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COMPARISON AND ANALYSIS OF TECHNOLOGICAL CAPABILITIES IN IRANIAN AUTOMOTIVE INDUSTRY (CASE STUDY: IRAN KHODRO AND PARS KHODRO COMPANIES)

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ABSTRACT

Given the importance of technological capabilities in economic growth and increasing prosperity, the concept of empowerment evaluation has gained importance in recent years. Various international models related to the evaluation of technological capabilities have been developed and introduced. Technology assessment is a tool that can better understand the technology and helps in decision making. Due to high importance of technology development, senior managers and businesses must understand the technological capabilities of their organization; identify the technological developments in the world as well as monitoring competitors' efforts to obtain new technologies to continuously improve their own technological capabilities. This study intends to compare the "L90 project" technological capabilities of Iran Khodro and Pars Khodro companies and by providing the identified strengths and weaknesses with suggestions to improve the technology and offer technology development and technology solutions in order to reduce the gap in the companies by using the Panda model and Ramanathan.

Keywords: *Technology, Technology Assessment, Technological Capability*

1. INTRODUCTION

Today, to remain competitive, organizations must inevitably turn to the evolution of technology and the creation of advanced technologies. Nowadays, the effective use of technology is the most important issue facing in technology-driven companies, and certainly this trend will intensify in the future. (Mgantz, 2004)

Technology simply does not include hardware and equipment and have dimensions of various components. Core technological capabilities in an organization include a diverse set of skills (the human capital of the organization), organizational routs (which run in the companies levels) and unique assets (advanced manufacturing technologies, information systems, computer-aided manufacturing and...) that are the competitive infrastructure advantages for the organization. (Harrison & Samson, 2002)

Based on that, organizations or companies in multi-aspects of the study are trying to acquire technology and make it totally formidable. But the question is that on way to acquire the technology, what is the best way to minimize the technological gap? In this study, two companies of the automobile industry have been studied, after an audit and assessment of technological capabilities of the companies, technological rifts are identified and appropriate technology will be provided to eliminate the gaps. Overall process as follows, first the product and related technologies are described, then a ruler is designed to measure the gap between technologies and to help to measure the technological gap between current and desired status. In subsequent, review of the reasons for the technological gap between current and desired status and ultimately to reduce the rifts of technology solutions are presented. (Tabatabaeeian, 2005)

2. Literature review

Today, with advances in technologies' different levels and the necessity of using modern technologies, the need for technology assessment is felt more than ever. Technology evaluation is a tool

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or an intellectual framework to better understand and make decisions about technology so in application of a new technology; we should first evaluate the status of existing technology. A necessity in selecting appropriate technology is its use for benefit of society and institution and its proper evaluation. Technology is in a human environment, and therefore different technologies with the physical environment and different human systems environment, including economical, social, cultural and political systems and its other constituent systems interact. In other words , different technologies ,affect different systems of the human environment around and these systems , in turn , have a reaction , so technology assessment should be undertaken with an overall view , in examining the advantages and limitations of technology criterion not only the technical effectiveness and economic benefit . But its relationship with human environment surrounding to investigate the concept of technology assessment, to maximize the positive effects of technology development is compatible with the surrounding environment (Jafar -Nejad et al, 2006)

In other word, assessment is a tool that arranges our knowledge of technology and its relation to the dimensions of larger chain technologies in order to make better decisions. Perhaps the evaluation is a tool, helps in our knowledge formation pyramid. In other words, by its help data can promote to information and then into knowledge and finally wisdom in the organization (which is an essential tool for decision making). (Tabatabaeeian, 2005)

Technology assessment in a general sense refers to a process in which the effects of systematic methods of introduction, development, change and modification in the technology in an enterprise or a society will assess and measured. On the other hand , companies and manufacturing enterprises have always been involved in administrative issues such as buying, selling, supplying raw materials, accounting matters, insurance, and etc, also changes in the severe competitive environment, so long term technology evaluation models and methods used in these firms do not fulfill the needs . In other words, managers and technical experts in companies and organizations, regarded to their experience are able to mentally determine the capacity of companies in various field of technology. Today, to remain competitive, organizations must inevitably turn to the evolution of technology and development of advanced technologies. (Jafar -Nejad, 2006)

Seems to acknowledge this mental estimation is the models of technological capabilities. Experience shows that the models and methods that are used in the companies should have two basic characteristics: First, "be simple and understandable, and second," in a short a reasonable time find result.

