

**ANALYSIS AND COMPARISON OF FACTORS AFFECTING MANAGEMENT OF NEW PRODUCTS DEVELOPMENT IN IRANIAN AUTOMOTIVE INDUSTRY (CASE STUDY: IRAN KHODRO AND PARS KHODRO)**

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**ABSTRACT**

One of the main motivating factors to provide new product or service by the organizations is to consider the various dimensions of demands and requirements of customers. Changing nature of competition rules in business world has been made the process of delivering new products to market as an important issue. Nowadays, more than ever, many organizations have found that simply rely on traditional competitive levers such as increasing quality, reducing costs and distinguished way of offering products and services is not enough and instead competing concepts such as speed and flexibility have gained significance in competence and the tendency toward offering new products and services is justified due to this change in the attitude. In this paper, along with introducing the new product development process and its objectives, the factors influencing the management of new products development in Iran Khodro and Pars Khodro car manufacturing companies have been investigated and known types of models in product development has been compared.

**KEYWORDS:** Innovation, New Product Development (NPD), Technology.

**INTRODUCTION**

The rapid growth of technology, risk appetite, risk in global markets and the increasing changes in customer's needs caused new product development (NPD) teams with increasing pressure. However, the process of NPD has always associated with a high level of uncertainty and complexity. In order to succeed in NPD projects risks involved in this process should be identified and examined. Remember that any product or service that is presented daily, at the end of its life cycle inevitably become outdated and the new technologies can give better and more appropriate responses to preferences and various needs of users and customers. But today, rapid product development processes and faster delivery of products and services to market is a problem that companies and organizations pay special attention to it. If the product development process is divided in to three sections of:

- 1) Production time: stage of developing early ideas for new products up to the stage of offering product to the market
- 2) Time of entering to the market: the supply and delivery of the product to the market (Market survey of product)
- 3) Time to gain profit: transition from break-even point and gain profit;

A company and organization will be the real winner in this competition that succeeds in all these three parts and at this time product development process can be considered as a success. Interestingly, at the time of supply and deliver of products to the market three different approaches are evident among the competitors. These approaches are:

1. Primary Approach in the Market

Organization is interested to be the first company which offers a new product to the market.

2. Fastest Follower Approach

This approach is not like the previous one but organization wants to be the fastest company which supplies the product to the market.

3. The general follower approach

Organization is not the follower, but will be one of the followers of the new product producers and suppliers (Tagavi Fard, 2006). The need for knowledge management, especially in NPD, is considered crucial and sensitive. Since the main challenge for the development of new products is anticipating issues that have not yet happened and this prediction should be done in a highly dynamic market with too many variables that are not under our inside or outside control. Researches show that technology and new products are not the main causes of failure and the main causes are

three main factors: (1) changes in the market are not predictable, (2) replacing the new products to compete (3) lack of time due to excessive time spent on the commercialization process. Not always one can measure the degree of the influence of these factors on the introduction of new products, since we were unsuccessful in the use of creative thinking to process even the amount of information that we had and turn them into knowledge. Obviously, in order to carry out this process properly, we need to acquire the knowledge which organization is in need and push it toward new products (Rezai *et al.*, 2008).

In the general definition, NPD is known as a process for the innovation of a new and distinguished product, therefore the development of new product is a type of product innovation. Before addressing the issue of NPD the concept of innovation which is not a new issue is discussed and has several definitions that are referenced in the table below:

**Table 1.** Provided definitions of the concept of innovation

Provider	Year	Definition
<b>Merriam</b>	2004	Innovation means to pose something new, or an idea, method or new equipment (Merriam-Webste Dictionary, 2004: 645)
<b>Soltani Tirani</b>	1999	Innovation is an activity that the idea or product derived from it goes in to the market and will remain in the market and creates social and economic impact (Sultan Tiran, 1999)
<b>White &amp; Bruton</b>	2007	Innovation is a process whereby the products, processes, new or improved products and services are developed and transferred to a suitable plan or market (White & Bruton, 2007)
<b>De Coster &amp; Butler</b>	2004	Innovation can include improving yield, product concept or service, or results the creation of a new and unprecedented value that there is no comparable equivalent for (De Coster & Butler, 2004)
<b>Afuah</b>	1998	Innovation is the use of new technological tools and market knowledge to offer new product or service to the customer (Afuah, 1998)

