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Research Article

Strategic planning for a food Industry Equipment manufacturing factory, Using SWOT Analysis, QSPM, and MAUT models

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ABSTRACT

Strategic Management is one of the most important tasks that managers in organizations are to accomplish. With the rise of domestic and international competition, the importance of strategic management has become undeniable. This is especially true in the era that the influence of governments on commerce has broadened. The aim of the present paper is to development an appropriate strategy for a company with a history of 40 years in providing production lines' equipments for a dairy producing factory. To reach this goal, this study applies SWOT analysis along with QSPM and MAUT models. After completing the checklists provided to assess the strength points, weak points, opportunities, and threats, the weight and importance of each factor was defined by the company managers and they were interviewed for final conclusions. Based on the acquired data, EFE and IFE matrixes were calculated and the results were analyzed on diagrams. The results showed that the company was placed in the region of aggressive strategies. These results were also confirmed by QSPM matrix. The strategy of increase in share of international markets gained the highest score and therefore, became the top priority. In MAUT model, the utility of the acquired strategies by SWOT analysis, were calculated using four attributes of cost, time, infra structure, and manager's preferences. The results were slightly different from what was acquired using QSPM model.

Key words: strategic planning, SWOT analysis, IFE matrix, EFE matrix, QSPM model, MAUT model

1. Introduction

Damirchi Industrial Factory relies on 40 years of experience in the fields of engineering and production in food industry especially manufacturing of single wall, double wall, and triple wall tanks for production lines of sterilized and pasteurized dairy produce. This article intends to draw up a proper strategy for the factory through SWOT analysis (the Strengths, Weaknesses, Opportunities, and Threats Matrix) and through QSPM (Quantitative Strategic Planning Matrix) and MAUT (Multi Attribute Utility Theory) models. *Strategy* is defined as "determination of fundamental and long-term objectives and causes of a company as well as adoption of a collection of measures and allocation of required resources to achieve those objectives and causes." A company's *strategic design* can be defined as "the process of development of the orientation and line of movement." It is worth mentioning that it is the strategic management that

puts the concept of strategy and its primary specifications into practice. This operational process is characterized as a continuous process which includes the sequence of the following activities in theory: strategic design, strategic planning, implementation of the strategy, review and updating (Matill, 2003).

Managers, on a daily basis, engage in strategy, which is a serious, accurate and often dreamy game; it is played by managers with other groups in their organization or with individuals inside or outside it (Stacy, 2003). Managers are not busy doing anything more important than the process of strategic management; appreciation of the world trade and business calls for an understanding of the strategic management process. With domestic and foreign competition intensifying, appreciation of strategic management seems to be more necessary in a time which sees the influence of governments in business operations increasing (Ebrahimnejad, 2009).

As strategies undergo changes, some problems like resistance of employees might arise; therefore, appropriate relations should be applied to inform them of the planned changes and the necessity to make them. It is aimed at attracting support for changes and involving the employees in the process of change (Milton, 2010).

Damirchi Factory has many rivals in Iran and enjoys roughly 5 to 10 per cent of the market share at the moment. Among foreign rivals, Turkish competitors are more capable than the others. In manufacturing of production lines of dairy produce, the Chinese are more famous for production of filling equipment, so china does not constitute a rival for Damirchi in the field of manufacturing of tanks. The article goes on to explain SWOT analysis and QSPM and MAUT models and to work out a proper strategy for this industrial factory.

2. SWOT Analysis and QSPM and MAUT Models

The process of strategic management begins with analyzing internal strengths and weaknesses of the organization and external threats and opportunities of the organization called SWOT analysis, and the data obtained in the previous stage are used for development of a strategy for the organization (Karami et al, 2009). To that end, we should first draw an EFE (External Factor Evaluation or Threats and Opportunities) matrix and IFE (Internal Factor Evaluation or Strengths and Weaknesses) matrix. Then, the SWOT matrix is developed through adjustment of the internal and external strategic factors, which are the base and foundation for devising a strategy. Next, priorities are identified based on the final matrix and a proper strategy is presented. The SWOT matrix is commonly used to systematically analyze internal and external environment of organizations (Kangas et al, 2000; Wheelen, 1995).

