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An application of logarithmic fuzzy preference programming-based AHP and FRS techniques to develop and prioritize strategic objectives

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Abstract

Vital decisions made at the strategic level in an organization are not only intricate but also costly to alter. It is therefore important to find a comprehensive approach to deal with such a possibility. One of the major problems of a common balanced scorecard (BSC)-based model in strategic management is lack of a ranking system for strategic objectives in order to enable prioritization of the operational actions for strategy development. In this paper, we have proposed an approach to apply the Logarithmic Fuzzy Preference Programming (LFPP) and the Fuzzy Ratio System (FRS) techniques to resolve this issue. To propose a comprehensive approach, the strategy canvas concept, the four actions framework of the blue-ocean strategy model, and the competitive strategy development techniques of the Judo Strategy model can be employed for problem formulation. To check for applicability, the proposed model was applied to a case of X Tile and Ceramics Company. This research applied a combination of the Judo Strategy and the blue-ocean model in the form of a BSC strategic planning to develop strategic objectives as well as utilized the LFPP and FRS techniques to rank the objectives based on their strategic goals.

Keywords

Blue-ocean strategy, FRS technique, Judo strategy, LFPP technique, MCDM.

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Introduction

With the intensifying global competition in the present age, a company's ability to develop purposeful and intelligent strategies is an extremely effective factor to define the companies' success status. One of the applied frameworks in strategy development process is the balanced scorecard (BSC) model, which is one of the most applied frameworks in this aspect.

First, to develop strategies using BSC-based models, the following must be defined: vision, mission, and the core values. Next, with the assistance of the experts, the external and internal environment analysis should be performed. Added to the disclosure of the status quo, results of this analysis should identify the strengths, weaknesses, opportunities, and threats of the environment (Dyson, 2004). Further, the strategic position of the organization should be identified by using models like Internal-External matrix. The generic strategy should be then developed. In the next step, the discovered strengths and weaknesses, the opportunities and threats, as well as the experts' ideas aligned with the generic strategy should be considered to identify the strategic options. Eventually, the strategic goals and strategic objectives should be developed using tools like SWOT matrix (Helms & Nixon, 2010) for implementation and control in the next steps.

Obviously, the aforementioned process is not devoid of flaws, as some critical issues are witnessed, as mentioned below:

In the strategy development process using a BSC, often the strategic options are determined after the generic strategy development in expert meetings. Using the experts' ideas, regardless of the comprehensive picture of the status quo and the senior managers' desired horizon, the company's research team develops the strategic goals based on qualitative information.

Instead of emphasizing on a comprehensive precise market picture as well as the company's market position, it seems that development of the quantitative macro-goals is majorly based on the personal views of different people in the team, which does not seem like a precise method. In the present research, inspired by the canvas strategy (Kim & Mauborgne, 2002), we attempted to simultaneously investigate the

strategic options of the existing companies in a tile and ceramics industry and utilized the four actions framework introduced in the blue-ocean strategy model to develop strategic goals.

As mentioned before, most of the existing tools for strategic analysis produce descriptive analysis based on the description of the internal and external conditions of the organization. This in turn, presented a guideline based on subjects such as explanation and analysis of the external and internal conditions, strengths and weaknesses, and opportunities and threats (Kangas *et al*., 2003). Obviously, quantitative matters were proposed on purposeful strategic objective designation, which are the most critical rings of strategy development. One of the few efforts to propose a prescriptive model for strategy designing and development through the use of one of the oldest texts on strategy is the combination of war techniques of Sun Tzu's Art of War with strategic management subjects. This perspective toward strategy designation contradicts with the common strategy development perspective (Ko & Lee, 2000). On the other hand, to be successful in the contemporary market, an organization needs to develop strategies with the simultaneous consideration of the company's and rivals' market positions as well as the rivals' behavior and competitive decisions in the global commerce field. This compatibility with the global highly competitive environment is one of other fundamental flaws of the widely used frameworks for strategy development, especially those based on the BSC and SWOT matrix. Since strategy development by using these models is time-consuming and inflexible, and because there is a need for a clear competitive path to direct the organization's competitive behavior, we employed the Judo Strategy method to design strategy and draw the competitive path. Inspired by the judo sport, this model concentrates on the strategy concept as a tool to emerge victorious. Moreover, presenting a purposeful structure, this model prescribes methods to apply in the strategy development process through simultaneous attention to the four fundamental components, namely, the company's and rivals' objectives, the company's position in the edge of strategic horizon, rivals' market position, and rivals' competitive behavior (Yoffie & Kwak, 2001a, pp.1-16).

In addition to the fundamental issues mentioned above, one of the most important problems of the BSC model is that its main model does not have the capability of ranking on its own. Therefore, several researchers of strategic management have attempted to resolve this issue by adding decision-making techniques for strategy development. To solve this problem, we present two decision-making techniques, the LFPP model and the FRS ranking model, and use them to rank the strategic objectives based on the different degrees of importance of strategic goals.

