

THE STUDY OF THE EFFECTIVENESS OF TECHNOLOGY TRANSFER IN IRAN'S AUTOMOTIVE INDUSTRY BASED ON DAVID'S MODEL (A Case Study of Iran Khodro Company)

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ABSTRACT

Due to the efforts of all countries in the promotion of technology, Iran is also trying to acquire the technology of the day. Since the industry is a major driver of the economy, industries are trying to increase their level of knowledge and technology through some solutions. Therefore, one of the most common methods is the transfer of technology.

The automotive industry is the mother industry that in many cases has used the technology transfer. If transfer of technology is not effective, it not only does not lead to progress but also will lead to the loss of capital; hence, this study determined the effectiveness of technology transfer in Iran's automotive industry.

With respect to the study of technology transfer of Logan automobile using David's technology transfer model in Iran Khodro Company, its effectiveness was evaluated in four axes of model and the results indicated that the effect is moderate.

Key words: technology transfer, effective transfer of technology, David's technology transfer model

1. INTRODUCTION

All countries seek to increase their income and development and strive to achieve new knowledge. That's why technology is one of the important factors in the development and countries with no technology try every possible way to achieve this. They generally should either themselves achieve their technology or provide it from foreign sources. Because of the very high costs and time that must be spent on the acquisition of new knowledge and technologies, many countries try to develop through technology transfers. Since the automotive industry is considered as the mirror of economic and industrial development of any country and plays an important role in moving the country's economic wheel, the use of technology transfer is very common in this industry. As today's automotive industry is changing rapidly due to the rapid growth of technology, the Iranian automotive industries should take advantage of good practices in the effective transfer of technology, particularly through foreign direct investment (FDI) and joint ventures (JV) with the world's valid companies to achieve this. This type of cooperation is very common in the automotive industry such as joint ventures of French Renault and Japanese Nissan or common designs of automotive interior parts.

Today, about 70% of the world light cars market share accounts for five auto giant companies: Toyota, DaimlerChrysler, Volkswagen, General Motors and Ford. Thus, creating strategic links with large auto manufacturers and obtaining valuable experience can be shortcuts that transfer technical knowledge in addition to transfer of the intended technology and create gradual change in the structure of the industry and competitive behavior by increasing jobs in addition to job creation.

Technology transfer is a good way that if done correctly can lead to the industry's growth and prosperity. Of course, the transfer of technology has its own features and terms that will lose its profitability without considering this. Thus, technology transfer should be specifically considered. Therefore, it is necessary to know features and types of technology transfer prior to the transfer of technology in every field and suitable models and methods are used for the transfer of technology.

2. STATEMENT OF THE PROBLEM

The study tried to determine the effect of technology transfer in automotive industry. This is important because in many cases, the industry attempts to transfer technology in order to achieve the day's technology but it is not profitable at the end not only due to different reasons such as negligence of the major criteria of technology transfer and no proper investigation of the context, etc. but also it leads to double costs or dependency. The study examined the technology transfer made in Iran's largest auto manufacturing in order to determine whether technology transfer has been made properly in the company and whether it comply with the transfer terms and features.

The fact is that technology transfer in this industry has been occasionally made in a way that results in the growth of industrial thinking needed in the country and thus after 50 years of the first automobile assembly plant in Iran, the industry has failed to gain proper position in the auto industry in the world market in spite of relative advancements in the manufacturing and assembly.

Technology transfer: it is a process that allows the flow of technology from a source to a receiver. In this case, the source is the owner or holder of knowledge while the receiver is the beneficiary of such knowledge. The source could be an individual, a company or a country (Khalil, 2010).

