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Technology transfer strategy in the upstream oil industry (oil fields development) of the Islamic Republic of Iran has provided the effectiveness of technology transfer model

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Abstract The aim of this research is the determining strategy of technology transfer in the upstream oil industry (oil fields development) of the Islamic Republic of Iran with the use of effective conditional models of technology transfer. In this study, the views and attitudes of 30 managers and experts familiar with the issues of technology transfer, including transfer of technology in the development of the country's oil fields و have been investigated. In order to analyze the collected data, SPSS software and regression test and Friedman were used. The results of the analysis of data collected indicate among the factors the transfer of technology in the development of oil fields, transfer issue is a top priority which of the sub-criteria of scientific knowledge and physical technology have the most priorities. In evaluating technology in the enterprise, using high precision machinery and equipment have the highest percentage and use of planning techniques and coordination of production and copying equipment and parts required and also the possibility of design changes for optimum use of existing cases have the lowest level.

Keyword: Technology Transfer, Development of Oil Fields, Strategy, Contingent Effectiveness Model, Upstream Oil.

1 Introduction

Technology, is one of the most important factors in the success of organizations that will be present in the arena of global competition. Technology transfer is also an important issue that provides the possibility of access and acquisition of technology to use it effectively for economic development and growth of less developed countries in terms of technological. Technology transfer, from the owner countries of technology and technical knowledge to other countries carried out in various forms.

Today, developing countries due to restrictions \ domestic financial resources on the one hand and the transfer of advanced technologies and modern on the other hand, have to choose the most appropriate solution for the transfer of needed technology. In this regard, the Islamic Republic of Iran, with its vast reserves of oil and gas, is one of the potential area. Optimum use from the God-given wealth can smooth the country's economic way of development.

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Arena activists oil in the world, have a program or strategy for development. One of the most important programs, planning in the field of technology in the business environment with the keyword "technology strategy" is known. Basically, attention, observation and monitoring of the technological progress of the world, especially Iran's neighbors in the field of oil lead to the success and active presence of National Iranian Oil Company in the global arena and research documents and reports the current posed powers in this field in the world, clear the road ahead [1].

Accordingly, the formulation of technology strategy which is one of the most important goals of firms and countries in every field of industry and the subject of this study is the area of the oil industry, was investigated.

In this context, oil and gas industries as well as in terms of the nature of their projects, demands access to adequate information, authentic financial resources, superior technology and mass production. But what strategy should be used to transfer this superior technology, is important.

Branstetter and Chen's study has been a comparative and causal-comparative analysis of the cost effectiveness of R & D and purchase of foreign technology on output and productivity in the Taiwan industry. The results using regression analysis is generally the results of applying R & D and support costs related to the purchase of foreign technology was approved and positive productivity growth has helped Taiwanese companies [2].

In Belderbos and colleagues' study that estimates the productivity dynamic model is based on a large sample of Japanese manufacturing firms in the years 1996 to 1997 and 1999 to 2000 has been done. The results of this study indicate that both, R & D related to foreign and technology transfer within the company help increasing productivity. At the same time transfer technology reduces profit margins [3].

Mcbeath and colleagues in a study that has been review the documented success factors and proposes an integrated framework. According to the results of research, five key issues required for successful knowledge transfer to new production facilities established for the moving parts are: willing to share information, willingness to receive information, transfer of explicit knowledge, tacit knowledge transfer and verification and review. Then a rational framework for the transfer of technical knowledge to new facilities is organized [4].

In Elmer Hansen and colleagues' study, using qualitative data of the company levels in the analysis of the use of different training mechanism, you can fill the gap ignoring the corporate level and explain the difference in collecting the technical capacity. It were analyzed by study eight companies in Malaysia industry in the period 1970-2011. The findings show that firms rely on combine education of foreign technical partners and internal training had the most progress in terms of technical capacity. However, for some companies that have learned the principles of local competitors to imitate, it is very important spillover effects. On the other hand, companies that are actively seeking to learn of foreign partners, have more development and have found innovative levels of major technical capabilities. These findings to a broader range of industrial sectors in emerging economies is concerned [5].

In Srivastava and his colleagues' study the alignment between strategy of a firm technology and the effects of efficiency of enterprise knowledge structure, has been tested. They tested how internal and external R & D strategy are aligned with the depth and diversity of tech stock of company. The results showed that long-term performance of a firm by high-tech is worse when the company increases internal R & D intensity, but when companies increase internal R & D, increased, but when the company's formal alliance intensity of R & D increase their quality is lost or deteriorated [6].

