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Critical evaluation of vital role of human beings and computer systems in decision making process

R. Gurunath,

Research Scholar, Dr. MGR Educational & Research Institute, Dr. MGR University,
Chennai – 600 095, India

Dr. K.R. Anil Kumar

Dept. of MCA, Dayananda Sagar College of Management & Information Technology,
Bangalore - 560 078, India

Dr. S.K. Srivatsa

Senior Professor, St. Joseph's College of Engineering, Chennai, India.

Abstract: In nature and humans lives, decisions are the result of complex interactions between many factors. It is usually difficult to determine the weightage of different factors in making a final decision. This paper evaluates the manual decision making and computerized decision making systems not as a comparative study. However, it is done as a study for highlighting its suitable strengths in various situations and circumstances, since both the methods are not suitable in every situation and circumstances. The various levels of decisions, a few techniques of decision making, problem analysis v/s. decision making have also been discussed in detail along with the principle elements of decision making. The authors of the paper have evaluated the possible characteristics of human decision making process. The authors feel that along with many existing criteria, another important criterion known as past experiences plays a very vital role in decision making process. The past experiences of a human being will be considered in human decisions, has also to be incorporated in the computer system, as a artificial intelligence system. It is a great challenge in front of us. When this is achieved to a considerable extent, the computers can take wiser decisions.

Index Terms: Computerized decision making, T-chart idea, Buriden's Ass, Decision Matrix, GIS, Expert systems.

I. INTRODUCTION

A decision is the process of making the choice between two or more available alternatives. It is the process of choosing the best alternative to achieve the desired objectives. Decisions are made to achieve goals through suitable follow-up actions. It is a process by which a decision is taken. The decision means, course of action. Decision-making lies embedded in the process of management.

II. VARIOUS LEVELS OF DECISION

Some decisions are of higher importance than other decisions. Decisions also have priorities and significance. Depending on its significance and priority, resources need to be spent on that can be decided. In this directions, there are three levels decisions are considered. They are as follows:

1. Strategic. Strategic decisions are taken at the highest level. This type is concerned about general direction, long term goals, philosophies and values. These decisions are the least structured and most imaginative; they are the most risky and of the most uncertain outcome, partly because they reach so far into the future and partly because they are of such importance. Eg. The decision to be taken about the field to select in higher studies after graduation is called as strategic decision. Another example can be diversification of existing business set up by making additional investments. Generally, these types of decisions will be taken by the owner, partners, top level management people such as managing director of an organization [8].

2. Tactical. Tactical decisions support strategic decisions tend to be medium range, medium significance, with moderate consequences. For example: When a person wants to become a pilot, the tactical decision include which flying training school has to be selected and which course in that college has to be selected to become a successful pilot. When a manufacturer has to take a tactical decision to reduce the price of his product over the competitors, he has to decide what method has to be adopted to reduce his manufacturing cost, by introducing latest technology to reduce his production cost. Normally, the middle level management takes these types of decisions.



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3. Operational. These are every day decisions, used to support tactical decisions. They are often made with little thought and are structured. Their impact is immediate, short term, short range, and usually low cost. The consequences of a bad operational decision will be minimal, although a series of bad or sloppy operational decisions can cause harm. Operational decisions can be preprogrammed, pre-made, or set out clearly in policy manuals. Generally, these decisions are taken by the people who implement the strategic decisions taken by the management.

If the tactical decision is to purchase some furniture, the operational decision involves where to purchase the furniture. One can have his own idea and policies for purchasing furniture at one or two particular shops. It means the structured operational decision, to purchase furniture is “when furniture is needed, go to Big bazaar or Family mart”.

The problems should be examined and decisions should be made at all of these levels. When all the strategic decisions are implemented properly at the tactical and operational levels, then the positive and negative aspects of the strategic decision will be reflected in the organisation.

III. A FEW TECHNIQUES IN MAKING DECISION

There are a few easy and practical techniques which can be applied to decisions such as simple or complex. They share the assumption that circumspect analysis is the key to making good decisions. Many decisions are made with too little information and too little thought, in a non-deliberate way. The first three techniques are especially for whether-type decisions, those involving yes/no, either/or, or two-possibility decisions.

