Technology transfer process to the Gulf Cooperation Council (GCC) countries: An analytical perspective

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Abstract
- International technology transfer promises economic growth and prosperity of nations. For decades, the Gulf Cooperation Council (GCC) states of the Arabian Gulf critically depended on imported technologies in promoting and stimulating their economies. It is evident that technology transfer process to the GCC states is ineffective. This limitation can be attributed to various accumulated and emerged factors. The review of the literature revealed that most authors had addressed this issue from a specific and narrow perspective. This paper aims to examine this issue from a broader and a comprehensive perspective.

Keywords-- Gulf Cooperation Council (GCC); technology transfer; technology strategy; indigenous technological capability.

I. INTRODUCTION
Technology is the knowledge needed to design, create or implement a production process or the services relating to the process. It is the specific application of scientific and technical knowledge to the production of goods or services[12]. Technology is a critical factor and an essential element for socio-economic development. It represents the building block for industrial establishment and development. It is recognised as a key factor for the promotion of efficiency of production and continuous improvement of productivity in techno-economic systems[7]. All types of technologies are embodied in tangible items such as tools, equipment, documents, machinery and industrial complexes. They are also expressed in intangible forms such as patents, licences, know-how contracts and skills. Knowledge, innovations and professional skills are incorporated in the form of nascent technology. Thus, the acquisition of technology is imperative for the development process and growth of economies. Moreover, since technology changes continuously, with new products and processes...
frequently developed, in acquiring it, one has to consider it as a continuous process, and that it grows with the expansion of economic activity [5].

II. THE CONCEPT OF TECHNOLOGY TRANSFER

The transfer of technology from industrialised to developing nations has grown intensively in the past decades. Various evidences from early and late industrialists indicate that technology, known as the commercial application of scientific knowledge, has been a major thrust of industrial and economic development. A successful transfer of technology promises economic growth and prosperity of nations. For the purpose of this paper, the definition of Sarfaraz and Emmamizadeh (1993) is adopted. It conceptualises technology transfer as the process of transferring from one nation to another the know-how required to successfully utilise a particular technology.

The benefits of technology transfer are twofold. In the short term, the immediate recipients benefit by boosting productivity, quality improvement, new products/processes or lower costs. Over the long term, their benefits depend on how much they learn from the technology and the ability to strengthen their technological capabilities. Technology transfer process has two aspects. The first is product transfer, such as machines, equipment, tools, etc., whereas the other part is the know-how transfer, such as human experience, technical information, training programmes, etc. Transfer of technology, therefore, can be in any of the above forms or their combinations.

The nature and magnitude of transfer is greatly affected by the social, economic and political conditions in both countries— the receiver and the sender [6]. Technology transfer process involves complex and diverse activities. The degree of complexity and diversity depends upon many factors, such as the nature of the required technology, the dimension of technology, the technological gap, the accumulated experience of the acquirer and the means of the transfer process (ibid).

The transfer of technology among nations or firms occurs through different channels or mechanisms, where each channel has its own characteristics, merits and shortcomings and may in some cases exist independently of other channels. These channels include foreign direct investment, joint ventures, contracting, franchising, licensing, management contracts, turnkey operations and exporting. Salami and Reavill (1997) point out that the effectiveness and the appropriateness of each of these channels depend on several economic, strategic and policy factors. They depend on the nature of the acquired technology, the transfer cost and risks, the level of technological and managerial capabilities of the recipient, the objectives and goals of both the
supplier and the recipient, the policies and strategies of the recipient government and the ability and capacity of the recipient to learn and absorb technological know-how.

III. AN OVERVIEW OF GCC COUNTRIES
The Gulf Cooperation Council (GCC) comprises six Arab Gulf states: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates (UAE). According to the GCC charter, the underlying objectives of the GCC are: to effect coordination, integration and inter-connection between member states in all fields, such as economy, finance, trade, customs, tourism and legislation, administration[10]. The economies of most of these states are small and relatively open. These countries share similar economic, technological and industrial aspects, as follows[2]:

- the public sectors in the GCC play a major role in socio-economic activities,
- oil contributes about 90% to the total GDP and three-quarters to annual government revenues and exports,
- these countries possess a sizable financial assets,
- an extensive welfare system is in place in all GCC countries,
- these countries rely extensively on foreign technologies for their economic and industrial development.
- government services in many GCC countries are provided free or at highly subsidised prices,
- GCC countries are highly dependent on a large expatriate labour force, particularly technical specialists, reflecting the small size of the domestic workforce and the limited domestic supply of adequate skills. Expatriate workers account for about three-quarters of the total workforce in most GCC countries,

IV. TECHNOLOGY TRANSFER TO THE GCC
As the case with most developing countries, GCC states depend on imported technologies in promoting and stimulating their economies. The abundant financial resources raised from oil revenues enable GCC states to acquire the latest technologies worldwide. The acquired technologies are concentrated in six major fields: communications, medical services and equipment, petrochemical and chemical industries, military equipment, civil aviation industry and water and power stations. Turnkey is the dominant type of technology transfer[2].

