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Assessing and Identifying Entrepreneurial Opportunities in Petroleum Industry in Iran

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Abstract

Endowed with abundant oil and natural gas resources, Iran has pursued a development strategy of self-reliance with some success and did not face an import constraint. Yet, has adopted an import substitution policy and used its oil revenues to acquire foreign technologies to industrialize. Iran is today a middle-income developing country, with a significant industrial base, a relatively well-developed science and technology infrastructure and good human development. However, unlike other middle-income countries, Iran is still largely a natural resource-based economy. Diversification is an imperative, not only because natural resources are exhaustible but also because export success in world markets increasingly demands knowledge-intensive production and innovation-based competition. Above all, there is a need to provide quality jobs for the 800,000 literate Iranian men and women that enter the labor market every year. The shift to a more knowledge-based economy will require creating a national innovation system that can not only import and adapt technologies, but also improve upon them, innovate new technologies and diffuse them economy wide. In this paper, the entrepreneurial opportunities in Iran's petroleum industry are assessed with having Norway's petroleum industry as a successful example. Iran's petroleum industry is serious need of more dynamism, which has to be encouraged by a more market-pull in the overall system and a greater involvement of the private sector. This calls for more privatization, including activities hitherto organized under National Iranian Petroleum Company, or creating independent public corporations that are regulated as private firms. The fact that conception of privatization as elitist concentrations of capital and power should not exclude developing an entrepreneurial and innovational policy for a privatization and industrial development that ensures reduction in capital and power concentrations and more dynamism in a more market oriented system.

Keywords: Entrepreneurship, Petroleum Industry, Innovation, Private sector

Introduction

Iran has pursued a development strategy of self-reliance with some success. Endowed with abundant oil and natural gas resources, Iran did not face an import constraint. Yet, Iran adopted an import substitution policy and used its oil revenues to acquire foreign technologies to industrialize. Iran is today a middle-income developing country, with a significant industrial base, a relatively well-developed science and technology infrastructure and good human development. However, unlike other middle-income countries, Iran is still largely a natural resource-based economy. Diversification is an imperative, not only because natural resources are exhaustible but also because export success in world markets increasingly demands knowledge-intensive production and innovation-based competition. Above all, there is need to provide quality jobs for the 800,000 literate Iranian men and women that enter the labour market every year. The shift to a more

knowledge-based economy will require creating a national innovation system that can not only import and adapt technologies, but also improve upon them, innovate new technologies and diffuse them economy wide.

According to the 20-year Vision Plan of Iran's oil and gas industry, which has been developed on four pivotal axes, Iran would be the first producer of petrochemical substances in the region in 2025, in terms of value. Also by the end of 2025, some 7% of global oil market would belong to Iran. The third axis belongs to gas to such an extent that by the end of the Vision Plan Iran would be the third gas producer in the world with a share of 8% to 10% of the world gas trade and gas products. Also, in the fourth axis Iran would hold the first place in terms of oil and gas technology in the region.

Statement of problem

It has been one hundred years since the first oil eruption in Iran and Middle East in Masjid Soleiman and the birth of petroleum industry in Iran. Ever since, petroleum industry have had an important role in industrial and technological development and creating job in Iran. Petroleum has been the primary industry in Iran since the 1920s. Despite Tehran's attempts to diversify the economy, the oil and gas industry is still the critical engine of economic growth. Oil revenues accounted for 65 percent of government revenues in fiscal year 2008-2009. This trend has remained fairly steady over the last few decades (Mohammadi, n.d.). The Iranian government's dependence on oil revenues has resulted in prolonged patterns of rentierism — or dependence on a single natural resource—in its political economy (Mohammadi, n.d.). Iran's revenues have fluctuated due to the vagaries of the world's oil markets, periodically depressing government revenues. The government has often not been able to cut spending for political reasons and funded its deficits by borrowing from the Central Bank. Periodic bouts of lower oil prices have also led to foreign exchange shortfalls and a fall in imports, especially industrial inputs. Excessive domestic demand and disrupted industrial production has lead to periods of high inflation (Mohammadi, n.d.). On the other hand, Issues such as development and efficiency of human resources, fundraising and financial plans, lack of high technologies, poor managerial systems and organizational decision makings and the critical situation of the reservoirs in Iran's petroleum industry, are the challenges that petroleum industry in Iran is facing these days. Despite having 155 billion barrel accessible crude oil reserves, Iran's total oil production is approximately 4 million barrels per day. This is while other countries such as Russia and America are having higher oil production rate despite having fewer oil reserves (Manoochehri, Gh., n.d.). Main Part of these challenges is due to lack of application of entrepreneurship and innovation as well as inefficient knowledge and technology transfer in Iran's petroleum industry. In this study, in the following sections, I will discuss the entrepreneurial opportunities in Iran's oil and gas industry.

Company Status

According to the 20-year Vision Plan of Iran's oil and gas industry, which has been developed on four pivotal axes, Iran would be the first producer of petrochemical substances in the region in 2025, in terms of value. Also by the end of 2025, some 7% of global oil market would belong to Iran. The third axis belongs to gas to such an extent that by the end of the Vision Plan Iran would be the third gas producer in the world with a share of 8% to 10% of the world gas trade and gas products. Also, in the fourth axis Iran would hold the first place in terms of oil and gas technology in the region (Razmkhah, 2011). To reach the above mentioned position in the region, the following actions have been conducted so far in the Iran's petroleum industry:

NASR Master Plan (NASR Document,IIES, 2007)

In 2007, the NIOC Activities and Systems Reengineering (NASR) master plan was initiated by the Italian consulting company, Bain & Co. The project was initiated to reengineer the organizational structure and processes of NIOC as well as redefining the strategic plan of the MoP. The project was conducted in three phases:

Phase 1: Defining the master plan including:

- Assessing the problems of NIOC;
- Conducting the SWOT Analysis of NIOC;
- Reassessing the vision and strategies of NIOC;
- Defining and proposing the optimal situation;
- Conducting the gap analysis and the action plans to reach the optimal situation.