The current research has been presented in four sections. Section 2 explores the theoretical literature of the BSCs, canvas strategy, the four actions technique of the blue-ocean strategy, Judo Strategy, LFPP technique, and FRS technique. Section 3 introduces the proposed framework. Section 4 is a case study applying the proposed framework to a manufacturing company of tile and ceramics. Finally, Section 5 explores the conclusion and discussion of the study.

Literature Review

The BSC

To measure an organization's objectives, BSC explains the mission and strategy of the organization in the form of performance measurements (Kaplan & Norton, 1996a, pp.23; Kaplan & Norton 1996b).

BSC first measures the company's success level by means of checking for several financial indicators. A company's financial success originates from a good performance for the customers. Hence, customer satisfaction is evaluated at the lower level. Weakness/ strength of this aspect is in turn a symptom of the weakness/strength in the lower level processes. Weakness/ strength of processes is also caused by weakness/ strength in learning and growth. Flexibility is one of the advantages of this model, as other aspect may be either added or removed from the model (Kaplan & Norton, 1996b).

A previous study indicates that former works on strategy development using BSC are mostly about using decision-making techniques as a strategy development tool and for prioritization

strategies. Some of these works are mentioned here: Lee *et al*. (2008) employed the Fuzzy Analytic Hierarchy Process (FAHP) technique to rank objectives in the BSC. Wu at al. (2009) performed performance ranking through introduction of a novel technique. Cebeci (2009) weighted the system-selection criteria in the BSC based on the organization strategies.

The Judo Strategy

Presented in 2000 by Professor Yoffie, Judo Strategy is a metaphor of the judo sport. It provides an instrument through which a company can not only resist against its robust rivals but also find an opportunity to overcome robust rivals through the three principles of movement, balance, and leverage. Judo strategy includes 10 integrated techniques (Yoffie & Kwak, 2001a, pp.19-172; Yoffie & Kwak, 2002).

a) Mastering movement

Movement includes the following three techniques:

Technique 1. The poppy dog ploy: In every competition, the first goal is to survive. Therefore, the first technique of Judo strategy advices competitors to maintain a balanced behavior and to avoid face-to-face fights with low victory probabilities.

Technique 2. Define the competitive space: This technique tries to identify the weaknesses of the opponents through precise evaluation, followed by investing on the identified weaknesses.

Technique 3. **Follow-through fast:** After rivals become aware of the previous two techniques and their efficiency diminishes by swift serial movements and by presence in different commercial areas, application of this technique not only surprises the opponent but also achieves appropriate advances and evades defeat.

b) Mastering balance

Maintaining balance in a fight includes four techniques:

Technique 4. Grip your opponent: This technique implies that if you are to avoid future fights with stronger rivals, you must establish partnerships with your future opponents or sign collaboration contracts.

Technique 5. Avoid tit-for-tat: Despite all efforts, often a robust

opponent finally decides to enter competition. At such a time, avoiding tit-for-tat practice by the weaker party is vital for its survival.

Technique 6. Push when pulled: This move helps you benefit from your opponents power and body movements. Consequently, in the world of trading, by adding products, services, and the competitor's technology, one can disbalance the opponent and make them face a rather painful and unpleasant decision.

Technique 7. Ukemi: Ukemi is the technique of safe falling that gives the fallen opponent a slightly better position. This technique teaches how not to insist on erroneous strategic decisions (Yoffie & Kwak, 2001a, pp.19-172; Yoffie & Kwak, 2002).

c) Mastering leverage

"Balance" techniques allow an organization to face larger and stronger opponents with no defeat. However, in several cases, to emerge victorious in an industry, a power beyond the competitive power is required for a company. In judo, this additional power is called the "leverage power".

Technique 8. Leverage your opponent's assets: This technique recommends that, with a raise in your rival's advantages, you can grasp their market.

Technique 9. Leverage your opponent's partners: Establishing relationships with the partners of rival who have differences with each other is an effective background to weaken a robust competitor and lead them to defeat.

Technique 10. Leverage your opponent's competitors: This technique believes in collaborating with and strengthening the opponents of an opponent in order to weaken the opponent and increase one's chances of victory (Yoffie & Kwak, 2001).

Investigations have revealed that Ko and Lee (2000) conducted research in the field of strategy development to employ the techniques given of the book "Art of War" in strategy development. For this purpose, they introduced the SFF framework as a new model for strategy development and employed it for strategy development in a bank in Hong Kong (Ko & Lee, 2000). However, generally, the relative number of researches on strategy designation is very few.

Hence, the judo strategy concept remains one of the few efforts made in the field of strategy designation (Yoffie & Kwak, 2001b; Yoffie & Kwak, 2002). After creation of the judo strategy concept, actions were performed to exploit the same for the development of macro-strategies of several American companies (Yoffie & Kwak, 2001). Finally, techniques of this novel model were introduced to describe the application of judo strategy for overcoming stronger opponents (Yoffie & Kwak, 2001a, pp. 2-19). One of the other efforts made to apply judo strategy was in the application in China's automobile industry (Quan, 2011).