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DastjerdiKarimi and colleagues' study to determine the assess of the impact of the technology transfer of auto Thunder90 on the competitive performance of the Iranian part makers, using structural equation modeling was performed. The results show that technology transfer has a direct impact on the competitive performance of companies operating in the manufacturing of Tondar90 automotive that has led to increasing quality and reducing the cost of production the other hand in the process of technology transfer, firms' attention focused more on the aspects of hardware and software technology [7].

In another study, Asghari and colleagues have explored the importance of technology transfer in the oil industry, and production and barriers to reduce the technological and gap between the income of oil producing countries and technology producing countries. Article is based on a real and successful transfer of technology and a simple model of technology transfer. The results show that for countries with low levels of production endogenous technology, transfer of technology to fill this gap is inevitable. As a broad definition, technology transfer, systematic chain of goal activities through which technology is used in a other place than the place of its production. In general, the development is a multi-dimensional process that calls for fundamental changes in the social structure, understanding people and national and local organizations, therefore, technology transfer should be consistent with development goals. Reaching this goal requires extensive efforts and generator thinking about the present situation [8].

It is well known that the difference in production is part of the difference in income in the country and technology played a major role in determining the amount of being productive [9]. In many countries, foreign sources of technology were estimated 90% of domestic product growth [10]. However, since the establishment of global technology occurs in developed countries, technology transfer may significantly affect the pattern of technological change in those countries. This means that the increased coalition process also may be lead to a high income in underdeveloped world; Undeveloped world where final production earnings related to technology transfer may be more than the earnings in the developed world [11].

Technology as hardware (output technology, material, equipment and means of production) and software (skills, knowledge, organization and management of technology) is known [12].

More literature of construction management has discovered the benefits of compliance and implementation of new technologies [13]. Technology transfer should form part of the technology development program. In order to promote technological self-reliance, recipients must are involved in transfer mechanisms. Hybrid technology and appropriate tools must be carefully selected and ensuring easy use and transfer of technology and being appropriate with available technology and local sources can use to an organization's of being productive and organization development [14].

2 The contingent effectiveness model of technology transfer

This model is known with the five categories of technology transfer factors or odds which includes:1-characteristics of the transfer agent, 2-characteristics of the transmission media, 3-characteristics of the transfer object, 4- demand environment, 5- The transfer receiver features. These dimensions are not fully comprehensive but broad enough to include many variables in studies of the state technology transfer activities. The arrows in the model show relationship between different aspects (broken lines represent weak links). In short, this the model suggests that the effects of technology transfer it can be understood what the

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organization is doing transmission and how to do it and what is transferred and for what the system.

The term "contingent" in this the model is a key factor because of the assumption that technology transfer is a definition that includes multiple sectors and this sector generally have multiple objectives and a few effectiveness criteria. The effectiveness of the various measures considered, including (1) out-the-door (was anything transferred?), (2) market impact, (3) economic development, (4) political advantage, (5) the development of scientific and technical of human capital, and (6) Opportunity costs, (7) public values [15].

In this paper, the factor of technology transfer in the development of Iran's oil fields and these are described below.

2.1 Transfer agent

The organization has a structure that enables fast action. This structure will facilitate decision-making process. Chief technology expressly provided the technology. There is evidence that the organizational structure are determined based on technologies and not on products. Roles and tasks are designed to facilitate teamwork. Teams do their tasks and only the administrator can check their work. Teams can set goals and assessment so they can support the company's overall strategy [16].

The recent development in the theories based on company's resource also emphasizes the need to understand how to coordinate the resources and company's capabilities. This involves knowing that resources come from where and how to collect and are set to produce acceptable returns [17].

2.2 Transfer media

Selection or methods of technology purchase (internal research and development, joint companies, permission to build or buy a building permit) support from technology strategy. Decisions on specific technology life cycle position are adopted. In making decisions, factors such as the company position, importance and urgency of the purchase, investment, life cycle position and the type of technology considered. Investment projects are evaluated and come to pass based on financial statements and on the basis of competitive advantage that develops [16].

The most common channels of technology transfer between countries are: direct investment in wholly-owned subsidiaries of the technology or joint companies, licensing agreements, turnkey project, installation and service of the equipment purchased. Some of the other channels that their importance is growing in many developing countries are: independent technology licensing and contractual agreements to provide technology [18].

