Introduction of TRIZ to the Process and Levels of Decision Making

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Abstract: The aim of this article is to propose a classification for decision making levels according to the type of alternative generation and to introduce TRIZ as a tool in the process and special levels of decision making.

Key words: Decision Making, TRIZ, Strategic Management, Risk Management, Safety Management, Security, Scenario planning

1- Introduction

According to Mintzberg, managers have 10 roles which could be grouped in three main categories. First, the interpersonal roles including figurehead, leader, and liaison. Second, the informational roles including monitor, disseminator, and spokesperson. Third, the decision making roles including entrepreneur, disturbance handler, resource allocator, and negotiator. Among the roles of managers, decision making seems to be the most important of all. Peter F. Drucker believes that decision making is the key executive task of a manager: "Decision making is only one of the tasks of an executive. It usually takes but a small fraction of his time. But to make good decisions is the specific executive task." (Cooke & Slack, 1991) Harrison goes further and says: "It's instructive to recall the notion, that management is synonymous with decision making." (Cooke & Slack, 1991)

Planning is believed to be one the main functions of management. Planning is a series of decisions made to create a coherent road map for future. As a result, a good plan (future) requires good decision making. (Seyedjavadein, 2003)

Decision making involves five steps: definition of the problem, identification of the alternatives, determination of the criteria, evaluation of the alternatives, and choice of an alternative. (Anderson et al, 2000) In decision science, there are several approaches and techniques developed to take each step as effectively as possible. For example, there are two approaches of quantitative and qualitative in evaluation of alternatives, each of which including several stochastic and/or deterministic techniques.

Decisions or decision making can be categorized according to the approaches taken to make decision or according to the state of decision maker in the process of decision making. For instance, a decision is structured if the decision maker can define

and formulate the problem clearly. Conversely, a decision is unstructured if there is a great deal of ambiguity and the problem is ill-understood.

In the following sections, we are trying to give a classification of decisions according to the second step of decision making, alternative generation. It is believed that the process of alternative generation in day-to-day issues differs from that of such important and risky affairs as safety and security. Several techniques have been developed for decision analysis (which in fact is alternative analysis), but, surprisingly, very few systematic techniques are available for alternative generation (on which decision analysis is to be based). In the final section of this article TRIZ is proposed as a powerful alternative to serve this purpose.

It should be noticed that the focus of this article is on the second step of decision making. Thus, analysis and discussion of the other four steps is beyond the scope of this article, although they may be called into attention if necessary.

2- Literature Review

2-1- Problem Solving and Decision Making

Problem solving is the process of identifying and filling the gap between what is desired and what is actually happening. This process involves seven steps:

1. Identify and define the problem
2. Determine the set of alternative solutions
3. Determine the criterion or criteria that will be used to evaluate the alternatives
4. Evaluate the alternatives
5. Choose an alternative
6. Implement the selected alternative
7. Evaluate the results to determine whether a satisfactory solution has been obtained

Decision making involves the first five steps. Thus, the process of decision making starts with identification and definition of a problem and ends with choice of the best alternative known. The act of decision making happens when an alternative is chosen. Figure 1 depicts these two concepts. (Anderson et al, 2000)

The first two steps of decision making have very dangerous, common pitfalls which can lead to a wrong decision. In the first place, the decision makers think that they know what the problem is, but they really don’t. They have just felt a gap or an ambiguity by such clues as loss of market share, increase of accidents in workplace, increase of costs, potential opportunities of improvement, etc. Thus, it's very important to understand, define and formulate the real problem properly, because "the right answer to the wrong problem is a little use as the wrong answer to the right problem".

Even a well formulated problem may be poorly solved because the decision makers tend to consider only the previously tested or "good enough" alternatives. Old good decisions do not necessarily lead to success in the future, because the environment

and circumstances change fast and new opportunities and threats emerge. Furthermore, don't we want to make progress and make better decisions than before? Thus, decision makers have to make sure that they have considered as many alternatives as possible.

