

Developing a stage-based framework on prioritize strategies by TOPSIS for preparing roadmap- case study in auto parts company

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Abstract: As the complexity and increasing change in today's competition, creating opportunities and effect of choosing various ways in fate of organizations becomes an important matter in management decisions. To recognize the way and choose consciously to be in survival and progression way need to determine the strategies and priorities to achieve them. Auto part industry has an important role in economic and business and whereas auto parts industry is one of the important element in supply chain of automobile, pay attention to this industry and having a long term-planning is a great helping in efflorescence of this industry. This paper studies about strategy prioritization in preparing roadmap and offer a framework for it with use of multi criteria decision making methods. First we choose roadmap type and decision making method, then implement the framework in an auto parts company. The results show that using of multi criteria decision making method in preparing roadmap causes to implement reasonable and according to ability of organization.

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1. Introduction

In today's societies and increasing competition that are available, organizations should adapt themselves with environmental conditions quickly to remain in competition. This will be possible with long-term and short-term planning.

One of the most common long-term planning methods is the roadmap that that can use for considered scope. Preparing the technology roadmap is a need-based technology planning process to help identify, choose and develop the technologies that are required. (Hosseini Nasab *et al.*, 2011)

Certainly achieving to the organization visions need to analyze the proper situation, proper developing, implementation, continuous measuring and monitoring until achieving to them.

In order to achieve these, need to use tools to manage each stage. TOPSIS as one of the multi criteria decision making is the tool that is used in this paper and will priority strategies with it for preparing roadmap. Regarding to barriers to implementation of strategies, roadmap can use for removing them.

In this paper has been used TOPSIS to increase efficiency and effectiveness. In preparing roadmap first, customer and market should be recognized completely then organization's visions and strategies should be determined and finally, long term planning up to short term planning should be done. In this regard, problems such as how to measure and implement the strategies presented and, also the organization success in notice to importance and priority of strategies and then, breakdown planning for

assigning resource of organization such as money, time and other resources to achieve to the strategies with needful efficiency and effectiveness is discussing.

2.0 Literature Review

2.1 Road map

1. Kavyani and cooperators in a research have evaluated and compared models and frameworks of roadmap, according to a theoretical approach after determining their properties and specification. After comparing these models contains three aspect of content, process and fields of weak point and strengths point are studied. The results of study, is offering a category of models that helps organizations to choose according to their targets and conditions, the roadmap proper models. (Kaviani, Kourosh *et al.*, 2012)

2. Hosseini nasab and cooperators have tried to recognize the similarities and differences of technology roadmap that is preparing for various areas of industry. The results show that there is variety of approaches for preparing technology roadmap for a special industry and the way of preparing roadmap has high dependence to the considered situation and targets. (Hosseini Nasab *et al.*, 2011)

3. Robert phaal and cooperators in a research explore the issues of how to design and architect roadmaps and roadmapping processes. The structure of the roadmap, and the process for developing and maintaining the roadmap, should be designed to serve the purpose for which the activity is intended to satisfy, providing a 'common language and structure' for both development and deployment of strategy. (Phaal, Robert *et al.*, 2009)

4. Kajikawa and cooperators in a research, propose a framework describing engineering knowledge, and analyze two S&T roadmaps based on the framework. According to their results, there are two types of roadmaps with respect to their description levels. One is entity-level description that is seen in environmental science and life science. Another is attribute-level description seen in the manufacturing industries including the semiconductor industry. We assume the attribute-level description of roadmap to be more effective because it enables us to set quantitative goals. (Kajikawa, Yuya *et al.*, 2008)

5. Phaal and cooperators in a research, doing a brief review on the technology roadmap and categorize the roadmaps. A rapidly increasing literature on roadmapping itself is presented by the writer. Also considers the use of the roadmaps from two main perspectives. The first is a company perspective and the other is multi-organizational. (Phaal, Robert *et al.*, 2005)

6. Bahari in his research collection that named roadmap, study on history, types and methods related to roadmap. They also represent the weak and strength point of this tool at the end. (Bahari, Mojtaba, 2012)

2.2 Multi criteria decision making

7. Mahin Nastran and cooperators in a research for studying on zonular unequal pattern and needing to determine the difference between the zones and the priority of one place toward the structure of the same places in the city, use the TOPSIS. The results show that among the city zone of Isfahan, there are six deprived areas with priority coefficient of 0.22 to 0.34 in the lowest level of enjoyment and have the first priority of development. (Nastaran, Mahin *et al.*, 2010)

