

# **A Sectoral Innovation System Assessment : Iran's Petrochemical Industry**

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*Mohammad Halimi*

*Hi-Tech Industries Center of Iran*

The Islamic Republic of Iran is a major player among oil, gas and petrochemical producers in the world. The main focus in this paper is on a systemic perspective on the development, strengths, weaknesses and possible failures of the innovation system in this sector. Petroleum and petrochemicals have tight linkages and they are subsumed under the same Ministry of Petroleum and hence share some institutional framework conditions.

The increasing importance of oil throughout the period following the Second World War, combined with the price hikes of the 1970s, made Iran one of the major actors in the global market for oil and one of the most sought-after destinations for foreign oil companies. The petrochemical industry had less strategic interest for foreign oil companies, and this enabled domestic capacity in R&D and related areas to be developed more easily than in the oil and gas sector.

A striking feature of the Iranian system is that the upstream oil, gas and the petrochemical sectors, as well as other commercial and research activities in petroleum-related fields, are organized directly under the Ministry of Petroleum (MOP).

Commercially oriented activities are organized as companies or divisions under the ministry, the most important being the NIOC (National Iranian Oil Company, responsible for upstream exploration and production of oil and gas), NPC (National Petrochemical Company), NIGC (National Iranian Gas Company) and NIOPDC (National Iranian Oil Refining and Distribution Company). Each of these companies or divisions has full strategic and operational responsibility in its field. In each, there are R&D directorates responsible for conducting research and development. In sum, the Iranian oil and petrochemical industries are organized as fully integrated public corporations directly under the MOP.

The analysis so far points to the important role of government policies without which an assessment of the innovation system will make little sense. The Iranian system is defined by the broader political-economic system, and changes in the innovation system as such without some broader changes in the surrounding political-economic system may have little effect. Hence, a critical weakness in the system, namely lack of transparency, is very much a political issue, but it has significant impacts on the performance of the innovation system. This was illustrated clearly in the case of upstream oil and gas, where lack of information, or more precisely lack of shared information, creates a suboptimal situation

in which companies will not have incentives to bring out the best technology and knowledge and where the necessary learning along the production curve will not take place.

In many developing countries, including Iran, exploration and production of oil and gas resources are conducted by government-owned corporations. This has been a highly legitimate way for Governments to earn revenues from oil and gas resources. But in the Iranian case, much of the oil rent is lost due to a missing link in the system: a government or state function that ensures that business players (be they private/foreign oil companies or NIOC itself) need to compete and develop knowledge to recover as much oil and gas as possible from the reservoirs.

The vast capital investments required to develop the petroleum and petrochemical industries provide ample reason for the sector to be owned by the Government. But as the case of oil and gas shows, the key issue may not be whether the sector or firms are government-owned or privately owned, but rather, in the former case, how the state performs and organizes its functions. The high level of integration between petrochemical business operations and the Ministry of Petroleum makes both strategic and operational decision-making political and bureaucratic rather than strategic and adaptive. Hence, even if the NPC continues to be government-owned, much can be done to organize the company more independently from ministerial processes and hence separate political from business issues. This would help create a better and more adaptive environment for innovation processes in the sector.

Aside from these general or political-economic considerations, some other points are worth highlighting. Over time, a strong R&D capacity has been built up in connection with the petrochemical sector. This is strength of the innovation system. Both within NPC (as in the Research and Technological Company) and outside in universities and research institutes, this capacity is considerable and has apparently played an important role in the expansion of the petrochemical sector over the past decade or so. However, this particular system also has its weakness in terms of the way it is organized and the way research and development is prioritized.

R&D activities are driven by a combination of strategic Five-Year Plans and individual proposals that do not ensure that research is geared towards the wider and long-term needs of Iranian downstream industries. It is evident that parts of R&D activity should be defined internally, but the large capacity in NPC and the sector as such is in contrast to the lack of capacity in the private sector, resulting in a skewed system where the main thrust of R&D is defined bureaucratically and to a lesser extent by market orientation. For R&D activities to be relevant for NPC, the prioritization and selection mechanism could be more future-oriented and transparent, for example with clearer and more explicit selection criteria.

There is an apparent lack of dynamic science-industry relations, both in universities and research institutions. Private engineering firms have virtually no support for R&D activities and little contact with public R&D institutions. Universities, even those linked

to petrochemical activities, tend to conduct research that is general and basic, and they are less motivated to engage in R&D activities that are both more advanced and linked better to future industrial development needs, like sophisticated polymers.

Licensing has played a major role in the expansion of petrochemical production by providing access to existing knowledge. The drive for a rapid build-up for the benefit of exports and import substitution and to satisfy the need for intermediate products of user industries seems to have led to a lack of attention to building up domestic technological and knowledge capabilities. This is changing through more active use of joint ventures, whereby NPC and affiliates gain ownership of technologies and are able to build knowledge rather than importing technological equipment.

## **Conclusions**

The Iranian petrochemical 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. There is increasing demand worldwide for petrochemical products, and there is willingness in the Iranian Government to continue investing and expanding the sector. However, unlike the production system, the innovation system has a number of deficiencies, many of which are linked to the way it is organized as a government business area. The sector is fraught with bureaucratic bottlenecks and has too few dynamic stimuli. R&D activities are still too oriented towards expansion rather than higher-value-added production. 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 the Government and influenced by government operating habits and practices. These are largely centred on an innovation system that operates by command, i.e. through the formal and bureaucratic decision-making structures put in place to accommodate national or government control over the respective activities. This kind of government control renders the innovation system less strategic and adaptive than now required by the Iranian economy.

Given the fact that more than 80 per cent of the Iranian economy is government-run, the conditions for privately owned industries are close to anaemic. The system is in serious need of more dynamism, which has to be encouraged by more market pull in the overall system and a greater involvement of the private sector. This calls for more privatization, including privatization of activities hitherto organized under NPC, or creation of independent public corporations regulated as private firms. Conceptions of privatization as an elitist concentration of capital and power should not exclude developing a policy for privatization and industrial development that ensures reductions in concentrations of capital and power and more dynamism in a more market-oriented system.