Using Fuzzy Multi-Criteria Decision Making for Strategic management

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Abstract: This paper discusses the use of MCDA for supporting strategic management. By considering the technical issues associated with the content of strategic decisions, and also the social aspects that characterize the processes within which they are created, this paper try to present a new approach for selection best strategy for each scenarios in strategic management. By using fuzzy TOPSIS technique, we propose a new method for strategy selection problem. By using TOPSIS technique we support strategy selection decisions. Also this article applied improved TOPSIS to make comparison more intuitionitic and reduce or eliminate assessment.

Key words: Multi-Criteria, Strategic management, Fuzzy, scenario planning.

INTRODUCTION

Strategic management is a field that deals with the major intended and emergent initiatives taken by general managers on behalf of owners, involving utilization of resources, to enhance the performance of firms in their external environments. It entails specifying the organization's mission, vision and objectives, developing policies and plans, often in terms of projects and programs, which are designed to achieve these objectives, and then allocating resources to implement the policies and plans, projects and programs (Nag, Hambrick, and Chen, 2007).

Most papers use multi-attribute value analysis, such as Phillips, (1986) and Goodwin and Wright, (2001). On a more theoretical level, Belton and Stewart, (2002) discussed the potential use of MCDA and scenario planning. Stewart (Stewart, 1997; Stewart, 2005) presented several technical issues about this integration and provided a thoughtful discussion on how it could be made. Montibeller, et al., (2006) suggested a framework for conducting a multi-attribute value analysis under multiple scenarios, in the same way as Belton and and Stewart (2002), but with an emphasis on the robustness of strategies.

The popular view of strategic decisions is that they typically involve a high degree of uncertainty, high stakes, major resource implications, and long-term consequences (Johnson, Scholes and Whittington, 2005). This view is associated with the traditional conceptualization of strategic decisions as the product of intentional attempts at rational choice, and context-setters for subsequent strategic action (Schwenk, 1995).

One of the strengths of this traditional view is that it conceptualizes the strategic decision making process in a way that is consistent with the reality faced by practicing managers. This conceptualization, however, has been criticized for assuming a rational and linear relationship between decisions and actions that has not been empirically proven (Mintzberg and Waters, 1990; Starbuck, 1985). The fundamental point underlying this critique is that organizational decisions are not always decisive, in the sense that they not always imply the presence of "commit ment to act". Intentionality and action are difficult to trace and correlate empirically. Sometimes decisions result in action, in the form of a commitment of resources, sometimes they do not (Mintzberg, 1987).

Notwithstanding the above criticisms, we believe like others (Laroche, 1995) that the view and quest of intentional decision making is an undeniable aspect of organizational life. In our experience, managers act in accordance to the belief that strategic decisions must be intentional acts and the result of a well-designed rational process. Indeed that is the main reason that they look for our help as decision analysts. There is, therefore, a clear role for Decision Analysis in these contexts, to support strategic decision making.

MATERIAL AND METHODS

Process of Decision Making in Strategic Management:

High velocity, hotly competitive markets, traditional approaches to strategy give way to "competing on the edge," where strategic decision making is the fundamental capability leading to superior performance. After all when strategy is a flow of shifting competitive advantages, the choices that shape strategy matter greatly and occur frequently.

The research data corroborate this view, demonstrating that firms with high performance in profitability, growth, and marketplace reputation have superior (that is, fast, high-quality, and widely supported) strategic
decision-making processes. These processes support the emergence of effective strategy. Firms that were more modest performers had strategic decision-making processes that were slower and more political. Their strategies were more predictable and less effective. Executives in these firms often recognized that their strategic decision making was flawed, but they did not know how to fix it.

Will Mulcaster argues that while much research and creative thought has been devoted to generating alternative strategies, too little work has been done on what influences the quality of strategic decision making and the effectiveness with which strategies are implemented. For instance, in retrospect it can be seen that the financial crisis of 2008–9 could have been avoided if the banks had paid more attention to the risks associated with their investments, but how should banks change the way they make decisions to improve the quality of their decisions in the future? Mulcaster's Managing Forces framework addresses this issue by identifying forces that should be incorporated into the processes of decision making and strategic implementation. The forces are: Time; Opposing forces; Politics; Perception; Holistic effects; Adding value; Incentives; Learning capabilities; Opportunity cost; Risk; Style—which can be remembered by using the mnemonic 'TOPHAILORS'.

**Decision Making Process Based on MCDM:**

Since the 1980s scenario planning has been suggested as an alternative way of considering uncertainty in strategic decisions, instead of traditional forecasting. The main idea is to construct a small set of possible future scenarios that describe how the main uncertainties surrounding the problem would behave (e.g., interest rates, prices of commodities, demographic trends). Each scenario presents a coherent story that may happen in the future and is used to explore how different strategies would perform under such circumstances (Schoemaker, 1993, Van der Heijden, 2004, Schoemaker, 1995). Once scenarios are ready and strategies are devised, a table can be built, which describes qualitatively the outcomes of each strategy under each scenario.