8. Haj Molla Ali kani and cooperators in a research, study on research projects about country telecommunication development in the next decade. In this regard, some criteria or index for comparing and consider their combined impact on the prioritization of these plans, using TOPSIS to prioritize them. (Haj molla ali kani *et al.*, 2002)

9. Saffarzadeh and cooperators in a research prioritize the airports and their service level. As for the correct management of airports should know about performance and total component system, they present the way of evaluating and prioritize airports according to the factors which are effective on efficiency and service level. After identifying and categorizing of these factors, the opinions of experts have been getting. (Saffarzadeh, Mahmoud *et al.*, 2011)

10. Safaee and cooperators by combining of multi criteria decisions technics, prioritize the strategy of achieving to the international class of production. One of the important effects of 20th century in manufacturing and commerce Circumstances, is becoming global and production Going beyond as a

limited decision and in a National territory and become to a strategic decision in an international border. They use a combining approach by FAHP and FVIKOR techniques to evaluate production strategies comparatively in global class in steel industry of mazandran state. (Safaei ghadikalae *et al.*, 2012)

11. Shiung Wu and cooperators in a research integrate the analytic network process (ANP) and technique for order preference by similarity to an ideal solution(TOPSIS), which can be utilized by marketing strategists in a real industry to determine the appropriate marketing strategy. The purpose of the study is to model the marketing strategy decision-making problem as a multi-criteria decision-making (MCDM) problem and provide a five-step decision support framework to make and carefully assess the marketing strategies. The proposed framework can be easily understood and followed by marketing strategists to determine the appropriate marketing strategy. (Shiung Wu Cheng *et al.*, 2010)

12. Xiaoqian Zhu and cooperators in a research establish a quality credit evaluation index system. To the best of our knowledge, there hasn't been a widely-accepted quality credit index system and no quantitative method has been employed in quality credit evaluation up to now. They has established a quality credit evaluation index system for air-conditioning enterprises in Chinese market and use TOPSIS (technique for order preference by similarity to ideal solution) method to evaluate quality credit of the enterprises. The analysis of experiments verifies that the proposed quality credit index system is reliable and TOPSIS is suitable for quality credit evaluation. (Zhu Xiaoqian *et al.*, 2014)

13. Lei GAO and cooperators in a research has proposed a system for improving decision support system that contains two parts. They have used their proposed system as the assessment of management strategies for recreational fishing in the Ningaloo Marine Park. In the management of recreational fishing, multiple biophysical and socio-economic objectives need to be considered. The identification of best management options is technically challenging because of the lack of scientific tools to inform resource managers of future responses/impacts of these different options. The system consists of two main components: an integrated agent-based model for simulating recreational fishing behavior and reef ecosystem dynamics; and an evaluation model based on the analytic hierarchy process (AHP) together with a technique for order preference by similarity to ideal solution (TOPSIS). The evaluation component is responsible for assessing alternative strategies based on the simulation outputs generated by the former. (GAO, Lei *et al.*, 2013).

Table 1 Literature Review of roadmap and TOPSIS

Research number	The idea uses in research	Use other strategy tools	Use other priority tools	Use roadmap	Use TOPSIS
1	Comparing models and offer category and solution in choosing proper model in each conditions			*	
2	Comparing various types of roadmaps and prepare similarity and difference			*	
3	Study on how design and architect roadmaps and their process			*	
4	Study on roadmaps of science and technology , and introduce various types of roadmaps according to acquired results			*	
5	Study on roadmaps and present it in two aspect of company perspective and multi-organizational			*	
6	Practical study on roadmap (history, objectives, drawing methods)			*	
7	Use TOPSIS for studying on regional unequal pattern.				*
8	Use MCDM in Prioritize research projects to qualitative and quantitative improvement in telecommunication development				*
9	Use AHP in prioritizing the airports according to efficiency and services level		*		
10	Use merged MCDM method to prioritize production strategies in international class	*	*		
11	Use ANP and TOPSIS to prioritize strategies		*		*
12	Use TOPSIS to evaluate quality index of company				*
13	Use MCDM and simulating for decision support system				*
This paper	Prioritize Strategies by MCDM to improve process of preparing technology roadmap. Case study on auto parts company		*	*	*

Certainly achieving to the organization visions need to analyze the proper situation, proper developing, implementation, continuous measuring and monitoring until achieving to them. In order to achieve these, need to use tools to manage each stage.