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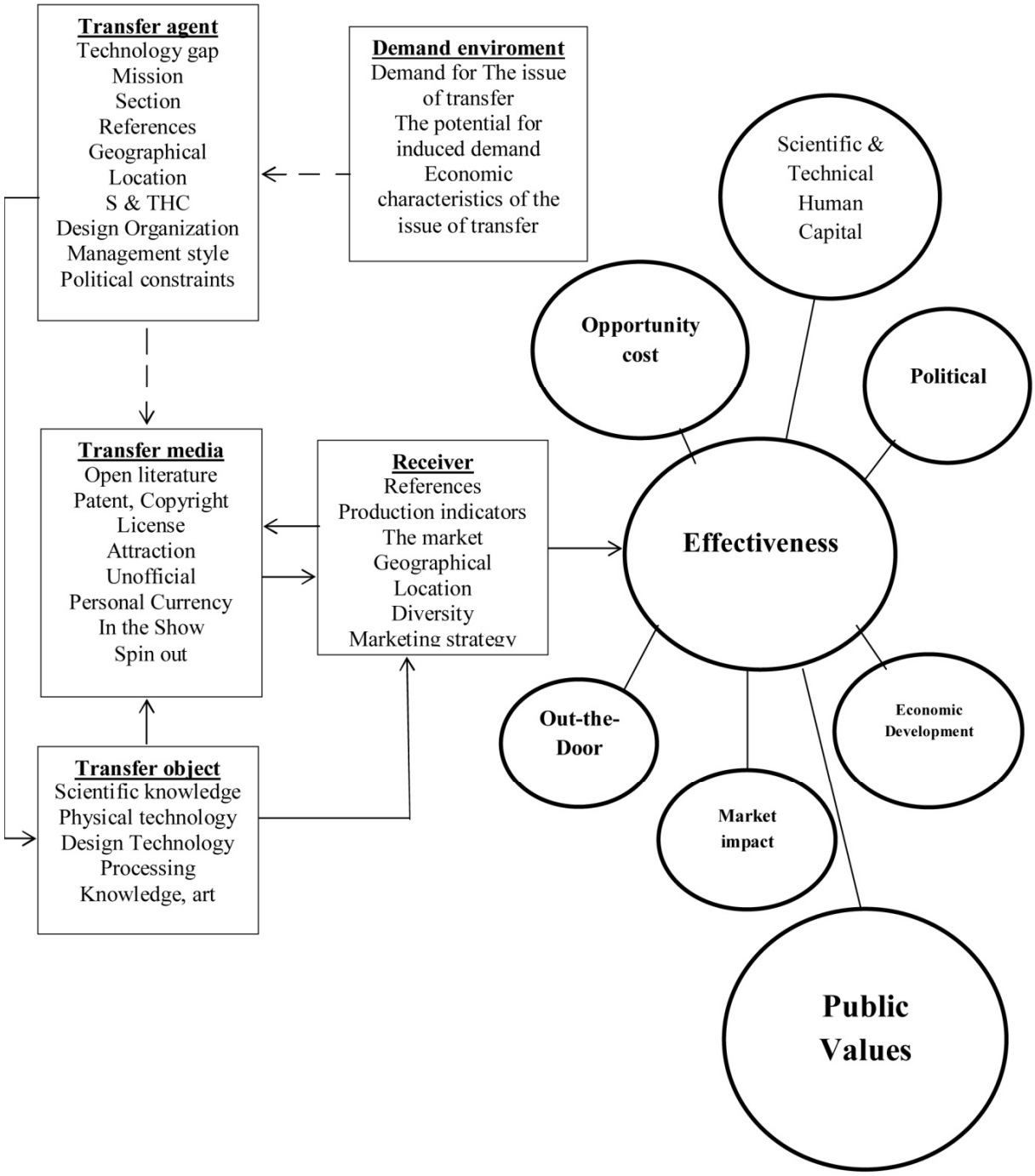

Fig. 1 Revised model of the technology transfer effectiveness [15]

Given that the choice of technology and the organizer of technology requires a highly advanced information and communication infrastructure, is important. The validity and importance of these features is beyond the studies that companies must do on the technological potential sources. Advanced information and communication infrastructure allow electronic exchange of technical information and provides the company access to databases around the world [19, 20].

The authors have identified formal and informal channels to transfer knowledge and technology. While the transfer of knowledge and technology usually involves a legal contract

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patents and joint research activities, informal transfer channels refers to personal communications and therefore focuses on tacit dimension of knowledge transfer [21]. In fact, a lot of research focused on the mechanism of transfer of knowledge and technology of universities, for example, those who embody or leads directly to the legal instruments, such as building permits and license and royalty agreements [22, 23].