Table 1 - Definitions provided for technology concept

Provider	Year	Definition
Ghazi Nouri	2004	Technology is any practical knowledge organized based on scientific theory or experience which are used in skills in methods of production, organization or machinery. (Ghazi Nouri, 2004)
Brown	1998	Technology is strategies and objectives lead human to generate expertly and efficiently. (Brown, 1998)
Khalil	2000	Technology is all the knowledge, products, tools, and methods and systems that are served in the product or service being offered. Technology is the procedure and means by which objectives will be achieved. Technology, practical application of knowledge and the tools to help human's struggling.(Khalil, 2000)
Jordan	2003	Technology is scientific application of science and technology achievements in order to answer one or more needs. (Jordan, 2003)

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Another dimension of evaluation, is addressing technological capabilities. Technological capabilities are a broad concept that refers to the ability to make effective use of technology and the ability to manage changes and innovation in technologies. (Kianwie, 2003)

Technology definition: Technology experts have provided broad definitions for technology. Table 1 shows the technologies definitions that are provided by experts:

Technology assessment involves continuous efforts to identify, analyze and to evaluate the effects of application of existing or emerging technologies on different sectors of society. The results of these efforts as guidelines are provided in order to select the most appropriate technology to decision makers. According to this definition, understand that technology assessment is a continuous and permanent action. In technology development nothing is more important than evaluation and it is noteworthy that any assessment or acting in this filed needs early actions in the original index identification. This assessment must include all parts of technology such as brain-ware, software and hardware and the manage-ware and management. (Ghazi Nouri, 2004)

Technology capability assessment is a process in which the current level of technological ability and technological capabilities of the organization are measured to identify strengths and improvement points to compare with competitors or desired level to identify technological gap. (Putranto, 2003)

The level of technological capability gap indicates the level of required technological capability in companies and the companies' current technological capabilities. (Tsukamoto, 2008)

There are Different models related to technological capabilities assessment, these views and assessment models are provided in three general categories in Table 2:

Table 2 - Classification of approaches and models for the assessment of technology capabilities (Khamse, 2013)

Models to determine the technological gap	Models assess the causes of technological gap	Models provide a mechanism to compensate for the technological gap
Atlantic technology model	Ford Model	Ford Model
Porter's model	Lindsay Model	Lindsay Model
Panda and Ramanathen model	Atlantic Technology Model	Fall Model
Floyd Model	Floyd Model	Garcia - Arrola Model
Needs management technology Model	Needs management technology Model	Lane Model
content assessment technology Model	capabilities of technological Model	needs assessment Technology model
Technology Status Evaluation Model		Science and Technology Management Information System Model
EVA model		Needs management technology Model

3. Introduce the model used in this study:

To evaluate the technological capabilities of firms in this study, the Ramanathen and Panda technological levels evaluation model is used. According to this model, enterprise capabilities are measured in dimension by completing a questionnaire. This model is illustrated in Figure 1.