Phase 2: Planning the project and performing the quick impact short-run projects;

Phase 3: Performing the long-term plans.

Research, Technology and Innovation master Plan in Iran's petroleum industry

In 2009, Deputy of research and technology of Iran's Ministry of Petroleum defined the comprehensive Research, Technology and Innovation master Plan in Iran's petroleum industry based on the article 10 of establishment law of MoP as well as the commanded policies by Iran's supreme leader which insisted on developing fundamental and applicable research and creating the potential for attracting and developing technology as well as exporting the know-how and technical services. In this master plan, the main responsibilities and duties of the deputy of research and technology of the ministry as well as its subsidiaries are defined. By performing and following the defined responsibilities, Iran's petroleum industry will be able to compete at international level in field of research and technology in oil and gas industry.

Privatization of State-owned companies

According to The general policies of the Article 44 of the Constitution of the Islamic Republic of Iran in June –July 2006, The economic system of the Islamic Republic of Iran shall be based on public, cooperative and private sectors, with proper and sound planning. The public sector includes all large-scale industries (including petroleum industry), mother industries, foreign trade, large mines, banking, insurance, power supply, dams and large irrigation channels, radio and television, post, telegraph and telephone, aviation, shipping, roads, rails and the like, which are public property and at the disposal of the Government. The cooperative sector includes cooperative production and distribution companies and institutions established in cities and villages on the basis of Islamic principles. The private sector includes such activities related to agriculture, cattle-raising, industry, trade and services that supplement the economic activities of public and cooperative sectors.

In view of the provisions enshrined under article 44 and in Article 43, general policies of Article 44 of the Constitution of the Islamic Republic of Iran are intended to achieve the following objectives:

- Accelerated growth of national economy;
- Promotion of broad-based public ownership to achieve greater social justice;
- Enhancing the efficiency of economic enterprises and productivity of human and material resources and technology;
- Enhancing the competitive capability of the national economy;
- Reducing financial and administrative burden on the government encumbered as a result of its controlling role in economic activities;
- Increasing the general level of employment.

A 2004 amendment to the Article, however, has set in motion a ten-year plan to privatize eighty percent of Iran's state-owned assets (Oil & Gas Eurasia, 2011). In line with the implementation of the policies outlined in Article 44 of the Constitution, in 2007, Iran planned to sell 40% of the shares of the petrochemical industry as 'justice shares', which were only made available to the underprivileged strata of Iran **(**Iranmania, 2007)**. I**n 2007, Iran's Petroleum Ministry released the list of 21 companies to cede to the private sector in line with the Article 44 of the Constitution. The list was approved by the ministry and the terms and conditions of delivery were set by the Iranian Privatization Organization (IPO). Out of the companies, five belonged to National Iranian Oil Company (NIOC), nine to National Petrochemical Company (NPC); five are affiliates of National Iranian Gas Company (NIGC) and two of National Iranian Oil Refining and Distribution Company (NIORDC). Moreover, at least 11 companies and refineries belonging to National Iranian Oil Refining and Distribution ceded their shares to the private sector in late 2012. Isfahan, Bandar Abbas, Tabriz, Shiraz, Kermanshah, Lavan, and Tehran (Shahid Tondgouyan) oil refineries were be transferred to the private sector but the ownership of Abadan and Arak (Imam Khomeini) oil refineries are remain in government control (Oil & Gas Euroasia, 2011).

Defining the comprehensive entrepreneurial document of Iran's petroleum industry

With aiming to develop and promote the entrepreneurship in petroleum industry as well as identifying entrepreneurial opportunities to create new occupations in the petroleum industry and also to motivate entrepreneurs to invest in SMEs in Iran's petroleum industry, the comprehensive document of entrepreneurship in Iranian petroleum industry was defined in 2006 by the office of entrepreneurship of MoP. In this document, the entrepreneurial objectives, strategies, plans of petroleum industry are defined in a five year vision statement. Moreover, the entrepreneurial activities of all subsidiaries of MoP are aligned in one direction in this document.

Materials and Methods

In this paper, after identifying the as-is situation of the I.R.Iran Ministry of Petroleum, we have studies Norwegian petroleum industry as one of the best practices which had the situation of I.R.Iran Ministry of Petroleum's situation about 20 years ago. By having studied the aforementioned sector in Norway, we will identify the gap analyses and provide related solutions.

From Theory to Practice: Regional clusters in Norway

Fuelled in particular by revenues from petroleum production, which started in the beginning of the 1970s, Norway's GDP per capita increased fivefold in nominal terms from $9,551 in 1980 and to $56,648 in 2010, which is the second highest in OECD (OECD, 2012). As seen in Figure 1, even excluding petroleum, which constitutes 23% of the economy, Norway's GDP per capita would be just behind the United States and Switzerland. The total 2010 GDP of $277 billion—1.75% of the American economy—made Norway the world's 23rd largest economy (World Bank, 2012). Manufacturing only accounts for 9% of the economy, a smaller share than in peer countries (Statistics Norway, 2012). Living costs are high; domestic purchasing power is only 67% of the United States.

