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An Integrated Model for Decision-making under Uncertainty and Risk to Select Appropriate Strategy for a Company

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A R T I C L E I N F O

A B S T R A C T

Recognition and select appropriate strategies to improve the condition of organizations in the eve of the crisis is important. Due to proper planning horizons in strategy-focused organizations, risk and decision making under uncertainty is greatly reduced. Therefore, it's necessary to specification and characterization the relationship between strategic management and risk management and select the best strategy of it. Accordingly, in this paper to demonstrate a direct correlation between the results of managerial strategic decision making and environmental analysis of organizations to find its strategic condition is used compilation model that both of them in order to inappropriate condition of organization are for selection the best option. The strategic areas identified by analyzing the internal and external environment of the organization, which includes the recognition of strengths, weaknesses, opportunities and threats with the help of SWOT Matrix. Finally, based on the criteria and methods of Wald classical approaches, Hurwicz, Maximax, Savage, Laplace, mean-variance decisions are based on expectations, the most likely conditions, Expected Opportunity Loss (EOL), the cost of uncertainty, the coefficient of variation and limits of responsibility, two strategies are determined by the choice of strategies. Also research has been conducted in Epic Arya Carton and the results are presented.

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1. Introduction

According to Steiss (2003), "In the business world, however, "strategy" often is used to refer to specific actions taken to offset actual or potential actions of competitors. In a more fundamental sense, the term denotes linkages with the goal-setting process, the formulation of more immediate objectives, and the selection of specific actions required in the application of resources to achieve these objectives" (p. 1).

Strategic management is defined as the process by which managers of the firm analyze the internal and external environments for the purpose of formulating strategies and allocating resources to develop a competitive advantage in an industry that allows for the successful achievement of organizational goals (Cox, Daspit, McLaughlin, & Jones, 2012). It's not about predicting the future, but about preparing for it and knowing what exact steps the company will have to take to implement its strategic plan and achieve a competitive advantage (Blatstein, 2012). Its subjects of interest overlap with several other vigorous fields, including economics, sociology, marketing, finance, and psychology (Hambrick and et.al, 2004). Also, it consists of three separate processes which are interconnected together and influence each other that involved strategic planning, strategic implementation and strategic control (Misankova, Kocisova, 2014).

Strategic planning was considered as an effective way of implementation of the strategy in the past. It makes the firm focus on a high level productivity and profitability by promoting the firm's competitive advantages (Kopaneli, 2014). According to David (2009), "strategic planning is sometimes confused with strategy formulation, because strategic plan is constructed in this stage" (p. 48). While strategic management and strategic planning have the same meaning however their difference is that latter one is more used in the business world while the former is used in the academic environment.

There are various technique and methods for strategic planning that one of them is SWOT. By the 1960s, the capstone business policy course at the Harvard Business School included the concept of matching the distinctive competence of a company (its strengths and weaknesses) with its environment (opportunities and threats) in the context of its objectives. This framework came to be known by the acronym SWOT and was "a major step forward in bringing explicitly competitive thinking to bear on questions of strategy." Kenneth R. Andrews helped popularize the framework via a 1963 conference and it remains commonly used in practice. A SWOT analysis is a structured planning method used to evaluate the strength, weaknesses, opportunities, and threats involved in a projector in a business venture. It can be carried out for a product, place, industry or person. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieve that objective (Humphrey, 2005).

For first time, risk and uncertainty conditions of enterprise have investigated systematically by John Von Neumann and Oscar Morgenstern (Chichilnisky, 2000). Thus, they presented rational principle according to expected utility hypothesis for decisions under uncertainty condition. Also, criteria of risk and risk aversion can be discussed by it. There are six strategic decision elements that include basic mission, target groups, goals and objectives, program/service mix, geographic service area, comparative advantage (Shirley, 1980). Pearce and Robinson created a model about the strategic management and decision making which includes company mission, internal analysis, external environment, strategic analysis, choice long-term objectives, generic and grand strategies, action plans and short-term objectives, functional tactics, policies that empower action, reengineering and strategic control and continuous improvement (Pearce & Robinson, 2000, p. 11-15).

