RANKING THE CREATIVITY AND INNOVATION TECHNIQUES BASED ON THE IDENTIFIES INDICATORS IN IRAN'S AUTOMOTIVE INDUSTRY

Mahtab Afsari[1]
Hesam Javadi Vasigh[2]

Abstract

The current study aims at identifying and ranking the creativity and innovation techniques in automotive industry of Iran. Considering the purpose of the research, the current study is practical and in terms of method it is a descriptive-survey one. Data were collected using a questionnaire, and to confirm its validity and reliability, content analysis and Cronbach's alpha coefficient were used, respectively. Fuzzy TOPSIS technique was used to analyze data.

The results of the study show that fishbone diagram has been identified as the most important creativity technique in Iran's automotive industry and creative mutation, nominal group, Delphi, creative visualization and returning to the customer techniques stand in the next ranks.

Key words: P.P.C technique, ASIT Method, Fuzzy TOPSIS.

1. Introduction

Economic activities extension is not a new phenomenon; but globalization is undoubtedly the most important and obvious economic distinctive feature of today's world. Increased economic competition at international level is one of the most important achievements of economy globalization (Rhee et al, 2010) [14]. To cope with this great storm of evolution and transformation and not to give in to this competitive wave, organizations have overlapped at one point from ancient times and that is to focus approaches and all efforts toward achieving the results that lead to creating

[1] Leibniz University Hannover, Germany, e-mail: Mahtab_af2040@yahoo.com
[2] Tehran Fire Department (TFD), Iran, e-mail: Hesam_vasigh@yahoo.com

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competitive advantages and be effective and determinant for organization performance indicators such as earning more income (Manuela *et al*., 2012) [13].

The speed and quality of achieving performance indicators in the competitive world depend on choosing diagnosis methods and the powerful use of organizations and their key competencies (Lee, Hsieh, 2010) [12] .

In the third millennium, creativity and innovation are ways of improvement. As methodologies of improving customer satisfaction through costs reduction and quality improvement, creativity and innovation techniques are among the most important projects of creativity and innovation (Jimenez- Jimenez et al, 2008) [11]. In recent years, an increasing desire to use creativity and innovation techniques has emerged and most of the pioneer organizations such as Motorola, General Electric and Kodak have experienced it well. The system of creativity and innovation is a comprehensive and flexible system to achieve, preserve and maximize the organization success that if the system is employed logically, it will lead to the improvement of processes performance (Hurley, Hult, 2015) [10].

Initially the creativity and innovation in production sector were introduced as a differentiating and cost reducing method and could stabilize its position in industrial and productive organizations. Somehow it could be expressed that today the use of creativity and innovation has expanded due to a variety of reasons such as increased market share and customer satisfaction (Huang Lin et al, 2014) [9] .

On the other hand, several researches indicate the failure of the creativity and innovation techniques implementation in manufacturing industries. Reviewing the failure cases of creativity and innovation projects show that in spite of the identification of creativity and innovation advantages and factors affecting it, these factors' status has not been properly perceived, as Han and Kim expressed that less than 50% of the surveyed companies had been satisfied with their creativity and innovation programs (Han, Kim, 2012) [8], Halit reported that some of the creativity and innovation techniques implementations had been time consuming and costly and they had not lead to the expected results (Halit, 2014) [7], Goes asserted that about 60% of the total creativity and innovation programs had failed to reach the desired results (Goes, Park, 2016) [6].

In Baker's view, one of the failure reasons of creativity and innovation programs is the lack of proper acquaintance with the various techniques of creativity and innovation as well as the lack of their localization in different industries. He believes that using a common technique of creativity in all industries is doomed to failure and these techniques should be localized based on each industry need (Baker, Sinkula, 2013) [5].

In automotive industry, factories such as Toyota, Mercedes Benz and Ford have been named as pioneer factories to implement these techniques, in a way that Toyota Company spent approximately 2 years for implementing creativity techniques and their training. In addition, Toyota Company announced that all costs in-

curred in creativity and innovation project were compensated within 2 years from its complete implementation. Moreover in Toyota experts' view, this method had played an important role in increasing the company's market share in international markets (Halit, 2014) [7].

Investigating Benz Company, Manuela *et al*., found out that creativity and innovation techniques through the strategic reduction of costs with the approach of customer orientation and lean *production have* led to increase in market share and the company's final profit growth in international markets (Manuela *et al*., 2012) [13].

On the other hand, the automotive industry in Iran has had a tangible progress during recent years, but it has not yet been able to find a proper status in global markets, not even in competition with imported vehicles. One of the most important reasons to which experts refer is the lack of creative engineers in domestic automotive design. Unfortunately, in spite of the attempts made to create a creative method *to build an international Iranian brand* in Iran's automotive industries, no expected progress is seen in vehicle design. *Much debate* has sparked in this field, but the most important issue, which has been noted, is the lack of creativity and innovation programs.

Therefore, in the current study, after the most important techniques of creativity are represented, the effective indicators in implementing those techniques in Iran's automotive industry are identified and then in order to optimally allocate resources, techniques prioritizing (ranking) is finally carried out using multi-criteria decision-making techniques so that the best method can be presented for developing innovation programs.