Technology transfer can be conventionally defined as the transfer of intellectual technological assets, including skills, knowledge, and equipment and construction methods from the produced or developed location to another place. Strengthening production and the establishment of strong and dynamic economy requires the development and deepening of industrialization, of which technology plays a major role. Technology transfer takes place in two ways: vertical and horizontal transfer. The vertical transfer or transfer of research and development transfers the technical information and findings of

applied research to the engineering design and development stage, and then enters the production process by commercialization of technology. In the horizontal transfer, the technology transfers from one level of competence to the same level of competence in another country. In this case, the higher the level of technology receiver, the lower the cost of technology transfer will be and absorption is done more efficiently. Due to the deep technological gap between developed countries and developing countries, these countries have been taken steps to reduce the technological gap and provide their required technologies from developed countries. However, the major question is why technology transfer takes place in many of the developing countries for many years but these countries have failed to reach an appropriate level of economic development and growth? The answer is yes but technology has been not transferred effectively because a process perspective with a model to suit the environmental conditions in these countries was not provided for this sensitive and complex issue. The successful transfer of the technology needs to identify the goals of the industry, the needed technologies, technological resources, transfer methods and factors affecting it, how to attract and develop it, which involve hiring respective professionals. Without experts in the field, the transfer of technology usually does not take place or take place incompletely or inappropriately (Ahmadi & Tavakkoli, Tadbir, 109).

Technology transfer is not an activity that is done just once and should not so. Transfer of technology is a continuous process with follow-up activities. For the transferred technology takes root in its receiver industry, it must be properly fed. This requires implementation of a training program, strengthening, education, research and development to keep alive technology and grow in the new environment. If the technology does not support, it may quickly be faded as a plant. The basic tools necessary for the success of technology transfer are producers, buyers, investors and entrepreneurs that the last one is of particular importance (Achak, 2005).

Effective transfer of technology

The technology selected from the most appropriate source with regard to the goals and macro strategies of the country and automotive industry, which has been transferred by the most effective methods appropriate to the needs of the country and the best technical, economic, and legal conditions and enables the importer country to be succeed in the modification, development, and innovation of product and commercialization in national and international markets.

Infrastructures affecting the technology transfer

For technology transfer, it is necessary to provide the ground for the transfer of technology. Regardless of necessary infrastructures, technology transfer failed. Some of these factors may not seem necessary to transfer the technology at first glance but it should be noted, however, these factors will affect the transfer of technology. These infrastructures include:

- Legal infrastructure
- Information infrastructure
- Equipment infrastructure
- Economic, social and cultural infrastructure
- Technological infrastructure
- Organizational infrastructure
- Human infrastructure

Obstacles to the effective technology transfer

According to the studies conducted from 1948 to 1978, about 143 violations were found in the transfer of technology in Iran. Certainly, this rate has increased significantly since 1978. Therefore, the most important obstacles to transfer technology effectively are as follows:

- Shortage of skilled labor in the field of technology transfer
- Lack of proper contracts
- Failure of industries to use the experiences of research centers of the country (lack of good communication between industry and university)
- Negligence of technological compliance with the requirements of the country or enterprise
- Lack of adequate research funding for the technology transfer process
- Lack of documented policies in technology transfer
- Failure to develop a certain model in accordance with the needs of the country and enterprise for the effective transfer of technology

Therefore, the transfer of technology has been not actually made effectively and technological artifacts have been mainly considered rather than technology knowledge (Eslami, 2007).

From the perspective of Bennett and Hopkins, the main obstacles to a successful transfer of technology are divided into four groups that are (Hyung, 1997):

1. Problems and obstacles to select technology such as lack of familiarity with the owners of the needed technology and financial and information constraints
2. Problems of the receivers of technologies such as lack of knowledge and professional experience, financial problems and limited management resources.
3. The problems associated with the suppliers of technology, of which a mismatch between cultural and social issues among the suppliers and recipients of technology, delay to perform commitments in different stages of technology process that is done commonly by different titles intentionally or unintentionally (some solutions should be included in the contract to solve these problems), distance and lack of relationship between receivers and suppliers of technology and necessary support of the transferred technology and ultimately a lack of trust between the parties can be mentioned as the most important ones.
4. Problems associated with the government: in developing countries, nonobjective governmental intervention in projects and the lack of necessary conditions in terms of governmental laws, taxes and fiscal policies and a lack of appropriate legislative of business can be mentioned as one of the main barriers to technology transfer and subsequent stages.

Methods of technology transfer: for the technology to be transferred, it should be demonstrated that under what conditions the activities have been carried out that are so varied according to the type of technology and conditions of technology receiver and provider. For example:

- Licensing contract: according to Khalil's definition (2010), the receiver buys the right to use technology from the other person.

- **Franchise:** is a form of licensing with the exception that in this case, the source of technology usually provides a type of constant support, such as raw material supply, product marketing, support and training of personnel with the recipient of the technology (Khalil, 2010).