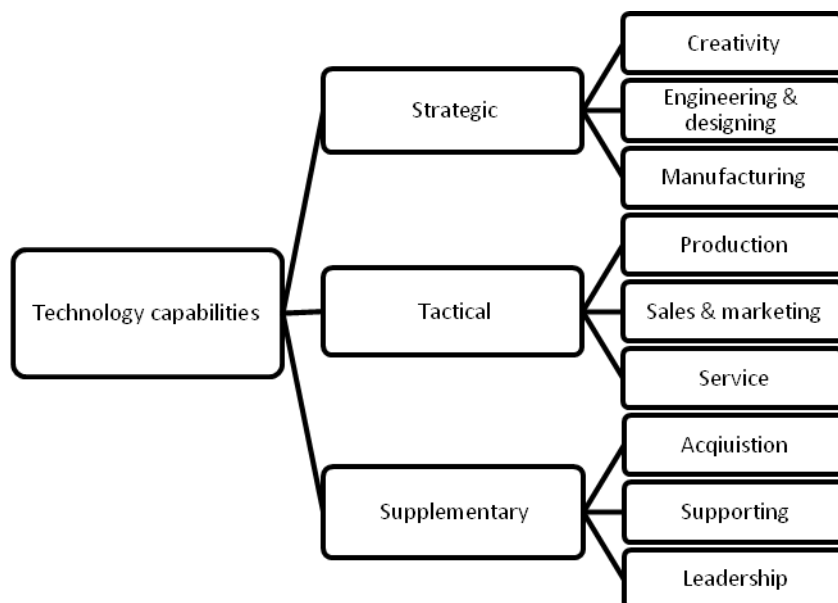


Figure 1: Classification of technological capabilities based on Ramanathen Panda model (Radfar, 2011)

4. Introducing L90 Project

Thundar project production was defined in Iran Khodro and Saipa automobile industry groups and Saipa awarded its production right to Pars Khodro. Thundar project was signed on the date October 12, 2003 and in 2004 the Pars khodro company begun its production. Production lines designed and implemented to produce 35 cars per hour and maximum of 150,000 cars in a year. Thundar was a platform for domestic auto makers to use modern technology for the first time in producing competitive vehicles in the global market. But too much sensitivity and attention to the Thundar made it political, led French Renault companies have enough time to fill their markets gap in Iran by producing a variety of different platforms.

Now regard to the problems that parts makers and Renault Pars in providing the required parts faced, daily production of Thundar on average is 150 cars and, this figure is about 20 cars in Iran Khodro per day. At first Thundar car were manufactured in three models of E0 and E1 and E2, which now only model E2 which has all the options and features is producing.

5. Objectives, methods and research questions

The purpose of this study was to compare levels of technological capabilities Pars Khodro and Iran Khodro Companies and determine technological gap in the each level. This study in terms of purpose is functional and survey.

A) The main research questions are:

1. What is the total level of technological capabilities of Iran Khodro in L90 project?
2. What is the total level of Pars Khodro technological capabilities in L90 project?
3. Levels of technological capabilities in Pars Khodro and Iran Khodro companies L90 project how do they differ?

B) Secondary research questions are:

1. Pars Khodro and Iran Khodro companies strategic capabilities in L90 project, how do they differ?

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2. Pars Khodro and Iran Khodro Companies tactical capabilities of the L90 project, how do they differ?
3. Pars Khodro and Iran Khodro companies have complementary capabilities in L90 project, how do they differ?
4. Iran Khodro and Pars Khodro Companies technological gap in three basic dimensions of empowerment are how much?

6. Population

Junior and senior managers and experts of Iran Khodro and Pars Khodro are graduated with a bachelor's to PhD degrees and have working experience of more than three years, and are chosen as experts and form the population of this research (Table 3). Statistical community took part in the study, are according to the terms specified. The questioner validity was confirmed by experts and its reliability by alpha 89%. Diagram 1 is working experience of the population and Diagram 2 displays the population's education. To do this 60 questionnaires sent to engineering units of Iran Khodro and Pars Khodro (30 questionnaire for each), 47 of them (i.e.78 %) responded and were examined. Also, due to the small number of experts sampling was not used and a statistical method to determine the total number is selected.

