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Technology planning system for the Iranian petroleum industry: Lessons learned from sanctions

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ABSTRACT

Iran's petroleum industry is facing challenges including maturity of hydrocarbon fields, growing population of the nation that demands additional revenues from petroleum exports, and international economic sanctions that have limited access to technology sources. Restrictions from international technology providers have led managers of the industry enterprises to try to develop their needed technologies inside the country. The Ministry of Petroleum has supervised this and as a result, a technology planning systems has been developed and implemented since 2009. In this paper, an overview of the Iranian petroleum industry is provided from a technology planning perspective. The focus has been on the events and the behavior of the system after the implementation of the new technology planning system, which coincides with the period of the intensification of international sanctions against Iran. Results of the study, and a comparison between features of the technology planning systems before and after 2009 show that while the new approach has promoted the planning system from several aspects it still suffers lack of attention to two key elements of a planning system i.e. integration and alignment between different levels of planning. As a result of recognizing the necessity of an evolutionary model at the industry level to address these two factors and by reviewing experiences from several countries, a general model is proposed. The proposed model brings the two issues of integration and alignment in technology planning systems into consideration with special attention to key factors such as technology roadmaps in different industry levels, common areas of technology, soft aspects of planning, and interaction with external stakeholders. The proposed model shows a good compliance with several experiences in the Iranian petroleum industry including the development of MFL Pigs technology; the story of which is covered as a case study.

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1. Introduction

During the last few decades, the discovery of oil and the subsequent increase in national revenues derived from export of petroleum have had certain consequences in all the Middle Eastern countries. One such consequence is lack of integration in innovation processes (from research and development to market and product) and the innovation systems in these countries. In other words, while their research and technology activities have absorbed some part of the oil income, they have not necessarily been productive enough to produce more revenues and contribute in meeting the economic and industrial needs of the society.

This problem might not have fully come to surface in some of these countries such as Kuwait or Saudi Arabia where the per capita oil

revenue is very high. However, in Iran – with a population of about 80 million residents, and a daily export of around one million barrels (<http://www.opec.org>) – the oil revenues cannot meet the main expenditures of the government.

Before the Islamic Revolution in 1979, the discovery and extraction of oil were entirely performed by foreign companies. Moreover, all Iranian oil fields were still at the beginning of their lifecycles, and it was easy and inexpensive to exploit them. After the Islamic Revolution and due to changes in the Constitution, transferring oil reservoirs to foreign companies in the form of divestiture or joint venture production was prohibited. Also, the Iranian Ministry of Petroleum was placed in stewardship of the oil reservoirs and delegated as the Iranian government representative in managing the resource. From 1979 to 1995, the presence of foreigners in the Iranian petroleum industry was limited to contractors, with contracts funded domestically. In 1995, the first mutual sales contract was concluded with the French oil company, Total. Since 1995, contracts in the petroleum industry have been in either of three different forms of Engineering, Procurement, Construction

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(EPC), Engineering, Procurement, Construction and Financing (EPCF) and buy back contracts. These contracts did not provide any incentive mechanism for the foreign companies to apply advanced technologies and sustainable reservoir extraction strategies. In the EPCF and EPC contracts, all project activities from planning to procurement of the required items and equipment, installation, implementation, pre-establishment and establishment are undertaken by the contractor. The contractor is required to finish the project at the appointed time and withdraw. In buy back contracts, the short project duration (5 to 7 years) does not provide any incentive for foreign companies to implement advanced technologies, transfer technologies and participate in learning activities, reservoir management, and sustainable extraction.

Moreover, in the last few years, with the intensification of international sanctions against Iran, even these types of investment and oil reservoir developmental activities have become much more difficult and now the industry is facing several challenges including the followings:

- 1- A noticeable number of great hydro carbonic fields of the country are more than half way through their life span. Hence, continuing production and increasing the recovery factor of these fields need a certain level of technical knowledge. The average recovery factor of the Iranian oil reservoirs is 25%, whereas the global average recovery is between 35 and 40% (Kokal & Al-Kaabi, 2010).
- 2- The doubling of the country's population since 1979 has raised the need for oil income in order to provide the primary requirements and develop the social infrastructure in a way that no sufficient financial resources would remain for domestic investments in oil fields. Taking advantage of foreign investment has also become difficult because of the sanctions.
- 3- Since the foundation of Iranian oil industry, politicians have only paid attention to the increase in oil production and accordingly the generated income. They have had no opportunity to deliberate on plan and prioritize the allocation of the petroleum industry resources to the areas of research, technology development, and innovation. There has not even been any legal or organizational framework for acquiring the technical knowledge from the foreign companies investing in Iran. Furthermore, because of the extensive interconnection of the gas and oil industry with different branches of technical, engineering and basic sciences and several interdisciplinary fields, the learning model in this area requires an intra-organizational planning approach which makes it a difficult and complicated job in the overly bureaucratic environment of Iran.