- **Joint Venture:** two or more companies exploit their abilities in the form of a joint company and thus share their knowledge and resources to create new technologies, produce a product or use their technical knowledge aimed at completing each other.

- **Foreign direct investment (FDI):** technology transfer is performed by one or more companies in the transfer of capital and technical, management and marketing skills to a foreign country through its branches or the establishment of new offices in that country. In Iran's car industry, this method has been used seriously in recent years. Thus, the managing director of Iran Khodro reported exports to \$ 10 billion of the components to international markets to the next 10 years (Karamad Journal, 2006).

- **Turn Key:** in this case, a country or organization buys a project completely from a foreign source.

- **Educational Acquisition:** a company wants a smaller company to provide his own experts for it.

- **Contract of research and development (R&D):** if necessary technological resources are not provided and resources outside the organization are needed to change or innovate, the company can afford the cost of research projects in the university and research centers in order to develop a particular technology and invest a company in a research field to create new technologies in the research centers and then exploit the results.

- **Consortium:** In this method, a number of companies and public institutions cooperate together in order to achieve a particular aim in the field of technological innovation but no share is exchanged between them. In this method, companies do not share all their industrial secrets and capabilities and collaborate only in the specific context.

Some informal methods of technology transfer may also include:

- Benchmarking of the best
- Sending out the labor to the countries holding technology
- Recruitment of scientific and technical personnel
- Imports of capital goods and machinery
- Reverse engineering

Technology transfer models

Apart from the specific method or methods, organizations use technology transfer models to determine the components of technology transfer. Some of these models can be mentioned below:

- Tenkasi and Mohraman's (1995) model
- Gibson and Sung's (1995) model
- Johnson and Foster's technology transfer model
- Interaction model of university and industry, Int.J. Technology Management (1995)
- Ruttan and Hayami's (1973) model
- K. Malik's (2002) model
- Ford's (1988) model
- Moor's (1999) model
- Conceptual model of the Canadian International Development Agency (CIDA)
- Canadian International Development Agency [CIDA], (2004)
- Technology transfer model in the perspective of technology importers (Hugo Amezcua, 2004)
- Effective transfer of technology model (Daniel Rouach, 2003)
- 7C model in the successful transfer of technology (UNEP-IETC, 2004)

This Japanese model refers to the seven factors of effective transfer of technology that are as follows:

1. Context, 2. Challenges, 3. Choice, 4. Certainty, 5. Communication, 6. Capacity, 7. Commitment
- Roberts and Barry's technology transfer model (Roberts, 1985)
- Gilbert's technology transfer model (Gilbert, 1995)

David Al Gore's model of technology transfer (2004)

David Al Gore's model was designed in 2004. The philosophy and underlying objectives of this model include:

1. Access to modern technology and international standards by establishing strategic links with foreign companies
2. Competitiveness of industries with regard to the promotion of technological level and increased effectiveness of technology transfer

