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An ANP application for identifying and prioritizing opportunities and threatens for technology transfer

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A B S T R A C T

During the past few years, there have been different changes in global market due to fast development of science and technology. These changes have increased competition among all existing companies and it has made it difficult for new rivals to gain market share. This paper tries to identify the opportunities and threats of technology transfer in one of world's fastest growing gas development regions called Pars Special Economic Energy Zone. The proposed model of this paper first identify important factors influencing both opportunities as well as threats and then uses analytical hierarchy process to rank all factors. The results show that the threats were more important than the existing opportunities and among the most important threats, embargo and sales of oil were the most important ones.

1. Introduction

Technology transfer in developing countries is a complex issue and, for many years, not only developing countries, but also many international organizations have spent significant amount of efforts on detecting different factors influencing technology transfer such as scientific, cultural and political issues. Detecting the level of development of countries is different and to decrease the distance between industrial and developing countries, technology transfer is necessary. Technology transfer is possible through different methods and instruments that are recognized based on the technological requirements. Nowadays, there is a fast trend on technology evolution and many developing countries cannot go along with it. Many people say that these evolutions have deep impact on economic, industrial, safety and cultural performances of many countries. In the globalization era, having competitive ability in all different fields is possible only through existing capabilities.

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Applying technology in the modern applications via innovation and domestic adaptation plays important role in developing any particular firm. Many countries have been developed without entering into area of basic science or even without having a full comprehension about a technology. They have been developed through developing and generalizing technology application. Industrial countries have special attention on creating and developing technology and they plan for it in various levels of technology management. However, in the developing countries, technology transfer is inevitable with the aim of filling the existing technology gap. In order to be successful in this field, developing countries need to manage the technology transfer by concentrating more on how to prepare the current underlying structure.

Technology is changing very quickly and its implementation and application expenses on one hand and competition in creating the new technologies by the industrial countries on the other hand, cause to generate different threats and opportunities in this field. Identifying these opportunities and threats helps accomplishment of technology transfer. The primary objective of this research is to identify the opportunities and threats of technology transfer, which is one of the main concerns of energy managers in Pars Special Economic Energy Zone. In this research, we will provide a list of prioritized opportunities and threatens, which helps the managers find possible opportunities and threats.

In this study, we are seeking the opportunities and threats of technology transfer in the field of energy. We hope that identifying and prioritizing the opportunities and threatens can be helpful for the related managers in the management process of technology transfer.

2. Research literature

2.1 Technology

Technology has different definitions. Some of them are as follows;

- Technology is a collection of combining science and technical skills in order to produce one or more goods, and necessary services for the society via combining factors such as primary materials, instruments and machineries, human power, earth and nature, money, capital, management, etc. (Ministry of Culture and Islamic Guidance, 1986).

- Technology is a phenomenon made by humankind in two basic forms of software and hardware. Hardware is any physical instrument and software is the knowledge of performing the work or techniques of applying instruments.

There are literally various criteria for selecting products such as maximizing the produced products, maximizing the rate of economic growth, decreasing the unemployment, encouraging the regional development, establishing equality in distributing the incomes, promoting the economic development and compatibility with native-social structure if possible.

2.2. Technology Transfer

It is not essential for a technology user to be the creator of technology. In fact, many innovations are created out of technology users. Technology transfer is a necessary process for wide applications of technology based on one or more users. Technology transfer is one of the most important words used in third world countries and in industrial countries. Nowadays using the imported technology as one of the necessary instruments is inevitable in order to reach the aims of economic renovation or desirable economic development. Accordingly, imported technology is considered as one of the important factors of producing the goods, services and exploiting from natural resources for the developing countries.

Technology transfer is a phenomenon that makes the technology development possible from one source to another. In this case, the source is the owner of technology while the receiver is the

beneficiary of this knowledge. Technology transfer is a kind of process of transferring both science and technology from a person or a group to a person or a group who use the new knowledge in order to do the works by their own ways. The process could classified as technology international transfer, technology regional transfer, technology transfer within company and inter-company technology transfer (Li-Hua & Khalil, 2006).

2.3 Policies of technology transfer

There are different ways presented for technology transfer and we can use different policies in the field of technology transfer based on the role of manufacturing and research centers.

2.4. Technology defective transfer

In this way at first, technology is located in the production route and then we can conduct it to the research centers gradually in order to use the results in the production field at proper time.