Scenario planning has been widely employed in practice and seems to be a tool which managers are comfortable to work with (Schoemaker, 1993, Van der Heijden, 2004). Scenario planning has proved to be a powerful tool to increase awareness about future uncertainties and enhance creativity in thinking about possible strategies. However, the literature on scenario planning is limited in discussing how to identify/design high-quality strategies from a scenario analysis. Even more, the scenario planning literature does not acknowledge the need to evaluate these strategies against multiple organisational objectives, despite ample evidence of multiple objectives in strategic decision making (Eisenhardt, K.M and Zbaracki, 2005). The fact that strategic decisions involve invariably multiple strategic objectives, suggests the adoption of MCDA as the evaluation tool for strategic choices.

The popularity and advantages of scenario planning, combined with the power of evaluation of MCDA, provides a potent set of decision-support tools for strategic decisions (Montibeller and Belton, 2006). Indeed, since the 1980s there are suggestions of considering the use of MCDA with scenario planning.

Let a set of $n$ strategic options be: $A = \{o_1, o_2, ..., o_n\}$. There are $m$ criteria: $C_1, C_2, ..., C_m$ each $k$-th criterion measures the achievement of one strategic objective of the organization. There is a set of $n$ scenarios $S_1, S_2, ..., S_n$. A model is built for each $s$-th scenario, which provides the overall evaluation of the $i$-th alternative under the scenario:

$$R_s(o_i) = \sum w_{ij} r_{ij}(o_i)$$

Where $w$ is the weight of the $k$-th criterion under the $s$-th scenario and $v$ is the value of the $i$-th alternative on the $k$-th criterion. Notice that this model allows different weights for distinct scenarios, in order to reflect different future priorities.

One important change that an organisation may experience, when using MCDA for strategic with its strategic objectives and also in better scoping the strategic choices it is considering (Barcus and Montibeller, 2008).

Since evaluation of strategy is a thinking human based evaluation, in this paper, we use a fuzzy approach in MCDM model. One of the most important models in MCDM methods is TOPSIS. In this research, a TOPSIS-based model is used to obtain appropriateness of given strategy in from of fuzzy logic for each scenario.

In this model, desirability of a strategy in fuzzy from is given such that in different profiles, the right and left distance of any fuzzy number from ideal value (best) and non ideal value (worst) are measured. This is the standard measuring of desirability of a strategy. Following steps are designed to obtain desirability of strategy, using TOPSIS method:

1. Multiplying the fuzzy numbers weight of criteria ($w_i$) by value of criteria for each strategy ($r_{ij}$) according to table 2:

$$N_{ij} = R_{ij} \otimes W_i$$
Where $N_y$ is a triangular fuzzy number like this:

$$N_y = (\alpha_y, r_y, \beta_y) \otimes (\rho_y, y, \gamma_y) = (\alpha_y + r_y \rho_y, r_y y + r_y \gamma_y, \beta_y + r_y \gamma_y)$$

2. Choosing the profile of $\alpha_y$.
3. Calculating following real numbers for each project and then producing matrix of $L_\alpha$ and $R_\alpha$:

$$x^+_y = \min \{x_y \in R \mid \mu_{\alpha_0}(x_y) \geq \alpha_y\}$$
$$x^-_y = \max \{x_y \in R \mid \mu_{\alpha_0}(x_y) \geq \alpha_y\}$$

The resulted matrix from $x^+_y$ is called $L_\alpha$ (meeting point of profile $\alpha_0$ with left side equation of fuzzy number).

The resulted matrix from $x^-_y$ is called $R_\alpha$ (meeting point of profile $\alpha_0$ with right side equation of fuzzy number).

Ideal solution and non ideal one for matrices of $L_\alpha$ and $R_\alpha$ due to n strategy ($j=1,2,........n$), m criterion ($i=1,2,..........m$), is defined as follows:

Ideal solution for $L_\alpha$:

$$A^+_{L_\alpha} = \{\max \{x^+_y\} \mid j = 1,2,....,n\} = \{x^+_1, x^+_2, x^+_n, \ldots, x^+_n\}$$

Non ideal solution for $L_\alpha$:

$$A^-_{L_\alpha} = \{\min \{x^-_y\} \mid j = 1,2,....,n\} = \{x^-_1, x^-_2, \ldots, x^-_n\}$$

Ideal solution for $R_\alpha$:

$$A^+_{R_\alpha} = \{\max \{x^+_y\} \mid j = 1,2,....,n\} = \{x^+_1, x^+_2, x^+_n, \ldots, x^+_n\}$$