Canvas strategy

One of the most important issues affecting senior managers with regard to making strategic decisions is the lack of a large comprehensive picture of the organization and its competitors for future inspiration. The strategy canvas graph was introduced to remove this very issue (Kim & Mauborgne, 2002). In other words, the strategy canvas is a graphic chart that helps managers observe the competitive environment of their industry, competitors, and their own company status while avoiding long reports of different units. The chart's horizontal axis is a set of factors critical to the industrialists and customers of a particular industry. Companies active in that particular industry compete with and invest in these areas. The vertical axis represents the importance that customers of an industry put on each of the key competitive factors.

Applications of the canvas strategy can be summarized as follows:

- Displaying all strategic factors influencing the competitive status quo of the company as well as helping predict the factors influencing the future strategic competition of a company in a given industry.
- Observation of the status of a company and its rivals and the capability to compare them.
- Identification of the factors and features most attended by customers, with greater potential for investment.

Concisely, one of the most important achievements of the strategy canvas graph is to allow observation of the various activities of an

industry simultaneously, which has much strategic worth (Kim & Mauborgne, 2002).

The blue-ocean concept

In an industry, the blue-ocean concept was adopted for the original market sections with few competitors. This concept stands against the red-ocean concept. In strategy literature, a red ocean is applied to mention markets with several competitors fighting to acquire a particular share of profit. This win-lose fight culminates into a bloody battle of businesses. Kim and Mauborgne (2004) introduced the concept of blue ocean to suggest operational solutions as well as techniques for eliminating red-ocean fight and for entering an untamed market of the blue ocean. Despite the common thought, this model tries to simultaneously increase buyers' value and decrease the production and presentation costs through consideration of the creativity factor.

For market observation in this novel model, the authors employed the strategy canvas concept for designing a new competitive environment using the four actions technique (Kim & Mauborgne, 2005a; Kim & Mauborgne, 2005b, pp.37-60).

The four actions in the blue-ocean model

In the blue-ocean model, first, the strategy canvas was drawn to monitor the market. After taking a comprehensive perspective toward the organization status in the corresponding market and to reconstruct the targeted elements, blue-ocean strategists employed the four actions framework containing the below-mentioned four questions:

1. Which features could be removed?
2. Which factor must be decreased?
3. Which factor must be increased?
4. What new features must be created?

The new status graph is depicted in the strategy canvas graph (Kim & Mauborgne, 2005a; Kim & Mauborgne, 2005b, pp. 37-125).

After presentation of the strategy canvas concept and in line with attending creativity in a strategy designation, Kim and Mauborgne (2004) proposed the blue-ocean concept to produce new competitive environments and to avoid saturated market competitions (Kim. They

later utilized the strategy canvas and the four actions framework to identify new competitive environments (Kim & Mauborgne, 2005a; Kim & Mauborgne, 2005b, pp. 37-60). Following these earlier efforts, Chang (2010) attempted to use the strategy canvas and the four actions framework in the form of the blue-ocean strategy concept in order to explain the achievements of a business brand in the mobile market. Sharma *et al*. (2010) employed the techniques of this strategy for economic development and growth in the Indian metropolitan areas.

Logarithmic Fuzzy Preference Programming (LFPP)

Because of the ease of judgment in fuzzy settings for comparing certain settings and as a practical method to solve the MCDM problems, the FAHP was subjected to ever increasing applications in recent years.

Application of the FAHP technique for MCDM requires a set of scientific weights obtained from pairwise comparison matrix. The existing methods can be classified into two types:

1. Assignment of a fuzzy number as the weight through fuzzy pairwise comparison matrix
2. Assignment of a crisp number as the weight through fuzzy pairwise comparison matrix.

Geometric mean, Fuzzy Logarithmic Least Squares Method (LLSM), Lambda-max method, and Linear Goal Programming (LGP) are members of the first group. In the second group are included Extent Analysis (EA) and Fuzzy Preference Programming (FPP) (Wang & Chin, 2011).

Due to the simplicity of computations, majority of users seek the second-group methods. The EA method was introduced by Chang (1996), and shortly afterwards, the acquired weights by this method were proved to be invalid by Wang *et al*. (2008), as the method could not correctly reflect the importance of decision or proxy variables relations. In fact, this method should not have been applied to obtain weights. Introduced by Mikhailov (2003), the FPP method had its own limitations. For instance, it could be employed to determine priorities and find conflicting vectors or vectors that are multiples of each other.

This non-uniqueness in solution questions this method's applicability. The LFPP was proposed to remove flaws of FPP (Mikhailov, 2003) in production of weights out of pair-wise comparisons (Wang & Chin, 2011). This method is one of the pair-wise comparison weighting methods, results of which are in the form of real numbers.

Given that, on one hand, this research requires a set of crisp weights to prioritize the strategic goals, and, on the other, it requires inconsistency rate due to the presence of real data, the LFPP technique was applied to overcome the problems associated with FPP technique.