1. T-Chart: T-Chart is an orderly, graphic representation of alternative features or points involved in a decision. In one form, it can be a list of positive and negative attributes surrounding a particular choice. Drawing up such a chart ensures that both the positive and negative aspects of each direction or decision will be taken into account.

2. PMI: T-Chart idea can be broken down into a three part structure, known as PMI. PMI refers to plus, minus, and interesting, (Edward de Bono). The plus or good points of the ideas have to be listed first and then all the minus or bad points and finally, all the interesting points, consequences, areas of curiosity or uncertainty or points which simply not to be cared at that situation, have to be listed.

Most people believe they list the pluses and minuses of a decision before making it, but in actual practice, many people make a decision or form an opinion before they consider the evidence in an orderly way

3. Buriden's Ass. This method of decision making is used when two or more equally attractive alternatives are faced. The method is to list all the negative points or drawbacks about each decision. When two or more alternatives seem very desirable, it is difficult to identify any drawbacks. The Buriden's Ass method focuses on the drawbacks.

For example, if a choice has to be between two alternatives whether to buy a flat or an independent house, it seems both are attractive alternatives. It is very difficult to decide to which one must be purchased. In this situation, one can use the Buriden's Ass method to decide between the two equally attractive alternatives. The drawbacks of the flat are people may not feel privacy, may be disturbed by the decision taken by the flat owners' association and so on.

The drawbacks of the independent house are lack of security, no co-operative way of getting things done for the house as is in flat and so on.

4. Measured Criteria. With this technique, one has to list the criteria he wants his decision to meet and assign points to each criterion based on its relative importance in the decision. Then, each alternative is given a certain number of points according to how fully it meets the criterion. For points he can use a scale of 1 to 100.

For example, when the comfortability of the journey is rated between three alternative journey modes such as car, bus and train, the train journey rated 90 out of 100, car journey rated 75 out of 100 and bus journey rated 60 out of 100. After all the alternatives have been assigned their due points for each criterion, all the points for each alternative are added the alternative with highest points is the one is likely to be chosen.

5. Decision Matrix or Weighted Decision Table. This is a slightly more sophisticated version of the measured criteria technique. Here a table is set up with each criterion given a weight depending on its importance in the decision and with each alternative given a ranking for that criterion [1].



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For example, suppose one wants to decide on which class to take next semester and he/she has the alternatives as shown in Table 1.

The various subjects have been provided for selection. In Table 1, the abbreviations used are as NS-Network security, AFM-Accounting & Financial Management, JAVA-Java programming, HRM-Human Resources Management.

TABLE 1: Specialized subjects and criteria for selection

Criteria	Points	NS	AFM	JAVA	HRM
Simple to learn	20	18	16	19	18
More opportunities	20	17	19	16	13
Previous knowledge	20	17	20	10	16
Best coaching availability	20	19	18	16	13
High marks scoring Opportunity	20	19	19	16	17
Total	100	90	92	77	77

The values in the decision matrix table are the ranks given by a student to select a particular subject among various available alternatives. The decision matrix has the alternative subjects available to students are shown across the top. In the criteria column of the Table 1, the various criteria to select a subject by the student have been given. Weightage for each criterion is given in the Points column of the same table. In this matrix, the student select AFM subject as it is having the highest score [9].

IV. LIMITATIONS IN HUMAN MEMORY

Human memory is considered to be one of the greatest gifts of god. When we want to remember things and sometimes considered to be highly disadvantageous in certain situations and in certain matters. Many things man has to forget since many things make a man sorrow if he always continues to remember. The unfavourable information must be forgotten by humans to lead his remaining part of life happily. However, memory plays a vital role in making any decision by him. Psychologists make a distinction between short-term and long term memory. Short term memory can also be called as working memory holds the information that is the focus of our attention, holds this information by rehearsal and is the workspace where ideas and concepts are registered, transformed and manipulated. The most important feature of this memory is that it has limited capacity for processing and storing information that leads to various issues and problems. The long term memory (LTM) retains large quantities of information over relatively long periods of time. There are some key limitations in long term memory that are particularly critical for decision making [4].