3. Increased relationship between industry and scientific-research centers

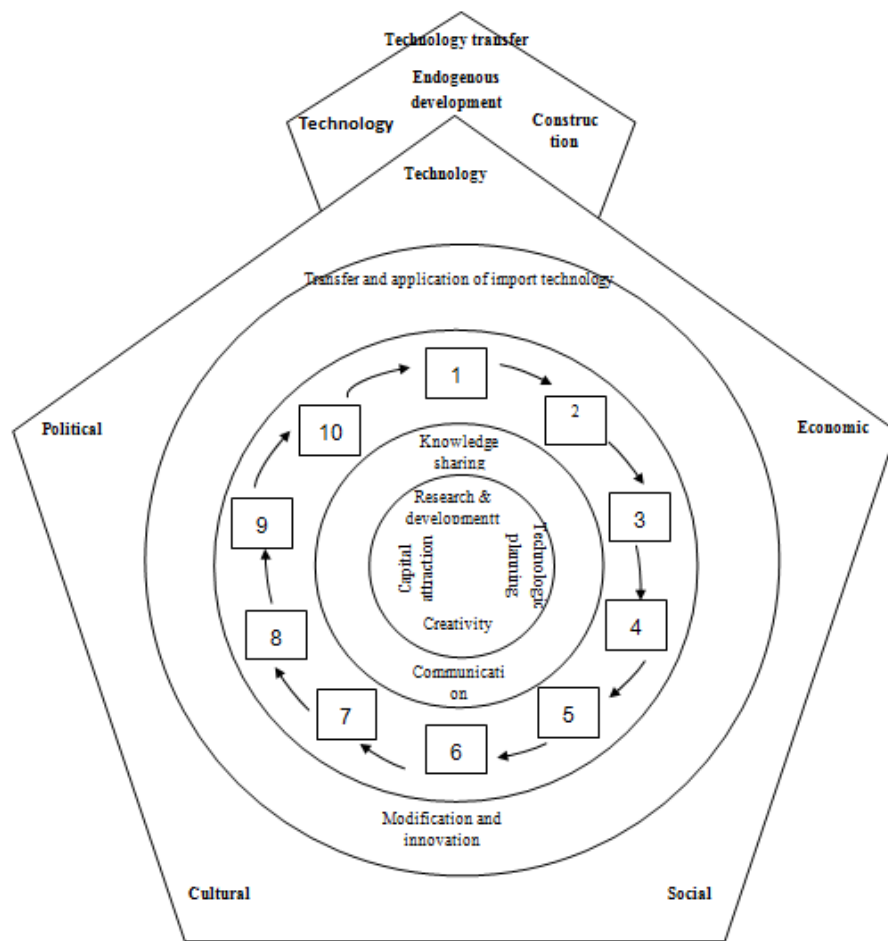
4. Access to global markets

5. Increasing the skills of human resources (fostering creative human resources)

The model was implemented in Malaysia and Singapore.

Internal components of the model:

1. Selection of the method of technology transfer
2. Consultation and negotiation
3. Conclusion of contract
4. Monitoring the implementation of the agreement
5. Conformity
6. Attraction
7. Development of Innovation
8. Release
9. Marketing of new technology and its development
10. Select the most appropriate holder



Source: Samiei Nasr, 2009

Key Concepts of David Al Gore's Model

1. Marketing: marketing is the final step in the process of the successful transfer and effective transferred technology marketing. It is the recognition of the market and provision of a clear strategy for obtaining the market.

The art of marketing is a set of variables that are known as 4P. These are product, price, place and promotion.

However, in recent years, development of global markets and communication technology have shown that these four factors are provided regardless of 4C that include variables of customer value, cost of customer, convenience and communication with the respective sectors in a fast, easy, visible, updated and integrated way. The category of communication is one of the factors affecting the effectiveness of technology transfer due to cultural issues, which should be considered.

1. Research and development

Research and development units, which are a group of experts, can play a major role in the localization and complete attraction of technology in addition to advice on the proper selection of technology and proper process of transfer.

The global developments and brutal competitions on the one hand are the source of threats and the ground for opportunities for organizations on the other hand. In such circumstances, the requirement for success in these markets depends on gaining competitive advantages and this requires research and development. For the alignment with globalization, where the customer-oriented approach is in the context of this process, it is necessary for the firms to strengthen and develop their research and development units and marketing research. In the new approach of the management; that is, placing the customer's demands at the center of activities, it is not possible to access to a customer's needs but through research and market research.

To state the importance of R&D in today's world, it should be said that research and development have been removed out marginalization and are at the forefront of innovation and competition. The production of information requires research; thus, it is expected in the information age that research is considered as one of the most important jobs. Studies showed that the average return on investment in industrial research and development is growing that indicated the important role of R&D to flourish. Emergence of global markets and competitors and new competitive strategies (that are based on quality, speed and cooperation treaties) forced managers to adopt new management strategies, structures and systems.

The developed industrialized countries know the establishment of R&D institutions and investment on them as important as direct investment in industries and consider this as a major cause of industrialization and one of the tools and mechanisms important for the creation of an environment that covers the technological development activities.