Quantitative strategic planning matrix (QSPM) is among techniques and methods very common in evaluation of strategic options and determination of relative attractiveness of strategies; attractiveness of strategies is used in the stage of decision-making. The technique determines which of the selected strategic options is feasible, and it actually prioritizes these strategies (Amadi et al, 2004). This method is widely used by academics and students in academia, but it is yet to be applied by strategic management consultants and organizations (Meredith, 2009).

In SWOT analysis and development of a strategy in different industries, multiple studies have been conducted so far. It should be mentioned that appropriate application of the SWOT matrix

can be a good foundation for formulation of a strategy (Kajanus, 2004), but evidence shows that SWOT analysis has some weaknesses (McDonald, 1993) which can be overcome by application of a QSPM model to ensure the proper development of a strategy.

One of the American approaches for multi attribute decision-making (MADM) is the multi attribute utility theory; this model is among compensatory techniques. The term utility refers to the tendency of each decision-maker toward having some specific results. In this method, utility functions which are comprised of n single index functions (n represents the number of indexes) are used; the total utility function is obtained through the addition of these functions. For each index, there is one utility function which is represented by U(x). The range of desirability can be put at either 0-1, 0-10 or 0-100. The range of desirability has been put at 0-1 in this article. These two values occupy opposite ends of a spectrum; they specify the most and the least desirable level of an index from the viewpoint of a decision-maker. First, a linear function is defined between these two ranges to determine the utility function of each index. Then, we transfer the value of each index to each option of the decision matrix, which makes it possible to determine the utility function of each index and, in turn, the total utility function.

After determination of the utility function, we calculate the desirability level of each option. The option which enjoys the highest desirability is selected as the premier option. The total utility function is written below:

$$U_T(X) = W_1U_1(X_1) + W_2U_2(X_2) + \ldots. W_nU_n(X_n)$$

In the above-mentioned formula W's represent the weight of each index, U's represent the utility functions and U_T represents the total utility function. This method has some advantages over other kinds of decision-making methods such as AHP. The most important advantage of this method is its ability to provide the decision-maker with proper information on weaknesses and strengths of options in each index (Yavuz, 2007).

3. Research Methodology

Some checklists were distributed between the manager director, the factory's manager and production manager to recognize the factory's current weaknesses and strengths and to recognize the actual and potential threats and opportunities of the manufacturing industry of the equipment for dairy production. After receiving the primary checklist and conducting an interview over strengths and weaknesses and threats and opportunities, which had been obtained through the checklist, we came to an agreement over them. Then the managers were asked to mark each item from 0 to 100. The marks were later normalized through the normal dimensionless method, the weight of each factor was measured and finally the significance coefficient was considered to be 1-4 according to the managers' viewpoint (very good opportunity or strength: 4, ordinary opportunity or strength: 3, normal threat and weakness: 2, and major threat or weakness: 1). Then the strategies were prioritized through the SWOT, QSPM and MAUT tools; we dealt with them in section 2. To determine the rate of indexes in each option in MAUT, a structured interview was conducted with the factory's production manager and manager and two of the factory's engineers, the results of which are mentioned below.

4. Analysis and Presentation of the Study's Findings (Results)

4.1 SWOT Analysis

The company should always examine its external and task environments in search of new advancements in technologies which might be applicable to its current or potential products. Beneficiaries, customers in particular, can be key members for development of new products.

Table 1: EFE Matrix

Row	Description	Weight	Significance Coefficient	Weighted Score
Opportunities				
1	Possibility of quantitative development of the factory	0.076	4	0.304
2	The existence of water jet and CNC technology to reduce costs	0.065	3	0.196
3	Opportunity for introduction on the internet and in fairs like the Industrial Fair	0.076	3	0.228
4	The existence of international opportunities (existence of markets)	0.076	4	0.304
5	The possibility for profitability through reducing some of the company's activity and outsourcing	0.065	3	0.196
6	Extension and growth in the range of products and services (providing formulation)	0.076	3	0.228
7	An increase in the diversity of products and diversity of the types of each products	0.076	3	0.228
Threats				
1	Existence of Turkish rivals	0.054	2	0.109
2	Profit margin under pressure	0.076	1	0.076
3	A reduction in the volume of interactions and contracts	0.054	2	0.109
4	The possibility for the development of information technology in the years to come for the supply chain and marketing by rivals	0.076	2	0.152
5	Transformation in the exchange rate	0.087	2	0.174
6	A reduction in the skilled welder labor force	0.087	2	0.174
7	A reduction in the number and strength of the suppliers (ability and technology)	0.054	2	0.109
Total		1		2.59