The life cycle of organization is born, growth, maturity and eventually death. Ichak Kalderon Adizes in 1997, studied the life cycle of organization and considered the decline in it and mentioned that

organizations don't pay enough attention to the decline and downfall. The decline could be cause of contrary changes in the external environment or in effectiveness pertaining to internal environment of the organization. In this level, the vertical and horizontal information increase a lot with the organization and the external environment. The conflicting and suggestive actions with time pressure compels the leadership to centralized decision making. High pressure of decline lead to decision makers make risky and fault decisions to accelerate the downfall. When all prior actions have failed and any major change couldn't help to survival of the organization. So, in this section it exposures to crisis. All the stakeholders, including customers, investors, suppliers and employees begin to distance themselves from the organization and have lost faith in it. In this situation, the organization requires fundamental changes and a new strategy to deal with the external environment.

Affiliate information and knowledge applied to solve a decision problem in probability conditions. Functional information moves the location of a problem from the pure uncertain to the deterministic. The quantification of uncertainty allows for the communication of uncertainty between persons. Probability is the tool for both communicating uncertainty and managing it. There are different types of decision models that help to analyze the different scenarios. Depending on the amount and accessible degree of knowledge, the three most widely used types are decision making under pure uncertainty, decision making under risk, decision making by obtaining information (Taghavifard, 2009).

In this paper, first part discusses the nature of strategic decisions, strategic decision-making process and other relevant problems. In the second part, uncertainty and the effective factors are explained. Finally, in the last part, uncertainty cases that occurred in strategic decision making and also the applied strategies are mentioned for reducing uncertainty level.

2. Research methodology

2.1.   Research methodology

This research is of applied type in terms of objective and of descriptive survey type in terms of problem research and data collection. Since this research studies the status quo, it is among descriptive researches. It is also a survey because data is collected by asking questions from the managers of Epik Aria Company.

In this research, both quantitative and qualitative methods have been used; the qualitative method is case study and the quantitative method is field and correlation study done using several questioners.

2.2.   The population

The population in the present research is 84 executive managers, including 12 women and 72 men, in Epik Aria Carton Production Company of Isfahan.

2.3.   Sample size determination

In view of the nature of this research and the population (limited number of mangers) a sample of executive managers has been selected to be subject of survey.

2.4.   Data collection tools

This research aims to study decision making on the basis of the opinion given by executive managers and authorities to choose the best strategic opinion. For this purpose, several questionnaires have been designed and classified into the following categories:

A) The first category has been designed to study the efficiency level of strategy creation process in organization and personnel's attitude towards strategic planning process in organization. The first category consists of two questionnaires as follows:

A questionnaire of 13 questions for the evaluation of strategic planning system of the company and the answers of "Yes", "No" and "Sometimes" and a questionnaire of 10 questions for the evaluation of altitudes toward, strategic planning process in the form of Likert scale with the answers of "completely agree", "agree" "I have no idea", "disagree" and "completely disagree".

B) A questionnaire of 25 questions to investigate decision-making style in organization in Liket scale with the answers of "completely agree", "agree", "I have no idea", "disagree" and "completely disagree".

C) Organizational risk evaluation questionnaires consist of two questionnaires as follows:

  1. A questionnaire of 21 questions for the investigation of the level of potential risk in re-engineering activities of business process with the answers of "Yes", "to some extent" and "No".

  2. A questionnaire of 8 questions for the study and evaluation of risk-taking in organization with the answers of "Yes", "No" and "I have no idea". The questions have been designed to examine how risk evaluation and control process is designed and to study the level of risk taking by executive managers.

D) The questionnaires for the evaluation of strength, weaknesses, threats and opportunities to study strategic options and opportunities in organization through questions matrix.

  1. The questionnaire for the evaluation of organizational threats, which consist of 11 questions and the answers of "Yes", "Perhaps" and "No".

  2. The questionnaire for the evaluation of organizational opportunities, which consists of 9 questions with the answers of "Yes", "Perhaps" and "No".

  3. The questionnaire for the evaluation of strengths of organization, consisting of 13 questions with the answers of "agree", "I have no idea" and "disagree".

  4. The questionnaire for the evaluation of strengths of organization, consisting of 15 questions with the answers of "agree", "I have no idea" and "disagree".

2.5.   Validity of questionnaires

The questionnaires were designed after integration, edition and addition of some items to 18 questionnaires on valid and standard management websites. The validity of questionnaires has been verified using content-related validity method on the basis of the opinion given by experts and managers of organizations and that given by advising professor and risk management and strategic standards.