There is strong evidence that human memory works by association and reconstruction rather than simple recall. However, they may not use all the associations nor in the same order, so their memories are often distorted (Hogarth, 1980; Klein and Methlie, 1995). When they retrieve a memory, aspects of the current context is often incorporated into that memory thereby changing it further.

When particular memories are accessed, related memories become temporarily more accessible increasing the chances that they will also be recalled, so biasing the retrieval of decision relevant information. However, computers can acquire and hold more information about a particular decision domain than most experts. It recalls precisely what they store in data their format. Hence, the computers have been used extensively to provide decision relevant information in the form of different types of information systems.

It has been demonstrated that the people were severely limited in processing of information at any given particular point of time, (Miller, 1956). It has been reiterated that the processing limitation mean that people were unable to carry out the mental operations necessary to make decision, (Simon, 1960). According to his suggestions, people adopt a simpler strategy, satisfying, which involves choosing the first alternative that is acceptable rather than the best. Given that limited capacity processing is seen as a primary constraint some have argued that computers should be used to support decision making, since they can provide the extra computational power needed to retain all the information about every available alternative and to undertake the



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complex calculations that underpin the rational model. Over the last 30 years there has been a raft of computer decision support systems designed to help decision makers overcome these limitations, (French et al 2009).

There are a lot of uses a variety of computer based techniques for delivering information to decision makers. The decision makers exist in the flow of time from past to present and present to future with the past setting the context for their current decisions; making decisions and solving problems in the present; and planning and developing strategies for what they think will happen in the future, French et al (2009). These three functions correspond loosely to three different types of information system: Databases that hold historical data and it can be queried and analyzed in a variety of ways. Knowledge Management Systems (KMS) can deploy what has been learnt from the past to address the problems of the present. Decision Support Systems (DSS) helps DMs anticipate and shape the future.

V. FACTORS AFFECTING DECISIONS BY HUMAN

A. Limited memory: As discussed in previous section, the human memory is limited capacity. He can not remember things beyond his capacity. There are certain situations when decision has to be taken by considering huge volumes of data such as weather forecasting. To forecast whether condition, large volumes of data has to be processed and in this situation, computers plays an important role. Computers can be better option in this situation [10].

B. Limited processing ability: Although it has been already discussed in the previous section of this paper, that the capacity of human brain in terms of processing the data, is limited, there are few exceptional cases where it has been observed that the processing speed of the human brain is much faster than the computer systems. To name a few, Shakuntala devi of India has a huge processing power in her brain. In 1977, in Dallas, she competed with a computer by giving the cube root of 188138517 and she succeeded.

In university of USA, she was asked to give the 23rd root of a 202 digit number. The answer was given by her in 50 seconds and it took 10 seconds more for a UNIVAC 1108 computer. However, this processing speed in human brain can not be seen in majority of the human brain.

C. Limited knowledge: When a decision has to be taken by a person who is not having proper and sufficient knowledge about the matter in which he has to take the decision, he can not take a sensible decision. For example, a person who do not have proper knowledge of cricket game, wants to select Indian cricket team players, he can not make a successful team because of his limited knowledge.

D. Lack of sufficient experiences: A decision maker must have sufficient experience in the mater which he is taking decision. Experience plays an important role in taking wise decisions. Experienced man with his past experiences can definitely take comparatively better decisions.

E. Lack of maturity: An immature individual can not take proper decision since he is not matured enough to do that.

F. Lack of sense of belongingness: When a decision has to be taken on certain matter, a person who is taking the decision must feel that it personally belongs to him. Unless he feels that belongingness, he can not exercise his fullest effort in taking proper decision.

G. Unhappiness about the situation: When a decision make is not happy with the situation for which he has to take the decision, his decision may not be wise [3].

H. Motivation: When a decision make is motivated, he takes personal interest in taking the decision by considering various positive factors related to the matter.