It is well recognised that technological acquisition of sophisticated equipment, machines, tools and documents is only one part of technology transfer. An effective technology utilization or absorption by the recipient is a substantial part of technology transfer. The extent of absorption capacity is highly dependent on the indigenous technological capabilities of the recipient to
operate, maintain and modify the foreign technology [12].

Despite the rapid expansion in the imports of advanced technologies in the past decades, technology transfer to GCC is generally characterised as ineffective [2, 4]. According to the Annual Global Competitiveness Report (2010-2011) the GCC countries have limited technological capabilities. This report uses various pillars to determine the competitiveness of nations. Among these, two distinctive pillars are relevant to technological capabilities: technological readiness and innovation. Technological readiness measures the agility of economies in adopting existing technologies for the enhancement of productivity of industries. Innovation pillar is concerned with the ability of a nation to innovate and expand the frontier of knowledge. Both of these pillars have array of different components which reflect the complexity and level of competitiveness. To capture the technological readiness and innovation of the GCC countries a selection of these components is presented in Table 1. Each figure in the table represents the rank of the country worldwide.

Table 1. Technological readiness and Innovation of the GCC countries.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bahrain</th>
<th>Kuwait</th>
<th>Oman</th>
<th>Qatar</th>
<th>S. A.</th>
<th>UAE</th>
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<tr>
<td><strong>Technological readiness</strong></td>
<td></td>
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<tr>
<td>Availability of latest technology</td>
<td>28</td>
<td>55</td>
<td>59</td>
<td>25</td>
<td>43</td>
<td>8</td>
</tr>
<tr>
<td>Firm-level technology absorption</td>
<td>59</td>
<td>42</td>
<td>60</td>
<td>19</td>
<td>40</td>
<td>4</td>
</tr>
<tr>
<td>Laws relating to ICT</td>
<td>28</td>
<td>99</td>
<td>36</td>
<td>40</td>
<td>45</td>
<td>10</td>
</tr>
<tr>
<td>FDI and technology transfer</td>
<td>15</td>
<td>123</td>
<td>46</td>
<td>5</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Overall</td>
<td>35</td>
<td>49</td>
<td>64</td>
<td>28</td>
<td>44</td>
<td>17</td>
</tr>
<tr>
<td><strong>Innovation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Capacity for innovation</td>
<td>58</td>
<td>85</td>
<td>87</td>
<td>109</td>
<td>31</td>
<td>39</td>
</tr>
<tr>
<td>Capacity of scientific research institution</td>
<td>112</td>
<td>83</td>
<td>63</td>
<td>32</td>
<td>37</td>
<td>53</td>
</tr>
<tr>
<td>Company’s spending on R&amp;D</td>
<td>87</td>
<td>100</td>
<td>62</td>
<td>64</td>
<td>34</td>
<td>30</td>
</tr>
<tr>
<td>University-industry collaboration</td>
<td>101</td>
<td>99</td>
<td>53</td>
<td>38</td>
<td>37</td>
<td>39</td>
</tr>
<tr>
<td>Government’s procurement on advanced technology</td>
<td>18</td>
<td>114</td>
<td>12</td>
<td>5</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>Availability of scientist and engineers</td>
<td>42</td>
<td>72</td>
<td>102</td>
<td>13</td>
<td>47</td>
<td>28</td>
</tr>
<tr>
<td>Utility patents</td>
<td>90</td>
<td>30</td>
<td>40</td>
<td>46</td>
<td>45</td>
<td>38</td>
</tr>
<tr>
<td>Overall</td>
<td>60</td>
<td>83</td>
<td>55</td>
<td>36</td>
<td>32</td>
<td>27</td>
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</tbody>
</table>

Source: Global Competitiveness Report [14].
There are number of factors constraining the successful transfer of technology to the GCC countries. Most of these factors are particularly related to the considerable technological gap that must be bridged between the suppliers and the recipients. These factors can be grouped into the absence of technology strategy, the weakness of science and technology base and the lack of indigenous technological capabilities [2, 4, 12]. Each of these factors is elaborated further.