Table 3: The parameters of descriptive statistics

Row	Education	Number		Average working experience (years)	
		Iran Khodro	Pars Khodro	Iran Khodro	Pars Khodro
1	BS.	19	15	12.85	13.13
2	MS.	7	5	12.7	13.6
3	PhD	1	-	12	-
Summation		27	20	12.58	13.24

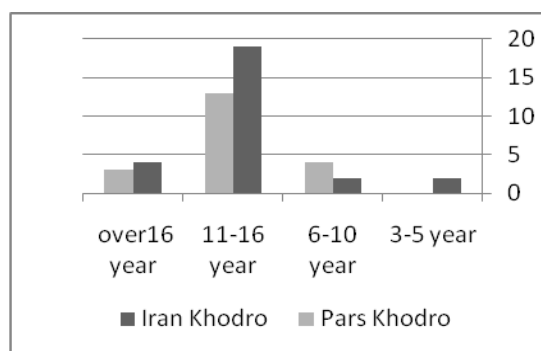


Diagram1: The population of working experience.

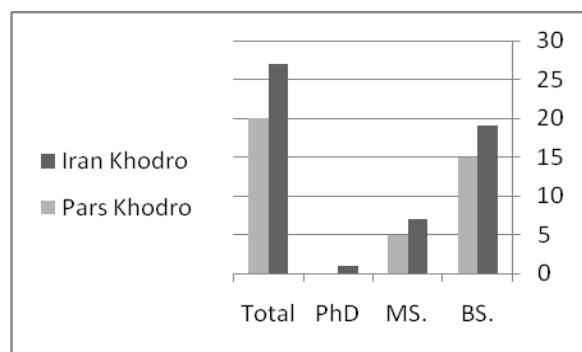


Diagram 2: The population education

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7. Summary of Findings

A) Summary of the findings of the research sub-questions

A - 1) what is Total level of strategic capabilities in Pars Khodro and Iran Khodro companies L90 project? Table 4 and Diagram 3 show the companies' strategic capabilities ratings in Pars Khodro and Iran Khodro.

Table 4: Average level of technological capabilities and strategic in Iran Khodro and Pars Khodro companies

Components	The success rate of each subsidiary dimension of Iran Khodro Co.	The success rate of each subsidiary dimension of Pars Khodro Co.
Creative Capabilities	69.21%	66.38%
Design and engineering capabilities	71.62%	71.80%
Manufacturing capabilities	71.43%	77.69%
Total average formidable strategic	70.83%	71.94%

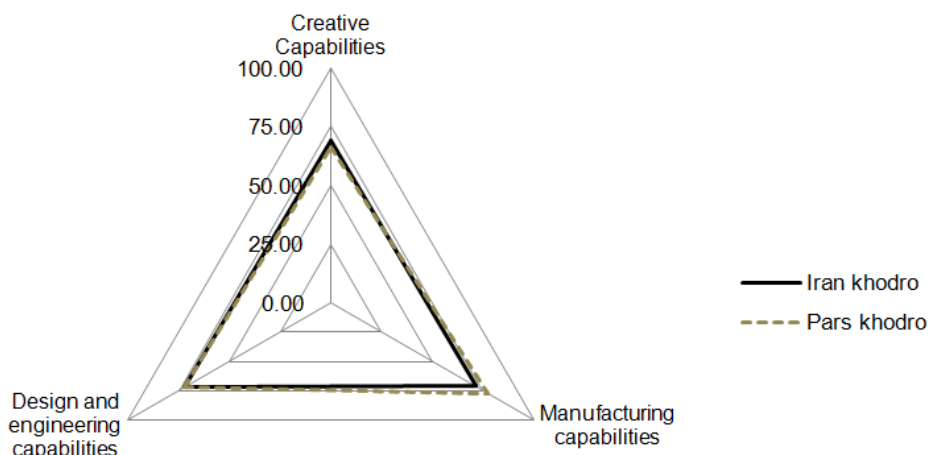


Diagram 3: Strategic Capabilities company Iran Khodro and Pars Khodro

A - 2) what is the tactical technological capabilities of Iran Khodro and Pars Khodro Companies L90 project?