2. The interface between research and development and marketing

R&D and marketing are two different groups that are involved in the development of new products in organization. New product development begins with the birth of ideas and continues to the product performance evaluation. The interface of activities between the two units can be defined on common objectives that are the cause for continuous interaction and emergence of a successful new product. Common objectives make interaction necessary. Although the quality of communication, organizational structure, attitude and orientation of the senior management and, ultimately, the structure of the activity of new product development projects affect the interface of activities, the role of organizational culture that also shapes employees relations of different units to themselves and others, should not be ignored. Employees in each unit have their own specific thinking. Marketers are often aggressive, ambitious with a characteristic of short-term thinking, good public relations, talky, innovative, progressive, confident, optimistic, poor planning and poor understanding of the operation. While R&D employees are usually smart, sophisticated, relied on the numbers and analysis, inattentive to the needs of the market, serious and specialist. Therefore, a balanced company is one where R&D and marketing employees are responsible for successful co-innovation with market orientation. Each of the components of the interface knows each other's talents, strengths and weaknesses and advances to cooperation by establishing good communication.

3. The relationship between industry and university

In the past, national competitiveness was largely defined based on the availability and effective use of raw materials, labor, transportation, and capital resources. However, in the era of globalization, advances in technology have become the most important determinant of sustainable economic growth. This great effect has caused to change the view to development of technology dramatically and systematic aspect of this process is especially considered in recent years. It should be noted that universities supply skilled labor in many scientific, research and laboratory capabilities needed for industries. Industrial centers, which are the scientific laboratories for academic learning experiences, need the specialist labor technical and management positions on the one hand and research and development on the other hand in order to use the required technology. Therefore, mutual needs of these two poles, and ultimately acceleration of the development process determine the need for establishment of university-industry relationship.

4. Centers of technology transfer

Given the role of technology transfer centers in the effectiveness of technology transfer, these centers have long been established in different forms in developed and developing countries. In order to monitor the implementation of policies and strategies and the general trend of movement of society to the technology development goals and coordinate different activities in this field, it is necessary that there is an executive organization with the highest decision-making authorities and technology transfer centers have such a role.

5. Trade and foreign investment (FDI)

Development of offices requires scientifically and practically the development of foreign trade and international economic relations in all countries. The task of governments in the economic system is to provide a healthy competitive environment in all fields and attention to trade and attracting foreign investment is of high importance for the effective transfer of technology.

History of automobile and transfer of technology in Iran's automotive industry

History and situation of the technology transfer in Iran's automotive industry after revolution is as follows (Magazine of Gestures-e-Santa, 2003).

1. A period before the start of the first development phase and the war period. This period lasted from 1978 to 1989 and can be called a period of recession in the automotive industry. During this period, all activities were being affected by the problems of war and its constraints.

2. Since 1989, the capacity of automobile production reached 400 thousand cars with great varieties in a big leap. During this period, the increased production and meeting the domestic market have been especially considered. Therefore, compliance and internalization of the parts had considerable quantitative growth. However, because of the monopoly of the market, approach to increased production, the lack of a competitive environment, lack of targeted tariffs and lack of a clear policy on the technology transfer, important variables such as quality improvement, cost reduction, product development and customer satisfaction have been not adequately focused.

3. In spite of the access to the small growth in years before revolution, Iran's automotive industry suffered from underdevelopment as other economic sectors of the country to 1993. Prevailing strategic thinking among the industrial directors of Iran's automotive industry and applying new policies, significant qualitative and quantitative developments occurred in the country's automotive industry. Since 2001 to present (2007), Iran's automotive industry achieved considerable growth. Total produced cars reached 790 thousands in Iran in 2004 and thus Iran's automotive industry was the 17th automobile manufacturer in the world and the 6th automobile manufacturer in Asia and Australia in 2004. Moreover, the level of Iran's automotive manufacturing accounted for over 30% growth in 2004 compared to 2003. In 2003, over 580 thousands cars were manufactured in Iran. This figure places Iran at the 7th international ranking in terms of the level of growth to the previous year. According to the same report, the total of automobiles manufactured in the world reached 64 million cars in 2004 that showed 8.5% increase to the previous year (Magazine of Sanat-e-Khodro, 2004).

Introduction to Iran Khodro Company

Iran Khodro Industrial Group (the former Iran National) was established by Ahmad Khayyami, Mahmood Khayyami and Hassan Khayyami in 1947. The company began its work by producing buses in 1948. In 1951, a contract was signed between this company and Talbot Company on the assembly and manufacturing Peykan, which was called Hillman in English. In 1952, Peykan's production was begun with the capacity of 60 thousands cars and it was gradually increased to 120 thousands cars.