In this method, weights of the pair-wise comparison matrix are obtained from the following nonlinear programming:

$$\text{minimize} J = (1-\lambda)^2 + M.\sum_{i=1}^{n-1}\sum_{j=i+1}^{n}\left(\delta_{ij}^2 + \eta_{ij}^2\right)$$

$$\text{Subject to}\begin{cases} x_i - x_j - \lambda \ln\left(\dfrac{m_{ij}}{l_{ij}}\right) + \delta_{ij} \geq \ln l_{ij}, \\ -x_i + x_j - \lambda \ln\left(\dfrac{u_{ij}}{m_{ij}}\right) + \eta_{ij} \geq -\ln u_{ij}, \\ \lambda, x_i \geq 0, \quad i = 1, \dots, n, \\ \delta_{ij}, \eta_{ij} \geq 0, \quad i = 1, \dots, n-1;\ j = i+1, \dots, n, \end{cases}$$

where λ is the minimum of membership degree in FPP method that is permanently positive due to the presence of δ_{ij} and n_{ij}, while l, m, and u are the lower, middle, and upper limit of the pair-wise comparison matrix elements, respectively (Wang & Chin, 2011).

The Fuzzy Ratio System (FRS) Method

The FRS method was proposed in 2011 as follows:

The decision matrix was developed based on the following variables: $\tilde{X}^k = \tilde{x}_{ij}^k = (\ \tilde{x}_{ij1}^k, \tilde{x}_{ij2}^k \tilde{x}_{ij3}^k\ )$

where

k: Number of decision makers; k = 1,2,. . . ,K

i: Alternatives; i= 1,2,. . . ,m

j: Criteria; j = 1,2,. . . ,n

In case of having the responses of decision-makers, the Fuzzy Weighted Averaging (FWA) operator was employed, as follows:

$$\tilde{x}_{ij} = \sum_{k=1}^{k} \widetilde{W}_k \, \tilde{x}_{ij}^{k} \Big/ \sum_{k=1}^{k} \widetilde{W}_k$$

where, $\widetilde{W}_k$ is the k^{th} decision-maker importance coefficient.

If the importance of decision-makers turns out to be identical, a unique importance coefficient can be used, as follows:

$$\widetilde{W}_k = \left(\frac{1}{K}, \frac{1}{K}, \frac{1}{K}\right)$$

The acquired matrix numbers can then be normalized with the below formula:

$$\forall i.j \;\; \tilde{x}_{ij}^{*} = \left(x_{ij1}^{*}, x_{ij2}^{*} x_{ij3}^{*}\right) = \begin{cases} x_{ij1}^{*} = {x_{ij1}} \Big/ \sqrt{\sum_{i=1}^{m} \left[\left(x_{ij1}\right)^2 + \left(x_{ij2}\right)^2 + \left(x_{ij3}\right)^3\right]} \\ x_{ij2}^{*} = {x_{ij2}} \Big/ \sqrt{\sum_{i=1}^{m} \left[\left(x_{ij1}\right)^2 + \left(x_{ij2}\right)^2 + \left(x_{ij3}\right)^3\right]} \\ x_{ij3}^{*} = {x_{ij3}} \Big/ \sqrt{\sum_{i=1}^{m} \left[\left(x_{ij1}\right)^2 + \left(x_{ij2}\right)^2 + \left(x_{ij3}\right)^3\right]} \end{cases}$$

1. Each goal's weight is multiplied by its respected column.
2. To calculate the $\tilde{y}_i^{*}$ value, a summation of the fuzzy numbers (adopted for the indicators that are to be minimized and maximized) was obtained and then a sum of minimums was subtracted from the sum of maximums.

$$\tilde{y}_i^{*} = \sum_{j=1}^{g} x_{ij}^{*} \ominus \sum_{j=g+1}^{n} x_{ij}^{*}$$

3. Subsequently, the BNP_i was acquired, which is the best non-fuzzy performance value for the i^{th} alternative:

$$BNP_i = \frac{\left(y_{i3}^{*} - y_{i1}^{*}\right) + \left(y_{i2}^{*} - y_{i1}^{*}\right)}{3} + y_{i1}^{*}$$

4. The highest BNP value stands for the best alternative. Other alternatives are also sorted by the descending order of BNPs (Balezentis, 2011).

LFPP and FRS applications

A massive body of research has been conducted until date on the applications of FAHP as the basis for LFPP and FRS techniques, some of which are mentioned in Table 1.