Table 5 and Diagram 4 show the Tactical technological capabilities of Iran Khodro and Pars Khodro Companies.

Table 5: Average level of tactical technological capabilities Iran Khodro and Pars Khodro Co

Components	The success rate of each subsidiary dimension of Iran Khodro Co.	The success rate of each subsidiary dimension of Pars Khodro
Production Capabilities	73.00%	80.94%
Marketing and sales Capabilities	73.14%	73.42%
Service Capabilities	67.03%	67.19%
Total average formidable tactical	70.80%	73.88%

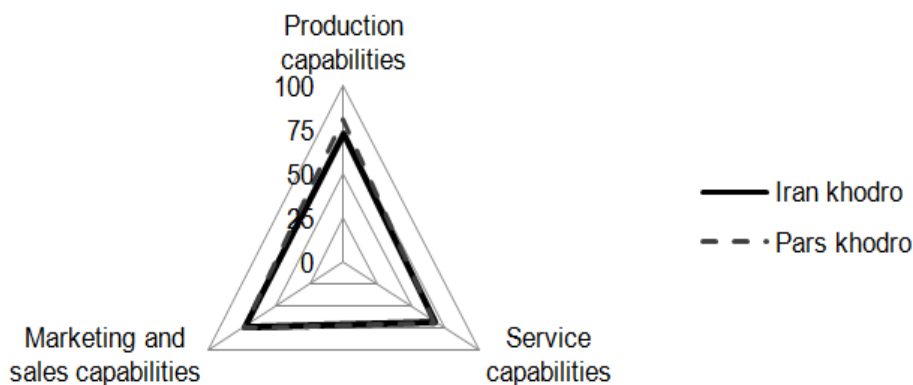


Diagram 4: Tactical Capabilities of Iran Khodro and Pars Khodro companies

A - 3) what is the level of complementary technological capabilities of Iran Khodro and Pars Khodro firms in L90 project?

According to the results of a study, Table 6 and Diagram 5 show the complementary technological capabilities of Iran Khodro and Pars Khodro firms.

Table 6: Average levels of complementary technological capabilities of Iran Khodro and Pars Khodro Co

Components	The success rate of each subsidiary dimension of Iran Khodro Co.	The success rate of each subsidiary dimension of Pars Khodro
Acquisition Capabilities	68.98%	76.44%
Support Capabilities	66.63%	66.80%
Leadership Capabilities	67.84%	75.19%
Total average formidable technological supplements	67.72%	71.08%

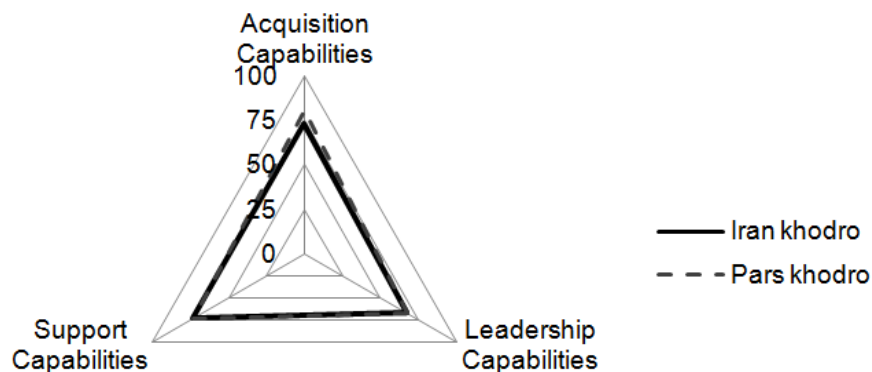


Diagram 5: complementary technological capabilities of Iran Khodro and Pars Khodro firms

B) Summary of the main research question findings:

B - 1): What is the total level of the technological capabilities of Iran Khodro in L90 project?