2.5. Imperfect transfer or autonomous method

In this method, technology is grown in the research centers and gradually it is brought to the production level in order to be able to produce after specific time. This method takes a long time.

2.6. Technology perfect transfer

This method is a combination of the previous two techniques where technology is first used in the manufacturing and research centers simultaneously and after some times, research centers try to develop and improve the production via innovation.

2.7. Technology commercial transfer

In this method, technology is entered in the production directly, and after its depreciation, new technology is replaced. Research institutes have no roles in this regard.

Many studies have performed in the field of technology transfer and its management process up to now. Ahrens (2002) discussed governance and the implementation of technology policy in less developed countries. Amesse and Cohendet (2001) discussed technology transfer revisited from the perspective of the knowledge-based economy. Gardner (1999) discussed science parks as gateways for international technology transfer in developing economies. Jacobs (1998) discussed several innovation policies within the framework of internationalization when a technology is subject to transfer. Lee and Lim (2001) discussed technological regimes, catching-up and leapfrogging by looking into some findings from the Korean industries. Ming and Xing (1999) looked into some new strategy of technology transfer to China.

3. Methodology

The proposed study of this paper uses the analytical hierarchy process (ANP) to rank different factors influencing technology transfer (Saaty & Vargas, 1998; Saaty, 2003, 2004). Others have already used the method we use. Yüksel and Dagdeviren (2007), for instance, implemented the ANP in a strength, weakness, opportunity, threats (SWOT) analysis in a case study for a textile firm. The first step in this research is associated with studying the research literature and performed studies in technology transfer in the field of energy. By studying these articles, the opportunities and threats of technology transfer are inspected. After extracting different opportunities and threats, a list of opportunities and

threatens is presented to the experts and specialists of Pars Special Economic Energy Zone. In this part, it is requested from the experts to add and delete their opinions about the opportunities and threats of technology transfer in this region. Then these opportunities and threats are collected. We then ask decision makers to make pairwise comparisons between different criteria and assign weigh to the opportunities and threats. According to the identified opportunities and threats, research model is shown in Fig. 1. as follows:

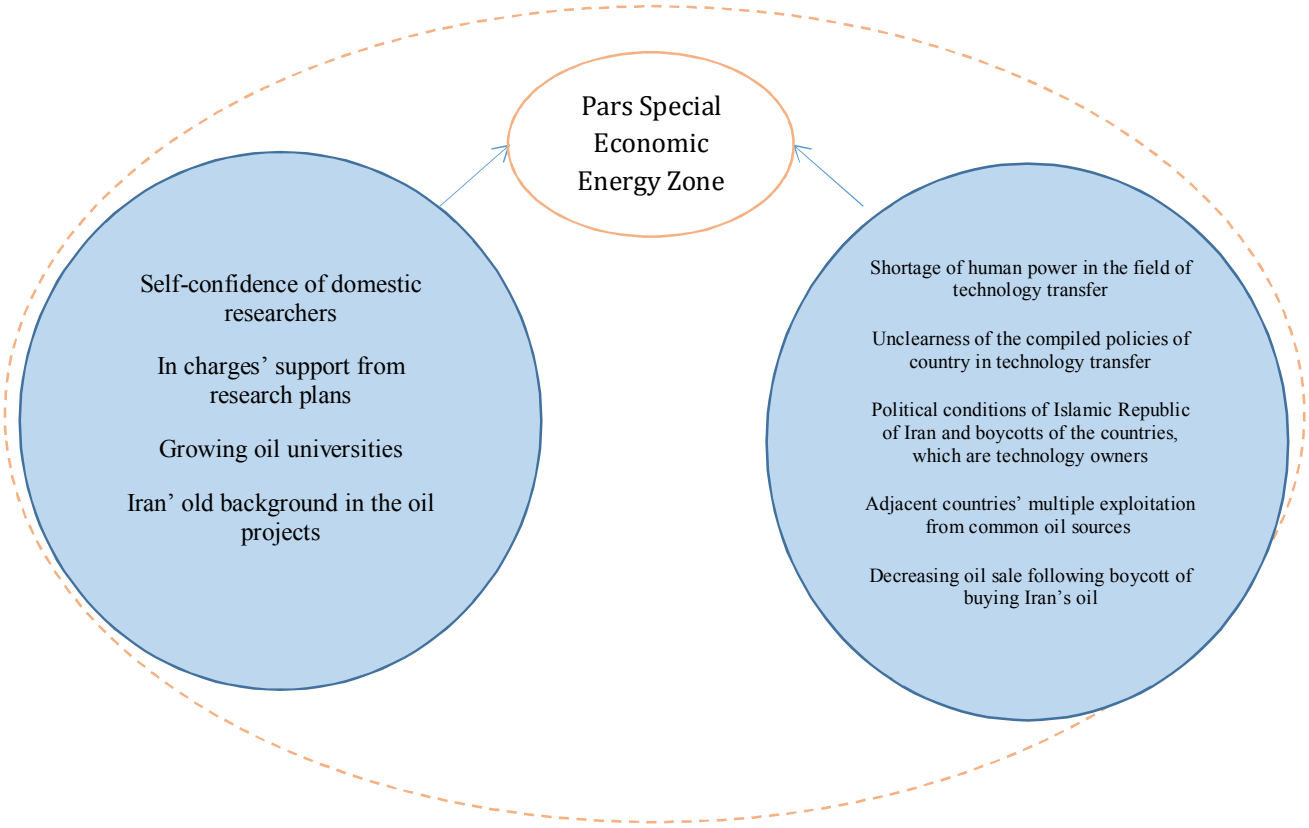

Fig. 1. The proposed model of opportunities and threatens in Pars Special Economic Energy Zone

The extracted opportunities and threats were distributed among experts and specialists via questionnaire designed in order to determine the validity and evaluating. We then collect the questionnaires, the opportunities and threats approved by more than 70% of the specialists. Table 1 and Table 2 summarize the most important opportunities and threats.

Table 1
Identified opportunities

Opportunities	Special mark
Self-confidence of domestic researchers	O_1
In charges' support from research plans	O_2
Growing oil universities	O_3
Iran' old background in the oil projects	O_4

Table 2
Identified threatens

Threats	Symbol
Shortage of human power in the field of technology transfer	T_1
Unclearness of the compiled policies of country in technology transfer	T_2
Political conditions of Islamic Republic of Iran and boycotts of the countries which are technology owners	T_3
Adjacent countries' multiple exploitation from common oil sources	T_4
Decreasing oil sale following boycott of buying Iran's oil	T_5

Based on the results of Table 1 and Table 2, the research ANP model came out as follows,

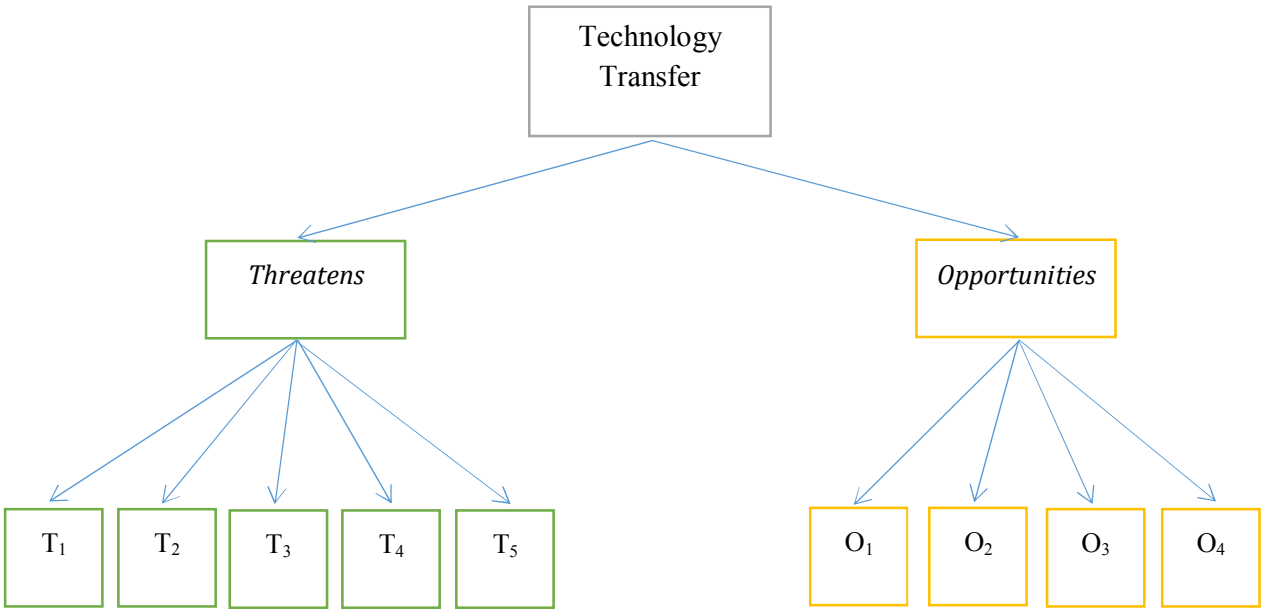

Fig. 2. The ANP model

4. The results

The model proposed in Fig. 2 has been designed in the software and the final model is shown in Fig. 3 as follows,