In addition to examination of the external environment, strategists should effectively keep evaluating the capability of their companies in innovation and changes of technology (Wheelen et al, 2010). Table 1 represents the EFE matrix or opportunities and threats as well as the weight, the significance coefficient, the weighted score, and the total score. Table 2 represents IFE matrix or strengths and weaknesses as well as the weights, the significance coefficient, the weighted score and the total score.

Table 2: IFE matrix

Row	Description	Weight	Significance Coefficient	Weighted Score
Strengths				
1	Existence of a successful accord system as a reward according to the performance for the motivation of employees	0.056	3	0.168
2	Presence of workers with multiple skills	0.064	3	0.192
3	The power of organizational resistance in the environment of international rivalry	0.04	3	0.12
4	The company's great ability against pressure of prices	0.032	3	0.096
5	The company's power for financing	0.04	3	0.12
6	Positive and strong relations in marketing and sale	0.064	4	0.256
7	High volume of business in food industry	0.056	3	0.168
8	The fact that the company has multiple specializations in manufacturing in food and chemical industry	0.064	4	0.256
9	Having the specialized package of business (consultation, design, manufacturing, installation etc)	0.048	3	0.144
Weaknesses				
1	Weakness of skilled manpower (welder)	0.04	2	0.08
2	Lack of proper application of information technology by the organization	0.056	1	0.056
3	Disability to cover costs in machining and turning sectors	0.04	2	0.08
4	Disability of the company to attract talent	0.064	2	0.128
5	High costs of sale and commerce	0.056	2	0.112
6	Senescence of machinery	0.064	2	0.128

7	Weakness of the trademark	0.056	2	0.112
8	Lack of experience of middle managers and supervisors	0.04	2	0.08
9	Failure to update the technology of manufacturing	0.04	2	0.08
10	Absence of innovation, research and development (R&D)	0.04	2	0.08
11	High operational costs (contracting, internal)	0.04	2	0.08
total		1		2.54

After determination of weights and scores for each factor the total of weighted scores for the IFE matrix was 2.54 and it was 2.59 for EFE matrix. Table 3 represents the SWOT matrix of Demirchi Company.

In the next stage, different types of strategies were transferred to the strategic planning table after the examination of specific components of SWOT (S, W, O, and T). The SWOT model is comprised of a two-dimensional coordinate table; each of its four areas is the marker of a group of strategies.

1. The strategies for maximum use of environmental opportunities with application of strengths of the organization (the area No.1 – SO strategy)
2. The strategies for the use of strengths of the organization to avoid facing threats (the area No. 2 – ST strategy)
3. The strategies for the use of potential advantages latent in environmental opportunities to make up for the weaknesses of the organization (the area No. 3 – WO strategy)
4. The strategies for minimizing the loss resulting from threats and weaknesses (the area No. 4 - WT strategy)

SO strategies are recommended for implementation due to being in the aggressive strategic region. 1- Discovery of international markets (focusing on regional markets in particular) and creating new international markets (particularly through fairs and internet for introduction to customers) and quantitative development. It should be mentioned that this strategy is currently at the early stage of implementation by the company. 2- Investment and acquisition of new technologies for the company to reduce costs in the long run. 3- Providing customers with new products and services, particularly the use of consultative services to attract customers and also to increase the revenue of the company. We use QSPM model to ensure the selection of a proper region and prioritizing the strategies more accurately.

