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Uncertainty Analysis on Factors Affecting the Technological and Innovative Levels of Surface Facilities of Crude Oil Treatment at National Iranian Oil Company

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ABSTRACT

Context/purpose: Factors affecting the technology, and innovation levels of crude oil treatment's surface facilities, are numerous and extensive. Localization of surface facility as a high-tech Technology, which include oil and gas production and processing units, has always been one of the main issues, and technology management and innovation are essential priorities for these facilities. The purpose of this practical, heuristic, and quantitative research is to develop the studies and identify the current state of technology for crude oil treatment's surface facility technology level in Iran and compare it with its global one. Methodology: Considering the wide range of factors that are used in evaluating technological and innovative capabilities with uncertainty. This research is applied in terms of purpose. Using a survey method and collecting qualitative data through a questionnaire, has led to descriptive results. This study by referring to experts and specialists, these factors according to their importance and priority in different classes of classification and then with statistical analysis, the relationship and correlation of these factors have been examined. For this purpose, 44 experts in oil and gas industry have been used for replying the qualitative questionnaire, then the fuzzy system model has been used to investigate the uncertainty in their answers and Quantitative results. Findings: The results of this study show that the most influential factors in surface facilities such as technological and innovative factors and managerial potential and human resources, etc. are not at an acceptable level compared to developed countries. Conclusion: The analysis of uncertainty between opinions of experts and factors investigated also confirms that attention to innovation and technology capacity and Technology capability and human resources in the National Iranian Oil Company should be increased.

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1. Introduction

Crude oil treatment surface facilities refer to oil collection systems, oil and gas refining units and transmission systems. Surface facilities that include oil and gas exploitation and processing units. Due to high technology, these facilities have always been installed and sometimes commissioned by European and American companies in Iran like south Azadegan, Yaran, and other oil and gas field in Persian Gulf or south of Iran. So far, no special action has been taken to acquire and localize the technology of these facilities and technology management has not been done for these facilities. Therefore, the factors affecting technology management face uncertainty. There are 4 factors affect technology management: 1-hardware, 2- software, 3- human ware, and 4- organization, which Iran's oil and gas industry faces trouble via all of these factors. (ACECR, 2010)

A look at the technology of Iran's oil industry shows that despite entering the field of maintenance, construction, production and even at a more limited in the field of design and engineering, is still the main weight of the capability of Iran's oil industry technology in the field of exploitation. In the field of technology transfer, it should be acknowledged that the lack of emphasis on the realization of all stages of a successful transfer (selection, acquisition, adaptation, absorption and development) and the lack of necessary mechanisms to achieve this, has kept the oil industry at the level of importer of foreign technologies. A clear indication of this claim is the repeated licensing of similar units. (Miqati Nejad et al, 2013)

An overview of Iran's position among national and international oil companies can show the need to survey, review and modify the absorption system, transfer and development of technology in the Iranian oil industry. At present, there aren't enough integrated suitable model for acquiring technical knowledge in the implementation of units of operation and design and construction of surface facilities and usually the implementation and plans of surface facilities are a priority and the existing facilities, because they have been designed and built with previous generations of technology, do not have proper efficiency and effectiveness. However, despite the project management and knowledge management unit in some development companies such as Pars Oil and Gas Company, at the same time, there is no organized, and integrated procedure in the design of new units of production companies and acquisition of technical knowledge and technology transfer should be considered in the implementation of units and there should be a suitable model for technology management and explanation of its factors that by integrating the plans can be achieved only once by transferring technology and localizing it to the technology of designing and building surface facilities, which reduces production costs, quality improvement, use innovation, increasing productivity, reducing the destructive effects of the environment, in addition to avoiding the recurring costs of purchasing technology, technology localization and design of relevant process units is possible and provide the possibility of exporting technological services in this field. On the other hand, these factors also face a degree of uncertainty among experts and officials of the National Iranian Oil Company, which makes it difficult to determine appropriate methods of technology management and innovation. (Roushan et al, 2019)

In the continuation of this article, by reviewing the thematic literature and reviewing the research background, while getting acquainted with fuzzy models and systems as a methodology for examining the uncertainty of components and factors, the research method is identified and summarized and conclusions are presented based on the findings of the article.

2. Literature Review

Our research shows that not much has been done to explain the factors affecting technology management and surface facilities innovation. In particular, these factors are fraught with uncertainties in terms of definition and implementation and multiplicity among experts. The following are some of the most important research papers and articles in this field.

The development of oil fields requires significant investment in underground fields (drilling operations, drilling services, repair and completion of wells) and the surface facilities (construction of collection networks, processing facilities and crude oil transmission). More than 50% of the initial investment cost (CAPEX) in the development of an oil field and a significant volume of operating costs (OPEX) of production, associated with surface production facilities including collection networks, crude oil processing facilities and collection Gases associated with oil and oil transfer system to the desired location. (Asadi, 2011; Qayyumi , 2007)

Obviously, in the stages of conducting conceptual studies and basic design (FEED) of surface production facilities (including oil collection system, oil and gas processing facilities and oil transfer system), defining different options and conducting sensitization studies, economic analysis of options available and finally selecting the best option, including the requirements of proper design for production facilities. In this regard, conducting optimization studies in the conceptual design stages and preparing and finalizing an oilfield master development plan (MDP) and FEED in order to minimize costs while ensuring continued production during the 30-year life of the facility, considered and completed Is important. (Asadi, 2011)