2.6.   Reliability of questionnaires

In order to examine the reliability of questionnaires, Cronbach's alpha test has been used. This test is used to determine the internal consistency of measurement tools such as questionnaires. Different numerical values can be given to the answer of each question. In order to calculate Cronbach's alpha coefficient, the variance of the scores of each set of questions (questionnaire) and the total variance have been calculated. Then, alpha coefficient has been calculated using formula 1.

$$\alpha = \frac{j}{j-1}\left[1 - \frac{\sum s_1^2}{s_1^2}\right]$$

Reliability coefficient of α test:

Number of questions of j test:

Total variances of questions $\sum s \frac{2}{1}$:

Total variance of test $s \frac{2}{1}$:

The validity of the questionnaires of this research has been tested using SPSS statistical software. The results are shown in table 1.

Table 1   Cronbach's alpha coefficient

number	Questionnaire as	Number of questions	Cronbach's alpha coefficient
1	Questionnaire for the evaluation of strengths of organization	15	0.895
2	Questionnaire for the evaluation of strengths of organization	13	0.904
3	Questionnaire for the evaluation of organizational opportunities	9	0.923
4	Questionnaire for the evaluation of organizational threats	11	0.856
5	Questionnaire for the evaluation of altitudes toward, strategic planning process	10	0.860
6	Questionnaire for the investigation of the level of potential risk in re-engineering activities of business process	21	0.810
7	Questionnaire for the study and evaluation of risk-taking in organization	8	0.867
8	Questionnaire to investigate decision-making style in organization	25	0.879
9	Questionnaire for the evaluation of strategic planning system of the company	13	0.876

3. Result and discussion

According to the results of previous researches, the effective strategies under decline conditions among the existing strategies have been selected to be the subject of study. Then, the strategies have been transferred to decision-making matrix. Quantitative values have been estimated for the comparison and selection of appropriate strategies using feasibility study and experts' opinion method. In order to get the results easier, three situations have been predicted and the likelihood for each has been assumed equal. In order to reduce computational complications and errors, operational risk taking have been considered equal for all predicted choices and situations in the form of likelihood. According to David, there are six appropriate strategies: Costs management, consolidation, partnership, vertical integration and reducing and assignment according to selection conditions. These strategies have been scored for each predicted situations in decision-making matrix on the basis of the feasibility study of the execution of each strategy. Considering decision-making criteria, the strategies have been compared and the best one has been selected. In order to do an easy and precise

computation, three situations: positive effect, no effect and bad effect which may occur in the execution of each strategy have been predicted.

In this research, the findings of the researches and the experts' opinion about the feasibility study of project execution have been used for the calculation of risk values and score of choices.

The quantitative values have been compared through feasibility study of each strategy in the occurred situation on the basis of four criteria and experts' opinion and scoring.

    1. Strategy execution complication (I)

    2. Technology (S)

    3. Environment (E)

    4. Performance time (P)

Finally, these four criteria has been combined and the estimated values have been multiplied by one another to get a number in the interval of [1, 10000], which serve as a basis for final comparison. The results of computation are show in table 2.

Table 2   Decision-making matrix

Situations / Strategies	Positive effect P	no effect P	bad effect P
Costs management	756	1008	1176
Consolidation	280	504	756
Partnership	252	504	756
Vertical integration	504	1764	1512
Reducing	640	1000	800
Assignment	756	1176	1512

3.1.   Results on the basis of decision-making criteria

In order to make an analysis of Wald, Hurwicz and Savage Mini Max, Laplace Variance mean, the most likely expected situations, expected opportunity loss (EOL), uncertainty cost, diversity coefficient and limited liability conditions in the factories in crisis have been discussed and compared. Six substitutions for business production in different fields (A1, A2, A3, A4, A5 and A6) and three different market opportunities have been calculated and analyzed in predicted situations (S1, S2 and S3). According to the results shown in table 3, choices 2 and 3 are more appropriate; that is consolidation and joint venture strategies. It is believed that it is necessary to emphasize more on the determination of uncertainty in the factories which are in crisis especially in production and processing of new product and market. Under such conditions, consolidation and joint venture strategies control costs and improve profitability by reducing costs.

Table 3   A summary of results on the basis of decision-making matrix

Criteria	Suggested substitute for the business
Maximin Wald criterion	A1 and A6

Table 3	A summary of results on the basis of decision-making matrix

Criteria	Suggested substitute for the business
Hurwicz criterion	A4
Maximax criterion	A6
Savage minimax regret criterion	A3
Laplace unsufficient reasons criterion	A3
Median – Variance analysis in financial theory	A2
Expectation-based decision making	A3
The most likely situations	A3
Expected opportunity loss (EOL)	A2
Uncertainty cost	A4
Changes coefficient	A3
Limited liability conditions	A3