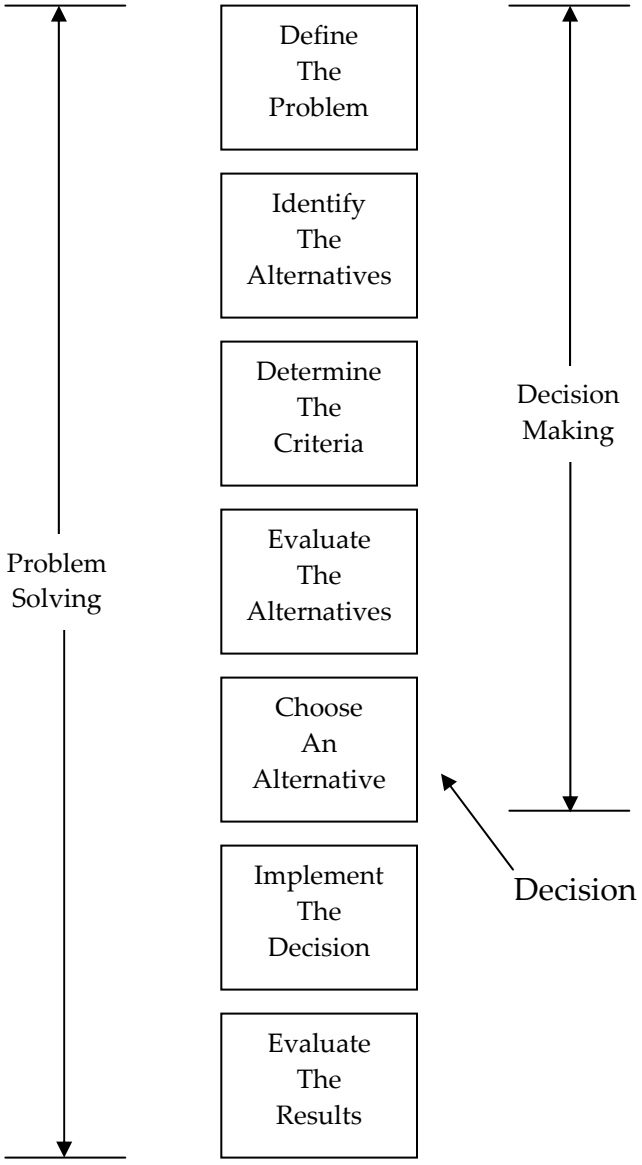


Figure 1: The Relationship between Problem Solving and Decision Making
Source: Anderson, David A.; Sweeney, Dennis J.; Williams, Thomas A.; *An Introduction to Management Science*; 9th Edition, South-Western College Publishing, 2000

2-2- Decision Making versus Consensus Building

The most important decision in the process of decision making is that whether decision makers are going to reach an agreement or to make a decision. To put it more simply, do decision makers try to make up their mind and choose the best alternative among those generated systematically or they try to express what they already have in their minds to persuade each other and build consensus?

Sometimes decision makers tend to ignore unpracticed alternatives because they may not be able to evaluate them or they are not willing to take risk. In this case, only few alternatives would be put forward for discussion. Not surprisingly, the decision makers decide quickly without much dispute.

2-3- Classification of Decisions

2-3-1- Classification of Decisions According to Organizational Hierarchy

A classification of decisions would be presented according to the organizational hierarchy. Work teams, bottom management, middle management, and top management are engaged in the process of decision making in everyday routine. As we move to the top of the hierarchy, risk and influence of decisions on organization increase. Hence, more resources, e.g. time, money, and effort. should be spent for better understanding and formulation of the problem, identification of as many alternatives as possible, determination of more accurate, realistic criteria, and a precise qualitative or quantitative method to evaluate the alternatives. (Seyedjavadein, 2003)

2-3-2- Classification of Decisions According to the Scope of Decisions

Decisions made by managers or employees range from the vision of a corporate to simple daily affairs. Obviously, more important decisions, i.e. more risky and more influential decisions are made by higher levels of organization hierarchy. Classification of decision making levels according to scope and influence of decisions are as follows: vision, mission, objectives, strategies, policies, procedures, daily routines, and daily affairs.