Grand surface oil refining facilities (surface facilities) are considered as the connection point of upstream and downstream in the hydrocarbon industry. Although many projects and activities have been carried out to improve and increase productivity in the upstream and downstream industries, but unfortunately in recent decades not much attention has been paid to surface facilities and most of the country's oil refineries are old. Obviously, due to the passage of time and changes in feed input, the optimal operating conditions of these factories have changed. Newer technologies have also been developed in other countries. The purpose of the paper is to study and identify the current state of surface facilities in Iran and compare it with current top technologies. This project will be a prelude to large projects to optimize and upgrade Iran's surface facilities. In a part of this project, which included a field visit to two surface facilities factories in Iran, the existing conditions were reviewed and according to the information of modern technologies and related process knowledge, suggestions were prepared to upgrade the mentioned units. Obviously, according to the specifications of each factory, different proposals have been presented. (ACECR Institute, 2019)

Surface facilities are widely used in the country's oil and gas processing and due to the fact, that in the systems sometimes changes occur due to unforeseen problems, therefore, in order to provide a suitable solution in the shortest possible time and with high accuracy, using simulation results is very effective. In this research card, using appropriate methods of separation and integration of C7 + group, it has been broken into 5-part quasi-components and component integration is performed and the GOR value is much better than the one-part condition and approached laboratory results. (Ganji et al, 2012)

In previous research on technology management in the upstream oil industry, less attention has been paid to this part of the large and influential oil industry with a specialized and comprehensive view. In a study that has been done by Dr. Roshan et al, in addition to reviews the position of technology in this part of Iran's oil industry and comparing it with successful management models and technology transfer, the distance of the country's technology with leading companies and countries in this field was determined. Then, by reviewing the upstream documents of the oil industry and interviewing 20 experts in this field, the challenges have been determined and a suitable management and technology improvement solution in the field of oil surface facilities has been presented. (Roshan et al, 2019).

The supply of equipment required by the oil industry in the upstream sector is still significantly dependent on abroad.

Reducing the costs of the oil industry, and developing export markets is important for the domestic construction of oil equipment in Iran. Therefore, in a study, using the general policies of science and technology to evaluate the legal system governing these industries, the conceptual model of the framework of science and technology policies and considering the challenges of the equipment manufacturing industry, the legal system governing these industries is examined. In this study, the weaknesses of the legal system have been enumerated and suggestions have been made in support of the equipment manufacturing industry of the country's upstream oil industries. (Najaf abadi, 2018).

In a study, a fully integrated simulated model including reservoirs, wells and surface facilities was built using MBAL, PROSPER and GAP software. In this study, using simulation by MBAL software, future production is predicted and time interval optimization is performed. The results of this study show a significant increase in the amount of oil produced and since the adjustment of the choke does not impose a cost on the system, as a result, it has increased profitability (Mahdiyani, 2017).

3. Research Methods

In line with the purpose of this article, based on the standard questions of the Capacity and Innovation Questionnaire of Bushehri et al. Model (2016) and the technological need assessment Questionnaire, TNA HubDay model, the variables were classified into several categories as effective factors: technology, infrastructure, legal, managerial, scientific-research, economic. a model has been designed and then, the studied variables and test methods of hypotheses, statistical population, statistical sample size and other related topics are described and statistical methods for data analysis are stated. The content and structural validity of all three questionnaires in the appendix were reviewed and approved by oil industry experts. The reliability of the questionnaire was done through Cronbach's alpha coefficient for questions. The alpha value of the Innovation Capacity, Technology Capacity and Technological Capability Questionnaire was obtained more than 0.826. This Cronbach's coefficient indicates that the questionnaires have good reliability. For this purpose, research variables, both qualitative and quantitative, are described and examined statistically. In the following, the research hypotheses are presented according to the test model and are implemented through the MINITAB software version 17 at a 95% confidence level and the results are presented. After statistical analysis, the analysis of research model uncertainty is performed based on fuzzy systems. Special attention has been paid to the expertise and responsibility of experts and specialists in the field under the method of selecting statistical samples. Considering that the factors and conditions affecting the capability of the National Oil Company cover different areas, by observing the limitations of this research and limiting the consequences of this research to the field of technology and innovation, 44 people from the statistical community to collect Data collection and tests are selected.

Data analysis was performed in two areas: statistical and optimization. In the statistical field, using frequency tables, graphs and central indicators and dispersion in statistics, a picture of the study population is described. To do this, the average indices of the variables for the desired factors in the questionnaire and the classification of these factors have been obtained. In line with the objectives of the research, to validate the results, the correlation coefficient between the variables in the presented classes of variables has been calculated and in terms of size and significance, hypothesis tests necessary to generalize the results of statistical samples to the community have been analyzed.

For optimal analysis of the results, the fuzzy model and its inference system have been used to investigate the information uncertainty related to the problem.

4. Analysis of Findings

The inputs of the fuzzy system of this research, according to the importance and priority of technological and innovative factors, are four variables of national and macro infrastructure, scientific-research, managerial potentials and human resources and their outputs are two variables: company technology consequence and economic consequence.

For each of these variables, according to the value of the weighted score, the values 1 and 5 are shown as the boundaries of the defined range of scales with trapezoidal fuzzy numbers and the rest of the numbers with a triangular fuzzy number. To examine the significant differences between the results of the technology and innovation questionnaires, we first examine the mean values of the classes of key variables of the questionnaire questions.

The common categories of these two questionnaires, which contained questions about the technological status and innovation of the National Iranian Oil Company, are:

- Class of necessary infrastructure to benefit from technology and spread innovation at the company level
- Class of benefit from new and up-to-date technologies
- Class of benefit from economic conditions and factors
- Class of using scientific and research approaches in technology development and innovation at the company level
- Class of commitment of management to technological issues and innovation
- Class of legal requirements used in technological and innovative constructions of the National Oil Company
- Class of human resource capital capabilities of the company in the use of technological resources and innovation

According to Table 1 and Charts 1, the difference analysis between the mean values and the standard deviation of technology and innovation is as follows:

In all classes, the average amount of variables related to technology is more than innovation. Because innovation requires high cost, risk, and commitment, these results and differences are expected to be real. On the other hand, technology-related conditions in a company have a longer history of being institutionalized than innovation and related issues.