Non ideal solution for $R_\alpha$:

$$A^-_{R_\alpha} = \{\min \{x^+_y\} \mid j = 1,2,....,n\} = \{x^-_1, x^-_2, \ldots, x^-_n\}$$

4. Calculation the distance of the strategies of each matrix from it ideal or non ideal solution is done using following equations:

The distance of strategy ($j$) of $L_\alpha$ from ideal solution

$$dL^+_j = \left[ \sum_{i=1}^{n} (x^+_{yi} - x^-_{yi})^2 \right]^{\frac{1}{2}}, j = 1,2,....,n$$

The distance of strategy ($j$) of $L_\alpha$ from non ideal solution:

$$dL^-_j = \left[ \sum_{i=1}^{n} (x^-_{yi} - x^+_{yi})^2 \right]^{\frac{1}{2}}, j = 1,2,....,n$$
The distance of strategy (j) of $R_{\alpha}$ from ideal solution:

$$dR_{j} = \left[ \sum_{i=1}^{n} (x_{i}^+ - x_{i}^-)^2 \right]^{1/2}, \; j = 1, 2, ..., n$$

The distance of strategy (j) of $R_{\alpha}$ from non ideal solution:

$$dR_{j} = \left[ \sum_{i=1}^{n} (x_{i}^+ - x_{i}^-)^2 \right]^{1/2}, \; j = 1, 2, ..., n$$

5. Calculation of strategy (j) relative closeness to ideal solution of $L_{\alpha}$ and $R_{\alpha}$ by using following equations:

$$C^* L_{j} = \frac{dL_{j}}{dL_{j} + dL_{j}}, \; j = 1, 2, ..., n$$

$$C^* R_{j} = \frac{dR_{j}}{dR_{j} + dR_{j}}, \; j = 1, 2, ..., n$$

6. Fuzzy desirability $U_{j}$ in $\alpha_{\alpha}$ profile is defined as follows:

$$U_{j} = \{(C^* L_{j}, \alpha_{\alpha}), (C^* R_{j}, \alpha_{\alpha})\}, \; \text{if}$$

$$C^* L_{j} < C^* R_{j}$$

$$U_{j} = \{(C^* R_{j}, \alpha_{\alpha}), (C^* L_{j}, \alpha_{\alpha})\}, \; \text{if}$$

$$C^* L_{j} < C^* R_{j}$$

In other words, right and left side value of fuzzy desirability $U_{j}$ is obtained using $C^* L_{j}$ and $C^* R_{j}$.

In TOPSIS model, the priority depends on relative closeness of each choice to ideal solution. That is why the sixth step equation is used.

Since in our proposed method, left and right distances of any fuzzy number from ideal and non ideal solutions are used to measure desirability strategies, and then the above equations are used as left and right sides of ideal fuzzy solution.

By creating various profiles and repeating the step (2-6), desirability fuzzy solution for all strategies is produced.

RESULT AND DISCUSSION

Most of the MCDA applications reported in the literature assess single-point outcomes, which try to represent the performance of an option if it were implemented. Particularly in strategic decision-making, however, considering long-term consequences is relevant and, many times, crucial. One relatively simple way of considering long-term consequences in these cases is by applying time discounting, as in net present value (NPV) analysis. This can be used for assessing the strategy’s performance under each criterion, for example the NPV for profit (French, Bedford, and Atherton, 2005; Barcus and Montibeller, 2008). A key challenge of NPV analysis is always to define a suitable discount rate. In private companies this may be relatively straightforward, as it is linked with the cost of capital. However, the same cannot be said about public decisions, where the level of discounting is debatable – a large rate can make costs in the long-term future negligible and favor short-termism (Santos, Belton and Howick, 2002).

Another avenue is the use of system dynamics models to simulate multiple long-term responses of a system, given some policy as input. These responses can then be employed to assess the policy’s performances in a MCDA model.

Conclusion:

Since MCDA has been less employed than it is expected for supporting strategic decision making in strategic management. This seems somehow contradictory, as dealing with multiple and conflicting strategic objectives is a crucial issue for making strategic decisions. For addressing this problem, this paper presented a
new approach for using MCDA in strategic management. In particular, we advocated the use of scenario planning to consider uncertainties, associated with an appraisal of robustness of strategic options against different scenarios. Therefore, the evaluation and selection of strategy for strategy management is customarily done using, technical and financial information. In this article, Authors proposed a new methodology to provide a simple approach to assess alternative strategy and help decision maker to select the best one. By using TOPSIS technique we support strategy selection decisions. Also this article applied improved TOPSIS to make comparison more intuitionitic and reduce or eliminate assessment.

REFERENCES