Existing research suggests that formal and informal knowledge and technology transfer may be to-go well together, informal communication to improve the quality of a formal relationship, and in formal agreements, mutual exchange on technology dimensions associated with informal relations [24, 25]. So there is the possibility that both may simultaneously occurs in order to codified transfer of knowledge in the form of patents or licenses as well as tacit knowledge through interaction between academic scientists and industry personnel [26].

2.3 Transfer object

Companies have different transmission methods, the ways that transmission of successful technologies from other institutions, like the other companies, laboratories and universities make possible. When a new technology is purchased, employees also have been transferred to support the transition process [16].

Basic research aims to achieve new knowledge is done with new understanding. This type of research is not done with a specific scientific purpose or for specific applications [27]. Based on the comment the National Science Foundation, the goal of basic research, access to knowledge that is more complete or more complete understanding of the subject under investigation, have not had the development of scientific applications.

Basic research can be done to develop the science, and the aim is transforming ideas into operational form [27]. The purpose of this type of research is accessing the knowledge or necessary understanding to meet a specific need and organized. Applied research, is a mixture of science and engineering [28]. Designing the technology include the regular use of knowledge or understanding of the researches for the production of materials, devices, systems or useful ways, including design and production of a new service or improve existing service. This stage is more a kind of technology, engineering or a science [29].

Past research shows that characteristics of technology transfer, the transferor of technology and the issue of transfer affect on the success of transmission [30]. Technology as a configuration and observations of technology that is relating to a subject specified products and processes. The study on technology transmission can not only focus on the production, because production will need to transferor with related knowledge to use of it. The transfer of technology and transfer of knowledge are moving together [31].

Technology transmission, in turn, include the transfer of physical assets, knowledge and human capabilities to increase the effectiveness of manufacturing and servicing to organization's projects [32].

2.4 Demand Environment

There are systems to effectively identify market needs and possible trends its changes. This information is provided for authorities of research and development and other staff of organization income and they encouraged to understand the information. Market trends are

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considered in the company's overall strategy and technology guards in this process participate actively [16].

Governments of developing countries will need to support technology transmission programs [32]. Conventionally related policy instruments are classified in two sections of elasticity of demand and pressure of technology tools [33]. The importance of improving the understanding of the right balance between the elasticity of demand and pressure technology is measuring with a policy mix that is confirmed by previous studies [34].

2.5 Transfer receiver

Technology strategy with issues such as the exploitation, development and preservation of the knowledge and ability of the company involved. It seems that many companies still do not understand the importance of technology, sufficiently [35].

The first step toward integrated business and technology strategy, attracting the agreement of the technical and commercial management of the company is about a shared set of priorities. Usually, the business sector, knows technology as a subset of business, while technologists know the business as subset of the overall progress of technological [36].

A deep understanding of the environment in which the company competes for the management of technology is crucial. The relationship between suppliers, distribution channels, customers and competitors can be changed with the creation or adoption of new technology. Business decisions in this area include decisions related to pricing, distribution channels, product positioning and so on. Marketing departments of company have design some systems for the operation of products and technologies. Projects should be used with policy and consistent with the company's overall technology strategy [16].

Transfer of technology is related to (a process that) which technology is transferred from one company to another company [37]. Transferred technology is a versatile product that can take many forms including tangible and intangible, with patent and non-patent. A successful technology transfer to the recipient not only requires technical knowledge for production, but also need the ability to manage, independent development and production for production with essential technology [38].

So as a strategy to improve the competitiveness between the company and industry, technology transfer not only in developed societies but in most growing economies, is well recognized [39].

In less developed countries, technology transfer process with certain obstacles, such as limited a receiver capable of expressing the technical needs, the intangible benefits of new technologies and incomplete knowledge of research institutions with new ways to connect with existing practices [38].

3 Methods

This section introduces the tools and methods of data collection in this research. As well as statistical techniques for analyzing research data in both descriptive and inferential statistics section is explained.

This study was an exploratory study that in terms of purpose is an applied research and in terms of collecting data is a survey research (descriptive) and a case study.

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The studied population in this research is professionals, managers and experts in the field of technology transfer in the oil industry and development of oil fields. Therefore, the analysis level for this research is organization.

According to the terms of the studied population, the number of experts in the field of technology transfer in the oil industry is limited, the sample size was not actually need and researcher has done census. **N≅ n** In order to collect the literature and research literature, library and field method is used for research.