A key question is why Norway has experienced sustained growth above the OECD---average over the last twenty years even in the non---petroleum part of the economy. Norway tops the productivity ranking in the OECD (OECD, 2012). Between 1973 and 2006, Norway was the only OECD country with higher GDP growth per capita than the United States. In 2011, GDP per hour worked was 28% above the US level; discounting the petroleum sector, Norway would be on

Par with the productivity of the United States, as shown in Figure 1, this might be driven by firms continuously introducing new technology due to the strong incentives to upgrade productivity per worker, since labor is expensive (Norwegian Ministry of Finance, 2009). In addition, Norway's

growth can be attributed to the tertiary sector expanding more rapidly than the primary and secondary sectors. Since 2000, education, real estate, financial services, oil and gas services and construction have enjoyed average annual growth rates between 3.5% and 5.5%, whereas manufacturing, fishing and agriculture only grew between 1.5% and 3.5% per year (Statistics Norway, 2012). This shift towards the tertiary sector may have shielded Norway from low---cost manufacturing competition, in particular from China. Furthermore, the structure of the Norwegian economy has helped Norway sharply improve its terms of trade. Between 1991 and 2011, prices of Norwegian export goods increased 85% more than prices on Norwegian import goods. Excluding petroleum, this figure would be 20% (Statistics Norway, 2012).

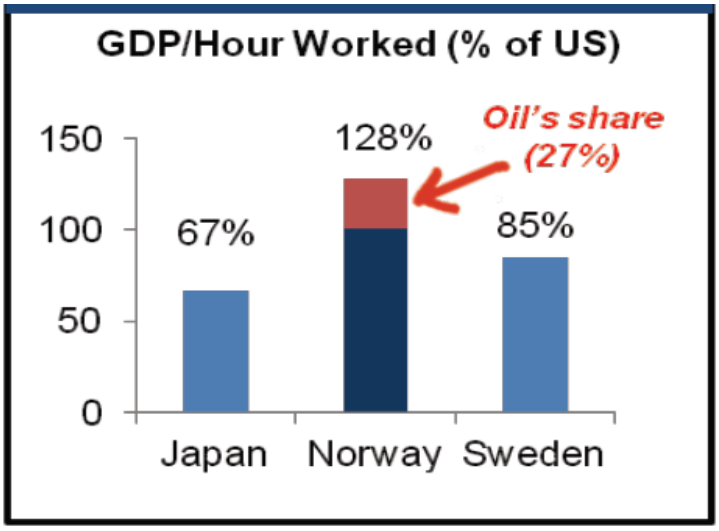

Figure 1. Productivity in Norway (Source: Giovanna & Dini, 1999)

The Norwegian oil and gas clusters

The growth of regional clusters of mainly small and medium-sized establishments (SMEs) in Western Europe and North America since the 1970s, has gained great interest among both academics and policy makers. In the 1970s and 1980s such clusters established a strong position in the world market for both more traditional products (e.g. Third Italy) and high technology products (e.g. Silicon Valley). In some industrial sectors, regional clusters of SMEs are looked upon as more competitive than large firms (Arne Isaksen, 1996). The basis for identifying regional clusters is the division of Norway into 103 labour market areas or travel-to-work areas and 39 industrial sectors. The data source provides figures for all of industry except primary industries and the public sector (Arne Isaksen, 1996).

There are several steps in the empirical analysis. The first step is to identify regional clusters, consisting of labour market areas where:

1. The locational quotient for an industrial sector is higher than 3.0, i.e. labour market areas where an industry has at least three times as many jobs as 'expected', based on the industry's significance on a national scale[1]. These labour market areas thus satisfy the first of the characteristics of regional clusters discussed above, namely local/regional specialization. The limit

[1] The locational quotient is the share of jobs of one industrial sector in a region in proportion to the sector's share of all the jobs in the country as a whole (Arne Isaksen, 1996).

for the locational quotient at 3.0 is based on estimation. We have tried different limits, and a locational quotient at roughly 3 is seen as reasonable for our purpose (Isaksen and Spilling 1996).

2. There are at least 200 man years in the sector; a lower limit is set so as not to include many very small clusters. By applying these two criteria it is possible to delimit 143 regional clusters Norway in 1990 with a total of just under 180,000 man-years. The clusters are spread throughout the country, in that as many as 74 of the 103 labour market areas had one or more than one cluster.

The areas which did *not* have any of these clusters in 1990 are of two types: 1) less central and small labour market areas with a relatively high number of jobs in primary industry and few in manufacturing; 2) urban areas with comprehensive industry and a relatively high number of jobs in most industries, but without any clear specialization within any industrial sector. Examples of these areas are outer parts of the Oslo area, but not the central parts of Oslo, which have most regional clusters. The second and third largest cities in the country, Bergen and Trondheim, have no clusters, according to the criteria applied here (Arne Isaksen, 1996). The 143 regional clusters identified are very heterogeneous. Only 24 are dominated by small and medium-sized establishments In the Norwegian context, SMEs are establishments with fewer than 100 employees. Nor was there any sign of the appearance of new small firm clusters between 1970 and 1990. Small firm clusters are found mainly within four industries: fish processing, textiles and clothing, wood products and furniture.

Most of the regional clusters and most of the employees are to be found in clusters dominated by large firms or with both small and large firms (Combined).