2-3-3- Structured and Unstructured Decisions

Structured decisions are clear, well defined, distinct, and unambiguous. On the other hand, unstructured decisions are ill-understood, fuzzy, and difficult to tackle. (Cooke & Slack, 1991) For example, the choice of leasing of a machine and buying it is a structured decision, because the problem is well defined, the alternatives are clear, and the information about price, depression, cost of maintenance are given. But the choice between developing a new product to increase market share is unstructured, because the problem is not formulated, the situation is unclear, and the possible alternatives are not identified. Figure 2 shows the boundary of structuring in the process of decision making.

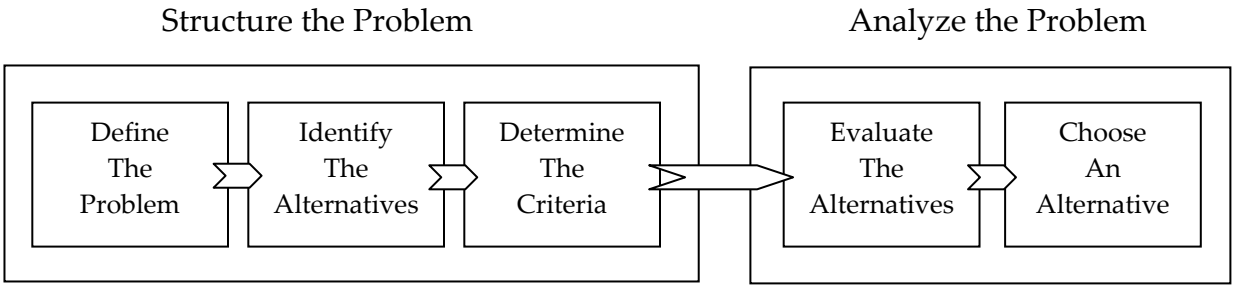


Figure 2: An Alternate Classification of the Decision Making Process
Source: Anderson, David A.; Sweeney, Dennis J.; Williams, Thomas A.; *An Introduction to Management Science*; 9th Edition, South-Western College Publishing, 2000

2-3-4- Strategic and Operational Decisions

If a decision is important, involves high degree of risk, affects the future of the whole organization, and is probably long-term, then it is a strategic decision. Low risk, short-term decisions which affect a specific sector of the organization are considered as operational decisions. Deciding to enter a new market or to install a new production line are examples of strategic decisions, while choosing between production and outsourcing of some minor plastic parts of a product is an operational decision.

2-3-5- Dependent and Independent Decisions

Dependant decisions are related to the past or future decisions or have some interactions with other decisions of the organization. On the contrary, independent decisions are those which are irrelevant of the past or future decisions or have little interaction with other decisions of the organization. The decision of entering a new market by marketing department is a dependent decision because it affects the production department, but the decision of changing one of minor suppliers by production department is an independent decision, because it has low effect on other departments.

3- Levels of Decision Making According to the Type of Alternative Generation

It is believed that alternative generation, the second level of decision making, can be categorized in four main types, as follows:

Type 1: In this type of alternative generation we look for the most *positive alternatives* which would add to the value of the system. An example of type 1 alternative generation is Kaizen. The main concept of Kaizen is continuous improvement. In the process Kaizen, efforts are made to do things better than before and to find better alternatives for whatever done in an organization. Better alternatives are those which can simplify and speed the processes. (Jafari et al, 2000)