2. Theorical background

2.1. Creativity and innovation role and importance

— The human civilization collection is the product of human creativities and innovations.
— Creativity and innovation pave the way for economic, scientific and industrial growth and development.
— All organizations and factories with all goods and services are the product of creativity and innovation.

Creativity is the ability to see things from a new and non-stereotypical angle. It is the ability to see aspects other persons have not been able to detect, and then to represent new, unusual and effective approaches. Creativity is a synonym of divergent thinking (achieving new approaches to solve problems) and is in contrast with convergent thinking (achieving correct answers). Those individuals who have divergent thought are different from others in their thoughts and actions and get distance

from customs and habits and use creative and new methods. In contrast, individuals with convergent thought follow customs and habits in their thoughts and actions.

There are many ways to be creative, but what is important is that if each of us recognizes our unique talents and reaches perfection in these areas, we can be creative. There is no guarantee that the world knows us, but creative life will bring us personal satisfaction. Therefore, it can be emphasized that creativity is found in all persons and creative talents can be increased by studying.

Institutes, their managers, professional staff, group leaders, and other staff of theirs face a lot of challenges on a *daily* basis; changes will accelerate day by day, the number of competitors is increasing significantly, business (economic activity) is becoming global, new technologies come to the world rapidly, considerable diversity takes place in the workforce, the lack of resources namely skilled workers can be seen, industrial society is changing to a knowledge-based one, the economic and market conditions especially at global level are becoming instable increasingly, and finally, business environment will become more complicated.

To cope with these challenges and taking advantage of their accompanied opportunities, institutes welcome creative problem solving and innovation in an unprecedented way. One of the main ways individuals and groups can improve their creativity is learning creativity processes, and techniques that take advantage of the gut feeling and inherent creative abilities, and also techniques that lead these capabilities toward the creation of new or advanced products or services or create more useful and efficient organizational processes.

Using creative problem solving skills, innovative solutions and new thoughts for solving the problem or fulfilling a specific need come to the mind. Such thoughts are differentiated completely with conventional solutions and have a higher quality. As creative problem solving skills mix the analytical and imaginative thoughts, it creates a balanced thinking. Therefore, just as intuitive thinking is important to achieve top results, critical and structural thinking is also of vital importance.

2.2. Stages of creativity process:

Creativity stages under different titles consist of five steps including:

— Absorption
  Searching for information about the problem or issue, breaking the problem and *root finding,* having a proper attitude towards new thought and being interested and sensitive toward the issue.
— Inspiration
  Inspiration is giving the mind a state of relaxation to create a new thought. This stage occurs very rapidly and it is very difficult to observe it.
— Testing
  The created idea is examined in this stage to ascertain whether it is useful and productive or not.

— Refinement
  The idea is modified in this stage in order to be practical and consumed. Stages 3 and 4 are time consuming.
— Selling (Presenting)
  If this stage does not take place, creativities will be mostly frustrated.

In absorption stage the creative person needs *lots* of *free time* and freedom in action. In inspiration stage there is no need to precise control and strictness. Providing creative persons with facilities and equipments, senior management helps them in examination stage achieve the desired result faster and easier .In refining and presenting stage, quick response and encouraging unfinished and unplanned projects cause an increase in motivation and individuals' moral of risk taking.

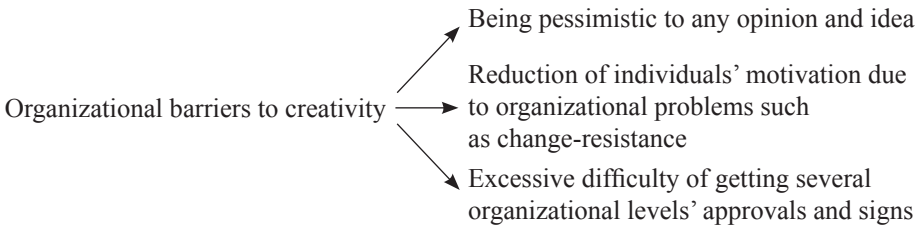
2.3. Creativity in organization

From organizational perspective, creativity is presenting a new thought and design to improve and promote the quantity and quality of organization activities (e.g. increasing productivity, increasing goods or services; reducing costs, products or services through the use of a better method, presenting new products or services, etc...)

Organizations have been divided into three categories based on their attention and emphasis on the extension of the organization and keeping pace with the environmental changes and the amount of creativity.

— Organizations that pay a great deal of attention to environmental changes and development and in terms of creativity are at a high level
— In contrast to these organizations, there are those which are weak in terms of paying attention to development and interpretation as well as creativity. These organizations remain conservative and traditional and will not become creative and innovative.
— Another category includes organizations which pay attention to development and change but as they are not creative, to response to their environment, they imitate and conduct imitative innovation.
— The last category includes those creative organizations which do not emphasize on development and change. These ones proceed creativity but as they do not consider innovation as a practical necessity, they neglect it and their new ideas are not applied.

The last category is the very creative organizations which o not emphasize on development and change. This group of organizations conducts innovation, but as sees no need to scientific innovation ignores innovation and their ideas will not become practical.