To cover the theoretical topics of research, from the Internet, general and specialized books, articles and journals, corporate reports, theses and also questionnaires and interviews to take advantage of feedback of experts and specializing in the research have been used.

In this study, a questionnaire was used to collect data and response spectrum used in it, is 7-point Likert scale.

4 Results

4.1 Describing the variable of the transfer factors

According to Table 1 it can be seen that variable of transmission factors has the least amount of 2.86, most amount of 6.63, average 4.9085 , standard deviation 0.91436 and variance 0.836.

Table 1 Description variable of transmission Factors

	Number	minimum	maximum	Average	Standard deviation	Variance
Transfer Factors	30	2.86	6.63	4.9085	0.91436	0.836

4.2 Description of transfer factors

According to Table 2 and Figure 1 can be seen that the highest average in the transmission Factors are related to the variable of the issue of transfer. The average of all transfer factors is more than 4. In explaining the diagram should be said, between technology transfer factors the issue of transfer has greater average than other and therefore is more important in the development of Iran's oil fields, that according to the different modes of transport issue that has been mentioned in the questionnaire according to the frequency tables of scientific knowledge and physical technology with the highest degree has more priority.

Table 2 Description of transfer factors

	Number	minimum	maximum	Average	Standard deviation	Variance
Transfer agent	30	2.25	6.88	4.8946	1.02315	1.047
Transfer media	30	3	7	4.7856	0.99052	0.981
Transfer object	30	3	7	5.095	1.11652	1.247
Demand environment	30	3	7	4.8851	1.15221	1.328
Receiver	30	2.86	7	4.8865	1.04286	1.088

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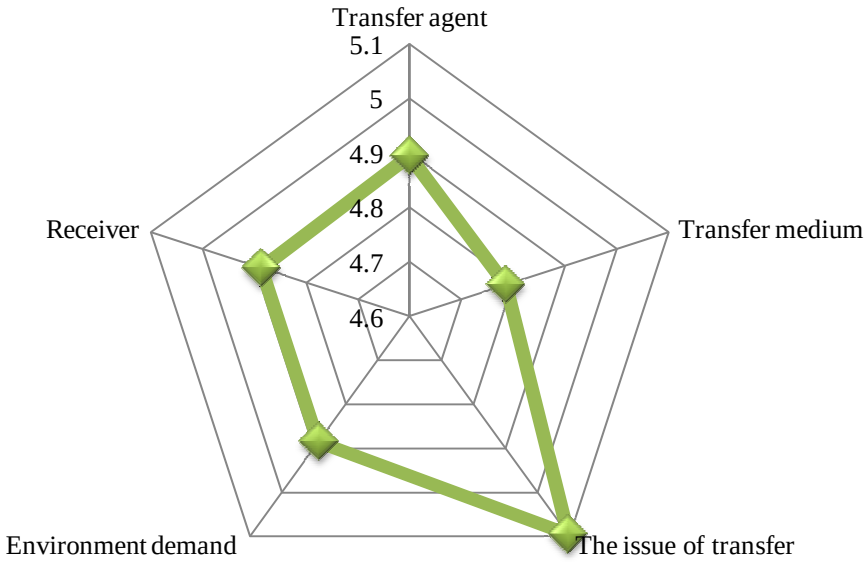

Diagram 1 Radar diagram of transfer factors

4.3 Ranking transfer factors

According to Table 3 can be seen that a significant level obtained for the above test that is less than 0.05. As a result, the rate of obtained average show those transfer factors have a significant difference so transfer factors can be ranked.

Table 3 Friedman test for ranking transfer factors

Variables	Rate Average	Chi square	d.f	The significance level
Transfer agent	2.88	14.667	5	0.012
Transfer media	3.60			
Transfer object	4.28			
Demand environment	4.00			
Receiver	2.93			

4.4 Description the variable of assessment factors

According to Table 3, which the variable of assessment factors has the lowest amount of 3.08, most 7, average 4.8462, standard deviation 0.92374 and variance 0.853. In explaining the diagram, according to the average obtained from questionnaires, now the problems of technology transfer process in the development of oil fields, using techniques of planning and production coordination and copy the required equipment and parts and design changes also allow for optimum use of technology, are available.