Iran Khodro Industrial Group is one of the largest automobile companies in the Middle East that accounts for an average of 50 to 55% of the car production in Iran permanently. In 1988, the agreement of manufacturing Peugeot 405 was concluded within three years. The greatest developments of 1994 were the company's seven-year plan and increase of production over 300 thousand cars per year. Mass production of Samand cars was begun as the National Automobile in 2002. In 2003, Pars, Samand and Peugeot 206 sedan projects were begun. Peugeot 206 sedan model is exported in collaboration with Peugeot Company to more than 39 countries. In 2006, Samand production projects in Republic of Azerbaijan, Belarus and Syria were operated. In addition, the production of Logan (called as L90 in Iran) was added to the products of the company in cooperation with Renault Company and caused to eliminate the monopoly of international

cooperation of Iran Khodro from the Peugeot Company. Samand production project began in Venezuela in 2006. The second national car of Iran Khodro was designed called as Rana in 1999. In 2008, the production record of 755,555 light vehicles was first registered in the history of the region in 2010 and nearly half of the country's share of the light vehicle production was provided with Iran Khodro.

3. METHODOLOGY

The study is applied research and data was collected by a descriptive survey because the research has been done on the existing and real subject and its results can be applied.

Moreover, the field method was used to collect. In terms of research, the study reported here is a survey research.

Population and statistical sample of the study

Since this study evaluated the effectiveness of technology transfer in the automotive industry and specifically deals with Iran Khodro, population of the study included all the experts and professionals working in the Iran Khodro. The population was 43 people, including 18 directors and 25 experts. Hence, questionnaires were distributed among the participants in order to achieve the required information.

Data analysis

Statistical techniques and methods were used to analyze the data collected from the questionnaires. The techniques included descriptive methods such as frequency, mean and percentage. Moreover, SPSS was used to analyze questionnaires. Distribution indicators and central tendency were used to represent data and results were shown in Tables of frequency distribution and statistical charts.

Variables of the study

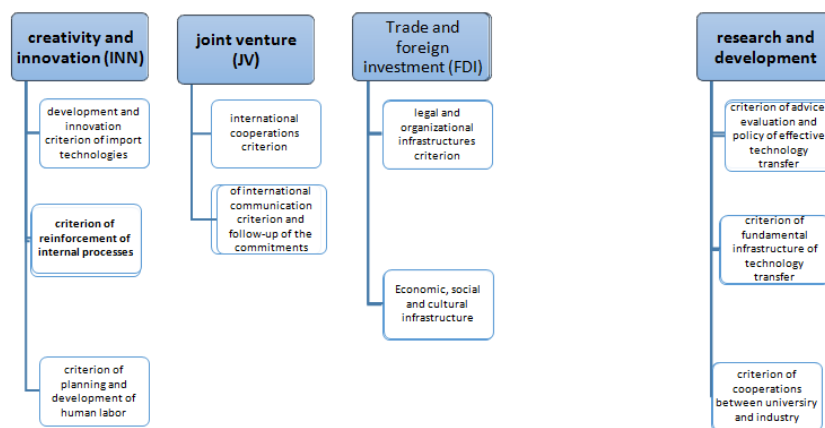
Since this study determined the effectiveness of technology transfer through David's model, responses to the research questions are its variables, which analyzed data of the questionnaire distributed among experts. Thus, the transfer of technology in automobile industry would be examined by the model questionnaire, distribution among the experts in the field, data collection, data analysis and review of data. Likert scale (5 options) was used to set the questionnaire and indicators under measurement were reflected in the form of questions.

As David's model has his own questionnaire, no action was undertaken to assess the validity of the questionnaire and just its reliability was computed by Cronbach's alpha coefficient and analyzed using SPSS. The reliability of the variables was 0.77, 0.71, 0.7 and 0.8 for the research and development, foreign investment, joint venture and creativity and innovation, respectively. The validity of the questionnaire was equal to 0.75.

The population of this study was all managers and professionals working in technology transfer of Iran's automotive industry. Of course, the study of technology transfer was not limited just to these individuals. However, since only qualified experts should be employed to determine the effectiveness of the competence, this study used census method and since the number of experts of this sector in Iran Khodro was known and limited, it was attempted to take advantage of the opinions of all experts. Thus, the sample of the study included 43 participants who answered the questionnaires.