The large firm clusters are mainly within the process industry and the engineering industry, and many of these clusters are based in one company owns. The combined clusters have many employees in producer services in the Oslo area (Arne Isaksen, 1996). The Norwegian oil and gas clusters consist of internationally competitive supply and service companies covering the entire value chain: from exploration via development, production and operation to decommissioning. Approximately 80,000 people are employed in the Norwegian petroleum sector. 60,000 of these are estimated to be directly involved in the supply and service industry. The skills, experience and technology developed on the NCS are utilized by the international oil and gas industry all over the world. An example is the Norwegian-based sub sea industry that has a leading position internationally with a 70-80 % share of the global market (Norweigian Petroleum Directorate, n.d.).

Shipping and Oil & gas are the two largest industries in Norway. A particular feature is the large number of companies having their markets in both shipping and Oil & Gas (and fisheries and also onshore industries) using their cross-over experience in research and development of new products and services (Norwegian Petroleum Directorate, n.d.).

Norwegian shipping companies provide services for the oil companies on the Norwegian Continental Shelf (NCS) and in performing rig- sub sea- and supply activities they are central players in the entire value chain. The oil industry and related maritime sectors is the strongest industrial cluster in Norway, and the dynamics of the network has contributed in positioning the Norwegian cluster in the global market (Norweigian Petroleum Directorate, n.d.).

Gap Analysis

Gap analysis is a tool that helps companies compares actual performance with potential performance. At its core are two questions: "Where are we?" and "Where do we want to be?" If a company or organization does not make the best use of current resources, or foregoes investment in capital or technology, it may produce or perform below its potential. This concept is similar to the base case of being below the production possibilities frontier (Wikipedia, Gap Analysis, n.d.).

In figure 06, the current situation and optimal situation of Iran's petroleum industry is pictured. As mentioned before, the one hundred year old Iranian petroleum industry needs renovation. Having huge headquarters, lack of agility and poor managerial systems are some of current challenges which the petroleum industry is facing. In previous section I discussed the current status of the company and the actions conducted so far to overcome the named challenges but of all mentioned solutions (i.e. Privatization, new research plans, know-how transition, etc) it has not been due consideration to entrepreneurship which is now considered the engine of development and economic growth (Karlsson, et al, 2004).

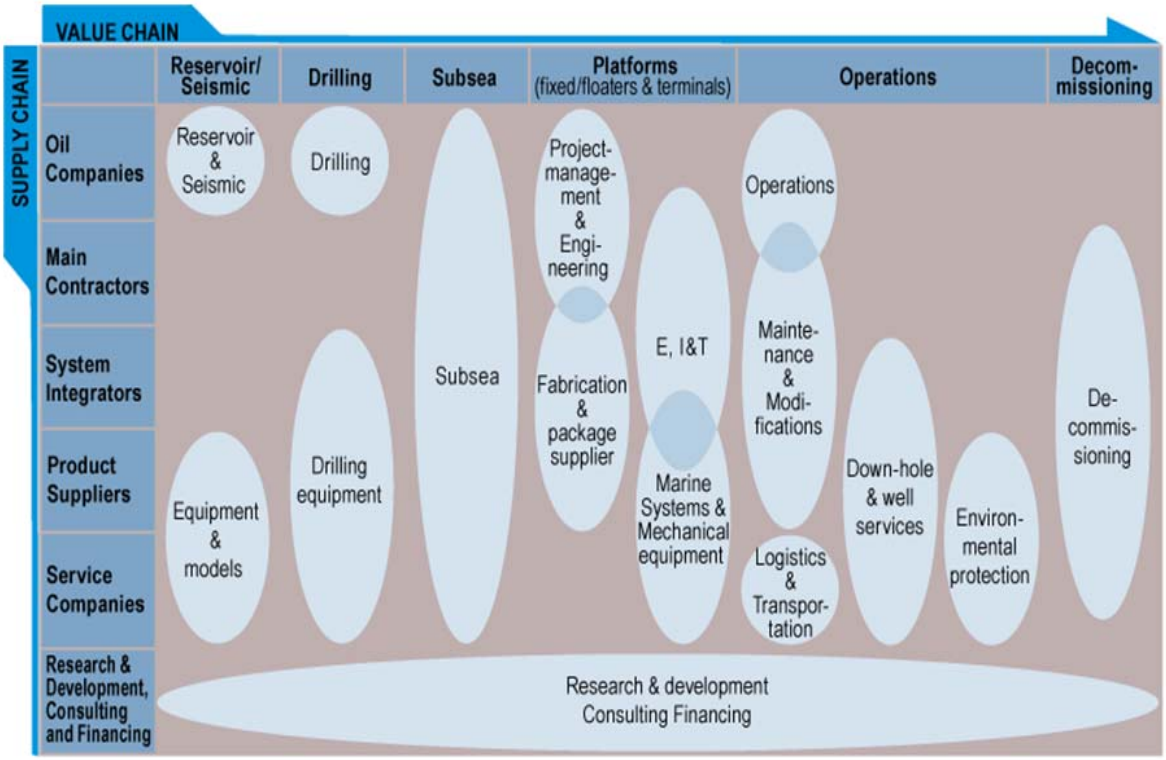

Figure 2: The Norwegian Oil & Gas Cluster Map (Source: INSTOK, Norwegian Oil and Gas Partners)