Innovation is generally defined from three perspectives (Cobbenhagen, 1999):

- 1) Innovation as new items, this approach focuses on the results of the development process, which may include products, services, processes, or new or improved management techniques.
- 2) Innovation as the adoption of a new phenomenon: this approach explores to the process of adoption and diffusion.
- 3) Innovation as a process of developing a new phenomenon: this approach refers to the innovation process which has been started due to the market demand and develops toward the expand use.

Development of new products will help us maintain our competitive and exclusive position and also will help us better use of resources and will increase production capacity and profits. We must deal with our competitors and must always have an appropriate response for changing conditions in a competitive market. This process will help us to avoid becoming obsolete and having our products out of market. This process will also lead to the development of our business. That's why we need a variety of products. A company should always be ready to supply new products to market since everyday a product is born and passes different stages of its life and finally abolishes and new product comes instead of it. According to the product life cycle, we recognize that the products that are provided by any company one day become obsolescent and decrease the sale volume and market share of the company and ultimately cause the loss to the company. Thus providing new products to keep the expected profit is essential. Given the importance and developing place of new products in organization as well as their applicability and above all believe and attention of managers to increase the use of this approach, the need for such a discussion is felt. It is clear that the development of new products as a means of developing new knowledge injects some results to the production system of organizations and convinces the institutional resources about the effectiveness of these tools to increase productivity so that through detailed analyses avoid unnecessary trial and error and financing costs which waste time, manpower and other resources. On the other hand, in addition to the change in the trend and tendency, the company performance moves toward the conformity of the organization with customer and contributes in the successful performance of tasks

and authorities and cause competitive advantage for company. Nowadays, the efforts of new successful product are a basis for the success of the company. New product development, in fact, reveals the strategy of the company. One of the most important ways that companies can implement their strategy is through the new products which they develop (Akhbari *et al.*, 2007). The starting point for product development strategy is to determine the development strategy by the organization. A company should know that it cannot enter in all fields and should focus on some aspects of the market that has the opportunity of success. In the table below strategic orientations are listed for NPD (Cooper, 2006).

**Table 2.** Strategies for Product Development (Radfar *et al.*, 2009)

Strategy	Property
<b>Fast delivery of product</b>	In this strategy products get to market faster. This strategy is suitable for companies that their product or technology is rapidly changing. Implementation of this strategy balance product yield, cost and reliability. In this case technology should be developed independent from the product development.
<b>Low cost of product</b>	This strategy focuses on product development with minimum cost and maximum profit. This strategy is most effective for companies that the life cycle of their products and goods has been reached puberty. In this case more time is needed to be spent on cost optimizing of the product and manufacturing process.
<b>Low cost of development</b>	This strategy was oriented to minimize the cost of development or product development through special funds. This situation occurs when company develops a product under contract with others and this is when financial resources are limited or developmental efforts are conducted in secret. This orientation to some extent is consistent with the first strategy.
<b>Product innovation and excellent performance</b>	This strategy relies mainly on having the highest level of product performance; the better level of performance characteristics and the latest technology with the highest level of product innovation and mainly is used by companies which have different products and industries. This strategy involves the high risk in the use of technologies and accepting the time and cost balance.
<b>Quality, reliability (safety products of)</b>	This strategy relies on ensuring a high level of quality, reliability and stability of the product and commonly used in the industry that due to the high cost of mistake elimination, the high quality is required. As the cost of the returns in the auto industry or food processing. It also requires a high level of reliability, such as aerospace products or it is important to consider safety issues, such as medical devices, pharmaceutical, nuclear and aerospace industries. This strategy requires additional time and expense for planning, testing, analysis and regular validation.
<b>Responding to market</b>	This strategy is based on providing a high level of service, being responsive to customers' needs and remains flexible to response new customers, new markets and new opportunities. Providing this situation, giving service and accountability in the strategy will require the deployment of additional resources and associated costs.