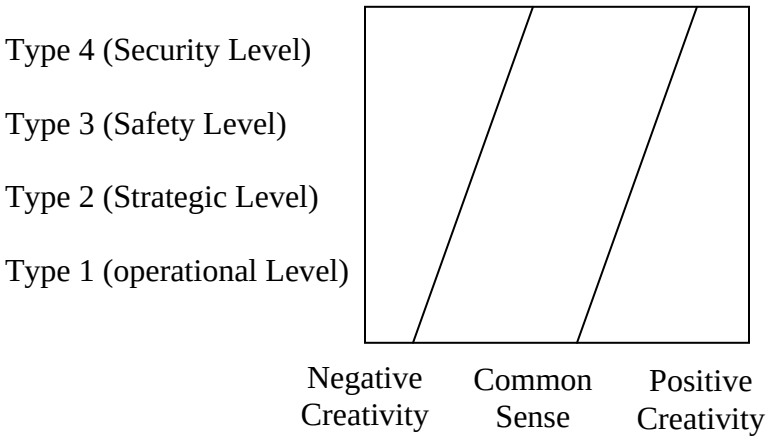
Type 2: In this type of alternative generation we look for the *positive alternatives* which would add to the value of the system while avoiding the *threats* to the system. An example of type 2 alternative generation is strategic management. Strategic management has two sides: strategic thinking and strategic planning. Strategic thinking role is "to seek innovation and imagine new and very different future that may lead to a company to redefine its core strategy and even its industry". Strategic planning role is "to realize and support strategies developed through strategic thinking process and integrate these back into the business". The aim of strategic management is to imagine and create the best possible future for a company by means of making the best use of opportunities and strengths and avoiding threats and weaknesses. (Thompson & Strickland, 2000)

Type 3: In this type of alternative generation we look for *potentially negative alternatives* which would damage the system in order to prevent them. Examples of type 3 alternative generation are safety management and risk management. As a safety management tool, HAZOP is a technique used to analyze and decrease the threat of potential events. In HAZOP, the most risky and potentially dangerous part of a facility such as a refinery is chosen for analysis. Then, the HAZOP team concentrates on that part of the refinery to identify all possible defects may cause an event. All the possible defects are then ranked according to their probability and magnitude of damage. Finally, the team suggests necessary actions to prevent the most risky defects. (Cox & Tait, 1998)

Type 4: In this type of alternative generation we look for the *most negative alternatives* which would damage the system seriously in order to prevent them at any cost. An example of type 4 alternative generation is scenario planning for security affairs. In scenario planning several scenarios for future events are created. Then, a number of plans are designed for each scenario to be out into action if the scenario came true. Scenario planning is also used in type 2 and 3 alternative generation, but it is the most effective tool in very high risk levels of decision making such as crisis management and national security.

It can be seen that there is a trend in the four types of alternative generation. In type 1, the decision maker has a positive background and tries to create more positive alternatives. In type 2, the decision maker has a positive background and tries to create more positive alternative, but he/she must be careful of threats or negative effects of the alternatives. In type 3, the decision maker has a negative background and tries to create more negative alternatives to be prevented to lower the cost of later corrections. In type 4, the decision maker has an extremely negative background and tries to create the most dangerous alternatives to be prevented at any cost. As can be seen, approaches toward alternative generation vary from those which try to maximize the positive effects of alternatives to those which try to maximize the negative effects of alternatives. As we move from type 1 to type 4, we need to generate more negative alternatives in order to prevent them. I other words, in types 1 and 2, *positive creativity* is necessary to create positive alternatives, while in types 3 and 4, *negative creativity* is required to create negative alternatives.

The four types of alternative generation can be entitled as *operational*, *strategic*, *safety*, and *security* according to their areas of application. Figure 3 shows the positive and negative creativity required to generate alternatives in these four types (levels). As the figure shows, positive and negative creativity are required in all four levels, but as we move from lower levels to higher levels negative creativity plays more role in alternative generation. It is believed that common sense is vital in all levels of alternative generation and decision making, in general.