Table3: SWOT Matrix

Internal factors(IFE) / External factors (EFE)	1- Weakness of skilled manpower (welder) 2- Lack of proper application of information technology by the organization 3- Disability to cover costs in machining and turning sectors 4- Disability of the company to attract talent 5- High costs of sale and commerce 6- Senescence of machinery 7- Weakness of the trademark 8- Lack of experience of middle managers and supervisors 9- Failure to update the technology of manufacturing 10- Absence of innovation, research and development (R&D) 11- High operational costs (contracting, internal)	1- High volume of business in food industry 2- The fact that the company has multiple specializations in manufacturing in food and chemical industry 3- Having the specialized package of business (consultation, design, manufacturing, installation etc) 4- Existence of a successful accord system as a reward according to the performance for the motivation of employees 5- Presence of workers with multiple skills 6- The power of organizational resistance in the environment of international rivalry 7- The company's great ability against pressure of prices 8- The company's power for financing 9- Positive and strong relation in marketing and sale
1- Possibility of quantitative development of the factory 2- The existence of water jet and CNC technology to reduce costs 3- Opportunity for introduction on the internet and in fairs like the Industrial Fair 4- The existence of international opportunity (existence of market) 5- The possibility for profitability through reducing some of the company's activity and outsourcing 6- Extension and growth in the range of products and services (providing formulation) 7- An increase in the diversity of products and diversity of the types of each products	WO strategies 1- Reduction in some capital-intensive activities and outsourcing those activities 2-Investment in research and development groups for quantitative and qualitative development	SO strategies 1-Discovery of international markets (focusing on regional markets in particular) and creating new international markets and increasing exports (especially through internet and fairs for introduction to customers) and quantitative development 2-Investment and acquisition of new technologies for reduction in costs in the long run 3-Providing the customers with new products and services
1- A reduction in the skilled welder labor force 2- A reduction in the number and strength of the suppliers (ability and technology) 3- Existence of Turkish rivals 4- Profit margin under pressure 5- A reduction in the volume of interactions and contracts 6- The possibility for the development of information technology in the years to come for the supply chain and marketing by rivals 7- Transformation in the exchange rate	WT strategies 1-Incresing the motivation of suppliers by different means for more proper functions like offering a part of the company's share to suppliers 2-Gradual sale of some worn-out machinery and outsourcing their tasks	ST Strategies 1-Focusing on marketing in regions in which Turkish companies have lesser share of markets 2-Gaining customer's confidence and signing long-term contracts to make up for the reduction in volume of interaction in the market 3-Development of information technology and application of it in order to enter new markets

4.2 Quantitative Strategic Planning Matrix (QSPM)

After allocation of attractiveness score (AS) to each factor, TSA is calculated for each strategy. Table 4 represents the QSPM matrix for a food processing factory. The number of opportunities, threats, strengths and weaknesses are taken into consideration according to tables 1 and 2.

Table4: QSPM Matrix

WO-2		WO-1		SO-3		SO-2		SO-1		score	Important strategic factors
TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS		
											Opportunities
12	3	8	2	16	4	12	3	16	4	4	1
3	1	3	1	3	1	12	4	3	1	3	2
6	2	3	1	9	3	3	1	12	4	3	3
12	3	8	2	12	3	8	2	16	4	4	4
3	1	12	4	6	2	6	2	6	2	3	5
12	4	6	2	9	3	9	3	9	3	3	6
9	3	9	3	9	3	9	3	9	3	3	7
											Threats
2	1	2	1	2	1	4	2	2	1	2	1
1	1	3	3	2	2	1	1	1	1	1	2
4	2	2	1	4	2	6	3	6	3	2	3
2	1	4	2	6	3	4	2	4	2	2	4
2	1	4	2	4	2	2	1	4	2	2	5
4	2	2	1	4	2	2	1	6	3	2	6
2	1	2	1	2	1	2	1	4	2	2	7
											Strengths
9	3	6	2	9	3	12	4	9	3	3	1
9	3	9	3	9	3	9	3	9	3	3	2
6	2	3	1	12	4	3	1	6	2	3	3
3	1	3	1	6	2	6	2	6	2	3	4
6	2	3	1	9	3	9	3	9	3	3	5
8	2	4	1	4	1	12	3	16	4	4	6
3	1	3	1	6	2	6	2	9	3	3	7
8	2	4	1	4	1	12	3	12	3	4	8
6	2	3	1	9	3	6	2	12	4	3	9
											Weakness
2	1	4	2	4	2	4	2	2	1	2	1
3	3	1	1	2	2	1	1	3	3	1	2
2	1	6	3	4	2	6	3	2	1	2	3
4	2	4	2	2	1	6	3	2	1	2	4
2	1	2	1	4	2	4	2	4	2	2	5
2	1	6	3	2	1	6	3	2	1	2	6
4	2	2	1	2	1	2	1	4	2	2	7
4	2	4	2	4	2	4	2	2	1	2	8
4	2	8	4	2	1	6	3	4	2	2	9