2.4. Creativity and industrial engineering

Industrial engineering is a major which is concerned with the development, improvement, and implementation of integrated systems of individuals, materials and information, equipment and energy.

Following the progress of science and technology in recent years, industrial engineering major and tasks delegated to industrial engineers have undergone a lot of changes.

Amongst prominent points of industrial engineering profession is cooperating with better individuals in order to do the works better, faster and safer and other points include investigating and choosing an option from a wide range of diverse and exciting opportunities. Also, dealing with all occupational levels of the organization is of affairs which requires industrial engineer to be familiar with creative people's characteristics. Creativity plays an essential role in different industrial engineering methods and areas. The role and importance of creativity and the need to take advantage from its techniques can be realized from a lot of issues such as work and time evaluation, value engineering, suggestions systems, facility layout planning, QFD, engineering economics, evolution management, benchmarking, methods engineering and systems analysis and much more [15].

2.5. Value engineering and creativity:

In value engineering studies, after completing the information and data, performance analysis phase will be conducted and after that it is time to find creative solutions which this stage can be called creativity phase. Creativity phase aims at proposing and expressing different ideas and solutions to perform any operation which has been chosen to be investigated. Considering the quantity emerged in this phase, any idea quality will show itself in the evaluation phase. The purpose of this phase is not to present the designing ways image of a product or service, but to create ways to continue the activities chosen for the study. Creativity is also a mental process which has integrated the previous experiences and brings us a new experience. The purpose is to present a new combination and another form to carry out an action with lower cost and better performance. So, creativity plays an important role in value engineering [3, 4].

2.6. System analysis and creativity:

One of the most important and main steps in making a decision is precise and comprehensive study of the affective environment or systems on the given topic. To do this, first it is essential to have a complete knowledge of the affective environment or systems. In this regard using the existing creative techniques about the environment and environmental factors will be very effective and useful. Amongst these techniques we can refer to the "Why?" technique, the trend maps technique to identify the past, Six Thinking Hats technique for being in different conditions and system study as well as its performance identification in different states and etc...

Finally, it is necessary to evaluate generated ideas in terms of being feasible and economical; and the best one of them should be chosen, and accordingly the final decision is made and implemented. Creative techniques such as Screening Matrix for Ideas technique is used to evaluate and choose the final idea amongst the existing alternatives.

2.7. QFD (Quality Function Deployment) technique

QFD as one of the quality engineering techniques in response to mentioned changes in market has been developed. In its matrix known as House of Quality, QFD gathers data in a matrix structure in a way that finally, we need to conduct a binary comparison on the product technical traits. In this comparison, some technical traits of the product are against and some contradict each other. This issue puts a difficult process ahead of the investigation team which the natural response in such circumstances is parameters adjustment. To solve this problem, that is removing the existing physical and technical contradictions, TRIZ is used. In TRIZ, the contradictions among product traits are recognized and formulating the subjective solutions are proceeded which will be evaluated in the next stages of the project. The use of both QFD and TRIZ toward presenting new ideas and employing them for deletion of the existing contradictions in the product will increase the organization's ability to satisfy the customers' needs and to enter into today's competitive world. In most stages of QFD, TRIZ is used [3, 4]. In these stages a variety of techniques of TRIZ such as brainstorming, P.P.C, PMI, and TKJ are used. Also, Matrix analysis, "what if?" technique, etc. are suggested.

Using creativity techniques the following questions will be answered:

— How can the goods or service performance be improved or upgraded?
— Can other characteristics be imagined for the goods / service?
— What are the ways for an institute to have a reliable name and produce reliable products?

Techniques such as P.P.C, Delphi, Nominal Group, etc. can be used in this regard.

2.8. P.P.C Technique

P.P.C method or technique has been designed with the aim of presenting the way people treat with ideas and with those who suggest ideas. The method seems more useful for individuals and organizations who use suggestions system and are interested in absorbing more ideas. "Positive, Possibilities and Concerns" are the words forming this technique.

This technique teaches the person, in response to others' ideas, to consider the positive aspects and look at it from a positive perspective, firstly. Then to see whether it is possible to generalize and develop it or not, and finally person's concerns will be expressed explicitly and in a correct manner with expressions such as "I am concerned about some aspects of your idea, can you help me remove my worries?"

2.9. ASIT

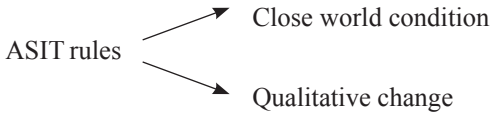
ASIT is a new knowledge derived from and supplements TRIZ. Of course, ASIT should not be mistaken for TRIZ tools, but in contrast, ASIT is a method which its main difference with TRIZ is that it only consists of five principles and two simple concise rules, and on the other hand its principles compared to TRIZ's are more comprehensive and universal and do not only consider engineering issues, but it is applicable in other branches, too [1, 2].