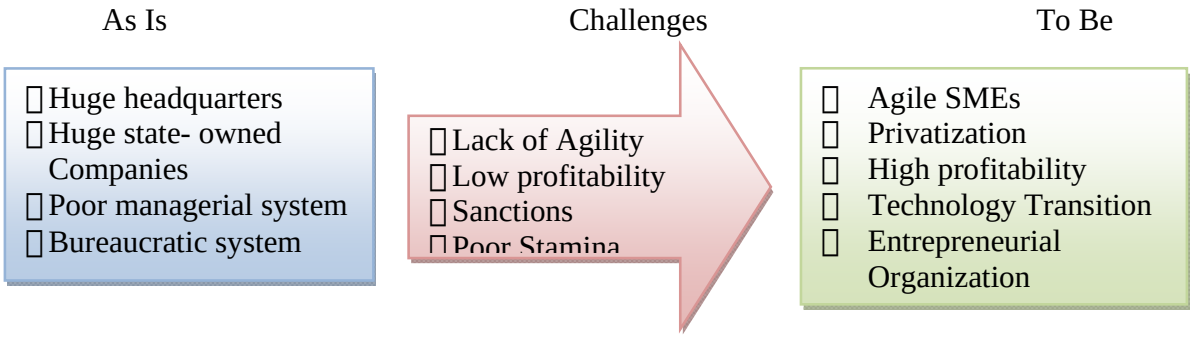

Figure 3: The As-Is and To-Be situation of Iran's petroleum industry (Source: The document of Entrepreneurship development in MoP, 2009)

Objective

Based on the Problem definition and the gap analysis of Iran's petroleum industry, the following objective is defined for the current study. The objective should be SMART which means it should be Specific, Measurable, Ambitious, Realistic and Time scaled. The objective of this study is supplying 40% of Iran's total GDP by means of establishing and developing entrepreneurial activities and forming industrial clusters in Iran's petroleum industry by 2025 horizon.

Structuring the problem

One of the most common sets of activities in the management is planning. In order to determine where the organization is going, whether it operates in the private or in the public sector, the organization needs to know exactly where it stands, then determines where it wants to go and how it will get there. Planning is an intelligent preparation for action. The planning process is differentiated from other pre-decision activities; in that it is systematic, deliberate and continuous (Glaister, F., 1999) Strategic planning is widely used by organizations at international level, as it is an integral part of strategy. Strategic Planning is the formal consideration of an organization's future course. All strategic planning deals with at least one of three key questions (Bradford, D., 2000):

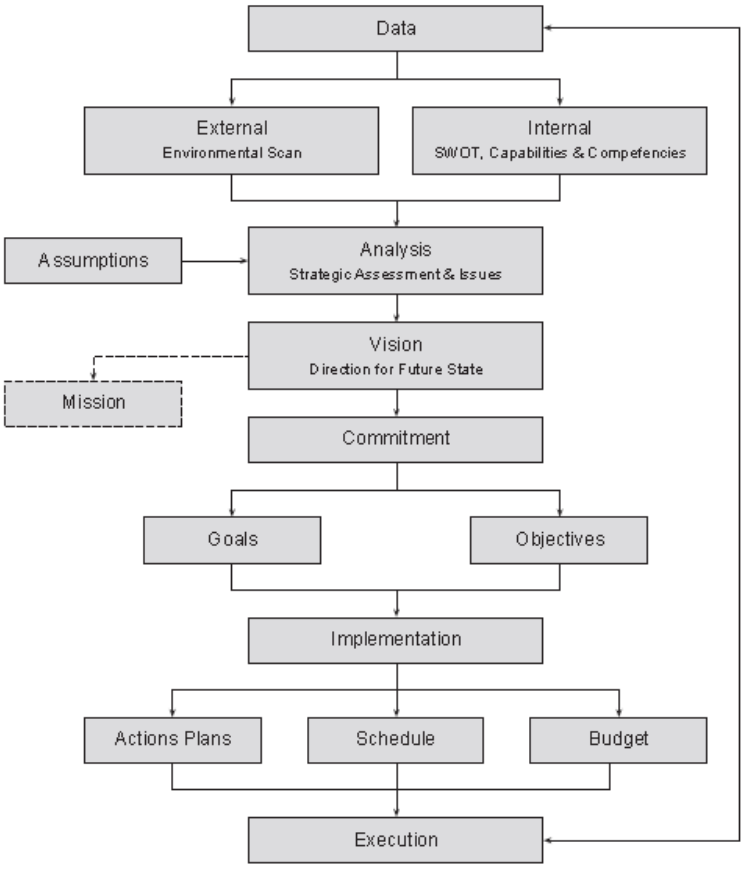

Figure 4: Schematic model of Bryson strategic Plan (Source: Bryson, 1995)

1) What we do? 2) For whom do we do it? 3) How do we excel?

Strategic Planning is a means to an end, a method used to position an organization, through prioritizing its use of resources according to identified goals, in an effort to guide its direction and

development over a period of time (Bryson, 1995). In public sector organizations, however, those in executive positions often have their powers constrained by statute and regulation which predetermine, to various degrees, not only the very purpose of the organization but also their levels of freedom to diversify or to reduce, for example, a loss-making service (Duncan, 1990). The primary financial driver in these organizations is not profit, but to maximize output within a given budget (some organizations currently having to try to do both) and, while elements of competition do exist, it is much more common to think of comparators rather than competitors. Much of the planning literature, currently being published, addresses the necessity of planning in the profit and non-profit sectors. Strategic thought and action have become increasingly important and have been adopted by public and non-profit planners to enable them to successfully adapt to the future (Kriemadis, 1997). According to Bryson (1995), strategic planning, can help public and nonprofit organizations anticipate and respond effectively to their dramatically changing environments. In this study, I will discuss the entrepreneurial opportunities in Ministry of Petroleum in Iran. The organization is considered a nonprofit organization and therefore, Bryson Model of strategic planning (figure 4), is used in deriving the strategies with aiming to reach the objective of the study.