According to the results of different aspect of the study, Diagram 6 and Table 7 show the average rate of technological capabilities

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Table 7: Results of the technological Capabilities of Iran Khodro L90 Project

Components	The success of any dimension in Iran Khodro company
Strategic capabilities	70.83%
Technological capabilities tactical	70.88%
Complementary technological capabilities	67.72%
Average Strategic capabilities	69.81%

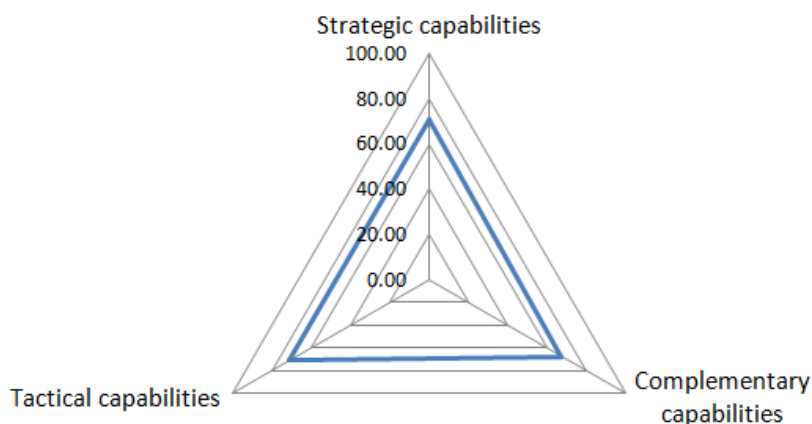


Diagram 6: Iran Khodro complementary technological capabilities in L90 Project.

B - 2): What is the Total level of Pars Khodro technological capabilities in L90 project?

According to the results of different aspect of the study, Diagram 7 and Table 8 show the average rate of technological capabilities.

Table 8: Pars Khodro total technological capabilities of the L90 Project

Components	The success of any dimension Pars Khodro company
Strategic capabilities	71.94%
Tactical technological capabilities	73.89%
Complementary technological capabilities	71.08%
Average Strategic capabilities	72.30%

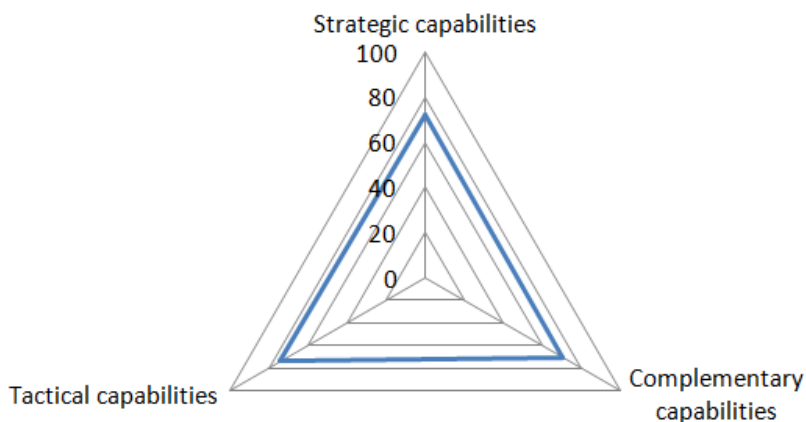


Diagram 7: Pars Khodro total technological capabilities of the L90 Project

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B - 3) what is the difference between Pars Khodro and Iran Khodro companies in technological capability of L90 project?

Diagram 8 compares the technological capabilities of different aspects of Iran Khodro and Pars Khodro firms. Table 9 show the average rate of technological capabilities.