If formulate roadmap appropriately, we can achieve the goals outlined in the statement. Also, due to practical difficulties and weaknesses in the formulation of the roadmap in this study TOPSIS tool being used to prioritize the strategies used in the road map.

2.3 Auto parts industry

According to automotive usual lifetime estimation in conditions of decreasing capitation income, the demand of automotive as a Luxury good is decreasing and consuming of auto parts of auto motive will increasing.

Also the auto parts industry can be the basis of automotive industry because the significant portion of final price of auto motive is to auto parts of it and the auto motive quality depends on consumed parts and its design. So without having a capable auto parts

industry, achieving to a mature automotive industry is out of mind.

Although the growth of auto parts industry in Iran is from Holy Defense duration in that economic and social terms, but the start of organizing the auto parts design and engineering company such as Sapco, Saze Gostar siapa, Mega Motor that is cause the growth of auto parts inside country, is the year 1372 that in the end of 1386, the volume of making auto parts of the companies inside country increase to more than 68,000 billion Rials. (Institution of State Audit Pension Fund, 2009).

In 1386, more than 2 percent of the world's auto parts industry was in Iran. (Institution of State Audit Pension Fund, 2009).

3. Purposed frame work and related tools

3.1 Six step framework

Generally roadmap causes integrating in resource assignment in order to achieve the long term targets of organization and the priority of strategies causes resource priority. TOPSIS could determine more important strategies and help organization to achieve to its long term targets.

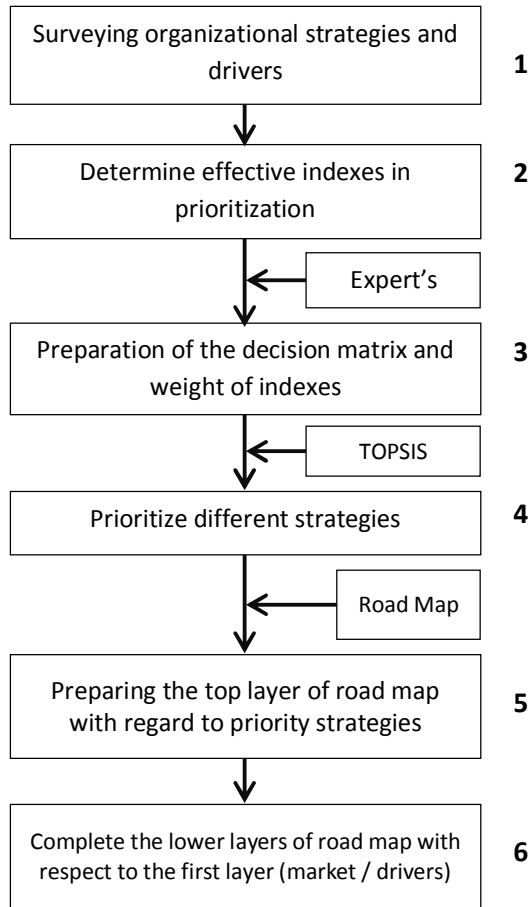


Figure 1: The proposed framework

For achieving to final result, first step is surveying the organizational strategies and drivers. The second step is determining the criteria that are effecting on targets and strategies of organization. Then the decision matrix should be prepared and in the third step should prioritize the strategies and targets with TOPSIS method and by finishing this step the entrance input information for the top (first) layer of roadmap is ready so in the last step should be determined and complete the other layers that included products, technology, research and development (R&D) and resources.

3.2 Study and choose the roadmap

In the continuous changing of today’s world, planning is the basic condition for doing responsibilities, achieving to goals and even continue the organization life. In the recent decades various tools has introduced to facilitate, scrutiny and Specifying the planning process, continuous monitoring of activities and evaluation of activities coordination with plans value. Roadmap is one of these planning methods that can be helpful in maintaining a competitive position. (Khalil, T, 2015)

Areas and fields which it is possible to prepare a road map for them are very varied. For example among these can be cited to the areas of technology, science and market. One of the most useful road maps is technology road map that is widely used in various industries for strategic and long-term planning. (Hosseini Nasab *et al.*, 2011)

Road maps according to the objective that is followed in preparing for and also format, presentation form and uses cases have various types.

Technology roadmap can pursue goals as follow: production planning, service/ capabilities planning, strategic planning, long-term planning, knowledge planning, process planning and integration planning. Based on studies and segmentation of results can be categorized technological road map as the format results in eight groups. Most important formats of results presentation in technology road map as follows: multi-layer model, column chart, tables, charts, visual presenting, exponential process. Evaluation shows that all models look at the strategic planning as the view of program and positions. More analysis of technology roadmap conform this result. (Kaviani, Kourosh *et al.*, 2012) according to studying and multi-layer road map benefits (schematic plan of multi-layer road map), in this paper we use multi-layer roadmap.