Conclusion

In contrast to other developing countries with comparable technological capabilities, Iran's economy is still largely dependent on the primary sector. The agriculture and the oil and gas sectors together account for 30 percent of GDP; the industrial sector accounts for 23.4 percent -including water supply, electricity and gas – (United Nations, 2005). Domestic manufacturing industry has been built mainly through licensing of technology from abroad and in some cases through reverse engineering. Products are largely sold in the protected domestic market and tend to suffer from low quality (and high costs). Moreover, the manufacturing sector, to a large extent, continues to rely on imports for components and raw material (for example, the pharmaceutical sector). Adequate emphasis should be placed on simultaneously developing appropriate supplier industries, which was a practice followed by other countries such as India that followed import-substitution policies (United Nations, 2005). Although there is a commitment to move towards a market-oriented economy and development of the private sector, State-owned enterprises (which are mainly large enterprises) continue to account for much of the industrial sector. It is difficult to assess the exact contribution of private sector *per se*, but its contribution to GDP value-added is estimated at fewer than 15 percent. The small and medium enterprises (SMEs), which form the backbone of economies worldwide, play only a small role in the economy. There is need for promotional policies for SMEs, and related measures to encourage entrepreneurship in Iran, such as provision of seed capital and venture capital, and the establishment of science and technology parks and business incubators with adequate funding and support services to assist start-up enterprises. The issue of establishment of property rights is still uncertain and discourages private entrepreneurship (United Nations, 2005). Iran's export base is narrow, relative to its industrial base and its technological capabilities. Manufactured exports account for only 9.3 per cent of total merchandise exports (United Nations, 2005). With the exception of mining and metals where technological improvements have resulted in the production of export-quality products, the overall industry is not diversified sufficiently and is not in a position to compete in international markets. Iran lags behind others oil producing countries in producing/exporting value added petroleum products. Nevertheless, given its technological capacities, Iran could develop biotechnology, pharmaceuticals and petrochemical products into export champions within a reasonable time frame. The main actors in the Iranian national innovation system are the government ministries, the research institutes/universities and the enterprises (United Nations, 2005). The uniqueness of the system is that almost all the research institutes/universities

and an overwhelming majority of the enterprises are State-owned. Largely due to the government ownership, there are close links between the research institutes/universities, enterprises and government. Other actors such as the business associations, business support organizations and consumer groups are very weak and play almost no role in the system. As a result, user-producer linkages are weak and innovation activities in Iran are not demand-driven. The absence of private enterprises that base their innovation strategies on conditions of demand and competition makes it difficult to derive larger economic benefits from innovation. Such larger benefits that Iran is not, presently, realizing would include opportunities for commercializing new products, emergence of spin-off enterprises and new entrepreneurs, etc (United Nations, 2005).

Iran's industrial sector lacks effective competition. Competition is the key driving force for innovation and technological change. The system of licenses and resource allocation (subsidies) ensures that there is only limited competition (that too mainly based on price) in vast majority of the industries. This lack of or limited competition does not motivate companies to develop new products or product features. Recognizing this, Government is gradually opening up the economy to competition, but the process is too slow (United Nations, 2005). A unique feature of Iran's innovation system is the marginal role played by the foreign companies, with the exception of oil and gas industry. Foreign companies bring in new technologies in the form of new products, processes and management techniques. The local operations of foreign companies lead to spillover effects and diffusion of new technologies into wider economy. They also spur competition and motivate domestic companies to upgrade their technologies and innovate in order to compete (United Nations, 2005). Government has established free zones where foreign companies can locate operations. However, for the wider diffusion of technologies into the whole economy that is a small move. Iranian authorities recognize the need for policies that will stimulate diversification, technological upgrading, learning and innovation. The Fourth Five-Year Plan 2005-2009 places emphasis on the adoption of policies for enhancing innovation, internal and external sources of R&D and mechanisms for building technological and innovative capacity (United Nations, 2005). The recent creation of a Supreme Council for Science, Research and Technology chaired by the President, and the establishment of a coordinating secretariat within the Ministry of Science, Research and Technology, provide a basis for overall goal and priority setting within an integrated innovation-based framework (United Nations, 2005).

The Iranian Petroleum sector has an enormous potential with its access to raw materials and a potentially large domestic market for products. The sector is well equipped with skilled manpower. In downstream petroleum sector, there is an increasing demand worldwide for petrochemical products and there is a willingness in the Iranian government to continue investing and expanding the sector. However, the sector is fraught with bureaucratic bottlenecks and has too few dynamic stimuli. The R&D activities are still too much oriented towards expansion rather than higher value-added production (United Nations, 2005). Forward linkages to end user industries are weak and lack the resources and governmental support needed to flourish. The current innovation system in oil and gas and petrochemicals is very much dominated by government and influenced by government operating habits and practices. These are largely centered on an innovation system that operates by command that is by the formal and bureaucratic decision-making structures put in place to accommodate national or governmental control over the respective activities (United Nations, 2005). This kind of government control renders the innovation system less strategic and adaptive than what the Iranian economy now requires. Given the fact that more than 80% of the Iranian economy is government run, the conditions for the privately-owned industries are close to anemic. The system is in serious need of more dynamism, which has to be encouraged by a more market-pull in the overall system and a greater involvement of the private sector. This calls for more

privatization, including activities hitherto organized under NIPC, or creating independent public corporations that are regulated as private firms. The fact that conception of privatization as elitist concentrations of capital and power should not exclude developing an entrepreneurial and innovational policy for a privatization and industrial development that ensures reduction in capital and power concentrations and more dynamism in a more market oriented system.