Table 9: Average percentage of capabilities and technological capabilities of Iran Khodro and Pars Khodro firms

The main dimensions	Sub-dimensions	Capabiliti es of any subsidiary of the Iran Khodro	The Capabilities of the Iran Khodro company	Capabilities of each of the subsidiary dimension of Pars Khodro	The core capabiliti es of the Pars Khodro
Technological Strategic capabilities	Creative Capabilities	69.21%	70.73%	66.38	71.94%
	Design and engineering capabilities	71.62%		71.80%	
	Manufacturing capabilities	71.43		77.69%	
Tactical technological capabilities	Production capabilities	73.00%	70.88%	80.94%	73.88%
	Marketing and sales capabilities	73.14%		73.42%	
	Service capabilities	67.03%		67.19%	
Complementar y technological capabilities	Acquisition capabilities	68.98%	67.71%	76.44%	71.08%
	Support capabilities	66.63%		66.80%	
	Leadership capabilities	67.84%		75.19%	
Average		69.80%		72.25%	

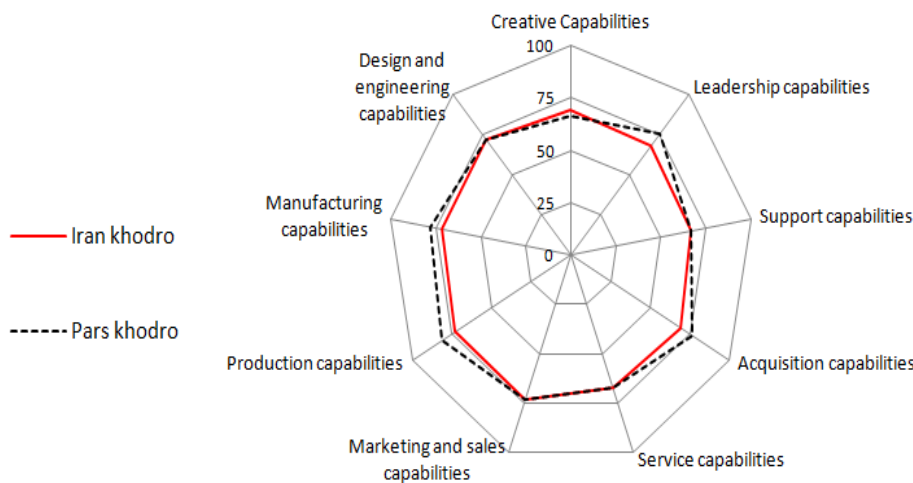


Diagram 8: Graph comparing various aspects of each company's technology capabilities

B-4): how much is the technological gap in three basic dimensions of empowerment in Iran Khodro and Pars Khodro Companies?

Given the current level and the desired level (100%) It can be said that in the two-level of technological capabilities there are three differences in each of, Iran Khodro and Pars Khodro the companies, the rates are shown in each of the core dimensions in Table 10 and Diagram 9.

Table 10: The small gap between the current level and the desired level of capabilities in each of dimensions in Iran Khodro and Pars Khodro Co.

Technological capabilities	The level of Iran Khodro	The level of Pars Khodro	Extent of the gap between current and desired level of Iran Khodro Co.	Extent of the gap between current and desired level of Pars Khodro
Strategic capabilities	70.83%	71.94%	29.18%	28.06%
Tactical capabilities	70.88%	73.88%	29.13%	26.11%
Complementary capabilities	67.72%	71.08%	32.29%	28.29%

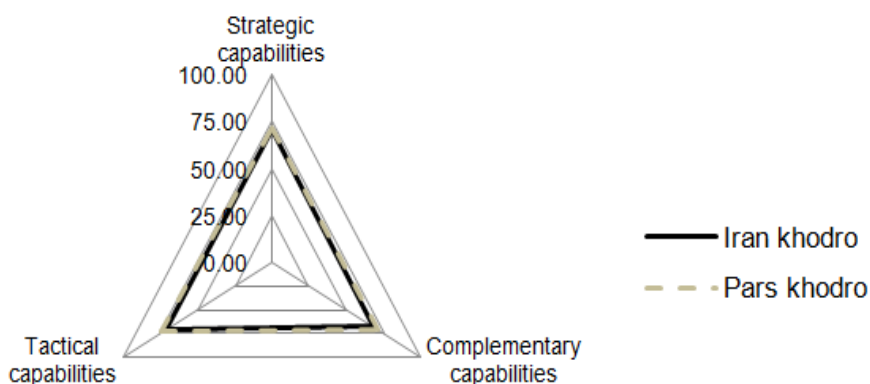


Diagram 9: Radar chart comparing the various aspects of each company's technological capabilities and gaps with desired level.