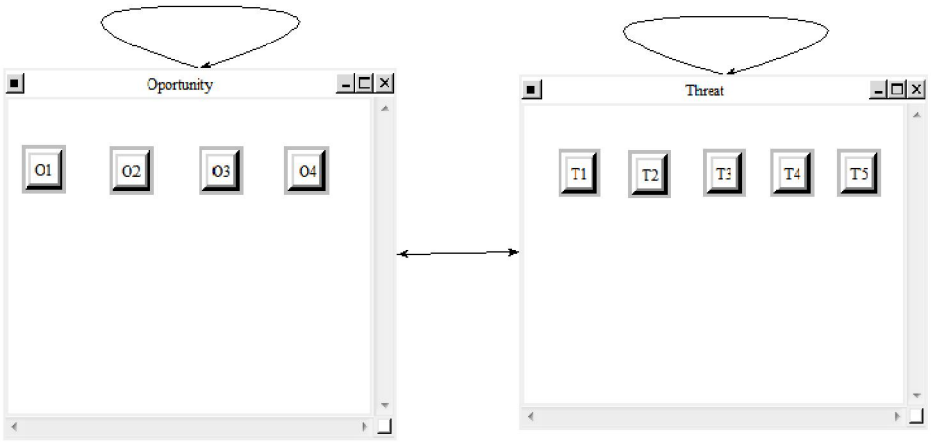

Fig. 3. Drawn model in the Super Decision software

After drawing the criteria, opportunities and threats of technology transfer, the dependences and communications among network components shall be found and a connecting model among the components shall be prepared. This level forms the most important part of a network analysis decision-making. After identifying the network groups, they shall be attached to each other and this attachment shall be performed based on types of relationships of their effective criteria. In order to determine the dependence among criteria, the group discussions were used. The collected data were prioritized in the questionnaire through Super Decision software. In order to perform the calculations after entrance of the experts' answer, pairwise comparison matrix and then cumulative pairwise comparison matrix of the experts' answer are calculated separately in Excel via geometric mean

calculation. The reason for using the geometric mean for cumulating the opinions, is the comparative nature of the numbers. Fig. 4 and Fig. 5 present details of entering the results in the software.