A. Technology strategy

It is well appreciated that an appropriate technology strategy is a prerequisite for an effective transfer and utilisation of imported technology. Most of the industrialised nations have taken concrete steps towards building essential components of their national technology strategies. Ford (1988) defines technology strategy as the policies, plans and procedures for acquiring knowledge and the ability of the organisation to manage that knowledge and exploit it for profit. Abdulrahman (1999) suggests that technology strategy should be implemented through the adoption of technology plans as integral parts of a national development plan. The technology plans should embrace essential responsibilities such as budgeting, management, coordination, stimulation and execution of technological activities and cover specific requirements at the sectoral and inter-sectoral levels for the assessment, transfer, acquisition and adaptation of technology. In other words, these plans should reflect short-term, medium-term and long-term strategies, including the determination of technological priorities and the identification of sectors in which imported technology would be required.

Despite realising the great importance of technology for their development and industrialisation, it seems that most developing countries are not yet able to employ effective strategies and policies for successful transfer of technology [14]. It is widely evident that any technology involves four major components: organisational strategy and structure, the know-how, the human side of a system and the physical part of that technology [13]. It seems that little attention has been devoted by developing countries to the first three components while the main focus has been on the last one.

The situation in the GCC counties is no different. As indicated earlier, the GCC states rely intensively on oil and oil-related exports for economic and industrial development. The nature of the development projects can be described as “explosive” due to the abundance of oil resources and the surge in oil prices since the 1970s. As a result, the GCC governments have adopted a heavy import-oriented strategy for the development of
their infrastructure projects without any remarkable effort to establish and augment a technological and scientific base, through a coherent and explicit technology strategy governing in order to benefit from technology transfer process [2, 3, 4].

B. Science and technology base

There is no doubt that institutions that plan and carry out development strategies are desperate for the development and augmentation of a technological base, and hence the technology transfer process. This is because they incorporate the technical, commercial, managerial, and financial and research expertise required to diagnose problems effectively and to select and fully absorb technologies. Although the GCC states recognise the crucial contribution that technology makes to economic development, their interest in building and developing a technological base started late, with limited efforts and modest pace. These efforts have so far focused on setting up a few technological and research institutions. The main objectives of these institutes are:

• to measure and analyse economic and social developments and public opinion pertinent to national issues,
• to conduct scientific research and studies concerned with the progress of national industry and which facilitate the preservation of the environment,
• to explore and study natural resources and means for exploiting them, energy and water resources, and methods to improve agriculture and develop aquatic resources,
• to render scientific, technological and research consultation services to the government and to the national establishment,
• to follow up the development of scientific and technological progress, and adapt it in ways that conform to the local environment.

The contribution of these institutions and centres to the technological and industrial development of the GCC countries has been limited, particularly in demonstrating the necessity of formulating a technology strategy\textsuperscript{1}. The absence of an explicit national technology strategy, the weak coordination between these institutes and governmental and industrial sectors and the lack of seriousness and commitment on the part of the government in implementing the recommendations of these institutes are the major factors of this limitation [4]. In addition, these institutions tend to be bureaucratic and unresponsive to needs of industries.

Another factor that contributes to the augmentation of science and technology base is the percentage of the GDP that is dedicated. The

\textsuperscript{1}It is worth mentioning that in 2003 the Kuwait Institute for Scientific Research (KISR) has proposed a national scientific and technological policy to the government of Kuwait but not yet approved.
funding of science and technology in the GCC countries has an average of 0.31% compared with 2%-3% in the industrialised countries[16]. This figure (0.31%) is far less than the minimum percentage (1%) for an effective science and technology base which is specified by the United Nations Educational, Scientific and Cultural Organisation [3].

C. The indigenous technological capability

One of the most crucial factors affecting the success of technology transfer is the presence of a certain level of indigenous technological capability in the host firm[7]. Ernst et al. (1998) define technological capability as the variety of knowledge and skills (managerial and technical) that organisations need to acquire, assimilate, use, adapt, improve and generate new technology. All these processes require continuous technological effort; in other words, the ability to use technological knowledge effectively. According to Enos (1991), technological capability has three main components. First, it exploits a complex mix of human skills that embody technical knowledge. The second component is the “institution” through which all the technical knowledge incorporated in individuals is assembled and applied. At the macro level the institution that facilitates such collaboration is the government, whereas at the micro level this role is played by the enterprise. The last component is a common purpose which is necessary to ensure that the result of this assembling of skills is productive. This implies that a firm whose managers are interested in any objective other than that of mastering and improving their production methods is unlikely to become technologically capable. A common purpose is needed to encourage excellence in the application of the technology. If a nation has been unable to sufficiently develop its indigenous technological capability then it has to obtain technology through transfer from other resources, mainly from developed nations.