Five principles of ASIT:

— **Unification:** Assign a new use to an existing component to solve the problem.
— **Multiplication:** Develop a slightly reformed copy of an existing object into the system to solve the problem.
— **Breaking Symmetry:** Turn a symmetrical situation into an asymmetrical one to solve the problem.
— **Division:** Divide an object into parts and reorganizing them to solve the problem.
— **Object Removal:** Remove an object from the given system to solve the problem.

In addition to the given system components, ASIT five principles can also be applied in system usages, objectives, definitions, decisions, etc., and obtain good results.

ASIT also has two rules:



The implementation stages of ASIT algorithm:

— Defining the problem's world by making a list of the given system components and its environment, the present and the future of the system and their relationship and predicting the system future

— Preparing for using the given tool by collecting the appropriate data and some simple generalized cases
— Finding a place where tools can be used practically, where ideas are born.
— Expressing the idea in one sentence
— The idea is extended and is explained carefully by sentences.

2.10. Creative problem solving techniques (creativity techniques):

1. Comparing to others
2. Searching for opportunity (unexpected events, incompatible situations, process needs, evolution in industry and market, population statistical changes, new knowledge, change in perception)
3. Ideal situation
4. Baggage of experience
5. Fishbone diagram
6. Returning to the customer
7. The mountain king principle
8. The due time
9. Direct analogies
10. A new look
11. Listening to the music
12. Mind mapping
13. Intellectual writing
14. Creative imagination
15. Creative mutation (Company's future description, ideal competitor description, ideal future products imagination, determining information the company needs)
16. Creativity circles
17. Delphi technique
18. Gordon technique
19. Group decision support system
20. NHK method, each person's ideas are investigated within small groups and exchanged with others. Ideas are written on the white board and investigated through brain storming technique.
21. Nominal group technique (idea creation, idea registering, discussing ideas, putting ideas to the vote)
22. The analysis of pressure amount

3. Methodology

Considering the *purpose* of the research, the current study is practical and in terms of method it is a descriptive-survey one. Research time territory is the year of 2016. In the current study, the effective indicators in implementing creativity and

innovation techniques in Iran's automotive industry are identified using experts' views and Delphi technique. Moreover, Fuzzy TOPSIS multi-criteria decision-making technique has been used in order to specify and rank the relative importance of each technique. Fuzzy TOPSIS method has been considered as one of the practical and applicable Multiple Criteria Decision Making techniques. This method focuses on ranking and selection of a set of options with conflicting criteria. It is a suitable solution for a problem with a number of conflicting criteria which can help decision-makers to reach the final decision; it is a feasible solution which eventually leads to the ideal. Through introducing the multi-criteria ranking index based on the criteria close to the ideal solution, the Fuzzy Topsis method determines the suitable ranking and the suitable solution. Moreover, when there is a lack of confidence in human decisions and cannot be converted to mathematical numbers, the results become somewhat misleading. Therefore, Fuzzy set was used in the current study. Fuzzy set has emerged to solve such problems and it helps in reducing the complexity of decision-making. The total number of statistical population is 100 persons. Samples were chosen using simple random sampling method and to determine sample size the Cochran formula was used as follows:

$$n = \frac{N \times z^2 \alpha/2 \times p \times q}{\varepsilon^2 \times (N-1) + z^2 \alpha/2 \times p \times q} = \frac{100 \times (1.96)^2 \times 0.5 \times 0.5}{(0.05)^2 \times 99 + (1.96)^2 \times 0.5 \times 0.5} \approx 79$$

Therefore, the required sample size is 79 persons. Data were collected using a questionnaire, and to confirm its validity and reliability, content analysis and Cronbach's alpha coefficient (table 1) were used, respectively.

Table 1. Computing the reliability of the research tool

Cronbach's Alpha	N of Items
0.8713	22

As Cronbach's alpha coefficient of the questionnaire is more than 0.7, the reliability is confirmed.

Data analysis

This part is related to ranking and prioritizing the creativity techniques to be applied in creative programs in Iran's automotive industry.

Firstly, in order to identify the effective indicators the standard Delphi method was used which its results are shown in Table 2:

Table 2. Delphi method results in identifying the effective indicators in implementing creativity techniques in Iran's automotive industry

No	Total identified indicators
1	Economic attractiveness
2	Being applicable
3	Creating customer value
4	Flexibility
5	Risk
6	Innovation in product
7	Creating strategy
8	Cost
9	Ease of use
10	Government actions and supports
11	Achieving time
12	Using new technology
13	Innovation in management
14	Strategic attractiveness
15	Staff's culture change
16	Money making
17	Innovation in process
18	Cultural effects
19	Technical knowledge and learning
20	Compatibility with system
21	Existing ability
22	Innovation in market

Next, according to Pareto principle (80/20), each of the experts was decided to specify the most important five indicators from their perspective and discuss their reasons. In the second round of Delphi method, 7 indicators were identified, therefore, the questionnaire sent to experts for the third time. At the end of this stage, the following 5 indicators were obtained:

1. Innovation in process
2. Innovation in management
3. Innovation in market

4. Innovation in product
5. Staff's culture change

4. Prioritizing and ranking the indicators using AHP method

Given that there are 12 different matrixes to compare indicators, therefore, AHP initially converts these matrixes to a unique matrix.