Research conducted in the field of new product development can be divided into two general categories. The first category includes the researches that provide some criteria for measuring the success of a research project to develop a new product and debate on its measuring methods. The second category includes the researches that focus on the identification of the factors influencing the success of a project of product development. Understanding the logical relationship between NPD, key factors and yield has an effective impact on product development strategy. The next two sections describe the studies conducted in these two areas.

Performance of a company in the field of product development can be evaluated by measuring some factors. Researchers have proposed various factors for this measure (Maniyan, 2011): Sung proposed four criteria to measure:  
1. The final dividend

2. The sale of new products in comparison with other competitors
  3. The percentage of new products profitability in comparison with the other competitors.
  4. The success of a new product and our expectations of that
- Cooper suggests three benchmarks to measure the performance of the product development:
1. The overall performance of the new product
  2. The success rate of new product
  3. The impact of new product on the company's condition

Hopkins suggests five criteria:

1. Measurement of financial indices
2. Measuring the achievement of the past objectives
3. The share of new products in the company's overall sales
4. The success rate of NPD
5. The points earned in total by product development

Cixous believes that horizontal and diagonal communication in organization can decrease the uncertainties of Product development and increase its performance. He suggested three criteria to measure the performance of NPD:

1. New product lifecycle
2. Sale and profitability of new product
3. The time which company needs to deliver new products to market

In most articles three criteria of profitability, time-to-market and product quality have been considered as the main criteria for measuring success of product development process. Fang Wu conducted extensive researches on the literature review of success key factors. According to them, the key success factors can be expressed as follows (Cooper, 2007).

**Table 3.** Key success factors in NPD process (Fang Wu, 2011)

**having skill in market research**

**having a clear strategy for product development**  
**engagement of senior managers with product development project**  
**having adequate resources**  
**needed advantages for product**  
**precise definition of the product at the beginning of the process**  
**prioritization of projects and focusing on it**  
**organizational structure and processes**  
**the reliability of the senior management**  
**strong market orientation and product innovation**  
**having qualified and well founded processes in product development**  
**appropriate management of product to the market on customer and competitors needs**  
**strong sale forces**

**level of investment in research and development**

long-term vision of  
 having stable vision  
 focus on strategy  
 development team with high-performance  
 multidisciplinary teams  
 high resolution skills  
 access to resources  
 technological opportunities and support  
 the expected profit  
 excellent time-to-market

high ability of the sale

For further and better exploration and getting final result in the selection of the key elements we classified them into four main groups. The four groups are:

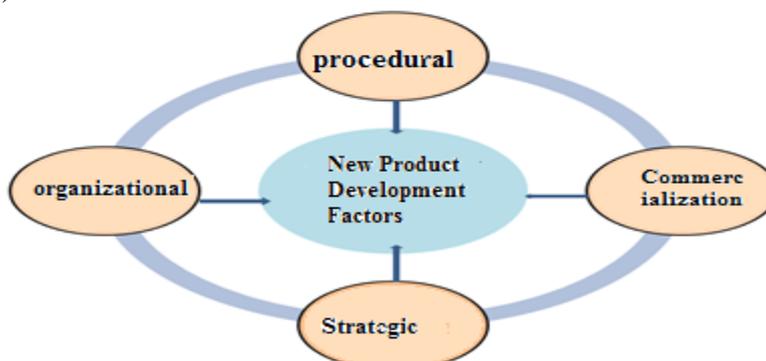
1. The procedural factors
2. Strategic factors
3. Technological factors
4. Organizational Factors

Cooper based on the criteria of profitability, success rate and new product sales studied 161 American, German, Danish and Canadian companies. His research was conducted in five categories of factors. These five factors are: process, organization, strategy, culture and active participation (Kuen, 2012). In his study four below factors are the main success factors:

1. The qualified process of product development
  2. Defined strategy of the product development
  3. Adequate human and financial resources
  4. The level of investment in research and development section
- He also introduces five other factors as the factors with low degree of influence:
5. Product extensible teams
  6. The participation of active senior managers
  7. Creative environment and culture
  8. The use of multi-functional teams
  9. The senior management commitment to NPD output

## MATERIALS AND METHODS

This study is descriptive research. In order to assess the factors affecting the management of NPD in automotive industry the well-known product development model introduced by Cooper was used in this study. According to this model, the development of new products is measured from four dimensions based on a questionnaire and the validity of questionnaire was confirmed by the judgment of experts and its reliability was proved 0.9 with Cronbach's alpha coefficient. Figure (1) shows the classification of influential dimensions on NPD.



**Fig 1:** Conceptual Model of NPD Factors (Asari *et al.*, 2014)

## OBJECTIVES AND RESEARCH QUESTIONS

### The main questions:

1. How is the status of each constituent indices of NPD management in both companies?
2. How is the status of each dimensions of NPD management in both companies?

### Secondary research questions:

1. How is the status of each of the of procedural dimension indices in NPD management in both companies?
2. How is the status of each of the indices of organizational dimension in NPD management in both companies?
3. How is the status of each of the indices of strategic dimension in NPD management in both companies?
4. The status of each of the indices in the commercialization of NPD in the company's management is how?

## STATISTICAL POPULATION

Middle and senior managers and experts of Iran Khodro and Pars Khodro with bachelor's degree up to PhD and work experience more than three years as professionals were the statistical population of this study (Table 4). The statistical population was specified due to the condition of company at the time of research. Table (4) shows the work experience and education level of statistical population. To accomplish this, a total of 80 questionnaires were sent to the engineering units of Iran Khodro and Pars Khodro among which 75 reliable questionnaires were collected from the managers and experts in the relevant sections (strategic parts of product development, marketing, technical and supply parts).

**Table 4.** Statistical Population Characteristics of Iran Khodro and Pars Khodro

Row	Educational level	Number		Average of Work Experience (Years)	
		IRAN KHODRO	PARS KHODRO	PARS KHODRO	IRAN KHODRO
1	Bachelor	24	26	14	11.5
2	Masters	5	14	12.5	12
3	Ph.D.	6	0	11	

**The main questions:**

1. How is the status of each constituent indices of NPD management in both companies?

According to data collected by questionnaire and their sum, the statue of NPD in both companies was determined in each of the indices as shown in Table (5).

Question/ Index	Pars Khodro(%)	Iran Khodro(%)
The company has documented and transparent NPD process	40.75	61.43
In the development of new products previous learned lessons (previous NPD experiences) were used.	40.75	63.43
There is a clear and shared vision between NPD project team members.	37.25	60.29
Company has accurate and correct definition for develop of new products and product configuration.	30.5	56.86
There was a precise definition of product performance and subsets, formulation of functional groups and their evaluation in the development of new products and still there is.	38	58.57
To develop new products and accurately identify stakeholder's needs.	36.25	55.71
In NPD, product validation and verification is done after engineering sample.	59.25	67.14
In NPD process the systemic planning and design revising takes place.	41.75	58.29
To develop new products and identification and evaluation of product technologies are carried out systematically.	46.75	57.71
Information technology and new methods of design (quick modeling - simulation and computer modeling) is used in developing new products.	45.25	59.71
Definition and assessment of contributions required by suppliers takes place in the NPD processes.	48.75	56.86
Support and commitment of senior management is evident for NPD.	61.25	62.86
R&D Management commitment and support is evident in develop of new products.	45.5	63.71
There is motivating environment and culture in company for NPD entrepreneurs.	33.5	57.14
Interdisciplinary and cross functional teams are used to develop new products.	34	55.43
The system of quality control (quality of design) can be utilized in the development of new products.	53	53.14
The organizational structure can be utilized in developing new products.	38.25	54.29
Providing adequate financial resources for managing NPD is done.	36.5	58.29
NPD has access to knowledge-oriented and expert human resources.	37.75	55.71
Level of technological capabilities and innovation to develop new products is appropriate.	37	61.43
The company is in need of risks to develop new products.	40.75	62.65
NPD's position in the company's business strategy is clear.	33.25	54.86
Company in the development of new products pays attention to the product life cycle.	28.25	56.00
Company pays special attention to the planning and infrastructure investment for the development of new products attention.	36	55.71
in order to carry out the NPD projects company develops technological strategies of the task and R &D.	31.25	56.00
To develop new products an intelligent system has been established in the company (including the management of innovation, knowledge management, technology and strategic management).	25	60.00
To develop new products the observation of available and emerging technologies takes place systematically.	29.5	51.43
In NPD attention is paid on shortening the cycle of idea to the market through concurrent engineering and timely to the market.	40.5	52.29
Company commercializes the NPD technologies in distinct forms.	25	55.43
In NPD much attention is paid on the design of after-sales services, systematic and timely logistic support.	40.75	51.43
In NPD, company pays attention to the issues of product release after its useful life cycle.	31	52.00
Attention is paid on the Innovation and product attractiveness from the customers and market perspective to develop new products.	34.5	50.29
Needs and expectations of customers for NPD are systematically identified and addressed.	31	53.71