All of these challenges and pathological studies in identifying the causes of failure in the industry have led the petroleum policy makers to conclude that the national petroleum industry needs a comprehensive plan to incorporate technology development and innovation. Disregarding this fact could result in an accelerated decline of oil production. For this reason, investment in the related training, research, and technological development activities has been taken into consideration since 2000. Universities and specific research centers have been founded to address this need. However, after a decade, policy makers once more realized that their predefined objectives had not been attained, with a lack of concentration and coherent planning being identified as the major weaknesses. Hence the necessity of developing a comprehensive system to prioritize and plan the research and development of technology was taken into account.

This introduction to the Iranian petroleum industry is followed by a general overview of the technology planning system in the petroleum industry of Iran in the second section of this paper. All policies and solutions adopted by the Ministry of Petroleum to confront the sanctions are also presented in this part. In the third and fourth sections, some international experiences of the American, Norwegian and Saudi Arabian oil and gas industries in the field of technology planning are discussed, the former two are well known as pioneers of this industry and the latter as a regional rival for the Iranian petroleum industry. The fifth section

introduces the proposed model for addressing integration and alignment issues in the technology planning system which shall be followed by the story of MFL pigs' technology development during sanctions as a short case study in Section 6. The paper is finally concluded in Section 7.

2. Technology planning system in the Iranian petroleum industry

Since the Iranian petroleum industry has been concerned with output rather than profit maximization, planning for technology development has never been the main concern of the executives over the last years. The majority of planning actions for technological development have been taken with respect to the intensification of sanctions and the aftermath challenges since 2009. Therefore, this paper is mainly focused on changes and developments after 2009.

2.1. The research and technology planning structure in the Iranian petroleum industry

Observing the international arena reveals that many developing countries including Japan, China, South Africa, North Korea, Venezuela, Ukraine, Cuba, and of course Iran have been faced with the challenge of sanctions in certain periods of their economic-social life. However, the way they have dealt with the phenomenon of sanctions, and the sanctions' effect on the process of development and on their innovation systems have been different (Soofi, 2013).

Moreover, considering the increasing importance and sensitivity of technology, and its role in the competitive market, and even its effect on the ranking and success of the countries (particularly developing countries), it is necessary to implement policies at national and regional levels (Ghazinoory et al., 2009). According to Iran's twenty-year national outlook, as well as the petroleum industry vision, technological acquisition is known to be among fundamental priorities, which are set to cope with sanctions and make use of opportunities.

The main actors of the Iranian Petroleum Industry in technology planning are divided into 5 main categories placed at different levels (Fig. 1):

1. Deputy minister of petroleum for research and technology (representative of the ministry):
The Research and Technology Deputy of Minister of Petroleum has several functions including policymaking, setting and implementing the goals, and approving related macro plans of the Ministry of Petroleum. (Technology, and Innovation in the Ministry of Petroleum, 2010).
2. The research and technology directorate of the four major companies (National Iranian Oil Company,¹ National Iranian Gas Company,² National Petrochemical Company,³ and National Iranian Oil Refining and Distribution Company⁴)

R&T departments are responsible for policy making and conducting research programs of the subsidiaries and operational areas (NIGC, 2012). From the viewpoint of decision making hierarchy, the Research and Technology Directorate functions as part of a matrix type of organization in each of the 4 major companies in relation with the research and technology deputy of the Ministry of Petroleum.

For instance, considering the policy of privatization of refinery units in Iran, during the last few years, 7 out of 9 refineries in the country were privatized while 20% of the share was kept for the government. Nevertheless, the main responsibilities of the Research and Technology Directorate in the administrative department of the National Refining and Distribution Company are: codifying and enforcing the coordination and supervision policies among the existing refineries, promoting

¹ www.rtd.nioc.ir

² www.research.nigc.ir

³ www.npc-rt.ir

⁴ www.niordc.ir

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