I. Pressure from other sources: Sometimes people are obligatory to others due to various reasons. In this situation, the decision maker may not have sufficient freedom to take his own decision. He may be forced to take certain decisions which he also feels not proper. However, he will be the victim of the circumstance at that instance of time.

V. QUALITY IN DECISION MAKING

When a proper and useful decision has to be made by minimizing the adverse affects of the decision, the decision has to be taken very carefully and judiciously.



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When a judge has to give a judgment, judge will verify all relative documents produced to that case. At this point of time, judge may decide about the fate of the case. Even though the case may show reverse of the first opinion of the judge, he may stick to the first opinion, since he is emotionally committed to his first opinion and will very often proceed to look for arguments and facts that support this opinion rather than listen thoughtfully to the facts and decide the case on its merits.

VI. PLANNING & DECISION MAKING - RELATIONSHIP

There is close relationship between planning and decision-making. Decision-making has priority over planning function. It is the starting point of the whole management process. Decision-making is a particular type of planning which involves commitment to resources for achieving specific objective. It is the top management which is responsible for all strategic decisions such as the objectives of the business, capital expenditure decisions as well as operating decisions such as training of manpower and so on. Actions can not be taken without the decision of the management. When decisions can not be taken, the resources can not be utilized to the optimum extent and it becomes unproductive. The managerial decisions should be correct to the maximum extent possible. For this, scientific decision-making is essential.

VII. PROBLEM ANALYSIS & DECISION MAKING

It is important to differentiate between problem analysis and decision making. The concepts are completely separate from one another. Traditionally it is argued that problem analysis must be done first, so that the information gathered in that process may be used towards decision making.

A. Problem analysis

Nature of problem determines the approach to decision making to be followed to solve it. There are three broad categories.

Structured: Well-structured problems are constrained problems with convergent solutions that engage the application of a limited number of rules and principles within well-defined parameters. For eg. Mr. A is a soldier and he has to wake at 6 in the morning when army bugle is played or blown. This procedure will be followed no matter what.

Unstructured: Problems possess multiple solutions, solution paths, fewer parameters which are less manipulable, and contain uncertainty about which concepts, rules, and principles are necessary for the solution or how they are organized and which solution is best. For eg. Mr. A thinks that he has to wake up at any time in the morning,

Semi-structured \rightarrow a gray area lies between the structured and unstructured range. Here part of the decision can be specified allowing for certain factors out of control. For eg. waking up is subject to a clock alarm (procedure), but it can be turned off as waking up at that time is also subject to some sort of individual judgment.

The performances have to be analyzed as to what should be the result against actual. The problem must be precisely identified and described. The problems are caused by various features. The causes of problems have to be deleted from the changes found in analyzing the problem. The cause which is most likely is one which exactly explains the facts totally.

B. Decision making

Objectives must first be established and they must be classified and placed in order of importance. Alternative actions must be developed. The developed alternatives must be evaluated against all the objectives. The alternative that is able to achieve all the objectives is the most suitable one which is useful and it may be the tentative decision. This tentative decision has to be evaluated for all predictable possible consequences. The decisive actions are taken and additional actions are taken to prevent any adverse consequences from becoming problems and starting both problem analysis and decision making. There are steps that are generally followed that result in a decision model that can be used to determine an optimal production plan.

C. Decision planning

Making a decision without planning is fairly common. However, does not often end up in a favorable way. Planning allows for decisions to be made comfortably and in a smart way. Planning makes decision making very simple. The decision taken will have four benefits if it is taken with planning. They are:



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1. Independent goals can be established with planning. When planning is made, there will be many choices to take decision.
2. Planning provides a standard of measurement. It is a measurement to check oneself whether is going towards the goal or not.
3. Planning converts values to action. When more number of thoughts is given towards the problem, carefully with planning, it will help converting the plans in to reality.
4. Planning allows to commit carefully since the resources are limited. The resources here many be money, time etc. With the available resources only, the commitment can be made with proper planning, to achieve the objectives.