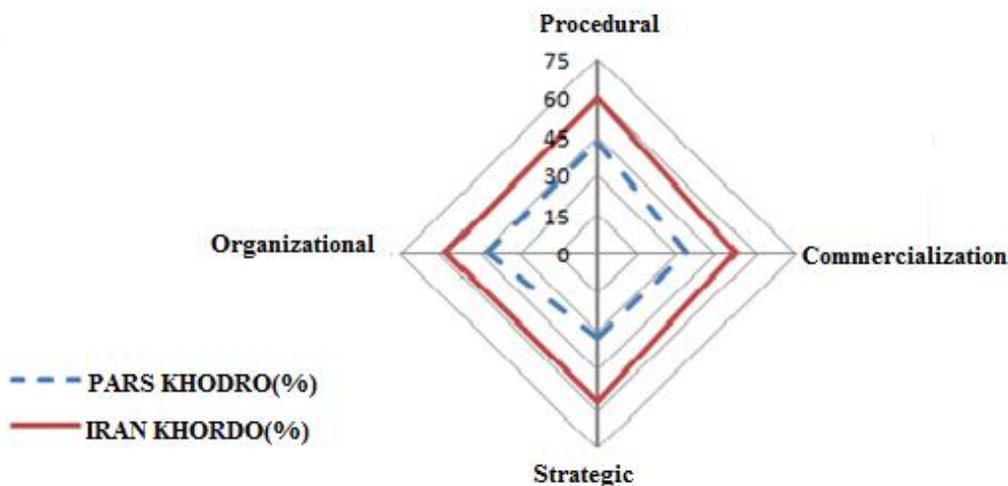
**Table 5.** Status indices affecting the development of new products

2. How is the status of each dimension of NPD management in both companies?

The comparison of success level in developing new products for each of the components and also the gap to the desired level in any of the companies are shown in Table (6) and Figure (1).

**Table 6.** Comparison and the quantities rate of gap between current and desired levels in each dimensions of NPD

Dimensions	Pars Khodro(%)	Iran Khodro (%)	The gap between current and desired level of Iran Khodro	The gap between current and desired level of Pars Khodro
<b>Procedural</b>	42.3	59.64	40.63	57.7
<b>Organizational</b>	41.86	58.00	42.00	58.14
<b>Strategic</b>	32	56.66	43.34	68
<b>Commercialization</b>	33.79	52.52	47.48	66.21
<b>n</b>				
<b>n</b>	38.45	57.27		