Using the geometric mean method is one of the best ways to combine all respondents' pairwise comparisons tables. The reason is that pairwise comparisons generate ratio data and the inverse state of the comparison matrix, makes it more justified to use this method, since geometric mean preserve the inverse feature in the pairwise comparisons matrix.

Using this method, the indicators comparison is as follows:

Table 3. Initial pairwise comparison of indicators after merging data

Indicators	I1	I2	I3	I4	I5
I1	1	2.3	0.82	1.35	2.23
I2	0.43	1	0.34	0.63	1.12
I3	1.22	2.9	1	1.78	2.87
I4	0.74	1.59	0.56	1	1.67
I5	0.45	0.89	0.35	0.6	1
Column sum	3.84	8.68	3.07	5.36	8.89

Where
I1: Innovation in process
I2: Innovation in management
I3: Innovation in market
I4: Innovation in product
I5: Staff's culture change

To extract priorities from the above table, concepts of normalization and weighted average are used. To do this, numbers of the above table are normalized using the below relationship:

$$r_{ij} = \frac{f_{ij}}{\sqrt{\sum f_{ij}^2}}$$

Considering the above relationship, normalized values of the above table matrix will be as follows. Therefore, data normalization is derived from weighted average, and values obtained from weighted average show each option priority.

Table 4. Normalized matrix

Indicators	I1	I2	I3	I4	I5	Indicators' final weight
I1	0.26	0.264	0.267	0.252	0.262	0.261
I2	0.112	0.115	0.111	0.117	0.125	0.116
I3	0.318	0.334	0.326	0.332	0.323	0.326
I4	0.193	0.183	0.182	0.186	0.188	0.186
I5	0.117	0.103	0.114	0.112	0.112	0.111

Therefore, the following matrix shows the indicators priority based on the obtained results:

Table 5. Final matrix of indicators prioritizing using AHP method

Indicators	Weight
I3	0.326
I1	0.261
I4	0.186
I2	0.116
I5	0.111

Therefore, according to the AHP method, creativity techniques indicators are prioritized as follows:

1. Innovation in the market,
2. Innovation in process,
3. Innovation in product,
4. Innovation in management,
5. Staff's culture change.

5. Calculating the rate of compatibility

Firstly, Weighted Sum Vector (WSV) is calculated. To calculate this vector, initial values of group comparisons (table 3) are multiplied by total priority vector (final weight of indicators) and each row sum is calculated:

WSV = [1.294 0.58 1.629 0.931 0.556]

By dividing each of the above vector components by criteria priority vector, compatibility vector (CV) is calculated:

CV = [4.96 5 4.99 5 5.01]

Then, the compatibility indicator (C.I) is calculated according to the following equation:

$$\text{CI} = \frac{\gamma_{min} - n}{n-1} = \frac{4.99-5}{4} = 0.0025$$

Where, n is the number of options and is the mean of compatibility vector.
Finally, compatibility rate (CR) is obtained from the following equation:

$$\text{CR} = \frac{CI}{RI} = \frac{0.0025}{1.02} = 0.0024$$

Where RI indicates random indicator value. This indicator is extracted based on the options number and using the random compatibility indicator table.

Therefore, given that calculated compatibility indicator is less than 0.1, it can be said that group pairwise comparisons have a good compatibility and the model is completely significant.

6. Fuzzy TOPSIS (FTOPSIS) technique

Using Fuzzy TOPSIS (FTOPSIS), ranking the creativity techniques in Iran's automotive industry is explained in this part. In this method, the weights of indicators' importance and experts' opinions are expressed as lingual variables which are converted to Fuzzy figures by evaluators based on the following table:

Table 6. Lingual variables for ranking

(0,0,1)	Too weak	(0,0,01)	Too low
(0,1,3)	weak	(0,0.1,0.3)	Low
(1,3,5)	Approximately weak	(0.1,0.3,0.5)	Approximately low
(3,5,7)	Medium	(0.3,0.5,0.7)	Medium
(5,7,9)	good	(0.5,0.7,0.9)	high
(7, 9, 10)	Very good	(0.7,0.9,1)	Very high

To apply the model and according to the algorithm of this technique, decision-making matrix should initially be converted to an unweighted matrix using Euklides software (table 7).