The key components of the effectiveness of technology transfer using David's model

Axes of technology transfer in David's model



Developed and extracted by Mostafa Fattahi

Before examining the results, it should be kept in mind that normality test of data was performed by Kolmogorov-Smirnov test for all the items in the questionnaire (80 items). The results showed $0 < p \text{ value} < 0.05$ indicating that answers of all the items of the study were normal and hence independent t-test was used to analyze the participants' comments on the effectiveness of technology transfer.

To analyze the results, we first grouped the results in the model axes. After reviewing the results of the axes of the model, the following questions must be answered.

1. Is the transfer of technology based on the research and development (R&D)?
2. Is the transfer of technology based on the development of trade and foreign investment (FDI)?
3. Is the transfer of technology based on joint ventures (JV)?

4. Is the transfer of technology based on creativity and innovation (INN)?

The axis of research and development

Results of the criterion of advice, evaluation and policy of effective technology transfer

P value	t	Difference	Mean
0	-9.099	-0.36	2.63

This criterion included 22 items. Due to the mean value, it was determined that transfer of technology had little effect on the criterion of advice, evaluation and policy of technology transfer.

The results of the criterion of fundamental infrastructure of technology transfer

P value	t	Difference	Mean
0	-7.874	-0.39	2.61

This criterion was composed of 16 items. The results showed that the technology did not transfer significantly in terms of fundamental infrastructure. Although it could not be stated that this criterion was not effective, the effectiveness was under average.

The results of the criterion of cooperation between university and industry

P value	t	Difference	Mean
0	-5.864	-0.22	2.8

The results of this criterion refer to the moderate effectiveness of technology transfer.

Overall, all the criteria have been effective in technology transfer on the research and development axis but their effectiveness was about average and downward.

Results of the research and development axis

P value	t	Difference	Mean
0	-10.75	-0.35	2.65

Cooperation between universities and industry in the research and development axis were unfavorable conditions to the other two axes, which indicated that the industry was trying to establish an effective relationship between themselves and the university. In general, the research and development axis, however, had lower effectiveness.

The axis of development of trade and foreign investment (FDI)

The results of the legal and organizational infrastructures criterion

P value	t	Difference	Mean
0.275	-1.105	-0.08	2.92

Examining the results of the items related to this criterion showed that the organizational performance was effective in legal and organizational infrastructure.

The results of economic and socio-cultural infrastructures criterion

P value	t	Difference	Mean
0	-8.373	-0.38	2.62

This criterion was measured by five items and showed that technology transfer was effective in this criterion too but its effectiveness was low.

The results of the axis of development of trade and foreign investment (FDI)

P value	t	Difference	Mean
0	-14.12	-0.25	2.75

Taken together and considering ineffectiveness of the criterion of legal and organizational infrastructures, and effectiveness of cultural and socio-economic infrastructure criterion, and fundamental infrastructure of technology transfer, technology transfer was generally effective in this axis and was near average.

Joint ventures axis (JV)

Results of the international cooperation criterion

P value	t	Difference	Mean
0.157	1.44	0.5	3.5

The results of international cooperation criterion revealed that the technology transferred in this criterion had good effectiveness. According to the results, many experts have stated that the level of international cooperation was acceptable in the industry.

The results of international communication criterion and follow-up of the commitments

P value	t	Difference	Mean
0	-14.41	-0.66	2.34

This criterion was made up of five items. The results indicated that the effectiveness was low and under average.

Results of joint venture (JV) axis

P value	t	Difference	Mean
0.519	-0.65	0.1	2.9

Overall, in the axis of joint venture that was made up of two criteria, the results indicated the effectiveness of technology transfer. Since the transfer method was based on the joint ventures, the amount of effectiveness was about average, which indicated that the method of technology transfer has been paid more attention in the made transfer.

The axis of creativity and innovation (INN)

This axis consisted of 16 items. The respondents answered them in terms of three criteria. The results of each criterion are as follows.

Results of development and innovation criterion of import technologies

P value	t	Difference	Mean
0	-4.28	-0.37	2.63

This criterion consisted of three items. Results showed that technology transfer has low effectiveness in the criterion.