However, despite the move towards a knowledge-based economy since the Third Five Year Plan in Iran, innovation has yet to become a strategic goal of policy-making in Iran. Policies and program developed by principal actors in the innovation policy system continue to focus in linear fashion on the supply of 'upstream' human and knowledge resources as generated by the education, scientific research and technological development processes (United Nation, 2005). The conceptual approach to innovation in terms of a 'National Technological Development System' reinforces this focus on the supply of research and technology, whether from within the emergent system or through international collaboration and licensing from abroad and on the role of technology in the growth of industrial output. Few policies, however, are directed towards stimulating the learning and technological mastery needed for innovation, and in the absence of such policies, the overall structure of the economy provides little incentive for doing so (United Nation, 2005). Within the existing policy framework, too little attention is paid to the central actors in an innovation process, which are the enterprises themselves, and to innovation as an interactive process involving users and producers of knowledge, goods and services. Translated into policies and practices, this approach to science and technology policy virtually omits innovation that is pulled by demand, excludes sectors other than the so-called 'high tech industries' from the innovation system and ignores both the role of Small and Medium-sized Enterprises (SMEs) and of enterprises located in 'traditional sectors' in technological upgrading and innovation. The system is thus segmented and lacks a dynamic process of innovation at its core. Current policies and policy-making practices have contributed to these shortcomings in the innovation system. A clear understanding of the integrated nature of innovation systems is still lacking within policy-making circles. So, too, are a national vision and a set of national goals and priorities, the absence of which cannot solely be attributed to the political controversies stemming from the co-existence of Parliamentary and Parallel governance systems.

Much more can be done within the existing organizational structure and in the context of existing mandates, if traditional habits and practices that limit information flows and collaborative behavior can be overcome. The following recommendations are made with this end in mind. They build upon a tacit division of labor that has begun to emerge with respect to 'high technology sectors' in the economy and suggest that this be generalized. There is an urgent need to create a national vision in which entrepreneurship and innovation would be seen as the key vehicle in economic growth and from which goals and priorities can be derived for the nation.

Recommendations

1. Improving coordination and coherence in horizontal innovation policy-making

As in distributed knowledge systems more generally, distributed policy making enables policy coordination and coherence to take place with a reduced need for centralized, hierarchical decision-making processes in petroleum industry. This framework facilitates task oriented behavior through management committees that combine the principal of an explicit division of labor with regard to critical policy tasks and functions within the innovation system and the variable geometry that brings together that set of MoP's subsidiaries and policies needed to support systems-embedded processes of innovation in and across productive sectors or in problem areas targeted for attention at the national level in petroleum sector.

2.Building research and technological capacity through joint ventures, licensing agreements and strategic partnerships with foreign firms and research institutions

Licensing has been practiced in Iran as a means to produce a variety of products in the oil, gas and petrochemical sector as well as in pharmaceuticals for the domestic market, but incentives for learning through licensing and more recently through joint ventures have been few. This is related to the continued emphasis in Iran on production rather than on innovation as the core of the development process. Little attention has thus been paid to the need for domestic capabilities in Iran, at least as measured by policies in place. More attention has been given to short term economic benefits from co-operation and licensing. But getting the most out of these agreements in the long term should warrant including them as major instruments in a national innovation policy and designing them accordingly. There are many ways to design and implement schemes to stimulate such learning and they generally have a high value for the long-term development of innovative capabilities and industrial development.

As a first step in this process, these important contractual arrangements should be put more firmly into a national strategy for building up the domestic R&D capacity and developing infant as well as more mature industries. Without taking the comparison too far, valuable insights can be learned from the Norwegian experience with their concession system and technology agreements.

Data also needs to be collected on past licensing practices. This can take place through the merger of existing registries of licenses and joint ventures currently located in a large number of ministries including the MOP, MOH, Ministry of Energy and Ministry of Justice. These data can form the basis for a restricted on-line distributed information system and make possible needed research into factors that have been a disincentive to learning through licensing and joint ventures in Iran and contribute thereby to an effective policy environment to deal with this problem.

In recent years, international strategic partnerships have become popular among enterprises and research institutions as a means of acquiring new knowledge, technologies and learning. Some of the Iranian research institutes already have such partnerships with some foreign research institutes on a smaller scale. Such partnering can be further strengthened. There is no evidence of Iranian enterprises entering into such partnerships either with foreign enterprises or research institutes. Iranian enterprises in petroleum industry can be encouraged to form such international partnerships with similar research institute or organizations.

3.Building user-producer links

Innovation is fundamentally an interactive process and user-producer interactions are at the core of a dynamic innovation system. Users may be downstream enterprises, which are clients of upstream firms as in the link between oil and gas producers and petrochemical firms. Users might also be located in the service sector or in the MoP.