Table 1. The External Factors Evaluation Matrix (EFEM)

Author and year of issue	Technique	Results
(Jian-quan, 2004)	AHP	Utilization of the AHP technique to determine entrepreneur evaluating index weight
(Bozbura *et al*., 2007)	Fuzzy AHP	Application of the FAHP technique to prioritize human capital measurement indicators
(Li & Huang, 2009)	Fuzzy AHP	Application of the FAHP and TRIZ techniques to develop innovative design of automated manufacturing systems
(Zolfani *et al*., 2012)	Fuzzy AHP	Employment of the FAHP technique to determine criteria weights to evaluate performance
(Mikhailov, 2003)	FPP	Proposing a novel technique to determine weights based on the FAHP technique
(Rezaei *et al*., 2013)	FPP	Application of an improved FPP technique to propose a multi-criteria framework to evaluate entrepreneurship orientation
(Momeni *et al*., 2012)	LFPP	Employment of the LFPP technique to rank effective organizational factors on creativity
Khanmohammadi *et al*., 2012)	LFPP	Application of the FPP and ELECTRE techniques for selection of a production system
(Balezentis *et al*., 2012)	FRS	Utilization of the FRS technique in selection of the employees of a business company
(Fathi *et al*., 2013)	LFPP	Simultaneous use of the LFPP and TOPSIS methods to select an organization's human resource manager
(Balezentis & Zeng, 2012)	FRS	Promotion of the technique for group multi-criteria decision making
(Van de Kaa *et al*., 2014)	LFPP	Application of the LFPP technique to select the best-suited photo-voltaic technology
(Fathi *et al*., 2014)	LFPP	Application of the LFPP and VIKOR techniques for ranking the solutions of knowledge management based on critical success factors

Methodology

The operational stages of the BJP model are as illustrated in Figure 1.

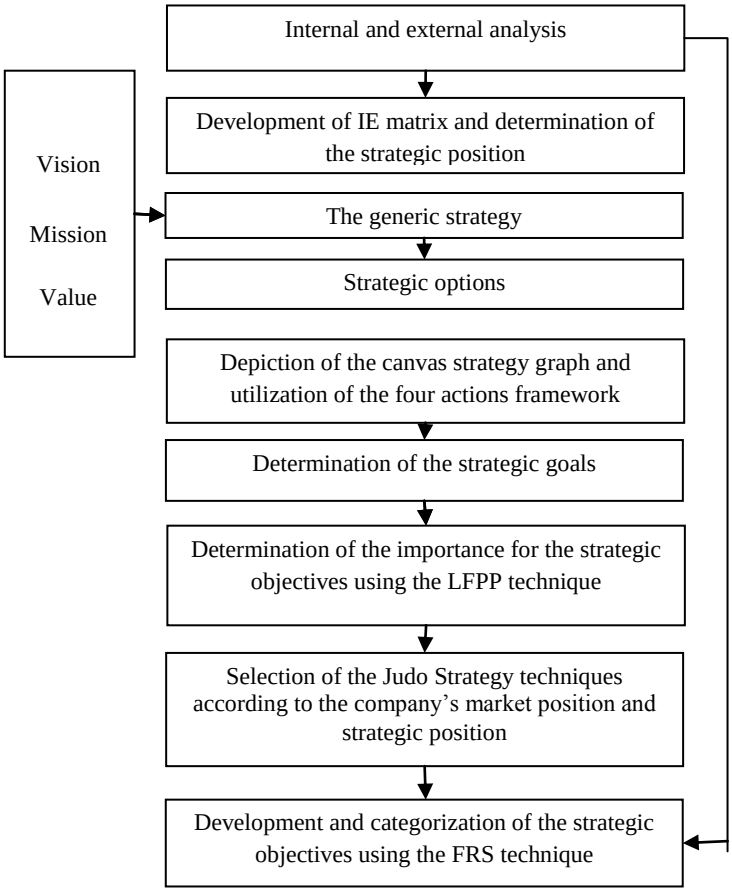

Fig. 1. The BJP model

To test the applicability of this model, in the next step, to employ this model for developing strategies for a real company.

Case study

The geographical scope suggested for the proposed model is for the X tile and ceramics company. This company is a manufacturer of tile and ceramics that has entered international markets because of presentation of high-quality products with appropriate designs.

The stages proposed by the novel model are uncovered here, as follows:

Stage 1. Development of vision, mission, and the core values

The vision, mission, and core values of the company are developed in this stage.

Stage 2. Internal and external analyses of the organization, identification of the present strategic position, and development of the generic strategy

The scores of opportunities and threats obtained using the EFEM matrix are given in Table 2.

Table 2. The External Factors Evaluation Matrix (EFEM)

Factor category	Score
Opportunities	48
Threats	−40
Final Score	8

The strengths and weaknesses using the IFEM matrix are given in Table 3.

Table 3. The Internal Factors Evaluation Matrix (IFEM)

Factor category	Score
Strengths	40
Weaknesses	65
Final Score	−25

Considering the obtained numbers, the company's position in the IE matrix was determined and, as a result, the generic strategy was developed as "stabilization of the present status along with maintenance of balance."