$$r_{ij} = \frac{f_{ij}}{\sqrt{\sum f_{ij}^2}}$$

Table 7. Un-weighted decision matrix

Total identified indicators	I1	I2	I3	I4	I5
C1	(0.7,0.9,1)	(0.866,0.983,1)	(0.766,0.933,1)	(0.733,0.916,1)	(0.25,0.433,0.633)
C2	(0.8,0.95,1)	(0.7,0.9,1)	(0.25,0.433,0.633)	(0.766,0.933,1)	(0.866,0.983,1)
C3	(0.25,0.433,0.633)	(0.9,1,1)	(0.7,0.9,1)	(0.8,0.95,1)	(0.7,0.9,1)
C4	(0.733,0.916,1)	(0.8,0.95,1)	(0.733,0.916,1)	(0.866,0.983,1)	(0.25,0.433,0.633
C5	(0.2,0.366,0.566)	(0.628,0.851,1)	(0.866,0.983,1)	(0.733,0.916,1)	(0.2,0.366,0.566)
C6	(0.7,0.9,1)	(0.628,0.851,1)	(0.733,0.916,1)	(0.733,0.916,1)	(0.2,0.366,0.566)
C7	(0.8,0.95,1)	(0.25,0.433,0.633)	(0.9,1,1)	(0.628,0.851,1)	(0.733,0.916,1)
C8	(0.628,0.851,1)	(0.866,0.983,1)	(0.2,0.366,0.566)	(0.8,0.95,1)	(0.8,0.95,1)
C9	(0.25,0.433,0.633)	(0.2,0.366,0.566)	(0.766,0.933,1)	(0.628,0.851,1)	(0.7,0.9,1)
C10	(0.733,0.916,1)	(0.766,0.933,1)	(0.628,0.851,1)	(0.2,0.366,0.566)	(0.628,0.851,1)
C11	(0.7,0.9,1)	(0.25,0.433,0.633)	(0.8,0.95,1)	(0.866,0.983,1)	(0.628,0.851,1)
C12	(0.25,0.433,0.633)	(0.7,0.9,1)	(0.9,1,1)	(0.628,0.851,1)	(0.733,0.916,1)
C13	(0.766,0.933,1)	(0.628,0.851,1)	(0.7,0.9,1)	(0.2,0.366,0.566)	(0.9,1,1)
C14	(0.9,1,1)	(0.628,0.851,1)	(0.7,0.9,1)	(0.8,0.95,1)	(0.2,0.366,0.566)
C15	(0.733,0.916,1)	(0.766,0.933,1)	(0.866,0.983,1)	(0.25,0.433,0.633)	(0.766,0.933,1)
C16	(0.8,0.95,1)	(0.866,0.983,1)	(0.25,0.433,0.633)	(0.766,0.933,1)	(0.628,0.851,1)
C17	(0.2,0.366,0.566)	(0.9,1,1)	(0.628,0.851,1)	(0.866,0.983,1)	(0.628,0.851,1)
C18	(0.7,0.9,1)	(0.628,0.851,1)	(0.733,0.916,1)	(0.2,0.366,0.566)	(0.8,0.95,1)
C19	(0.733,0.916,1)	(0.766,0.933,1)	(0.628,0.851,1)	(0.2,0.366,0.566)	(0.628,0.851,1)
C20	(0.9,1,1)	(0.628,0.851,1)	(0.7,0.9,1)	(0.8,0.95,1)	(0.2,0.366,0.566)
C21	(0.2,0.366,0.566)	(0.9,1,1)	(0.628,0.851,1)	(0.866,0.983,1)	(0.628,0.851,1)
C22	(0.7,0.9,1)	(0.23,0.431,0.630)	(0.8,0.96,1)	(0.868,0.980,1)	(0.620,0.853,1)

Then, the normal weighted matrix is obtained based on derived indicators co-efficients, weights diagonal matrix, and the unweighted matrix, (table 8).

Vij = wi *rij

Table 8. Normal weighted matrix

Total identified indicators	I1	I2	I3	I4	I5
C1	(0.49,0.774,0.94)	(0.6,0.845,0.94)	(0.53,0.8,0.94)	(0.51,0.78,0.94)	(0.21,0.42,0.63)
C2	(0.23,0.46,0.71)	(0.14,0.33,0.56)	(0.6,0.8,1)	(0.6,0.845,0.94)	(0.3,0.54,0.75)
C3	(0.6,0.8,1)	(0.51,0.78,0.94)	(0.49,0.774,0.94)	(0.3,0.54,0.75)	(0.14,0.33,0.56)
C4	(0.51,0.75,1)	(0.53,0.8,0.94)	(0.23,0.46,0.71)	(0.53,0.8,0.94)	(0.41,0.64,0.9)
C5	(0.6,0.845,0.94	(0.3,0.54,0.75)	(0.21,0.42,0.63)	(0.51,0.78,0.94)	(0.49,0.774,0.94)
C6	(0.3,0.54,0.75)	(0.49,0.774,0.94)	(0.41,0.64,0.9)	(0.14,0.33,0.56)	(0.53,0.8,0.94)
C7	(0.53,0.8,0.94)	(0.41,0.64,0.9)	(0.21,0.42,0.63)	(0.53,0.8,0.94)	(0.14,0.33,0.56)
C8	(0.21,0.42,0.63)	(0.51,0.75,1)	(0.53,0.8,0.94)	(0.23,0.46,0.71)	(0.6,0.845,0.94
C9	(0.49,0.774,0.94)	(0.14,0.33,0.56)	(0.51,0.78,0.94)	(0.6,0.8,1)	(0.41,0.64,0.9)
C10	(0.3,0.54,0.75)	(0.6,0.845,0.94	(0.41,0.64,0.9)	(0.49,0.774,0.94)	(0.14,0.33,0.56)
C11	(0.6,0.845,0.94	(0.3,0.54,0.75)	(0.51,0.78,0.94)	(0.41,0.64,0.9)	(0.21,0.42,0.63)
C12	(0.23,0.46,0.71)	(0.49,0.774,0.94)	(0.51,0.75,1)	(0.14,0.33,0.56)	(0.51,0.78,0.94)
C13	(0.53,0.8,0.94)	(0.14,0.33,0.56)	(0.6,0.845,0.94)	(0.6,0.8,1)	(0.21,0.42,0.63)
C14	(0.23,0.46,0.71)	(0.53,0.8,0.94)	(0.41,0.64,0.9)	(0.23,0.46,0.71)	(0.49,0.774,0.94)
C15	(0.14,0.33,0.56)	(0.23,0.46,0.71)	(0.6,0.845,0.94	(0.51,0.75,1)	(0.53,0.8,0.94)
C16	(0.21,0.42,0.63)	(0.51,0.75,1)	(0.49,0.774,0.94)	(0.14,0.33,0.56)	(0.14,0.33,0.56)
C17	(0.49,0.774,0.94)	(0.6,0.8,1)	(0.3,0.54,0.75)	(0.51,0.78,0.94)	(0.14,0.33,0.56)
C18	(0.23,0.46,0.71)	(0.51,0.78,0.94)	(0.14,0.33,0.56)	(0.49,0.774,0.94)	(0.21,0.42,0.63)
C19	(0.733,0.916,1)	(0.766,0.933,1)	(0.628,0.851,1)	(0.2,0.366,0.566)	(0.628,0.851,1)
C20	(0.7,0.9,1)	(0.25,0.433,0.633)	(0.8,0.95,1)	(0.866,0.983,1)	(0.628,0.851,1)
C21	(0.25,0.433,0.633)	(0.7,0.9,1)	(0.9,1,1)	(0.628,0.851,1)	(0.733,0.916,1)
C22	(0.766,0.933,1)	(0.628,0.851,1)	(0.7,0.9,1)	(0.2,0.366,0.566)	(0.9,1,1)