WO-2		WO-1		SO-3		SO-2		SO-1		score	Important strategic factors
TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS		
8	4	2	1	4	2	2	1	4	2	2	10
4	2	6	3	2	1	6	3		1	2	11
171		**151**		**188**		**202**		**215**		**Total TAS**	

WT-2		WT-1		ST-3		ST-2		ST-1		score	Important strategic factors
TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS		
											Opportunities
4	1	4	1	8	2	8	2	12	3	4	1
3	1	3	1	3	1	3	1	3	1	3	2
3	1	3	1	9	3	9	3	6	2	3	3
4	1	4	1	12	3	8	2	12	3	4	4
9	3	9	3	3	1	3	1	3	1	3	5
3	1	3	1	9	3	9	3	6	2	3	6
3	1	3	1	9	3	6	2	6	2	3	7
											Threats
2	1	2	1	2	1	2	1	2	1	2	1
1	1	4	4	2	2	2	2	1	1	1	2
2	1	2	1	4	2	2	1	8	4	2	3
6	3	4	2	2	1	4	2	2	1	2	4
6	3	4	2	4	2	8	4	6	3	2	5
2	1	2	1	8	4	6	3	2	1	2	6
2	1	2	1	2	1	2	1	6	3	2	7
											Strengths
3	1	3	1	9	3	9	3	9	3	3	1
3	1	3	1	12	4	12	4	9	3	3	2
3	1	3	1	6	2	9	3	9	3	3	3
3	1	3	1	3	1	3	1	6	2	3	4
6	2	3	1	6	2	6	2	6	2	3	5
4	1	4	1	8	2	4	1	16	4	4	6
6	2	6	2	3	1	6	2	6	2	3	7
8	2	8	2	4	1	4	1	4	1	4	8
3	1	3	1	6	2	9	3	9	3	3	9
											Weakness
2	1	2	1	2	1	2	1	2	1	2	1
1	1	2	2	3	3	2	2	2	2	1	2
6	3	2	1	2	1	2	1	2	1	2	3
4	2	4	2	2	1	4	2	2	1	2	4
4	2	4	2	2	1	2	1	4	2	2	5
8	4	2	1	2	1	2	1	2	1	2	6
4	2	6	3	4	2	6	3	4	2	2	7
4	2	4	2	4	2	2	1	2	1	2	8
4	2	2	1	2	1	4	2	2	1	2	9
2	1	2	1	4	2	4	2	4	2	2	10

WT-2		WT-1		ST-3		ST-2		ST-1		score	Important strategic factors
TAS	AS	TAS	AS	TAS	AS	TAS	AS	TAS	AS		
6	3	2	1	2	1	2	1	4	2	2	11
134		117		163		166		179		**Total TAS**	

The result obtained from the SWOT matrix is confirmed in QSPM matrix and, as it is observed, the aggressive strategies of SO-1, SO-2 and SO-3 enjoy highest scores in the QSPM matrix with 215, 202 and 188 scores respectively, and they constitute the first priorities of the company. Among them, the strategy of increasing exports and capturing regional markets (such as Iraq, UAE and some other Persian Gulf littoral states) has the highest scores and is the first priority of the company.

4.3 Multi Attribute Utility Theory (MAUT)

Four indexes of average annual costs for realization of each strategy, the required time for realization of conditions for implementation of each strategy, the existence of infrastructures and the ability of the personnel to carry out each strategy and finally the managers' preferences were taken into consideration for this model given to the obtained strategies in the SWOT analysis, and the decision matrix was obtained after interviewing the managers. Given that the calculation of the accurate cost for each strategy is very complicated and requires many predictions, the following spectrum is used with regard to evaluations for costs

Table 5: Cost Index

Estimated Cost (million Rial)	0-500	500-1000	1000-1500	Over 1500
Index number	1	2	3	4

Time is the period in which preparations such as required employment, mental preparation and empowerment of employees, required acquisition, etc are made. To determine to what extent the factory has the ability to implement the developed strategies infrastructure wise, we used the infrastructure index. The managers were asked to specify, with a number ranging from 0 to 100, the level of the factory's ability to implement each strategy at the moment.