There are four decision making stages (B. Aubrey Fisher) that should be involved in all group decision making. These stages are important for the decision making process to begin:

Orientation stage – This phase is where members meet for the first time and start to get to know each other.

Conflict stage – Once group members become familiar with each other, disputes, little fights and arguments occur. Group members eventually work it out.

Emergence stage – The group begins to clear up vague opinions by talking about them.

Reinforcement stage – Members finally make a decision, while justifying themselves that it was the right decision.

It is said that critical norms in a group improves the quality of decisions, while the majority of opinions (called consensus norms) do not. This is due to collaboration between one another, and when group members get used to, and familiar with, each other, they will tend to argue and create more of a dispute to agree upon one decision. This does not mean that all group members fully agree — they may not want argue further just to be liked by other group members or to "fit in".

VIII. DECISION MAKING STEPS

Each step in the decision making process may include social, cognitive and cultural obstacles to successfully negotiating dilemmas. It has been suggested that becoming more aware of these obstacles allows one to better anticipate and overcome them. The Arkansas Program presents eight stages of moral decision making based on the work of James Rest:

1. Establishing community: creating and nurturing the relationships, norms, and procedures that will influence how problems are understood and communicated. This stage takes place prior to and during a moral dilemma.
2. Perception: recognizing that a problem exists.
3. Interpretation: identifying competing explanations for the problem, and evaluating the drivers behind those interpretations
4. Judgment: sifting through various possible actions or responses and determining which is more justifiable
5. Motivation: examining the competing commitments which may distract from a more moral course of action and then prioritizing and committing to moral values over other personal, institutional or social values
6. Action: following through with action that supports the more justified decision. Integrity is supported by the ability to overcome distractions and obstacles, developing implementing skills, and ego strength
7. Reflection in action
8. Reflection on action

The decision making can also be done making the following seven steps [2]:

1. Outline your goal and outcome.
2. Gather data.
3. Develop alternatives (i.e., brainstorming)
4. List pros and cons of each alternative.

5. Make the decision.
6. Immediately take action to implement it.
7. Learn from and reflect on the decision.

The characteristics of human decision making are information, representation, visualization, communication, reasoning, intuition [6] and past experiences as shown Figure 1.

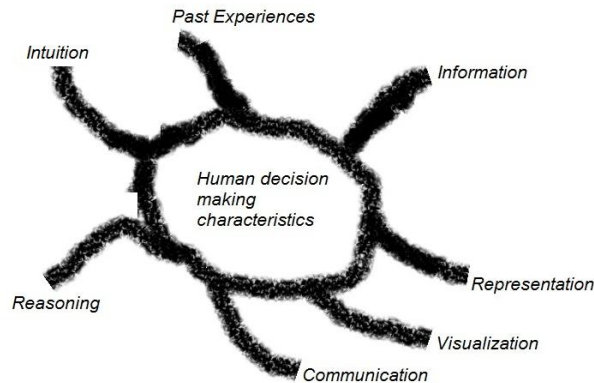


Fig 1: Elements of decision making by human beings

When one option has to be selected from various alternatives, the past experiences plays a vital role. In any situation, whether it is complex or not, our past experiences is a base for our decision making and predictions. Researchers have shown that past experience really does help when we have to make complex decisions based on uncertain or confusing information. They show that learning from experience actually changes the circuitry in our brains so that we can quickly categorize what we are seeing and make a decision or carry out appropriate actions [Zoe Kourtz., 2009]. Sometimes, the decisions taken may not be reversible. In such irreversible conditions, the situation may not be favorable. The taken decision may be a “firm” decision or “likely to change” decision. Firm decision is not likely to change and the same decision will be existing till the end of that particular situation. However, some decisions may be changed during the course of action. These decisions are changed according to the changing situations.