In the next step, the sets of positive ideal solution and negative ideal solution are determined:

$$A^{*}= (V_1^{*}, \dots, V_i^{*}) = \left(\max V_{ij} \,\middle|\, i \in I'\right), \left(\min V_{ij} \,\middle|\, i \in I''\right)$$

$$A^{-}= (V_1^{-}, \dots, V_i^{-}) = \left(\max V_{ij} \,\middle|\, i \in I'\right), \left(\min V_{ij} \,\middle|\, i \in I''\right)$$

Table 9. Ideal positive and negative solution

Total identified indicators	A^*	A^-
C1	(1,1,1)	(0,0,0)
C2	(1,1,1)	(0,0,0)
C3	(1,1,1)	(0,0,0)
C4	(1,1,1)	(0,0,0)
C5	(1,1,1)	(0,0,0)
C6	(1,1,1)	(0,0,0)
C7	(1,1,1)	(0,0,0)
C8	(1,1,1)	(0,0,0)
C9	(1,1,1)	(0,0,0)
C10	(1,1,1)	(0,0,0)
C11	(1,1,1)	(0,0,0)
C12	(1,1,1)	(0,0,0)
C13	(1,1,1)	(0,0,0)
C14	(1,1,1)	(0,0,0)
C15	(1,1,1)	(0,0,0)
C16	(1,1,1)	(0,0,0)
C17	(1,1,1)	(0,0,0)
C18	(1,1,1)	(0,0,0)
C19	(1,1,1)	(0,0,0)
C20	(1,1,1)	(0,0,0)
C21	(1,1,1)	(0,0,0)
C22	(1,1,1)	(0,0,0)

And each strategy's distance is calculated by the following equation:

$$D_j^* = \sqrt{(V_{ij} - V_i^*)^2}$$

$$D_j^- = \sqrt{(V_{ij} - V_i^-)^2}$$

Then value is calculated using the following equation:

$$CC_j^* = \frac{D_j^-}{D_j^- + D_j^*}$$

And finally, the existing options can be prioritized based on the descending order of. CC_j^*

Table 10. Final prioritizing (ranking)

Final rank	CC_j^*	Creativity techniques	indices
1	0.9784	Fishbone diagram	*C5*
2	0.9543	Creative mutation	C15
3	0.8976	Nominal group technique	C21
4	0.8211	Delphi technique	C17
5	0.7346	Creative imagination	C14
6	0.6974	Returning to the customer	C6
7	0.6437	Searching for opportunity	C2
8	0.6285	Direct analogies	C9
9	0.5973	Intellectual writing	C13
10	0.5724	Gordon technique	C18
11	0.5348	Creativity circles	C16
12	0.5104	NHK	C20
13	0.4719	Group decision support system	C19
14	0.4312	Mind mapping	C12
15	0.4087	A new look	C10
16	0.3528	Comparing to others	C1
17	0.3126	Baggage of experience	C4
18	0.2835	Ideal situation	C3
19	0.2792	22. The analysis of pressure amount	C22
20	0.2721	The due time principle	C8
21	0.2601	The mountain king principle	C7
22	0.2578	Listening to the music	C11

7. Conclusion

Definitely, the automotive industry is one of the industries in which, innovation and creativity, especially in design stage, has direct impact on the selling and success performance of manufacturer. Regarding the growing and close competition among notable domestic and foreign manufacturers in Iran, the importance of innovation and creativity is emerging more than ever. Because using the market differentiation strategy and presenting new designs and models, companies can achieve competition advantage.