8. Analyze the results

Based on the results in Table 9 and Figure 8 for the sub-dimensions of technological capabilities in Project L90:

Iran Khodro production capabilities in marketing and selling among the nine abilities have gets the highest score, and abilities to support the lowest score.

Pars Khodro's production capability among 9 abilities gets the highest score, and creative abilities and support have the lowest scores.

Iran Khodro is stronger in creative capabilities than Pars Khodro, it would be more due to the successful implementation of systems and standards and is also benefiting from better teamwork.

Pars Khodro in capacity building, manufacture, acquisition and strategic is different with Iran Khodro companies and scored better and stronger, This could be due to higher utilization of automation technology and also benefiting from better technology.

In the total score summation Pars Khodro is rated higher scores than Iran Khodro but the difference between them is very small and not very noticeable.

Based on the results in Table 10 and Figure 9 on the main dimensions of technological capabilities in Project L90:

Highest capability in Iran Khodro is strategic and tactical capabilities, but in the Pars Khodro the highest is tactical capabilities.

Lowest capabilities and highest technological gap in Iran Khodro is complementary capacities, but in Pars Khodro lowest capability and highest technological gap is in strategic and complementary capabilities.

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In all three strategic, tactical and complementary capabilities Pars Khodro is greater than Iran Khodro this can be due to a higher level of automation in Pars khodro lines. The difference in these capabilities is more evident in supplementary capability.

REFERENCES

- Brown, E (2000).** Technology, Technology Assessment for Managers, translated by Mohammad Zanjani, Tehran: Institute of Industrial Management.
- Jafarnejad, A. & et al (2006)** "Audit Technology and Technology Solutions for Reducing Gaps," Journal of Management Sciences in Iran, Volume I, Number 2.
- Khalil, T. (2002).** Technology Management, translation Syed Kamran Bagheri et al, editor, Payam Matn Pub.
- Khamse , A & et al (2013).** "The Paper Evaluates the Capabilities of the Technology Industry, after Sales Service", automotive engineering conference in Iran.
- Radfar, R. & et al (2011).** "The Paper Evaluates the Technological Capabilities of the Industry, First International Conference, Fifth National Conference on Management of Technology, Tehran.
- Sadeqi, A. (2012).** "Paper Evaluations to Assess the Level of Technological Capabilities in the Water and Power Industry, Journal of Industrial Technology.
- Tabatabaeeian, S.(2005).** "Capabilities, Technology Assessment Firm" Arian Chap.
- Ghazi Nouri, S. (2004).** "Technology Assessment Tool to Assist Policy Makers", first edition, Tehran: Publishing Center of New Industries.
- Mgantz, R. (2005).** "Formulation and Implementation of Concessions, Technology", Translation Syed Kamran Bagheri, first edition, Tehran: Publishing Center of New Industries.
- Harrison, noma & Samson, Danny. (2002).** Technology management,Mcgrow hill International Edition Kianwie;The Major Channels Of Intenational Teknology Teransfer To Indonesia,2003
- Putranto, K., Steward, D. & Moore, G. (2003).** International technologytransfer and distribution of technology capabilities: the case of railwaydevelopment in Indonesia, Technology in Society, Vol. 25, No. 1: 43-53
- Tsukamoto, O. (2008).** Overview of superconductivity in Japan –Strategy road map and R&D status, Physical C: Superconductivity, Vol.468, No. 15-20:.