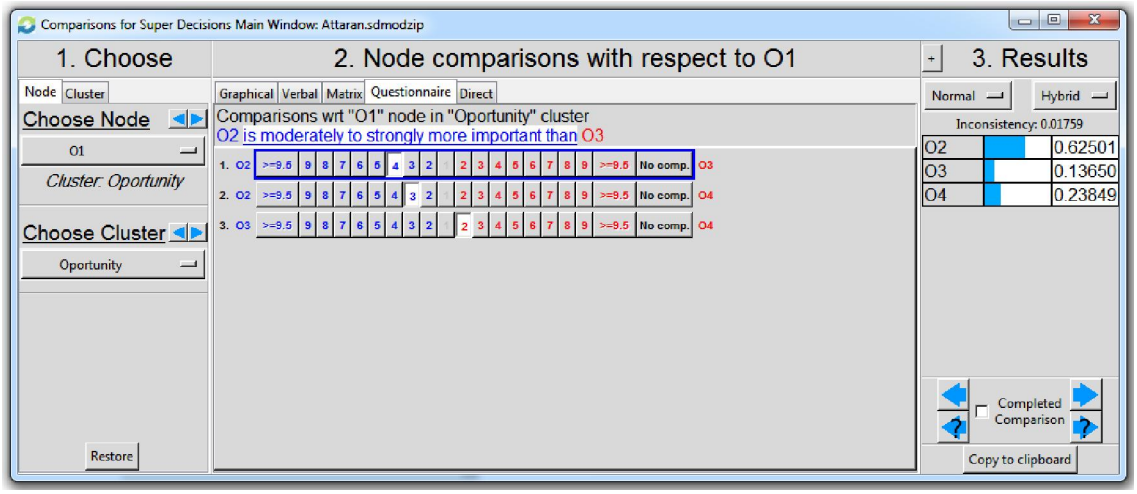

Fig. 4. Input/output of factors associated with opportunities

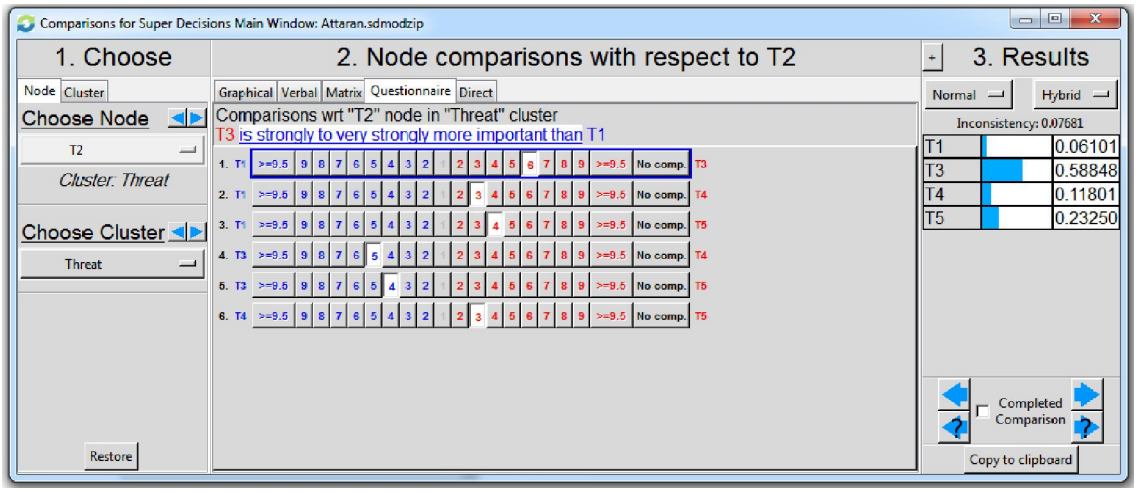

Fig. 5. Input/output of factors associated with threats

4.1 Prioritizing the opportunities

Finally, the rank of each identified opportunities of technology transfer is summarized in Table 3 as follows,

Table 3
Final rank of opportunities

Opportunities	Special mark	Final Weight	Final Rank
Self-confidence of domestic researchers	O_1	0.2718	3
In charges' support from research plans	O_2	0.2735	2
Growing oil universities	O_3	0.3105	1
Iran' old background in the oil projects	O_4	0.1440	4

According to the results of Table 3, growing oil-based universities receives the highest priority followed by research plans and increase self-confidence among domestic researchers.

4.2 Prioritizing the Threats

The rank of each threat is reported based on the results of the implementation of ANP and Table 4 demonstrates the final rank of each component.

Table 4
Final ranks of the threatens

Threats	Special mark	Final Weight	Final Rank
Shortage of human power in the field of technology transfer	T_1	0.1041	4
Unclearness of the compiled policies of country in technology transfer	T_2	0.0996	5
Political conditions of Islamic Republic of Iran and embargo issues	T_3	0.3139	1
Adjacent countries' multiple exploitation from common oil sources	T_4	0.2289	3
Decreasing oil sale following boycott of buying Iran's oil	T_5	0.2553	2

According to the results of Table 4, political conditions and embargo issues are the most important factors followed by decreasing sales of oil due to embargo and boycott and multiple exploitation issues are the other important issues.

5. Discussion and conclusion

In this paper, we have presented an empirical investigation to find out influencing factors on technology transfer in Iranian Oil and Gas industries. The proposed model used ANP method to prioritize difference factors influencing oil and gas industries in terms of opportunities and threats. On the opportunity side, it is possible to develop the industry through development of related course based materials and universities in the region. Unfortunately, on the negative side, the country is presently suffering from different political sanctions and embargo, which have been considered as the main obstacle for technology transfer. The other important issue is associated with common gas resources between Iran and her neighbors. Presently, the common oil and gas resources are used aggressively by other neighbor country, which makes it difficult in future for Iran to take advantage of these resources. We hope the government officials could develop some related university course in universities in the region so that more people could be trained and people could take advantage of possible job opportunities.

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