assumes that the user will definitely accept the investments from the group VERY GOOD and reject the investment from the group VERY BAD [9]. For the investment from group GOOD, MEDIUM and BAD, the system performs a group-specific sensitivity analysis which gives some additional information that can help the users to make up their minds. If the total preorder is used, it is not possible to give any additional information to the users that can help them to decide whether to accept or reject a particular investment.

Another perspective on investment decision-making relates to the issue of future uncertainty and its consequences for planning and decision-making [9]. High returns are often associated with high risks. A major role of INVEX is to aid managers in assessing various future alternatives and the levels of risk and return associates between them. A complete knowledge source is dedicated to the risk-bearing attitude [9].



**Figure 2: The division of investments in INVEX**

The decision-making processes will force planners and analysts to assign values to uncertain future consumption and also present investment in terms of present consumption. The process of risk analysis is employed to determine uncertainty in planning future investments and using all resources. The major sources of uncertainty are the demand projections and price, suggesting that major efforts have to be directed towards meaningful forecasting for cost and revenue variables.

In the risk-bearing model built into INVEX, a probability distribution is defined for investment effectiveness given a combination of uncertain variables that affect profits. In order to provide, for instance, net present value probability distribution, subjective probability distributions are first evaluated for the series of broad categories of revenue variables, cost variables, project life, and the cost of capital and so on.

### Privileges of Consulting Without Consultant

It is well known that humans can do many mistakes due to several factors including age, health, attitude and emotions. No doubt that humans are more creative than machines, however computer software are capable of simulating human expert behaviors with less errors and more reliability.

Expert system can also combine multiple expertise in which accessing to multiple human experts and take their expertise to build a software application contains structured techniques that have methodologies for knowledge acquisition. In another words expert system is a wide knowledge base containing several human's knowledge all together. Therefore, knowledge of several consultants is more

beneficial than single consultant.

Moreover, expert-consulting systems are more likely to be inexpensive compared to human experts in which consultants typically charge an hourly rate while consulting systems normally have a fixed price. In short, maximizes expertise and minimizes cost.

Another important notice about expert consulting systems that they are available for more people in a wider range of applications leading to limited number of human consultants. Additionally, user-friendly software development let more people tend to use these applications, which mean that any normal person can be an expert in a minute.

Consulting time constraints is no longer an issue for those who want an urgent consultancy service. To illustrate, expert consulting systems are available on demand once they are needed, no more appointments or arrangements are required. Consultancy service can be accessed any time.

Humans are exposed to many risks including death, mental and physical sickness, and retirements, thus all the knowledge they have is threatened by distinction. Expert consulting systems are ever lasting applications living for almost forever with the ability to update. Regarding the update issue, expert consulting systems are up to date in which any new expertise can be easily added to the knowledge base.

### 3. CONCLUSION

A consultant is an expert that has a wide knowledge of a subject matter, who offers a professional advises to solve a specific issue in a particular field. Expert system is computerized based, which imitates the human behaviors particularly expert knowledge and experience in a specific domain. It includes set of rules that perform solutions for problems faced in the related domains. Expert-consulting systems save time, save cost, available, offer multiple expertise, usability, updatable and ever lasting. Although the advantages of expert systems, there are still some limitations faced when they use them.

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