The biggest difference between these average values is related to the legal aspect. It is clear that from a legal point of view, innovation has its own specific and complex issues, which are significant from this perspective.

The least difference between these average values is related to the scientific and research aspect. This is a great and important result that, as expected, the issues in the field of technology as well as innovation are completely dependent on scientific and research approaches.

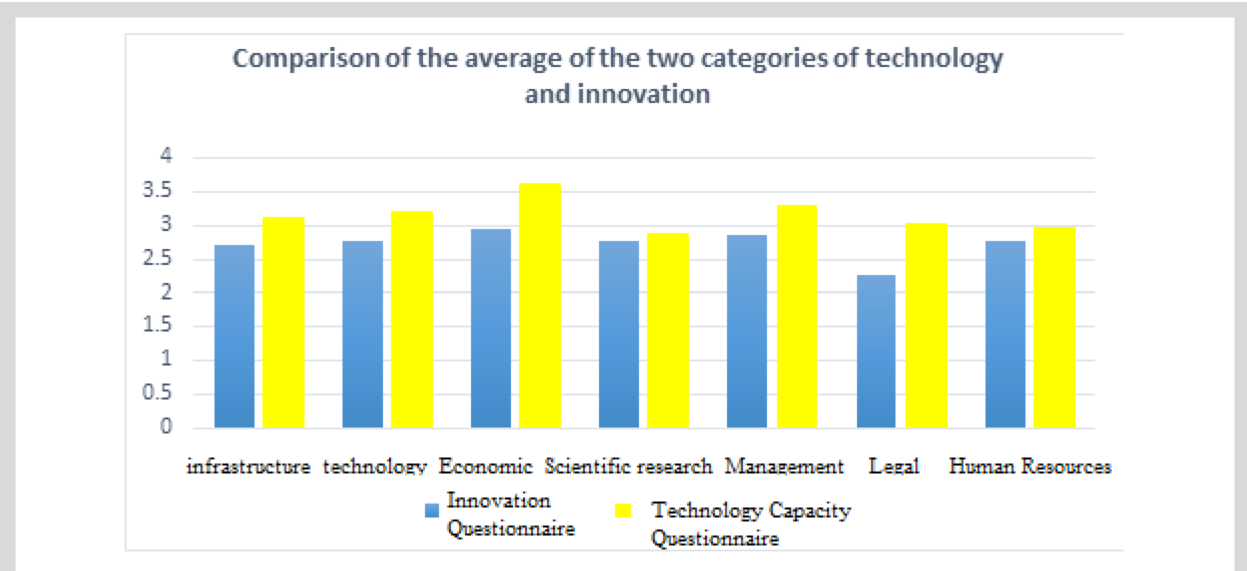
In all cases except the management class, the standard deviation of the categories related to the field of innovation has been more affected by the different respondents and as a result have higher values than the standard deviation of the field of technology.

This difference will be significant given that innovation conditions are risk-averse and require organizational and environmental costs and issues, and that there may be different ways of thinking about it at the company level, such as gradual innovation or leapfrog innovation.

The high standard deviation of the management class in the field of technology reflects the different views of respondents to the ability and commitment of management to the dissemination of technology, the use of modern and up-to-date technologies and technological development at the company level. While in the field of innovation, it is clear that the prominent role of management in the creation and application of innovation is undeniable, which most respondents acknowledged.

Table 1. Comparison of the average of the two classes of technology and innovation infrastructure.

Variable type	Standard deviation of the technology questionnaire	Standard deviation of the Innovation Questionnaire	The difference between the average classes	Average class of technology questionnaire	Average class of innovation questionnaire
Infrastructure	0.797	0.898	0.4	3.107	2.707
Technology	0.735	0.859	0.456	3.201	2.745
Economic	0.818	0.833	0.672	3.609	2.937
Scientific-research	0.815	0.935	0.117	2.874	2.757
Management	0.903	0.876	0.443	3.288	2.845
Legal	0.815	0.878	0.773	3.031	2.258
Human resources	0.801	0.925	0.207	2.971	2.764



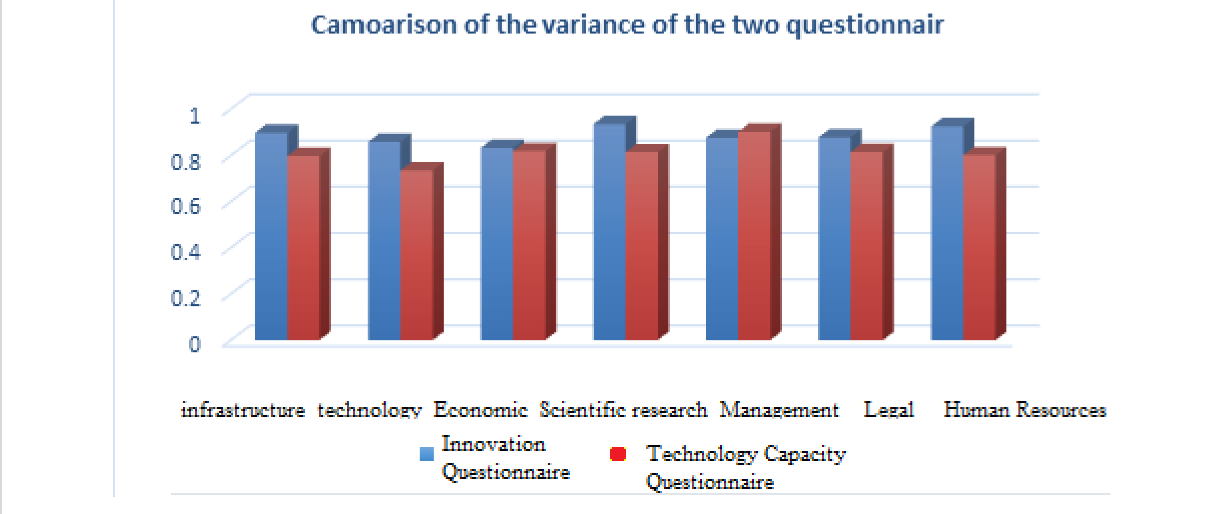


Figure 1. Comparison of the average of the two categories of technology and innovation.