Stage 3. Development of the strategic options

After multiple expert meetings with senior managers, consideration of the generic strategy, and examination of the internal and external analyses, strategic options were identified as follows:

1. Market share
2. Export
3. Sales
4. Distribution
5. Strategic partnership

Stage 4. Plotting the strategy canvas graph for strategic options and using the four actions framework to draw the future position

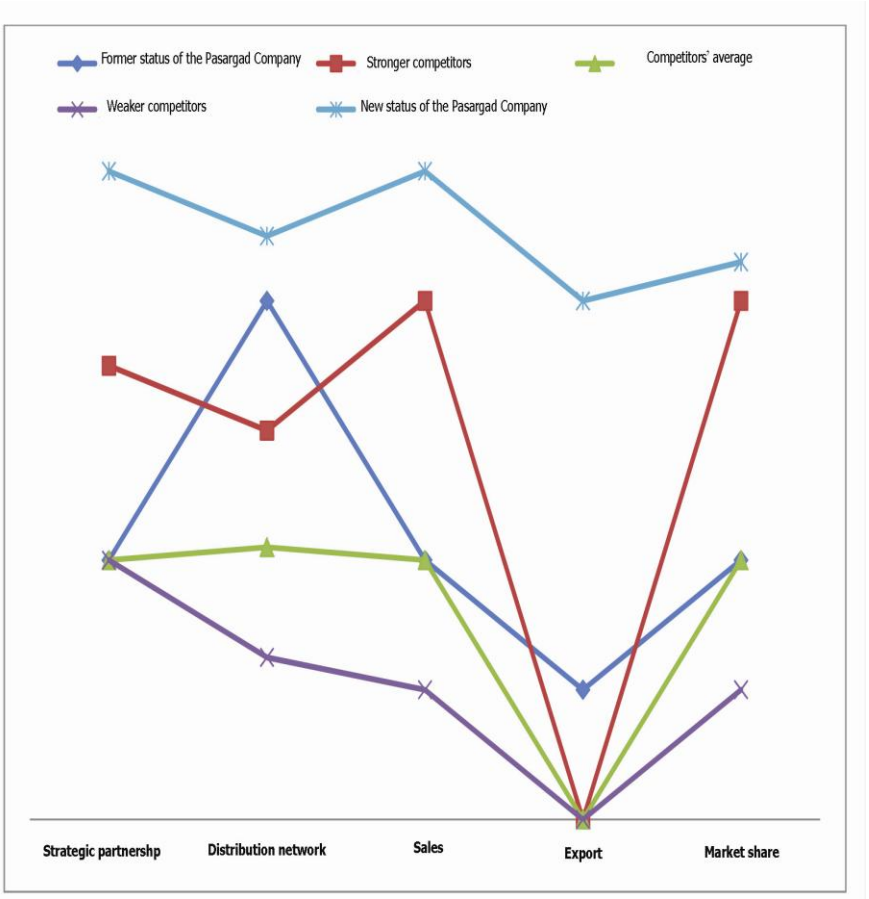

Fig. 2. The strategy canvas graph for strategic options

Results of the four actions framework for the development of the future status and the strategic goals of X Company given the strategy canvas graph are as follows:

1. Increasing the market share
2. Increasing exports
3. Improving the sales status
4. Strengthening the distribution network
5. Establishing strategic partnerships

Stage 5. Development of the strategic goals

After consideration of the generic strategy and the future position of the organization in the strategy canvas graph along with the ideas received from experts, the strategic goals were developed as follows:

- 10% improvement of the tile and ceramics distribution market share
- 3% increase of the exports share of total sales
- 400 billion Tomans of sales
- Expansion of the distribution network to 1000 representatives
- Establishing strategic partnership with tile and ceramics manufacturers

Stage 6. Finding the goals importance using the LFPP technique

Using arithmetic mean in this stage, the pair-wise comparison matrix of the strategic goals were developed (Table 4).

Table 4. Pair-wise comparison matrix for the strategic goals

Pair-wise comparison	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
	(L, M, U)	(L, M, U)	(L, M, U)	(L, M, U)	(L, M, U)
Goal 1	(1, 1, 1)	(2, 3, 4)	(2, 3, 4)	(0.167, 0.2, 0.25)	(0.33, 0.5, 1)
Goal 2	(0.25, 0.33, .05)	(1, 1, 1)	(1, 1, 1)	(0.2, 0.25, 0.33)	(0.25, 0.33, .05)
Goal 3	(0.25, 0.33, .05)	(1, 1, 1)	(1, 1, 1)	(0.25, 0.33, .05)	(0.2, 0.25, 0.33)
Goal 4	(4, 5, 6)	(3, 4, 5)	(2, 3, 4)	(1, 1, 1)	(1, 2, 3)
Goal 5	(1, 2, 3)	(2, 3, 4)	(3, 4, 5)	(0.33, 0.5, 1)	(1, 1, 1)
Weight	0.145	0.081	0.086	0.431	0.256

Using the pair-wise comparison matrix, the LFPP model was composed as follows:

$$\boldsymbol{minimize}\ \ J = (1-\lambda)^2 + 10^3 . \sum_{i=1}^{4} \sum_{i=i+1}^{5} \left(\delta_{ij}^2 + \eta_{ij}^2\right)$$

Subject to:

$$\ln(W_1) - \ln(W_2) - \lambda . \ln\left(\frac{3}{2}\right) + \delta_{12} \geq \ln(2)\,,$$

$$-\ln(W_1) + \ln(W_2) - \lambda . \ln\left(\frac{4}{3}\right) + \eta_{12} \geq -\ln(4)\,,$$

$$\ln(W_1) - \ln(W_3) - \lambda . \ln\left(\frac{3}{2}\right) + \delta_{13} \geq \ln(2)\,,$$