**Diagram 1.** Comparison of the current situation in each dimension of both companies

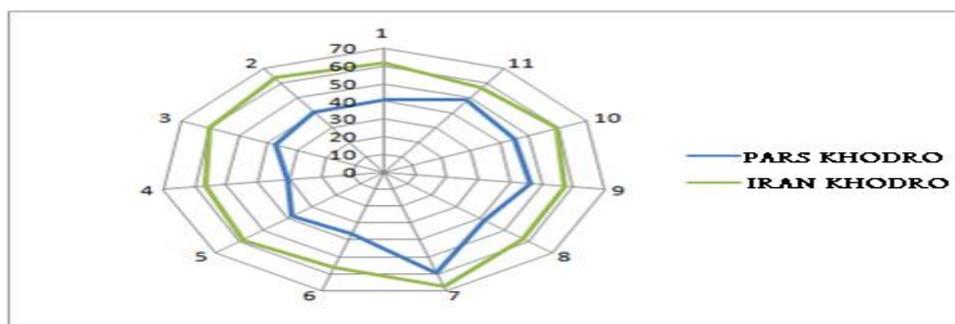
**Sub-questions:**

1. How is the status of each indices of procedural dimension in NPD management of both companies?  
According to data collected by questionnaire, the status of procedural dimension in NPD management of both companies in each of the indices was determined according to the Table (7).

**Table 7.** Status of procedural dimension indices affecting the NPDs

Row	Question/ Index	Pars	Iran
Volume-3 (Special Issue 3) 2014	<a href="http://www.sciencejournal.in">www.sciencejournal.in</a>	© 2014 DAMA International. All rights reserved.	

		Khodro(%)	Khodro(%)
1	The company has documented and transparent NPD process	40.75	61.43
2	In the development of new products previous learned lessons (previous NPD experiences) were used.	40.75	63.43
3	There is a clear and shared vision between NPD project team members.	37.25	60.29
4	Company has accurate and correct definition for develop of new products and product configuration.	30.5	56.86
5	There was a precise definition of product performance and subsets, formulation of functional groups and their evaluation in the development of new products and still there is.	38	58.57
6	To develop new products and accurately identify stakeholder's needs.	36.25	55.71
7	In NPD, product validation and verification is done after engineering sample.	59.25	67.14
8	In NPD process the systemic planning and design revising takes place.	41.75	58.29
9	To develop new products and identification and evaluation of product technologies are carried out systematically.	46.75	57.71
10	Information technology and new methods of design (quick modeling - simulation and computer modeling) is used in developing new products.	45.25	59.71
11	Definition and assessment of contributions required by suppliers takes place in the NPD processes.	48.75	56.86



**Diagram 2.** Status of procedural dimension indices affecting NPD

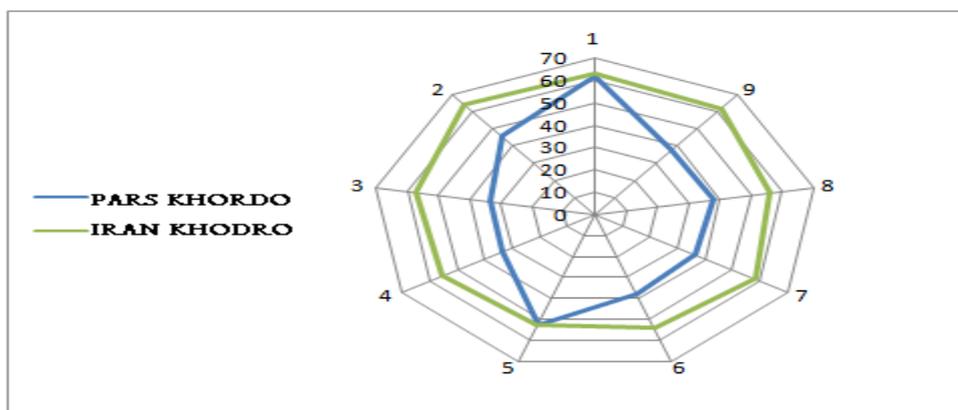
2. How is the status of each indices of organizational dimension in NPD management of both companies?

According to data collected by questionnaire, the status of effective organizational dimension in NPD management of both companies in each of the indices was determined according to the Table (8) and Diagram (3).