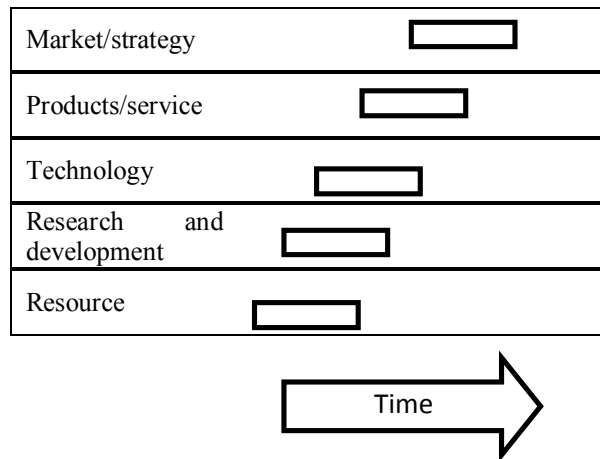


Figure 2: Layer road map

3.3 Multi criteria decision tool

Multi-criteria decision is a powerful decision making tool that it is structure the problem transparently and systematically. (Shiung Wu Cheng *et al.*, 2010) Also in these decision-making rather than one factor in measure of optimality of several criteria may be used. (Asgharpour, Mohammad javad, 2011)

TOPSIS stands for the Technique for Order Preference by Similarity to Ideal Solution. TOPSIS model was proposed by Huang and Yun in 1981. This model is one of the best models is the multi-criteria decision making. This technique is based on the concept that the choice should be closest to the positive ideal solution (the best possible), and the maximum distance from the negative ideal (the worst possible). (Shiung Wu Cheng *et al.*, 2010) TOPSIS method of multi-criteria decision is known because of reliable results, fast calculation process and easy to understand and use it. (Zhu Xiaoqian *et al.*, 2014)

4. Implementing offered framework in Auto parts company

The purpose of road map is to determine the path from the present to the future and create the necessary integration and coordination at all levels of

the organization by determining the necessary resources to achieve the goals. To demonstrate the above, an experimental study was done and in an Auto Parts company has been implemented. This paper is a practical, developing and is descriptive in data collection.

Use this tool to develop a road map with respect to offered framework, has been implemented which is given below.

4.1 First Step: tables of company strategies

According to the statistical sample of employees surveyed that they were selected, the following strategies were identified by interviews and questionnaires. Extracted strategies are SWOT matrix output that their type has been identified by combining of Strengths (S), weaknesses (W), opportunities (O) and threats (T) points. Tabel2 is showing these strategies:

Table 2: Strategies tables

ID	Strategy	Strategy type
1	Developing product in automotive projects	OS
2	Continuous and effective relationship to foreign beneficiaries	OS
3	Continuous and effective relationship to internal customers	OS
4	Provide new products with outsourcing view	OS
5	Continuous and effective relationship to automotive industries and customers	OS
6	Organizing purchase form china, Taiwan et....	OW
7	Investment in IT infrastructure (official automation and financial budget system)	TS
8	Managing finished price of products and maintain available market share	TS
9	Move toward low consumption production of automobile	TS
10	Optimize quality management system and internal process	TS
11	Improve political situation and financial index	TW
12	Changing approach form shifting to repairing	OW
13	Promoting knowledge of employees	OW

4.2 Second step: determine the effective index in prioritization

Indexes that were used in this study for prioritizing, has been extracted according to expert opinion that they are given below.

1. Strategy implementation cost
2. Revenue arising from the implementation of the strategy
3. The willingness of employees to strategy
4. Tendency of Customers to strategy and increasing market share
5. The willingness of suppliers to strategy
6. possibility Access to strategy In terms of time

4.3 Third step: Normalized the decision matrix and weights

Decision matrix according to expert's opinion as show in table 3 has been rated.