Table 6: Decision matrix

Strategies	Cost	Time (month)	Infra structure	Managers' preferences
so1	3	18	50	9
so2	4	6	10	4
so3	2	3	85	8
wo1	1	1	85	7
wo2	1	3	30	3
st1	1	5	60	5
st2	1	6	75	9
st3	1	2	20	3

Strategies	Cost	Time (month)	Infra structure	Managers' preferences
wt1	1	12	10	1
wt2	1	24	45	2
وزن	0.32	0.25	0.15	0.28

Finally, to take the managers' current viewpoint into account we used managers' preference index with a likert spectrum ranging from 1 to 9 (1: totally unfavorable opinion of the managers to this strategy, 9: totally favorable opinion of managers to this strategy). To obtain weights, every expert was asked to give the least significant index the number of 10 (from his/her viewpoint) and mark the others according to their preference. For instance, if they gave infrastructure index, as the trivial factor, the number of 10 and believed the cost index was three times as important as infrastructure they would give it 30. Then, the obtained numbers from each expert were normalized through a linear norm to obtain the weight of each index from the viewpoint of each expert. Finally, the mean of experts' opinions for the weight of each index constituted the total weight. Concerning the matters mentioned above, table 6 represents the decision matrix.

Concerning the decision matrix and the content of section 2, the linear function of utility for each index was obtained as below:

Cost Utility function:

$$U(A_1) = \begin{cases} 1 & x<=1 \\ -0.33x+1.33 & 1<x<4 \\ 0 & x>=4 \end{cases}$$

Time Utility function:

$$U(A_2) = \begin{cases} 1 & x<=1 \\ -0.043x+1.043 & 1<x<24 \\ 0 & x>=24 \end{cases}$$

manager's preferences Utility function:

$$U(A_3) = \begin{cases} 1 & x>=85 \\ 0.013x-.13 & 10<x<85 \\ 0 & x<=10 \end{cases}$$

Infrastructure Utility function:

$$U(A_4) = \begin{cases} 1 & x>=9 \\ 0.125x-.125 & 1<x<9 \\ 0 & x<=1 \end{cases}$$

Final utility of strategies are at table 7:

Table 7: Final utility of strategies

Wt2	Wt1	St3	St2	St1	Wo2	Wo1	So3	So2	So1	Strategies
0.426	0.45	0.649	0.92	0.764	0.657	0.93	0.838	0.301	0.534	Utility (score)

According to the acquired results represented in table 7, WO-1, ST-2 and SO-3 strategies constitute the first three priorities, which are respectively reducing some costly activities and outsourcing them, gaining the confidence of customers and signing long-term contracts to make up for the reduction in the volume of interactions in the markets, and providing customers with new services and products.

5. Conclusion

As mentioned above, the results achieved in the SWOT analysis, which is the presence in the aggressive strategic region, was confirmed in the QSPM matrix and, of course, entering and capturing the regional markets constituted the first priority. But the results of the MAUT were a little different. It might result from different factors, the most important of which might be the high costs of the strategies of the SO region. They need major investment, which leads to a reduction in the total utility. Also, taking some factors such as infrastructures and time, lead to influences on the total utility. The QSPM model is developed based on the personal opinion of experts, while in the MAUT models the organization's facilities and some indexes such as costs and time are taken into account in the format of a mathematical model. In MAUT model, we tried to incorporate the managers' preference index (a group of strategies to be received priority in managers' plans for the future) to reduce the mathematical nature of the model to some extent and to take the managers' viewpoint into consideration. Finally, as it is observed, the selected strategies have the highest priorities among the managers. Although the QSPM and MAUT are both among tools used to help managers to make better decisions, it is the manager who makes the final decision in nowday's changeable and dynamic environment.

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