**Table 8.** Status of organizational dimension indices affecting the NPDs

Row	Question/ Index	Pars Khodro(%)	Iran Khodro(%)
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1	Support and commitment of senior management is evident for NPD.	61.25	62.86
2	R&D Management commitment and support is evident in develop of new products.	45.5	63.71
3	There is motivating environment and culture in company for NPD entrepreneurs.	33.5	57.14
4	Interdisciplinary and cross functional teams are used to develop new products.	34	55.43
5	The system of quality control (quality of design) can be utilized in the development of new products.	53	53.14
6	The organizational structure can be utilized in developing new products.	38.25	54.29
7	Providing adequate financial resources for managing NPD is done.	36.5	58.29
8	NPD has access to knowledge-oriented and expert human resources.	37.75	55.71
9	Level of technological capabilities and innovation to develop new products is appropriate.	37	61.43



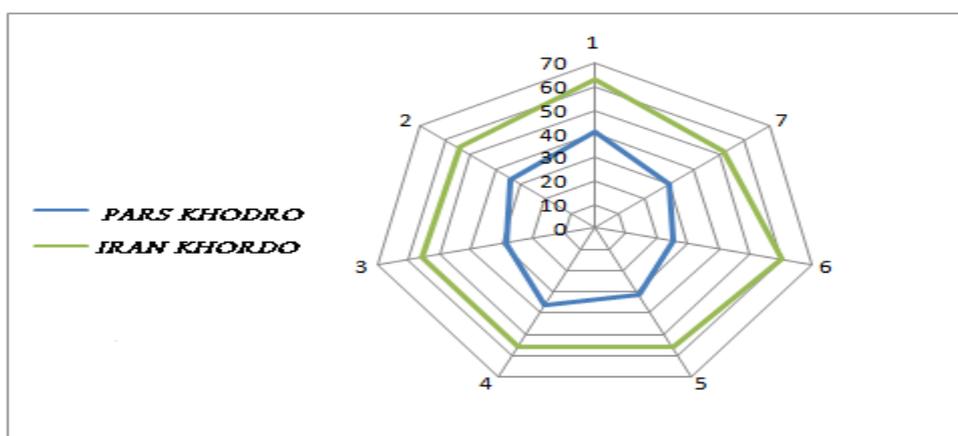
**Diagram 3.** status of organizational dimension indices affecting NPD

3. How is the status of each indices of strategic dimension in NPD management of both companies?  
According to data collected by questionnaire, the status of effective strategic dimension in NPD management of both companies in each of the indices was determined according to the Table (9) and Diagram (4).

**Table 9.** Status of strategic dimension indices affecting the NPDs

Row	Question/ Index	Pars Khodro(%)	Iran Khodro(%)
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1	The company is in need of risks to develop new products.	40.75	62.65
2	NPD's position in the company's business strategy is clear.	33.25	54.86
3	Company in the development of new products pays attention to the product life cycle.	28.25	56.00
4	Company pays special attention to the planning and infrastructure investment for the development of new products attention.	36	55.71
5	in order to carry out the NPD projects company develops technological strategies of the task and R &D.	31.25	56.00
6	To develop new products an intelligent system has been established in the company (including the management of innovation, knowledge management, technology and strategic management).	25	60.00
7	To develop new products the observation of available and emerging technologies takes place systematically.	29.5	51.43



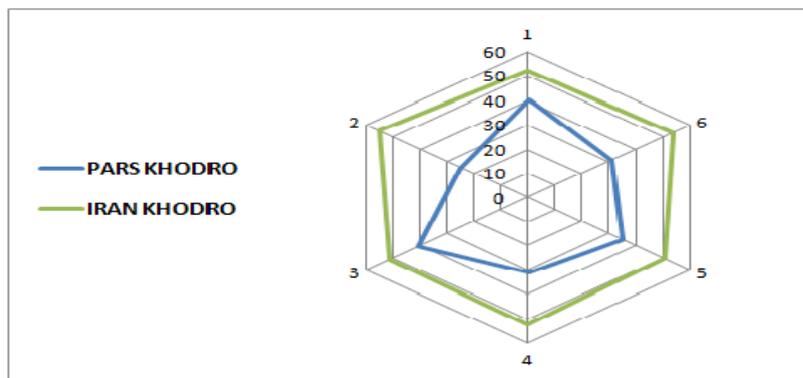
**Diagram 4.** Status of strategic dimension indices affecting NPD

4. How is the status of each indices of commercialization dimension in NPD management of both companies?

According to data collected by questionnaire, the status of effective commercialization dimension in NPD management of both companies in each of the indices was determined according to the Table (10) and Diagram (5).