Table 2 shows a comparison between the correlations of the class variables of the two questionnaires of technology and innovation. The analysis of related questions has the same content concept in each of the following categories:

Infrastructure variables in technology are more dependent on innovation and indicate that this is not far-fetched given the antiquity of technological policies and planning over innovative policies. In addition, there is a significant difference between the correlations of technology components to innovation. From the respondents' point of view, this shows that the innovative infrastructure in the company is still less relevant and effective than the plans and actions.

The correlation result of using technology components in the field of technology is more than innovation. This difference is significant in many components, which confirms that the technological capabilities in the development and dissemination of innovation have not yet been properly used.

The relatively high correlation between the components of the economic class in the field of innovation indicates that the respondents believe that these components if implemented and appropriate policy, can contribute to the economic growth and development of the National Iranian Oil Company. On the other hand, the weak correlation between the components of this class in the field of technology indicates that there is no proper relationship between technology variables in order to grow profitability and other economic variables and although technological capabilities and capabilities, as it appears from the provisions of the technological evaluation report, can play a major role in changing and improving economic indicators, but in practice, these capabilities do not show such a state in the current situation.

There is a significant difference between the components of the scientific research class in the field of technology and innovation. A comparison between these results shows that the scientific and research capabilities of the company and the available resources to build capacity for innovation have not been used properly. Besides, the weaker connections between components of innovation in a system, the more difficult formation of the innovation cycle in the system. Comparison between the components of management class in the two fields of technology and innovation shows that although this correlation between technological indicators is greater than innovation indicators, it is not so significant that managerial activity and attitude can be considered prominent in one area compared to another. In general, it can be inferred that in two areas, the correlation between variables and managerial components are moderate which due to the important role of management attitude and commitment in advancing the organization's programs and policies, this aspect should be reconsidered.

The components of the legal class in both areas are highly correlated and it shows that it is important that this aspect should be considered in the proper and legal formation of innovations and technologies and paying attention to related issues such as patents and technology, etc.

The components of human resources, due to their history and role in the formation of technologies, show a high correlation, but in relation to innovation issues, this correlation is low. One of the reasons for this is that human resources in our organizations are more of an operator than an expert.

Table 2. Comparison of the correlation between technology and innovation questionnaires.

Innovation infrastructure

	C5	C6	C31	C33	C40
C6	0.606				
C31	0.377	0.228			
C33	0.242	0.225	0.643		
C40	0.074	0.489	0.310	0.460	
C49	0.248	0.396	0.175	0.147	0.325

Innovation technology

	C2	C33	C34	C37	C43	C44	C45	C46	C47
C33	0.036								
C34	-0.038	0.574							
C37	0.173	0.239	0.608						
C43	0.143	0.026	0.224	0.144					
C44	0.388	0.429	0.387	0.275	0.524				
C45	0.265	0.523	0.484	0.309	0.433	0.790			
C46	0.531	0.328	0.344	0.467	0.487	0.614	0.620		
C47	0.375	0.152	0.187	0.297	0.499	0.391	0.363	0.552	
C48	0.333	0.112	0.020	0.023	0.298	0.282	0.297	0.297	0.405

Technology technology

	C2	C4	C6	C15	C23	C24	C30	C32	C33
C4	0.399								
C6									
C15	0.300	0.976							
C23	0.723	0.893	0.872	0.540					
C24	0.602	0.971	0.931	0.969	0.320				

C30	0.641	0.909	0.806	0.883	0.949	0.609		
C32	0.116	0.791	0.680	0.502	0.696	0.798	0.120	
C33	0.317	0.987	0.998	0.876	0.944	0.837	0.722	
C35	0.894	-0.008	-0.099	0.393	0.230	0.310	-0.234	-0.087

Economic Innovation

	C35	C38	C50	C51
C38	0.577			
C50	0.266	0.145		
C51	0.388	0.415	0.262	
C52	0.297	0.225	0.365	0.232

Scientific Research Innovation

	C15	C16	C18	C20	C30
C16	0.382				
C18	0.354	0.318			
C20	0.254	0.670	0.504		
C30	0.313	0.274	0.211	0.431	
C32	0.204	0.218	0.094	0.283	0.852

Technology Management

	C14	C18	C28	C29
C18	0.821			
C28	0.909	0.926		
C29	0.087	-0.291	0.075	
C34	0.264	-0.184	0.165	0.959

Innovation Management

	C1	C3	C8	C11	C12	C13	C14	C19	C22	C24
C3	0.663									
C8	0.609	0.618								
C11	0.459	0.652	0.561							
C12	0.233	0.381	0.387	0.618						
C13	0.673	0.644	0.572	0.685	0.566					
C14	0.410	0.339	0.299	0.506	0.461	0.546				
C19	0.386	0.381	0.540	0.428	0.387	0.602	0.483			
C22	0.283	0.382	0.324	0.459	0.049	0.363	0.231	0.356		
C24	0.306	0.132	0.596	0.254	0.054	0.172	0.017	0.470	0.196	

Legal Innovation

Pearson correlation of C26 and C27 = 0.828

Human Resources Innovation

	C4	C7	C9	C10	C17	C21	C25	C29
C7	0.148							
C9	0.254	0.139						
C10	0.278	0.597	0.373					
C17	0.210	0.507	0.147	0.672				
C21	0.210	0.501	0.325	0.347	0.453			
C25	0.431	0.598	0.548	0.516	0.372	0.603		
C29	-0.044	0.387	0.438	0.489	0.315			
C42	0.281	0.082	0.289	-0.061	0.086	0.174	0.323	-0.085

According to the dimensions of each class in the technology capacity and innovation questionnaires, the hypothesis of significant variance and standard deviation between classes in these two areas is examined and analyzed. The confidence level in the review and analysis of the test is 95%.