3.2.   Evaluation of the strategic situation of Sepehr Aria Company

In order to make any analysis of organizational environment and to design SWOT matrix, internal factors have been evaluated in comparison with rivals and the strengths and weaknesses of the system in the company using IFE matrix (Internal Factors Evaluation Matrix) after the evaluation and classification of internal and external factors of the organization. The results are shown in table 4. An analysis has been made of economic, technical, political, cultural and social factors using EFE matrix (External Factors Evaluation Matrix). The results are shown in table 5. The above-mentioned factors have been recorded in the margin of SWOT matrix. Finally, the appropriate strategies for st.so,wt and wo have been introduced on the basis of expertise. After making an analysis of four questionnaires for the evaluation of strengths, weaknesses, opportunities and threats the most effective indexes have been extracted.

Table 4   Internal factors evaluation (IFE) matrix of Aria Carton Production Company

	Internal effective factors	Weight	Factor score	Weight score
Strengths (S)	1. We have competitive skill	0.05	4	0.2
	2. We have lot of experience	0.05	3	0.15
	3. We are well-known by buyers	0.07	4	0.28
	4. We have exclusive technical know-how	0.04	4	0.16
	5. We have good performance in producing new goods	0.04	3	0.12
	6. We have better advertisements in comparison with our rivals	0.03	3	0.09
	7. We have better technical know-how/ technical skill	0.05	4	0.2
	8. We have made market researches	0.03	3	0.09

Internal effective factors		Weight	Factor score	Weight score
	9. We are pioneer in industry	0.06	4	0.28
	10. Our company is located in an industrial zone near materials consumers and customers	0.08	4	0.32
Weaknesses (W)	1. We do not have any clear strategic path	0.07	1	0.07
	2. We do not have sufficient managerial talent and knowledge	0.06	2	0.12
	3. We do not have some key skills and qualifications	0.06	1	0.06
	4. We are involved in internal operational problems	0.07	1	0.07
	5. We are not able to provide necessary financial resources to change our strategy	0.02	2	0.04
	6. We have higher total costs in comparison with our rivals	0.05	2	0.1
	7. We have low level of average profitability	0.06	1	0.06
	8. There is inefficient relationship with different sections of the company	0.04	1	0.04
	9. There is not occupational security	0.04	2	0.06
	10. There is no sufficient motivation in personnel	0.03	1	0.04
Total		1		2.51

The number of 2.51 of IFE matrix shows that strength aspects overcome weak aspects in the company.

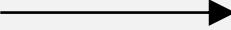**Table 5**   External factors evaluation (EFE) matrix in Aria Carton Production Company

External effective factors		Weight	Factor score	Weight score
Opportunities (O):	1. There are other groups of customers to whom we can render our services	0.07	4	0.28
	2. There are new markets or new areas of market to enter	0.07	2	0.14
	3. We are able to develop our production line or services	0.07	4	0.16
	4. We are able to make a diversity in the relevant goods	0.05	3	0.15
	5. We can control resources finding or supply activities (vertical integration)	0.04	2	0.08
	6. We are entering external markets	0.03	3	0.17
	7. Our rivals are selfish	0.05	3	0.15
	8. Market is growing faster	0.05	3	0.15
	9. Legal requirements have made it more difficult for us to do business	0.07	2	0.21
Threats (T):	1. External rivals are entering market at low cost	0.04	2	0.08
	2. Selling substitute goods are increasing	0.07	1	0.07
	3. Market growth is slower than what we expected	0.04	2	0.08
	4. There are sudden changes in external foreign currency rates and/or trade policies	0.05	1	0.05

Table 5   External factors evaluation (EFE) matrix in Aria Carton Production Company

External effective factors	Weight	Factor score	Weight score
5. Legal requirements are heavy and exhausting	0.03	3	0.09
6. We are vulnerable in making changes in business cycle	0.06	2	0.12
7. Bargaining power is increasing in our customers and consumers	0.02	3	0.06
8. Our customers' requirements are changing in an opposite direction of our specialties	0.06	1	0.06
9. It is easy to enter this industry	0.07	2	0.14
10. Change with low knowledge or without prior warning or notice	0.06	2	0.12
Total	1		2.34

   The number of 2.34 of EFE matrix shows that environmental opportunities overcome environmental threats in the company. After all environmental factors (opportunities and threats) and internal factors (strengths and weaknesses) are identified; they are transferred from EFE and IFE matrix to OTSW matrix. Then, combinational strategies are determined and recorded in table 6.