4.Targeting the supply of R&D

Much of Iran's R&D activity and its R&D financing takes place within Ministries. In the petroleum/petrochemical sector, for example, this tends to exclude private sector engineering firms. To the extent that Government has moved to support the development of the private sector, this legacy from the past is a serious obstacle. The growing attention in many industrialized countries to the need to build bridges between knowledge producers and users has resulted in a wide range of policy initiatives to spur public-private partnerships and science-industry relations. These include funding mechanisms to stimulate the formation of R&D consortia that bring two or more firms together to develop a new technology, solve a common problem or build a common interface and grants to underwrite the costs of patenting and of technology transfer from universities and public sector research institutes to industry (United Nation, 2005). Innovation Challenge Funds of this sort are recommended for Iran, as a means to improve linkages, stimulate knowledge transfers, provide

opportunities for long-term investments in R&D and encourage strategic change in the university sector. The more relevant university activities are for petroleum industry, the more likely are private investments and co-funding from the industry. Innovation Challenge Funds that include a matching-grant element have been successfully implemented in countries such as India, Brazil, Canada, Turkey and the European Union. These typically call for invitations to *submit research proposals jointly* by the private sector and the publicly-funded laboratories (including universities), with each party meeting part of the costs and supplemented by the matching funds. For instance, the Turkish Technology Development Foundation received a World Bank credit of around $ 10 million to undertake priority research tasks initiated by private companies jointly with a technical university (United Nation, 2005).

5.Targeting the Demand for Technology:

While competition pushes firms to innovate, demand pulls new knowledge into economic production. Demand is thus one of the key drivers of innovation. All too often there are market failures that result from the lack of expression of these needs through the mechanism of the market. For example, there is a clear need in Iran today to focus on upgrading in downstream industry and in users of upstream products such as refined oil for automobiles. The Innovation Challenge Fund discussed above can help to stimulate such demand but can only do so if the need is already felt by these firms, they are aware of the existence of such a fund, have the network required to create a consortium and the time to prepare a project. Experience in the European Union with such mechanisms has shown that special services must be made available to small and medium-sized enterprises to ensure that they are not excluded (United Nation, 2005). Even then, critical demand is too weak to be heard. The petrochemical sector, for example, has important forward linkages to end-user industries like textiles, plastics, travel goods and various end uses of polymers. As many of these industries are not competitive and lack innovation capabilities, they will not provide sufficient pressure on the petrochemical sector alone to produce the quantity and quality of products they need to develop and grow. Relative to the abundance and future growth of petrochemical production capacity, the end-user industries represent too small a stimulus. Hence, the petrochemical sector itself is organizing innovation more or less by command, which is through decisions internal to the Ministry of Petroleum (MoP) and its subsidiary NIPC and in function of five-year plans. To compensate for this and to help implement a more market-based decision making mechanism for innovation down the value chain, Government could take an active role in organizing advanced demand. Some countries are more active in using such instruments than others, and Sweden has for example a well-known tradition (United Nations, 2005). Such demand can be stimulated through government technology procurement program that support or fund technological development that would otherwise have no market. The buying power of public sectors is enormous if coordinated to strategic ends. The typical mode of technology procurement would be to let government institutions articulate demand for certain products or technologies and procure them at a price that includes the necessary research and development costs. Such program, however, should only be launched as part of a long-term industrial policy.

6. Upgrading SMEs

Small enterprise promotion could benefit from the development of Market-oriented Business Development Services. Technical cooperation projects can be designed to transform state service agencies into contract consulting and research mechanisms. The services typically provided are: Entrepreneurship Training, Advisory & Facilitation Services, Human Resource Development, Business Management, Marketing, Mentoring, Counseling, Networking, Financial and Personnel management, Legal assistance, and Export Assistance. Business Development Services can be made more affordable and effective by letting SMEs themselves choose between service providers in a

competitive market place. Vouchers systems can be proposed for further study, where the government gives selected entrepreneurs a voucher of designated value, and the entrepreneur is then empowered to choose the service provider from a list of accredited providers. State plans and development cooperation thus serve to stimulating market demand for business services and not on subsidizing the supply from service providers.

7. Developing clusters and incubators of knowledge-based activities in petroleum Industry

Inter-firm cooperation among firms and related services is frequently regarded as a major stimulus to innovation and to regional development (United Nations, 2005). Clusters are the result of a spontaneous tendency of SMEs to locate close to each other, but there are also organized efforts to set up clusters from scratch, mainly through free trade zones and techno-poles or science parks, which are artificial agglomerations of firms resulting from technology and export policies. Iran has experimented with a number of different initiatives. Currently there are three free industrial and trade zones already established in the Persian Gulf, (Qeshm, Kish and Chabahar), and three others are in the planning stages (Abadan-Khoramshahr, Jolfa, Bandar Anzali) (United Nations, 2005). In Iran the free industrial and trade zones were developed mainly for job creation purposes, and therefore were set up in poor and underdeveloped regions to attract both domestic and foreign investment thanks to duty-free access to imported inputs (but not to exemptions from labor and financial regulations). Most of these are still at their early stage of operation, but there are some cases which show how such zones can be used strategically to promote regional economic development and unlock disadvantaged areas from stagnation. In this context, it should be reminded that success in enhancing the share of technology–related exports and participating profitably in export markets is often based on productive linkages between the small producers and large foreign corporations, as well as with local research organizations, civil society and technical cooperation agencies. The key role of the government is to formulate policies, fiscal measures and related organizations that promote the level playing field and an outward-looking trade strategy. More recently, Iran has also already started to explore and disseminate the concept of incubators for early-stage enterprises and technology parks for commercializing its research outputs. The IT incubators at Isfahan Science & Technology Town, work in Kerman (which includes Darya -- the first Venture Capital Fund), and the Paradis Tech-park under construction near Tehran are promising developments (United Nations, 2005). With regard to the promotion of technology parks and incubators, a step-by-step program is recommended, through which an overall strategy can be elaborated into which such initiatives can be placed and through which coherence and complementarity can be enhanced. The program would Prepare a strategic framework identifying the policies, regulations, incentives and other forms of support required from the Government and the private sector.

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