Infrastructure floor

The dispersion of opinions among respondents in the field of innovation is greater than in technology. The reasons for this could be the institutionalization of technology infrastructures in relation to innovation or the uncertainty of the adequacy of existing infrastructures to spread innovation.

Technology class

The difference in technology is greater than in innovation. The majority of respondents believe that it is also based on assumptions that technology indicators are influential in the technological dissemination of the company. Also, some respondents considered the current state of technology acceptable and others considered it weak.

Economic class

The difference in innovation is greater than in technology. The result of this analysis is evidence that for the company's economic leap, the category of innovation should be considered more. On the other hand, according to experts, the current state of technology in the growth and development of economic indicators of the company is not very satisfactory.

Scientific-research class

Dispersion in the field of technology is greater than innovation in the scientific-research class. However, according to the analysis of the average difference in this class, the majority of respondents acknowledged the existence of indicators and appropriate scientific and research activities in both areas, but the difference between the higher variance in the field of technology and innovation shows that the majority of respondents considered the scientific-research capacities necessary to spread innovation before technology.

Management class

Dispersion in technology is greater than innovation in management. The higher variance difference in technology compared to innovation shows that the majority of respondents did not consider the current management situation at the company's technology level appropriate. On the other hand, most respondents considered management and its role in the development of company innovation undeniable.

Legal class

There is not much difference between the two areas of technology and innovation in terms of legal indicators, and all respondents considered the legal aspects important for all areas.

Human resources class

From the point of view of the respondents, the current situation of human resources is highly dispersed in the current technological situation. The analysis shows that the capability of human resources is accepted from the point of view of experts, but its management is not very satisfactory in the current state of the company's technology. Expectations of different specialties and skills from human resources and possibly their improper use can also be the reasons for this dispersion. Dispersion analysis in the field of innovation confirms the conclusion that the role of human resources and the development of their creativity and thinking can be important in the development of innovation.

According to the scores of the questionnaire for data collection, the fuzzy numbers defined for the input variables are as follows:

Very weak: [0 1 2.5]

Poor: [0.8 2 3.4]

Medium: [1.8 3 4.4]

Good: [2.8 4 5.2]

Very good: [3.8 5 6]

Figure 2 shows how to model input variables.

The fuzzy numbers defined for the output variables are also as follows.

Inappropriate: [0 0 1 3]

Continuation of current conditions: [1 3 5]

Suitable: [3 5 6 6]

Inappropriate and appropriate consequences of research are identified as trapezoidal fuzzy numbers and the continuation of the current situation with a triangular fuzzy number. For example, the "appropriateness" membership scores indicate that the output membership scores of 5 and above, 1, 3 and below are zero, the modeling of which is shown in Figure 3.

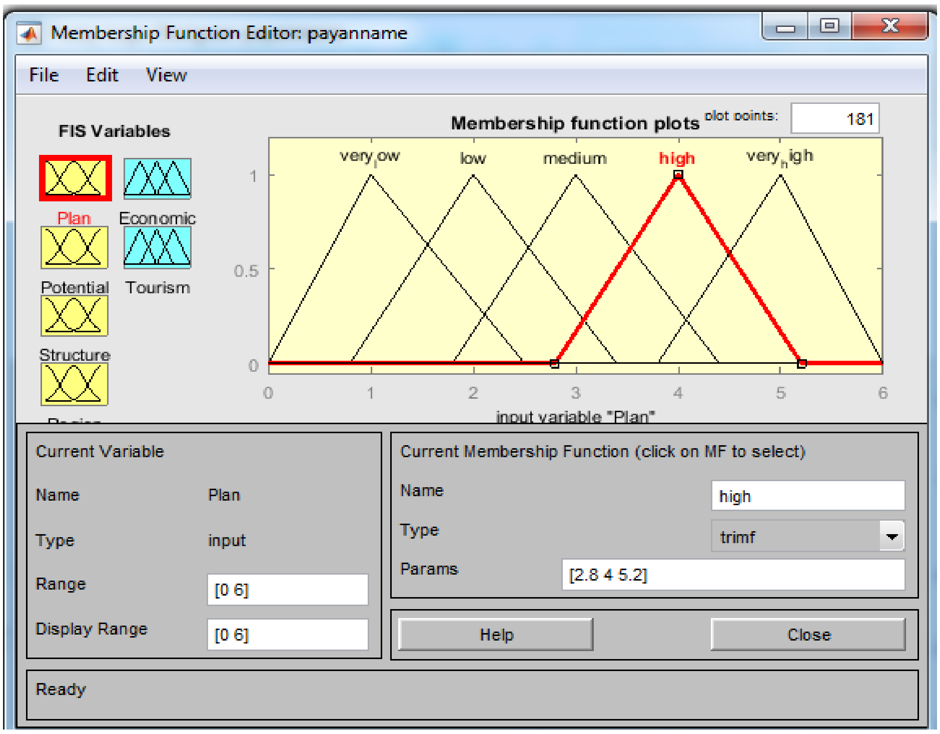


Figure 2. Input variables in the fuzzy model.