Table 6   SWOT matrix of the company

		Opportunities: - Other groups of customers - New markets or new areas of market - Ability to develop production line or services - Ability to make a diversity in the relevant goods	Threats: - External rivals enter the market at low cost - Increased sales of substitute goods - Market growth is slower than what we expected - Sudden changes in market rates
External factors	Internal factors ➔		
	Strengths: - We have competitive skill - We have a lot of experience - We have well-known by buyers - We have exclusive technical know-how - We are skillful in producing new good - We have better advertisements in comparison with our rivals - Better technical know-how / technical skill - Market researches - Being a pioneer in industry - The factory is located in an industrial zone new raw materials consumers and customers	Offensive strategy (SO): - Producing appropriate products for different age groups using creativity - Obtaining appropriate market shave with the help of R & D Department and diversity of products - Showing initiative in the market and being a pioneer in industry and position - Using competitive skill and participation in domestic and overseas exhibitions - Using competitive advantage and establishing an occupational, and specialized management system and using specialist personnel - Increasing working-shifts and using well-experienced personnel to increase production and filling in the vacuum of similar goods - Using good reputation and cooperating with supplementary companies - We develop our production line upon consolidation in the production units of the relevant companies	Diversification strategy (ST): - Making marketing activities specialized and scientific and reinforced and using managers' coalition - Introducing attractive and new products and using technical know-how to upgrade the brand - Entraining into constructive transactions and long-term contracts with raw materials supplies - Supplying high-quality raw materials from reliable and competent internal supplies - Using quality management systems techniques to improve the quality and reducing the cost price and sales price of products - Accepting the risks which cannot be accepted by other companies - Using exclusive technical know-how for competition with external products and entering into temporary contract with internal companies (joint venture) - Designing partnership advertisements of internal companies to compete with external companies
	Weaknesses: - Lack of clear strategic path - Lack of sufficient management talent and depth - Lack of key skills and competency - Involved in internal operational problems - Inability to finance financial resources for change - Higher total cost in comparison with rivals	Revision strategy (WO): - Focus on high-earning people for introducing luxurious and special products to them - Using a systematic, specialized and professional marketing management system for establishing effective relationships between different sections - Using IT system for organizing and coordinating management system - Providing on-the-job specialized training facilities for personnel and managers - Creating vertical integration for supplying financial resources and raw materials	Defensive strategy (WT): - Providing appropriate business conditions for well-experienced personnel and providing occupational security - Approving a certain percentage of marketing and sales income for advertisement section - Upgrading the quality of products and using modern technology for competing with overseas products - Reducing internal operations and grading the importance and priority to decrease total cost and reinforce profitability operations - Designing some plans for reducing residues

| | - Low average profitability

- Inefficient relationship between different sections

- Lack of occupational security

- Lack of sufficient motivation in personnel | - Holding temporary and permanent domestic and overseas exhibitions for introducing products and advertisements

- Obtaining financial facilities with focus on re-payment of facilities out of increased production and sales increased income of the organization with the help of those organizations, which are ready for partnership | and avoid repetition of works

- Increasing service supply speed

- Consolidation of low-experienced sections with low profitability and using similar sections in the company, which is ready for cooperation

- Vertical integration |

In view of four categories of the strategies put in questions matrix and the location of the company in internal and external matrix, those strategies relevant to the area determined in the internal and external matrix are selected (see table 7).

Given the matrix of EFE and IFE, ST strategies (using strengths of the organization to prevent threats) shall be taken into account. The result of decision-making matrix corresponds with those of environmental evaluation of Sepehr Aria Company. Therefore, partnership strategy can be used for organizing the critical and disturbed conditions of the company in the hope of restoring the company and increasing profitability.

Since, the selected strategies in decision-making matrix are consolidation and partnership it is concluded that partnership is within the strategic territory of the company according to the results of environment evaluation. Therefore, there is correspondence between the results.

Table 7 Internal and external matrix

Internal factors

	1 2.5 4	
	Diversification strategy (ST): **IFE=2.34** **EFE=2.51**	Offensive strategy (SO):
2.5	Defensive strategy (WT):	Revision strategy (WO):
4		

(External factors)

4. Conclusion

In more accurate study, it could be understood that these strategies have lowest feasibility of execution effect in optimal situation effect. Also, the TS strategies are more importance than the other strategies with environmental evaluation of this company and according to internal and external factors of evaluation matrix. In this case, effective strategies are vertical integration, participation, variation and alliance. Base on high risk of this company, the result of decision matrix and the environmental evaluation ate the same. Finally, crisis condition of this case organized with using participation strategic.

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