It should be noted that the classification introduced above is according to the type of alternative generation. Other classifications according to other characteristics of process of decision making may lead to the same result. For example, the four levels have the same order according to the level of uncertainty, risk and unstructuredness (Table 1)

Level	Risk	Structure	Time Range	Dependency	Type of Creativity
Security	Very High	Unstructured	Long-term	Dependant	Negative creativity
Safety	High	Unstructured	Long-term	Dependant	Negative creativity
Strategic	High	Semi-structured	Middle-term	Dependant	Positive-Negative Creativity
Operational	Low	Structured	Short-term	Independent	Positive Creativity

4- Introduction of TRIZ to Different Levels of Decision Making

Alternatives of a decision may range from known and experienced ones to those which should be creatively generated through decision making process for the first time. Minzberg et al. classify decision alternatives to four groups:

- Given: fully developed at the start of decision process.
- Found ready made: fully developed in the environment of the decision and discovered during the decision process.
- Custom made: developed especially for the decision in question.
- Modified: ready-made options with some customized features.

The quality of a decision, among all other things, is dependent on the number and quality of alternatives. A common pitfall in the second step of decision making is ending the process of alternative generation because of reaching a good enough alternative or a low risk, previously experienced alternatives. Thus, decision maker should make sure that all possible alternatives have been taken into account.

Some techniques have been developed to make the process of alternative generation more efficient. Creativity techniques such as brain storming have been useful and widely used in the process of decision making. These techniques are satisfactory in low risk decisions. In figure 3, by moving to higher levels of decision making the need for more systematic tools for alternative generation emerges. Evidences of this need can be found in safety management texts: “A structured and systematic approach to hazard identification is essential if important hazards are not to be missed”. (Cox & Tait) At security level, where ambiguity, uncertainty, and risk are extremely high, the situation becomes even more complicated. The most complex and difficult task of a scenario planning team is writing and crafting scenarios. The team should make sure that all scenarios are written and well crafted.

Systematic innovation can serve the purpose of systematic alternative generation. This is basically because TRIZ has developed a systematic approach toward problem solving. TRIZ can be applied to all levels of decision making, but it is especially effective in higher levels, safety and security, where decision makers need to identify the future events which would damage the current system in order to reinforce the system against those events. Additionally, decision markers can use TRIZ to discover potential failures of the systems that are in the process of design. In other words, decision markers can test their systems against the worst possible events and incidents. This process of generation of negative alternatives is called negative creativity.

An example of negative creativity is design of guns. As a designer or producer, you may try to design the best quality gun with long range, good shape, etc. But you should also think about the malfunction of your product in order to prevent them. You have to ask yourself: How can my guns kill people accidentally? Your probable answers are bad heat treatment or imprecise calibration. But, what if a child uses your gun to kill his/her friends? (Ungvari, 1999) You have to use negative creativity to answer as many what if questions as possible.

Classification of a problem in a level influences the way it is solved. A problem can be put in another category and hence, its process of solving changes. Imagine that you are going to design automatic window of a car. If you consider your job as an operational task, you may concentrate on the speed of the window. As a result, you may design a powerful electric motor for the window to move fast enough. Now, consider a case in which you categorize your job not only as an operational but also as a safety task. This time, you would not concentrate only on the useful and desired functions of an automatic window. You would ask yourself: How can the glass be dangerous? Suppose that you are riding your car with your daughter sitting on the front seat of the car. She asks you to buy her chips. You park your car, get out and walk to the nearest store. Your daughter wants to remind you of the taste of the chips she likes more. So, she stands up on the seat, takes her head out of the window and shouts. Accidentally, her hand touches the key of automatic window of the car and the window rises. Her head is between window and door now. Does this scenario change your approach toward designing a motor for car automotive glass? What other scenarios would be written?

5- Conclusion

It is believed that the process of alternative generation in day-to-day affairs is different from that of such risky, important decisions as safety and security. In minor decisions, decision maker has a positive background and uses positive creativity. But, in major decisions, decision maker has a negative background and uses negative creativity. Since number and quality of alternatives is crucial to the quality of the major decisions, a systematic tool such as TRIZ is required to guarantee the identification of as many alternatives as possible.

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