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$$-\ln(W_5) + \ln(W_3) - \lambda . \ln\left(\frac{5}{4}\right) + \eta_{53} \geq -\ln(5)\,,$$

$$\ln(W_5) - \ln(W_4) - \lambda . \ln\left(\frac{0.5}{0.33}\right) + \delta_{54} \geq \ln(0.33)\,,$$

$$-\ln(W_5) + \ln(W_4) - \lambda . \ln\left(\frac{1}{0.5}\right) + \eta_{54} \geq -\ln(1)\,,$$

Using the WINQSB software and the LFPP model, weights of the strategic goals (in experts' opinions) were calculated as follows:

Table 5. Goal importance using the LFPP technique

	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
weight	0.145	0.081	0.086	0.431	0.256

Stage 7. Finding competitive techniques from the Judo Strategy

Considering the IE position of stabilization of the present status along with the maintenance of balance in X Company and through investigations of the experts, the company was found to be in a relative balance in the external markets and is competing to be the best in the internal markets. Therefore, the balance principle was applied for the development of external competition strategies of the company. The leverage principle was applied for the internal competition strategies. Techniques of these principles were applied in strategy development.

Stage 8. Development and categorization of the strategic objectives in the aspects of BSC

Applying the techniques of judo strategy determined in the former stages and by using the SWOT matrix, the strategic objectives were designed and categorized based on the BSC structure as in Table 6.

Table 6. The strategic objectives

	Strategy symbol	Associated judo principle	Applied judo technique	Strategic objectives
Financial	3NSO	Balance	Grip your opponent	Establishing connections with large retailers and defining new partnerships
	4NSO	Balance	Grip your opponent and oppose indirectly	Allocation of a considerable amount of income to foreign suppliers in the early years of partnership
Customer	2NSO	Balance	Push your opponent	Designing and manufacturing consumer goods of the international targets

Continue Table 6. The strategic objectives

	Strategy symbol	Associated judo principle	Applied judo technique	Strategic objectives
Internal processes	5NSO	Balance	Push your opponent	Adding international similar products with lower price
	6DSO	Balance	Leverage your opponent's partners in your own advantage	Establishing connections with the best partners and suppliers
	11NST	Leverage	Leverage your opponent's partners in your own advantage	Finding customers for suppliers in order to attract the best suppliers of the opponents
	12DST	Leverage	Leverage your opponent's partners in your own advantage	Performing production with the assistance of the opponents due to respond beyond-production demands
	14DWO	Leverage	Leverage your opponent's assets in your own advantage	Cooperation with opponents in responding to overseas demand
	15DWT	Leverage	Leverage your opponent's assets in your own advantage	Looking for acquisition or backward integration of the best suppliers in the field of tiles
	16DWT	Leverage	Leverage your opponent's assets in your own advantage	Development of a plan in order to establish the best-suited connection with customers and attract the investors biased to the rivals
	7DST	Leverage	Leverage your opponent's partners in your own advantage	Helping suppliers to prevail the market and lower the prices
	8DST	Leverage	Leverage your opponent's partners in your own advantage	Establishing connections with the rivals' supplier in a range of prices to develop brands
	9DST	Leverage	Leverage your opponent's partners in your own advantage	Offering advantages to your own suppliers as well as the rivals' for the system to lock-in

Continue Table 6. The strategic objectives

	Strategy symbol	Associated judo principle	Applied judo technique	Strategic objectives
	10DST	Leverage	Leverage your opponent's assets in your own advantage	Investing on more advanced technologies than the ones with your rivals
	17DWT	Leverage	Leverage your opponent's assets and partners in your own advantage	Development of a continuous communication network in order to observe customers and rivals
	1NSO	Balance	Grip your opponent	Establishing connections with robust foreign companies in the field of designing and manufacturing of tile and ceramics for the abroad target markets to achieve mutual production and sales
Learning and growth	13NWO	Balance	Grip your opponent	Implementing mutual projects with foreign rivals to recognize and obtain supreme technologies
	18NWT	Balance	Grip your opponent	Attending international exhibitions in order to recognize novel technologies as well as to communicate and cooperate with rivals and suppliers

Stage 9. Prioritization of the product competitive strategic objectives through the use of FRS technique and the obtained weights from Stage 6.

In this stage, the fuzzy decision matrix was first normalized and then the obtained weights for the goals were used to normalize the decision matrix weighted in Table 7.