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Table 4 Description variable of evaluation factors

	Number	minimum	maximum	Average	Standard deviation	Variance
Evaluation factors	30	3.08	7	3.8462	0.92374	0.853

5 Discussion and conclusion

5.1 Transmission factors

In explaining the factors of transmission technology that includes transfer agent, transmission medium, the issue of transfer, demand for environment and the receiver of transfer, the issue of transfer has the greatest impact in the process of technology transfer, with this explained that according to the questionnaire which of the modes of transmission technology including scientific knowledge (conceptual knowledge, theoretical foundations), physical technology, design technology, processing (gradual and consistent progress) or the science and arts (applied knowledge, is specifically in relation to the oil industry) should be used in the process of technology transfer, according to obtained frequency table of respondents' responses of questionnaire, scientific knowledge and physical technology have the highest percentage this means that the majority agrees to acquire scientific knowledge or the theoretical foundations about the required technology to develop oil fields as well as to gain physical technology or buy their technology. Other cases are: the design of technology and applied knowledge to a level and then processing.

Other factors of technology transfer include the transfer agent, receiver of transfer, demand for environments and transmission medium.

As a result, according to the development of research centers in the development of oil fields to conduct conceptual studies to identify needy sectors to new technology and also identifying the best and most efficient form of transmission is important in the relevant section. As well as oil industry managers' using of academic research and trust the results to the researches and investment and encourage of research centers and universities to research in the field of technology in the development of oil fields.

5.2 Assessment of available technology

According to the results obtained of the questionnaire, currently the development of oil fields of country with using machinery and equipment with high precision have the highest percentage that Indicates that the oil company is now used significantly from the equipment. But the use of techniques of production planning and coordination and copy of equipment and parts required and also the possibility of design changes for efficient use of available cases are at the lowest level and this is weaknesses of using and using of technology in the development of oil fields. Accordingly, Establishment of Coordination between technological need and the amount of production to avoid the transfer of unnecessary technology, as well as accurate programming for need assessment in the development of oil fields is necessary. And using the equipment which has the ability of User change with a few changes in them in order to save on costs incurred in the transfer of technology is important.

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6 Suggestions for future researchers

Based on the observed limitations in this study, doing studies in deployment of quantitative models of technology transfer in the development of oil fields in Iran and examining the feasibility of the model in this area and also strategies to improve the effectiveness factors of technology transfer in the field of oil fields in Iran and as well as extension of conducted study to other areas of the oil industry such as drilling, exploration and refinery can be useful topics for future studies.

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Appendix A.

Evaluating and selecting the most appropriate strategy of technology transfer

Amount of impact / Factors(Transfer agent)	Very high	high	Relatively high	Average (partly)	Relatively low	low	Very low
The gaps of Technology							
Mission							
Part (Department)							
Geographical Location							
staff's Science and technology							
Organization Design							
Management style							
Political constraints							
Amount of impact / Factors(Transfer media)	Very high	high	Relatively high	Average (partly)	Relatively low	low	Very low
The open literature (research constantly are being updating the transmission of technology)							
Patent, Copyright							
License							
Unofficial routes							
private Currency (individual transactions)							
In the Showing							
Distribution of shares							
Amount of impact / Factors(Transfer object)	Very high	high	Relatively high	Average (partly)	Relatively low	low	Very low
Scientific knowledge (conceptual knowledge, theoretical foundations)							
Physical technology							
Design of Technology							
Processing (gradual and consistent progress)							
Science and Art (applied knowledge, specifically in relation to the oil industry)							
Amount of impact / Factors(demand environment)	Very high	high	Relatively high	Average (partly)	Relatively low	low	Very low
Demand for The issue of transfer							

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The potential for demand of induced	
Economic characteristics of the issue of transfer	
Amount of impact / Factors (Transfer reciveir)	
Science and technology staff	
References	
Production experience	
Marketing capabilities	
Geographical Location	
variety	
marketing strategy	

Appendix B.

Assessment of the company's technology

The degree of importance / Factors of Evaluation	Very high	high	Relatively high	Average (partly)	Relatively low	low	Very low
Effective using and control of equipment and machines							
Using the techniques of planning and coordination							
Adaptation of machinery, equipment and management techniques with the Conditions of company and country							
Using the machines and equipment with high accuracy							
Using the flexible machinery and equipment							
Having the machinery and equipment of a good level of standard							
Continuously monitor on the							

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quality of the machines	
Doing preventive and corrective repairs during downtime	
Copies of the required equipment and parts	
Investment in new equipment and codified factories	
Adapting imported technology with regional and working conditions of country	
The possibility of design changes to optimize use of existing materials	
Using the advanced technology	

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