The aim of conducting the current study was to identify and rank the creativity and innovation techniques in Iran's automotive industry. Delphi investigation results showed that five indicators of innovation in process, innovation in market, innovation in management, innovation in product and staff's culture change were identified as measurement indicators of creativity techniques. In addition, with experts' help and literature review, 22 techniques of the most important creativity and innovation techniques in the automotive industry were identified. Then, Fuzzy TOPSIS multi-criteria decision-making technique was used to prioritize and rank the techniques toward managers' decision complexity reduction in optimal resource allocation and implementing creativity and innovation programs.

So in this study the innovation and creativity techniques in automotive industry of Iran are been compared and ranked. Some reason for weakness of creativity and innovation among automobile industry engineers can be found below:

— engineers lack of familiarity with the principles and techniques of creativity,
— lack of organizational culture that reinforcing creativity,
— lack of supportive top managers,
— lack of proper training of creativity techniques and principles,
— weakness of group thinking and teamwork which is one of the best creativity endorsements.

In this study we try to first, identify and sieve the most important points and fields of innovation in automobile industry using Delphi method. That finally five innovation index in innovation process in market, innovation in management, innovation in process, innovation in market, innovation in product and innovation in creativity are identified. Then, 22 techniques from the most important innovation and creativity techniques in automobile industry were identified and using fuzzy TOPSIS were ranked.

Using these methods and creativity techniques and training them to engineers and also keeping up creativity workshops that teaches creativity skills to engineers in groups and in the framework of working teams, will help automobile manufacturers to gain a better place and more share from target markets through creating new products in accordance with market needs and competition conditions.

Conducted prioritizing and ranking showed that fishbone diagram holds the first important rank and creative mutation and nominal group techniques come to the next ranks. Of course, as using creativity techniques in an organization require the support of organization senior management, it can be said that the support of organization senior management is vital for creativity techniques implementation. Full participation and support of senior management is the basis of the successful implementation of creativity techniques. Senior management should provide needed recourses to facilitate the creativity techniques implementation and invest in financial and human resources for teaching creativity, because organizational processes will not improve unless the work forces are trained properly. It can facilitate the current training process as a way to develop personnel participation in quality improvement. Senior management should generalize a clear strategy to improve creativity all over the organization. Moreover, paying attention to the personnel's greater involvement in improvement activities and emphasizing on innovative performance in development plans and programs and personnel rewards should be increased.

As it was shown one of the indicators of improved creativity and innovation and implementation of creativity techniques in the automotive industry is change in staff's culture and attitude. Mostly, when significant changes occur, personnel are afraid of the lack of awareness and they do not feel the need to change. Therefore, training by helping personnel better understand and accept the related changes in the creative programs will be useful for the organization and is an appropriate way to overcome change-resistance. For instance, providing the organization with various trainings in creativity and innovation programs will improve different areas of human resource management (planning, cooperation, performance and staff satisfaction), and will stimulate the continuous growth and progress of personnel. It is also, as a useful mechanism, effective on selecting and promoting individuals, work skills extension, team work and participation in creativity development efforts. Therefore, special attention should be paid to the training issue.

Finally, this study using a rated list from creativity techniques in automobile industry, will help managers and decision makers of automobile companies to have a brighter view in programming for improvement of creative skills among their staff, and will increase the effectiveness of these training programs through choosing proper techniques of innovation and teaching them effectively, and will help the growth of creative thinking and creativity skills in organization.

Further, due to using TOPSIS technique in this research, it is suggested to the future researchers to use other multi-criteria decision-making techniques such as VIKOR and hierarchical analysis and compare the results.

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RANKING TECHNIK KREATYWNOŚCI I INNOWACJI NA PODSTAWIE WYRÓŻNIONYCH WSKAŹNIKÓW W BRANŻY MOTORYZACYJNEJ IRANU

Streszczenie

Celem badania jest zidentyfikowanie oraz stworzenie rankingu technik kreatywności i innowacji w branży motoryzacyjnej Iranu. Biorąc pod uwagę cel badania, ma ono charakter praktyczny, a zastosowana metoda to metoda opisowo-sondażowa. Dane zostały zebrane przy użyciu kwestionariusza, a w celu potwierdzenia ich trafności i rzetelności, zostały wykorzystane odpowiednio: analiza treści oraz współczynnik alfa Cronbacha. Rozmyta metoda TOPSIS została wykorzystana w celu analizy danych.

Rezultaty badania wskazują, że diagram rybiej ości został zidentyfikowany jako najistotniejsza technika w branży motoryzacyjnej Iranu. Na kolejnych pozycjach znalazły się następujące techniki: kreatywna mutacja, grupa nominalna, Delphi, kreatywna wizualizacja i powracanie do klienta.

Słowa kluczowe: Technika P.P.C, Metoda ASIT, Rozmyte TOPSIS.