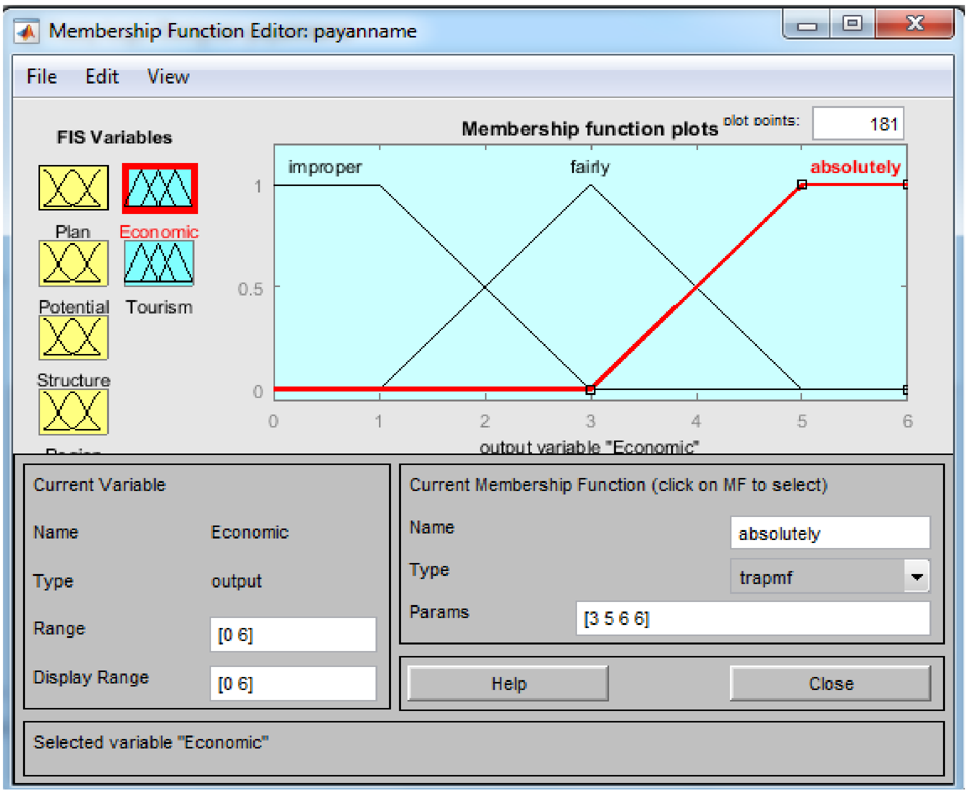


Figure 3. Output variables in the fuzzy model.

Based on 5625 possible states of the input and output variables of the problem, 84 rules are defined. These rules cover all possible cases based on the scores obtained from the analysis of the questionnaire and the tests performed to validate their results.

Given the high scores obtained by management variables and infrastructures and macro-national conditions, if the rules that apply to them are very weak or weak, inadequate economic and technological consequences are defined by rules 1 to 3. Rules 4 to 8 specify the average conditions for the management variable. The best result in this case for the economic consequence of the problem will be the continuation of the existing conditions. Because the change of economic parameters affected by the management style requires appropriate programs. But since some infrastructure conditions and macro-national variables may be in good shape, it is possible that the capacity for innovation and technology in the company will be affected by this issue. On the other hand, it should be noted that the development of facilities and infrastructure will largely depend on the managerial behavior; As a result, the number of independent rules will be small when the management variable is moderate.

Changing the conditions for the management variable to weak and very weak states, practically shows the unfavorable situation of both economic consequences and technology result. This is due to the high score of the management variable for changing views on the company's situation and accepting its technology and innovation. In this case, in the best form for the planning variable with a value of 2, which indicates a relatively weak state of management in the economic sphere of the company, this is a consequence of the technology of the not-so-favorable situation and the economic consequence of a completely unfavorable situation. (Figure 4)

Figure 4. Fuzzy model rules with weak variable management mode.

By changing the mode of the management variable to good and excellent, better expectations of the consequences of the problem can be achieved. In case 4 for the management variable, the average value for the economic outcome and the average for the technology outcome are obtained, which makes the continuation of the current situation optimistic in the view of researchers. (Figure5)