**Table 10.** Status of commercialization indices affecting NPD

Row	Question/ Index	Pars Khodro(%)	Iran Khodro(%)
1	In NPD attention is paid on shortening the cycle of idea to the market through concurrent engineering and timely to the market.	40.5	52.29
2	Company commercializes the NPD technologies in distinct forms.	25	55.43
3	In NPD much attention is paid on the design of after-sales services, systematic and timely logistic support.	40.75	51.43
4	In NPD, company pays attention to the issues of product release after its useful life cycle.	31	52.00
5	Attention is paid on the Innovation and product attractiveness from the customers and market perspective to develop new products.	34.5	50.29
6	Needs and expectations of customers for NPD are systematically identified and addressed.	31	53.71



**Diagram 5.** Status of commercialization dimension indices affecting NPD

## RESULTS

As can be seen in Table (5): in Iran Khodro the NPD has the highest score of 14.67% through the validation and verification of the product after engineering samples and the monitoring available and emerging technologies in systematic way to develop new products has the lowest score of 43.51. Also in Pars Khodro senior management commitment and support for the development of new products has the highest score of 25.61% and the establishment of intelligent systems in the company (including innovation management, knowledge management, technology management and strategic management) for NPD has the lowest score of 25%.

According to the results in Table (6): Iran Khodro Company in NPD management with 36.40% had the minimum gap and commercialization dimension in of NPD management with 48.47% had the maximum gap with the desired situation. Also in the Pars Khodro Company the procedural dimension in NPD management had a minimum gap of 7.57% and strategic dimension with 68% had maximum gap with desired situation. Also based on the results of Table (7): in procedural dimension of NPD management of Iran Khodro Company the index of validation and verification of the product after engineering sample in NPD had the highest score of 25.61% and the index of accurate identification of the needs of stakeholders to develop new products had the lowest score of 43.51% and in Pars Khodro company the index of validation and verification of product after engineering sample with 25.59% had the highest score and the index of having accurate and correct definition of product and its configuration for NPD had the lowest score of 5.30 %.

Also based on the results in Table (8): in effective organizational dimension of NPD management in Iran Khodro Company the index of support and R&D management commitment in NPD had the highest score of 71.63% and the index of appropriate usage of quality control system (quality of design) in NPD had the lowest rating of 14.53%. In Pars Khodro Company support and commitment of senior managers of the company for NPD had the highest score of 25.61% and the index of motivating environment and culture for NPD entrepreneurs had the lowest rating of 5.33 % .Also based on the results in Table (9): in effective strategic dimension of NPD in Iran Khodro Company the index of risk taking for NPD had the highest score of 65.62% and the index of systematic observations of existing and emerging technologies for NPD had the lowest score of 43.51%. Also Pars Khodro Company with 75.40% had the highest the risk taking index for NPD and the establishment index of intelligent systems in the company (including innovation management, knowledge management, technology management and strategic management) for NPD had the lowest score of 25%.

According to the results of Table (10): in the effective commercialization dimension on NPD at the Iran Khodro Company the commercialization index of NPD technologies separately had the highest score of 43.55 % and the index of paying attention to the innovation and product attractiveness from the perspective of market and customers for NPD had the lowest score of 29.50 % . Also in Pars Khodro Company the index of considering the design of automobile, after-sales service, logistics and systematic and timely support to develop new products had the highest score of 75.40% and the commercialization index of NPD technologies separately had the lowest score of 25 % .

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