Results of planning and development criterion of human resources

P value	t	Difference	Mean
0	-8.823	-0.5	2.5

Results of planning and development criterion of human resources showed that the technology transferred in the field of planning and development criterion of human resources had poor performance.

Results of the criterion of the internal processes reinforcement

P value	t	Difference	Mean
0.44	-0.779	-0.06	2.94

The analysis of the internal processes reinforcement criterion showed that the criterion was effective and the respondents believed that reinforcement of internal processes had moderate effectiveness.

The results of the creativity and innovation (INN) axis

P value	t	Difference	Mean
0.001	-3.702	-0.22	2.78

SPSS was used to examine and analyze the three criteria of this axis. The results showed that technology transfer was effective in the innovation axis, although the level was not very high.

3. CONCLUSION

By aggregating the data that was extracted from the four axes, it was found that the technology transferred in the three axes had moderate effectiveness. In the research and development axis, low effectiveness was found indicating inattention to research and development in organization. In the joint ventures axis on which the method of transfer was based, the organization was in desirable condition. The axes of the development of trade and foreign investment, and innovation and creativity were of the same status so that the effectiveness of transfer was almost moderate.

Level of effectiveness in all the model axes

Row	Axis	Mean	Difference	t	P value
1	Research and development	2.65	-0.35	-10.75	0
2	development of trade and foreign investment	2.75	-0.25	-14.12	0
3	Joint ventures	2.9	0.1	-0.65	0.519
4	Creativity and innovation	2.78	-0.22	-3.702	0.001

Independent t-test was conducted to determine the effectiveness of technology transfer. The following tables show the descriptive statistics of the effectiveness of technology transfer. The moderate effectiveness is equal to 2.72.

The overall effectiveness

	Frequency	Mean	SD
Effectiveness of technology transfer	43	2.72	0.12

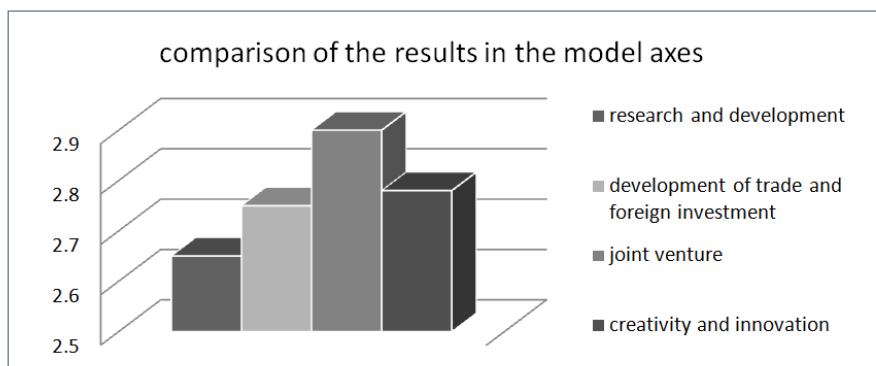


Fig. 4.6. Comparison of the results in the model axes

Table 4.18 shows independent t-test results. According to the results, the test is significant and participants have not a preventive view to the effectiveness of technology transfer. In other words, the average opinions of opponents is equal to 3 ($P < .05$).

Table 4.18. t-test of the answers

Effectiveness of technology transfer	t-test	df	Mean difference	p-value
.001	-14.5	42	-0.28	.001

According to the first table, the average effectiveness of technology transfer is 2.72 that showed the effectiveness of technology transfer was low.

Since effectiveness was moderate in the three axes model and in the R&D effectiveness was lower than the other axes, we can conclude that the organization could not make technology transfer quite effective. However, due to the use of joint venture by Iran Khodro Company, which is one of the best ways of transfer for both sides of the transfer, the company has failed to fully meet the criteria for transfer. Of course, due to the high average value of the joint venture axis, it can be said that the company has been relatively successful in this area.

On the other hand, the results of the questionnaire clearly indicated the lack of an integrated policy on technology transfer. For example, the results suggested the weakness of the industry on the relationship between university and industry or the use of knowledgeable labor, and labor training. It was also showed that the company did not have a plan to promote its human resources.

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