Table 2: Decision matrix

Index strategy	1	2	3	4	5	6
OS1	9	9	7	9	9	1
OS2	1	5	3	9	9	7
OS3	3	7	9	3	3	7
OS4	5	7	1	5	3	5
OS5	3	5	3	7	5	7
OW6	3	7	3	7	1	5
TS7	3	3	7	5	5	7
TS8	5	5	1	9	3	3
TS9	3	5	3	9	3	3
TS10	3	1	3	7	3	7
TW11	3	7	7	3	5	3
OW12	5	7	3	3	1	5
OW13	3	5	9	7	3	5

The weight table, according to expert opinion prepared as follows:

Table 3: Weights table

Criteria	W1	W2	W3	W4	W5	W6
Weights value	.22	.2	.1	.14	.1	.24

4.4 Fourth step: Prioritize strategies

Weighted normalized decision matrix has been achieved as show in table 5.

Table 4: Weighted normalized decision matrix

Index strategy	1	2	3	4	5	6
OS1	.131	.838	.366	.516	.526	.124
OS2	.145	.466	.157	.516	.526	.87+
OS3	.436	.652	.471	.172	.175	.87+
OS4	.727	.652	.52	.286	.175	.621
OS5	.436	.466	.157	.4-1	.292	.87+
OW6	.436	.652	.157	.4-1	.058	.621
TS7	.436	.279	.366	.286	.292	.87+
TS8	.727	.466	.52	.516	.175	.373
TS9	.436	.466	.157	.516	.175	.373
TS10	.436	.093	.157	.4-1	.175	.87+
TW11	.436	.652	.366	.172	.292	.373
OW12	.727	.652	.157	.172	.058	.621
OW13	.436	.466	.471	.4-1	.175	.621

The results of TOPSIS solution in respect of each of the strategies:

Table 5: Results

Rank / Priority	strategies	Di+	Di-	Cli+
1	TS10	0.1451	0.0402	0.7831
2	TS7	0.1322	0.0534	0.7121
3	OS5	0.1274	0.0584	0.6855
4	OS2	0.1465	0.0697	0.6775
5	OS3	0.1262	0.0765	0.6225
6	OW6	0.1172	0.0723	0.6185
7	OW13	0.1133	0.0726	0.6095
8	TS9	0.1088	0.0783	0.5814
9	OW12	0.1027	0.085	0.5471
10	OS4	0.0985	0.086	0.534
11	TW11	0.102	0.0893	0.5333
12	TS8	0.0915	0.0925	0.4972
13	OS1	0.0105	0.1703	0.0579

4.5 Fifth step: Prepare first layer of the road map by taking priority strategies

According to the priority extracted from TOPSIS results, which are reflecting the strategic priorities, first layer of our road map has been formed. Strategies in first layer are according to table 7.