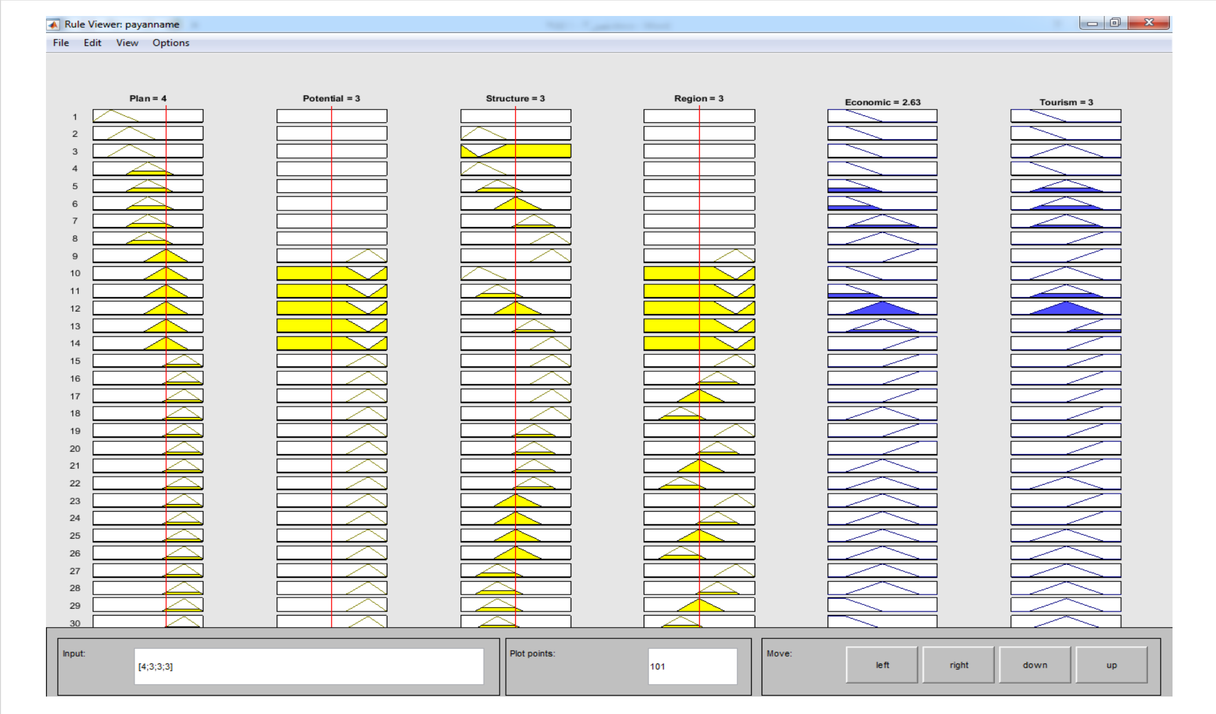


Figure 5. Fuzzy model rules with good management variable mode.

Another influential variable in the problem is the existence and development of infrastructure and the consideration of macro-national variables in order to improve the state of technology and innovation of the company. By changing the simulated values for this variable to better than average in the problem, the situation of the company improve significantly. At value 5 for infrastructure as shown in Figure 6, the consequences of technology are great which shows how much the technology and innovation capacity of the company depends on the appropriate infrastructure. In this case, according to other cases that are moderate, the economic consequence is almost normal.

Figure 6. Fuzzy model rules with excellent mode of infrastructure variables.

Obviously, the poor condition of the infrastructure variable will also have a negative impact on the consequences of the problem. Poor infrastructure and lack of attention to their improvement will lead to a very unfavorable situation of economic and technological consequences. (Figure7)

Figure 7. Fuzzy model rules with weak variable state of infrastructure.

Simultaneous changes in management and infrastructure variables are presented from other model analyzes. Considering the current situation of the two variables of human resources potentials and scientific-research activities, changing the other two variables to good state, the approximate value 4, the status of the economic outcome and the technology acceptance result of the company, according to Figure 8, shows an acceptable status for the economic consequences and appropriate for the technology consequences. This shows the importance of influencing the management and development of infrastructure simultaneously in accepting the company's innovation and technology capacity.

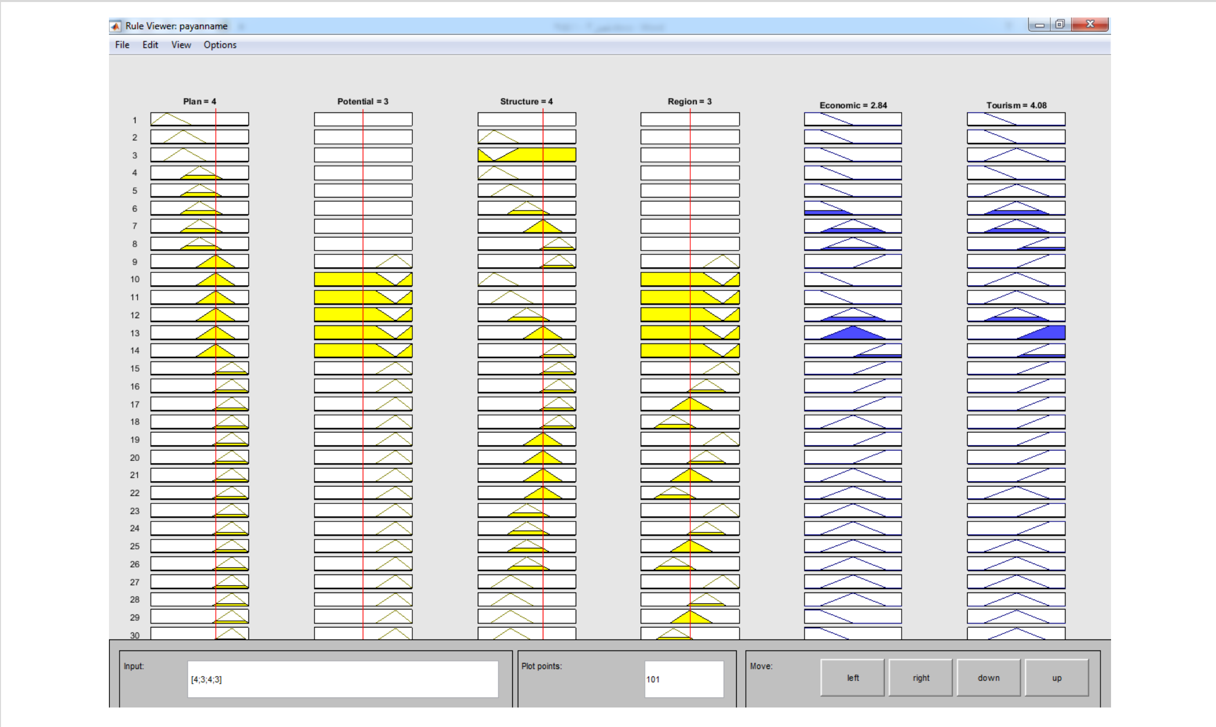


Figure 8. Fuzzy model rules with good simultaneous state of infrastructure and management variables.

5. Summary and Conclusion

In order to analyze the results of information processing from the reports provided by the technology Capacity Questionnaire of National Iranian Oil Company, Innovation Capacity Questionnaire of National Iranian Oil Company and Technological Capabilities Assessment Report of National Iranian Oil Company, based on the relationship and correlation between the infrastructure provided in the field of technology and innovation, first, this topic was examined and then the conditions obtained from the evaluation of technological capability were analyzed. To do this, from the statistical software analysis of SPSS & Minitab was used. The statistical analyzes used include descriptive statistics analyzes such as central parameters and tables and frequency charts and comparative statistics. Also, to better explain the method of comparative analysis, Inferential statistical methods such as analysis of hypothetical tests have been used. In addition, the validity of the results of these analyzes was examined by statistical tests and the hypotheses by which they are defined and fuzzy model was presented and analyzed to explain the uncertainty of possible results.