The lack of indigenous technological capability constitutes a major obstacle in the success of foreign technology importation to the GCC states. In particular, they sustain an incisive shortage of indigenous skilled human resources at all functional levels (i.e. engineers, technicians, specialists, operation managers, etc)[4]. Table 2 lists the percentage of the expatriates of the total labour force for each GCC state2.

Table 2. The labour force in the GCC.

<table>
<thead>
<tr>
<th>State</th>
<th>% of expatriates of the total labour force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>80</td>
</tr>
<tr>
<td>Kuwait</td>
<td>79</td>
</tr>
<tr>
<td>Qatar</td>
<td>84.8</td>
</tr>
<tr>
<td>Oman</td>
<td>81.5</td>
</tr>
<tr>
<td>S. A.</td>
<td>88.4</td>
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</table>

2 It should be noted that these figures include non-industrial labour, such as house work force.
This shortage accounts for the GCC states’ inability to establish a real partnership with foreign contractors who execute the vast majority of the advanced technical projects in these countries (i.e. power plants, communication networks and centres, civil aviation industry, industrial factories, etc.). Normally, the foreign contractor avoids any authentic technology transfer and concentrates on a technology-free transfer process – that is, transfer of capital goods unaccompanied by the transfer of scientific equipment and technical expertise and skills related to the imported machines and instruments [11]. While it is true that some training programmes are executed for the recipient countries’ workforce in the plants, there is no real technological partnership in the field of planning and the initial establishment of the industrial projects. Thus, this situation not only increases the dependency of Gulf States on the technical know-how of the advanced industrial countries, but they cannot guarantee the viability of their instruments without the participation of foreign contractors[2].

Another factor that inhibits indigenous technological capability is the incorrect conceptualization among many planners and decision makers of the technology transfer concept which involves technical know-how besides the physical items. The vast majority of the top management in the developing countries view technology transfer process as moving machines, tools and equipment. It is claimed that managers for years thought and acted as if technology transfer were that simple. However, shipment of human skills, knowledge and culture is, on the contrary, quite different from moving physical things[5].

The following brief case demonstrates the inefficiency of the technology transfer process to the GCC countries.

The petroleum sector case

The petroleum sector is the largest and the most capital-intensive sector in the GCC countries. The GCC countries collectively possess nearly 54% of the world’s conventional oil reserves, and large additional amounts of unproved and undiscovered reserves [10]. The petroleum sector in GCC is quite a robust, highly promising industry forming the backbone of economic growth for over decades. Consequently, the GCC states have invested intensively in constructing, developing and modernizing the infrastructure of this sector. All oil companies in the GCC are fully owned and subsided by the governments. In 2012, the GCC states produced over 25.2 million barrels of oil per day, accounting for over 30% of the world’s oil production. This production yielded revenues of
over $572 billion to the GCC, which represents more than 90% of the total GDP [10].

Despite the significance of this sector and the decade of accumulated experiences, GCC states remain highly dependent on foreign technical assistant in managing this sector. By managing we mean sustaining the development, operation and maintenance of the sector. The dominant form of technology transfer in this sector is turnkey[2]. Turnkey contracts or projects are normally applied when the transferred technology is highly complex, whereas the scientific and technological infrastructure in the recipient country is poor. Very often, the foreign contractor through turnkey type, avoids any authentic technology transfer, and concentrates on a technology-free transfer process [11]. This form has widened the technological gaps in the GCC states and perpetuated technological dependency.

V. CONCLUSION

The transfer of technology to the GCC countries has contributed greatly to their enormous development in terms of industrial infrastructure and standard of living. Although the GCC technology trade has increased during the past five decades, technology transfer to the GCC states has remained very limited. It seems that the attempt of GCC to quickly and dramatically transfer their economies and societies elucidates their weak or non-existent indigenous technological capabilities and hinders the success of the transferred technology. It appears that these difficulties emerged and accumulated as a result of various factors. The absence of technological strategy that regulates technology transfer process, the weakness of science and technology base and the lack of indigenous technological capabilities are the prime factors that account for such limitation. Unless there are vigorous policy measures and strong governments’ backing and commitment toward developing, augmenting and sustaining technological base, technology transfer process to the GCC states will remain ineffective.

REFERENCES


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