IX. DECISIONS BY COMPUTER SYSTEM:

The decision making systems by computer systems are exponentially growing and human beings are largely depending on these systems. The following are two examples where we are heavily depending on:

A. Geographic information systems (GIS): It has evolved as a means of assembling and analyzing diverse spatial data. These systems evolved from centuries of mapmaking and the compilation of registers. GIS is a special case of automated information systems where the database consists of observations on spatially distributed features, activities or events, which are definable in space as points, lines, or areas. A geographic information system manipulates data about these points, lines, and areas to retrieve data for ad hoc queries, presenting the geographical data, modeling and analysis of data for a wide range of applications [7].

B. Expert Systems: In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning about knowledge, like an expert, and not by following the procedure of a developer as is the case in conventional programming. An expert system has a unique structure, different from traditional programs. It is divided into two parts, one fixed, independent of the expert system: the inference engine, and one variable: the knowledge base. To run an expert system, the engine reasons about the knowledge base like a human. Expert systems are designed to facilitate tasks in the fields of accounting, the law, medicine, process control, financial service, production, human resources, among others. Typically, the problem area is complex enough that a more simple traditional algorithm cannot provide a proper solution. The foundation of a successful expert system depends on a series of technical procedures and development that may be designed by technicians and related experts. Example technologies: closed ecological systems, genetically modified food, agricultural robot, precision agriculture [5].



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X. CONCLUSION

The authors of this paper feels that the decision making process is a complex process and it needs past experiences also when a wise decision has to be taken.

Human take wise decisions when he overcomes the points what has been discussed in section IV of this paper. On the other hand, the computer system does not face these problems since the decision will be taken based on the criteria provided to the computer system to take a particular decision. Human decisions may be ambiguous. However, the decision taken by computer system is unambiguous.

The decision of the human beings is situational dependent and can change at any moment of time due to various factors. However, the decision of the computer system is definitely based on the criteria which are already been loaded in to the system in the form of software. The computer systems have been loaded with technologies related to decision making such as data mining, data warehousing along with many decision making procedures. In spite of all these, the decision making efficiency of the computer system is having its limitations and drawbacks. In short, we can say that the computer system is intelligent only artificially and human is naturally intelligent. These natural and artificial intelligence can make a huge difference in decision making and the effects and side effects of the decision. In certain situations, the computer decisions are more reliable. In this paper, the authors have made an attempt to improve the efficiency of the computer systems to make wiser decisions, by introducing an important criteria to take the decision, ie. past experiences. There is a long way to go with many inventions and innovations to bring the computer decisions nearer to the human decisions. Human intervention may be needed only when decision has to be taken regarding strategic and higher managerial matters and we can rely on computer systems regarding tactical, operational and day to day routine matters decisions. This can really reduce the human intervention in many situations in taking decisions, and computer system only can take such decisions so that, humans can concentrate on much productive work.

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REFERENCES

- [1] David Ullman, "The Bayesian Decision Matrix: A Simple Method to include uncertain and collaborative decision making in design", Robust Decisions Inc., 2011.
- [2] Gaurav Akrani, "Decision Making Process In Management - Problem Solving", Education Management, 2011.
- [3] Marc L. Resnick, 2012, "The effect of decision making in the emotional context of health care", 2012 Symposium on Human Factors and Ergonomics in Health Care.
- [4] A. John Maule, "Can computers help overcome limitations in human decision making?", Proceedings of NDM9, the 9th International Conference on Naturalistic Decision Making, London, UK, 2009.
- [5] Khalid Eldrandaly, (2007), "Expert systems, GIS, and Special decision making: Current practices and trends, Expert Systems Research Trends", 2007 Nova Science Publishers, Inc.
- [6] Jens Pohl, "Elements of Human Decision-Making", InterSymp-2006, Baden-Baden, Germany, August 7 to 12, 2006.
- [7] Longley, P., Goodchild, M., Maguire, D., and Rhind, D. (2005), "Geographic information Systems and Science (New York: Wiley).
- [8] Strategic decision-making determines the objectives, resources and policies of the organization, (2003), The University of Dublin.
- [9] Robert Harris, "Decision Making Techniques", Virtual salt, 1998.
- [10] Andrew Borden, "Human Intuition and decision-making systems", Issue: Information Security, Vol.1, Number 2, Pages 67-72, 1998.