According to the objectives and questions set in this research, the summary of the results obtained from the analysis of research data and information is as follows;

Surface facilities are not comparable with countries with technology from the point of view of most experts and respondents.

The role of universities and research centers in a logical way do not have the ability to conceptualize technology capacity building in the oil industry from the perspective of the respondents.

Respondents did not consider managerial support for technology capacity building as an acceptable measurement tool.

From the respondents' point of view, the allocation of financial resources is not a suitable indicator for technology capacity building.

The volume of education and research and the type of programs defined cannot indicate the capacity of technology.

Technology models and software systems are not a good indicator to explain the country's technology capacity.

According to the correlation analysis, the similarity of the variables mentioned in the questions and the thematic relevance of the questions, the questions were classified into eight categories and the results of statistical analysis for these classes showed that the macro and national spheres affecting the industry such as related laws, regulations and policies have had a significant impact on the consensus of experts among the classes. Also, the impact of economic factors on the optimization of the industry, despite its importance, has witnessed differences of opinion among experts.

Another important result of this analysis is the weakness of scientific and research work and human resources in industry. Insufficient connection of research centers and universities and knowledge-based companies with industry is one of the most important reasons that need to be confirmed. On the other hand, human resource training and human resource specialization is one of the most important issues for which careful and appropriate planning should be done.

More attention to the optimization of management tasks and processes, as well as the appropriate development of infrastructure in various areas affecting the industry are other important results that should be used in technology capacity building.

Respondents did not accept the relationship between company structure and problem-solving creativity and the nature of innovation. There is not much of a favorable environment for the company to encourage innovation and managers do not provide adequate support for innovators and their activities. Training courses are also institutionalized equal to innovation capacity building and the relationship between the industry and the university is weak in this regard. At the same time, government laws and regulations are not a good incentive, and it has been strongly emphasized that laws have not facilitated innovation capacity in any way. Respondents acknowledged the mutual influence of the company's units in advancing the results of research and innovation studies and they have emphasized that this cooperation and interaction between units must continue more effectively.

From the respondents' point of view, the performance of project systems and the speed of project implementation and the cost reduction approach in capacity building innovation have been accepted and hence the role of effective communication with suppliers and consultants in this area is emphasized.

What emerges from the statistical analysis of the questionnaires is that there are doubts about the use of current innovative experiences and the processing of innovation capacity in the future and the necessary resources are not provided to the projects properly and at the right time. Therefore, the achievements of research in this field do not seem to be very satisfactory to spend resources. Market research and strategy creation in the company are also poorly evaluated and the majority of respondents do not consider the role of employees in innovation appropriate. Given that the necessary aspect is ready for the company to become a leading organization, the company's ability to improve productivity and use technology in an innovative role to promote capacity and innovation is considered positive.

According to the correlation coefficient between the variables and the relationship between the factors defined in the questionnaire, these factors were classified into 7 categories: infrastructure, technology, economics, science-research, legal management and human resources that attention to management and economic factors has gained a high score and legal factors are among the lowest. It is expected that in addition to facilitating rules and regulations, attention to improving management in the field of innovation capacity will be a priority for the company.

Planning to improve the state of technology acquisition due to the low average of this class should be a priority, it should be noted that in order to obtain technology from external sources, at the same time, it is necessary to improve the relationship with suppliers. Because the correlation between acquiring technology from external sources and effective communication between suppliers is relatively low and both factors need to be considered.

In general, according to experts, the National Iranian Oil Company is in the middle to high levels of learning, application and absorption of technology, exploration, core competency, technology strategy and awareness. However, in order to improve the general situation to the desired state, the following items are suggested:

- Given that experts consider core competency to be an important factor in assessing technology capability, however, the existence of disagreement among experts indicates that in the opinion of some experts, central competence is not in a favorable situation. Therefore, in the situation of technology evaluation, it should be noted that the company has certain technological capabilities but has not been able to take advantage of them well.
- The company is aware of the role of technology in business strategies and is ready to evaluate other technological opportunities to eliminate weaknesses in technology. Therefore, the current weaknesses in the company's technology should be extracted and the best technology resources should be identified to eliminate the weaknesses. To do this, according to the available statistics on the state of strategy acquisition and technology selection of the company, which are not in a good condition, it is recommended to get help from external sources such as: consulting organizations to prioritize, how to choose technology and use it.
- Strategies that are in line with the company's vision and goals should be clearly defined. A good landscape must also be designed in this regard. Then apply strategies to achieve goals based on key technology priorities.

The role of foreign individuals and organizations is very important for the company. Because in two categories of technology acquisition, evaluation and technology selection, this role is clearly felt. Therefore, the company must plan for external links to improve its technology status. In this regard, it is suggested that the use of universities and government institutions for key projects, individuals and companies to develop technology must be planned.

Offer to NIOC:

- Systematic relationship with research centers and universities and knowledge-based companies
- Attention to human resource training and the use of specialized human resources
- Optimization of management tasks and processes
- Supporting innovation and creativity in the company and creating a suitable platform for innovation and creativity of employees
- Cooperation and interaction between engineering, production, research and training units
- Effective and systematic communication with consultants and suppliers of goods and services
- Define a clear vision and appropriate strategy to create technological and innovative capacity according to market research
- Appropriate planning for knowledge of the company's technology industry and then the acquisition of technology from external sources
- Improving rules and regulations to motivate managers and employees to innovate
- Paying attention to providing appropriate financial resources to create technological and innovative capacities in the company
- Improve productivity and use the innovative capacity of the company to become a leading organization

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