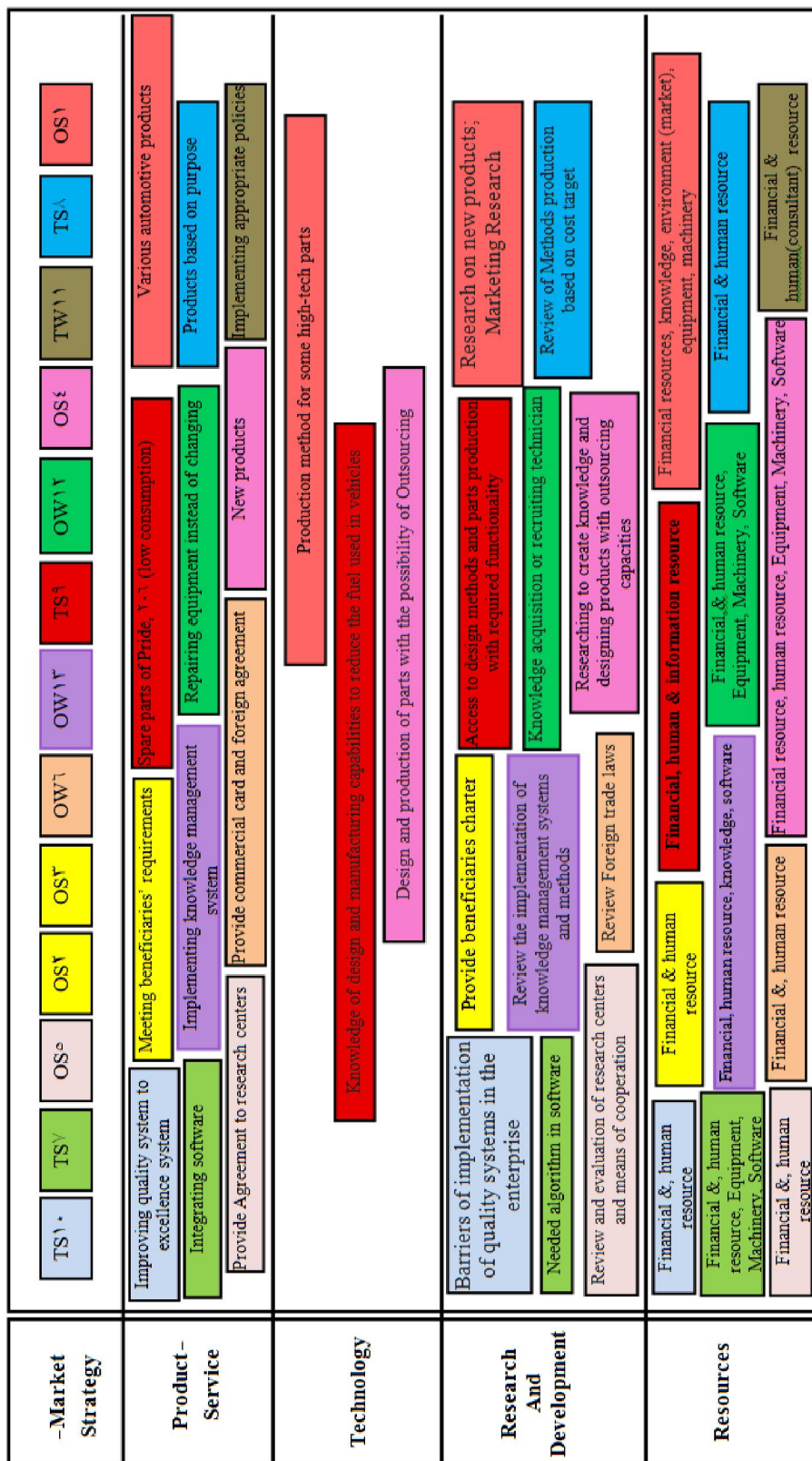
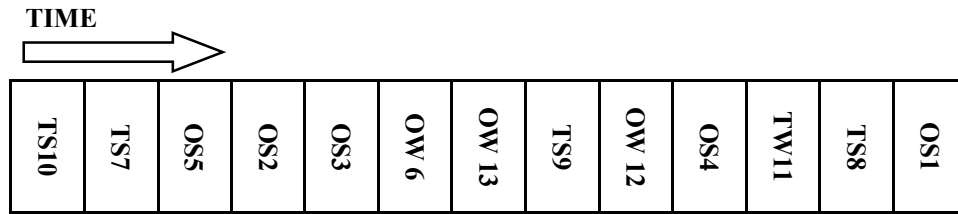


Figure 3: Layer roadmap of Auto Parts Company

Table 6: First layer of road map

4.6 Sixth step: complete the next layer with regard to the first layer

After completing the first layer of the road map with regard to priority of strategies, time to complete the rest of the map layers arrive. With opinion of the experts, planning has been done to achieve the strategy in various dimensions. So that to achieve to any strategy is the need for what products or services. Then, for each product or service need to technology and in the next layer, to achieve to technology what research and development is needed and finally, what resources are needed to do the top layer. Figure 3 show the completed road map for automotive parts company.

4. Conclusion

The purpose of this paper is to offer a framework for prioritizing strategies to prepare a road map organization. Much of this research includes the prioritization strategy using multi-criteria decision and also explains the offered framework in preparing the roadmap for organizations.

This paper is a practical, developing and is descriptive in data collection. Statistical Society of the investigation, including staff and some stakeholders of auto parts company. Data was collected with using questionnaires, observations and interviews.

The framework offered in this paper consists of six stages. (1) Identify organizational strategies. (2) Determine the effective indexes that are important in prioritization of strategy. (3) Then the decision matrix that is consisting of a combination of strategies and indexes are formed and determine the value of its elements with our expert's opinion. (4) Then, with using TOPSIS algorithm, adapted solutions the matrix formed. (5) The top (first) layer of the road map is forming by using the results of previous stage. (6) Finally, the lower layers of the road map are completing by using the priorities of top (first) layer of it. According to the framework in the auto parts company, first it should implement the basis cases in its system and reinforce internal process and technical capabilities and relationships and assign necessary resources for them. Then increase its resources in long-term planning to solve technological and research

bottlenecks that consist “Developing product in automotive projects” and “Managing finished price of products and maintain available market share” to achieve to long-term targets.

The results of this research have shown that we can use multiple criteria decision-making methods to prioritize strategies and other thing available (for example market, customer, competitors, drivers, goals, strategies) and thus the prepared road map has a high operational reliability.

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