Stage 10. Weighting the normalized decision-matrix through the use of the obtained weights for the goals

Table 7. The weighted decision matrix

The normalized matrix by FRS	10% improvement of the tile and ceramics distribution market share	3% increase in the exports share of total sales	400 billion Tomans of sales	Expansion of the distribution network to 1000 representatives	Establishing strategic partnership with 6 tile and ceramics manufacturers
The strategic objective symbol	**(L, M, U)**	**(L, M, U)**	**(L, M, U)**	**(L, M, U)**	**(L, M, U)**
1NSO	(0.01, 0.02, 0.02)	(0.00, 0.01, 0.01)	(0.006, 0.01, 0.014)	0.060, 0.066, 0.066)	0.00, 0.004, 0.013)
2NSO	(0.020, 0.022, 0.022)	(0.002, 0.005, 0.008)	(0.00, 0.002, 0.006)	(0.033, 0.047, 0.06)	(0.013, 0.022, 0.031)
.	.	.	.	.	.
.	.	.	.	.	.
15DWT	(0.020, 0.022, 0.022)	(0.011, 0.014, 0.015)	(0.006, 0.010, 0.014)	(0.060, 0.066, 0.066)	(0.031, 0.040, 0.045)
16DWT	(0.015, 0.02, 0.022)	(0.011, 0.014, 0.015)	(0.002, 0.006, 0.010)	(0.060, 0.066, 0.066)	(0.040, 0.045, 0.045)
17DWT	(0.015, 0.02, 0.022)	(0.011, 0.014, 0.015)	(0.014, 0.018, 0.020)	(0.060, 0.066, 0.066)	(0.031, 0.040, 0.045)
18NWT	(0.020, 0.022, 0.022)	(0.011, 0.014, 0.015)	(0.014, 0.018, 0.020)	(0.060, 0.066, 0.066)	(0.040, 0.045, 0.045)

Subsequently, the values of Y were calculated and the BNP values were obtained as well. Finally, the strategic objectives were sorted according to the descending order of BNP, as listed in Table 8.

Table 8. Strategy rankings

The strategic objective symbol	BNP	Rank	The strategic objective symbol	BNP	Rank
1NSO	0.109	13	10DST	0.102	15
2NSO	0.097	18	11NST	0.132	10
3NSO	0.101	16	12DST	0.130	11
4NSO	0.147	3	13NWO	0.143	6
5NSO	0.112	12	14DWO	0.137	8
6DSO	0.099	17	15DWT	0.147	3
7DST	0.105	14	16DWT	0.145	5
8DST	0.136	9	17DWT	0.152	2
9DST	0.140	7	18NWT	0.159	1

Discussion and Managerial Implications

The aim of this research was to formulate and rank the strategic objectives of a manufacturing firm competing in the wavy market of tile and ceramics through the simultaneous use of MCDM technique with the Judo Strategy and the blue-ocean model under the framework of BSC. Given the importance of the chief managers' ideas for the development and prioritization of the strategic goals, the goals were formulated by means of the BSC, strategy canvas graph, the four actions technique, and expert meetings. The strategic goals were subsequently ranked using the LFPP model. Next, the SWOT matrix and the Judo Strategy were employed to identify the competitive objectives of the X Company. Eventually, the strategic goals were ranked through application of the SWOT matrix as well as the Judo Strategy, considering the effect of the weights of strategic goals.

From the managerial viewpoint, the chief management and its impacts on the strategic goals' prioritization was clear. In other words, it was clear from the weights assigned to the strategic goals that

managers of the company under the study keep a keen eye on the strategic partnerships and strengthening of the distribution network. This pattern was evident when analyzing the prioritized strategic objectives.

From the strategic viewpoint, due to the agility of the judo and blue ocean strategy models, the BJP model could assist companies to formulate and prioritize dynamic competitive strategic objectives, especially in the wavy markets requiring an exact competitive framework.

Conclusions

After a review of the popular frameworks regarding the strategy development process as well as the applied models in these frameworks, we explored the flaws of these methods in the identification and development of strategies as a tool to overcome competitors. The strategy canvas graph, the four actions framework, and the Judo Strategy were illustrated as the well-suited systematic tools were applied to reduce the effect of the experts' personal ideas in the process of development and designation of strategies. The BJP framework, which is the result of a combination of strategy canvas techniques, the four actions framework, the Judo Strategy, as well as the LFPP and FRS techniques with the BSC model were uncovered. After presentation of the model, the model was applied in the development of the strategic objectives of the X tile and ceramics company.

One of the achievements of the BJP framework is the proposition of a purposeful systematic path for the development and designation of a strategy based on pre-determined techniques, rather than mere basis on the personal subjective ideas of the experts. To name few of the influential limitations of this research, the following could be mentioned: the time shortage for a comprehensive investigation of the X Company to develop strategies, senior managers' lack of knowledge about the decision-making techniques, the strategy canvas graph, the blue-ocean strategy, and the Judo Strategy.

Because of the high significance of proper prioritization of the

strategic objectives, it seems that intuitive fuzzy numbers can be applied in future to consider the uncertainty of the methods such as AHP and Ratio. Moreover, application of the meta-heuristic algorithms for solving the linear programming problems could be of practicability and usefulness. The Judo Strategy essence, which is a competitive model, can also be applied in the formulation of the products' competitive strategies, to pursue the above model to the level of product strategy, and for improving the same. Furthermore, the other techniques of the blue-ocean strategy could seemingly be applied in the objective development stage as well.

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