Assessing and Furthering Technology Transfer in the Gulf Cooperation Council Countries

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Abstract

In this study, we assess the gulf cooperation council countries' technology transfer (TT) framework to determine whether GCC has the foundation and structure necessary for a successful technology transfer. This study describes the challenges and obstacles facing the GCC countries in implementing TT. In addition to providing suggestions to maximize community benefits, promote TT locally to increase local self-sufficiency, and provide the necessary recommendations to increase its effectiveness and value.

Keywords.

Turnkey method, FDI, joint ventures, Center for Technology Transfer, advanced technology

1. Introduction

Technology transfer (TT) is a protracted, complex, and multifaceted process impacted by several variables from various sources. It includes the adoption and use of the technology in the receiving organization as well as the transfer of technological assets, knowledge, and implicit knowledge from one organization to another. The effective transfer of relevant technologies is essential for the long-term sustainability of developing nations' economies and societies.

Technology transfer is not a brand-new phenomenon. The spread of technology happens naturally through commercial and military contacts, skills, technology, and abilities are transferred from one culture to another. Prior to the colonial era, technology and invasions were frequently transferred from the East to the West. The majority of today's debate about technology transfer is around North-South technology transfer. On the other hand, technology transfer between industrialized countries takes place on a far larger scale.

The direct acquisition of capital goods and equipment, national training in specific technologies, and the engagement of foreign specialists and consulting firms are all examples of direct transfer channels. The development of wholly owned subsidiaries by foreign corporations, developing turnkey plants and facilities, and joint ventures with regional businesses are examples of indirect strategies. We have to acknowledge there will always be a technical divide between developed and developing nations. Due to the European industrial revolution and the rise of highly industrialized advanced ~~nations~~, this gap has been widening since the early nineteenth century. After gaining independence, less developed nations worked to close the technological divide because advanced technology is the cornerstone of economic development.

Technology is transferred and commercialized through official and unofficial channels, t. Training and education, hiring of students and researchers from universities and businesses, sharing tools and equipment, technology services and consulting, sponsored research and R&D cooperation, and other mechanisms are examples of formal channels. Figures 1 and 2 show the technology transfer life cycle and various important stakeholders involved in the process, respectively.

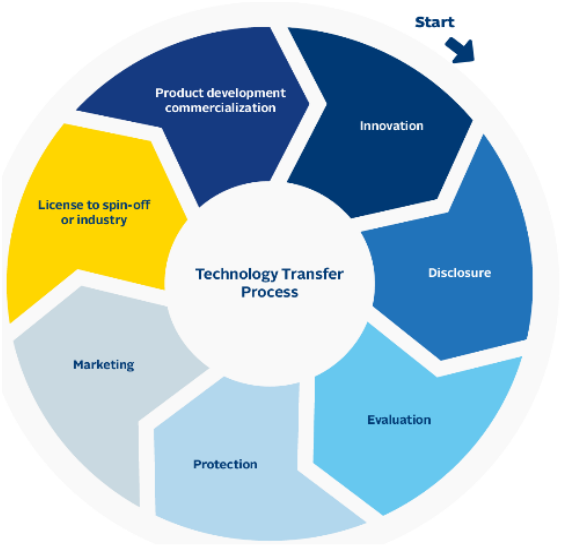

Figure 1. Technology Transfer life cycle.

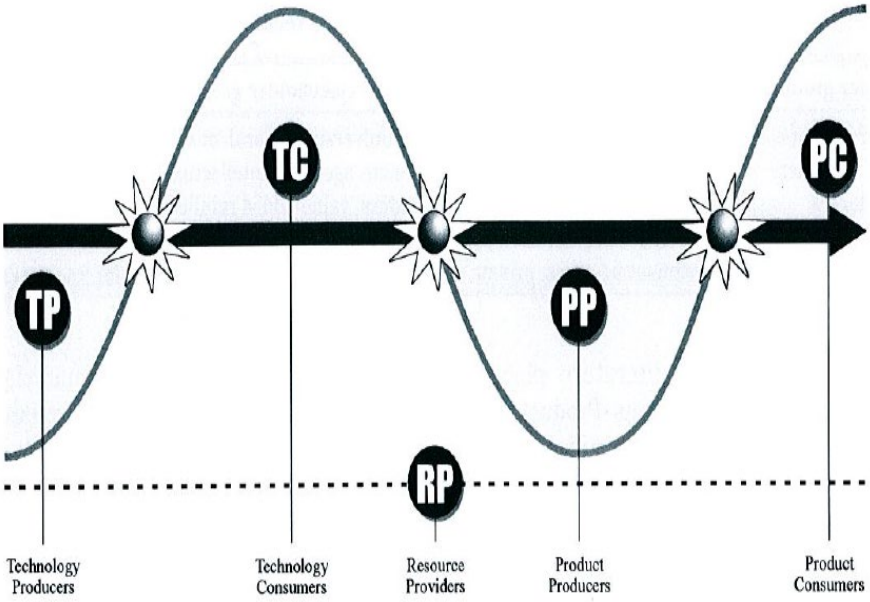

Figure 2. The five stakeholder groups involved in Technology Transfer

The literature is full of publications highlighting different aspects of technology transfer. Battistella et al. (2015) presented a thorough review of the literature. Other studies portrayed various aspects of TT, for example, Sazali et al. (2012) described the different technology transfer concepts. Meanwhile, Antwi-Afari and Fugar (2014) discussed the various types of nabling factors for technology transfer, such as the transfer environment, learning environment, transferor characteristics, and transferee characteristics. Alkhazaleh et al. (2022) study summarized, analyzed, and criticized the actual models and their influential variables for industrial technology transfer. One of the findings of this study is the significance of cooperation between technology recipients, agents, and inventors for technology transfer success. Arenas and González (2018), on the other hand, went into considerable length about the technology transfer that occurs as a result of university-industry collaboration.

Understanding technology transfer from research organizations, especially universities, to industry is crucial when the technologies' goals are to improve the industry's environmental and/or social characteristics as well as to maximize the return on investment for both funders and society at large (Good et al., 2019). Panmaung et al. (2020) pinpointed the components and metrics ~~that determine~~ whether technology transfer programs in Thai SMEs are successful Singhai et al. (2021) built a conceptual model and conducted an empirical analysis. A survey was created and distributed to ~~key~~ technology transfer stakeholders. The five most important criteria for successfully transferring technology were discovered to be communication, innovation, expertise, product quality, and drive.

The Gulf Cooperation Council (GCC) nations want to become developed nations, and technology transfer could offer alternative ways to achieve rapid growth and long-term development by replacing labor with capital. If these nations are to have a chance of achieving their goals, forceful policy measures and solid government support must be implemented (Al-Rouubaie and Al-Zaye, 2006). According to Al-Mubaraki and Busler (2012) Innovation, entrepreneurship, and technology commercialization (IET) are essential aspects of economic diversification and development. This article has also examined the impact of IET on the economy, policy, and industry of the GCC states and developing countries.

Elmuti and Abou-Zaid (2014) explored the benefits and challenges of exporting technology to GCC countries. According to the research, these countries have resources and incentives available to investors but lack industrial management and technical skills among the country's small population, as well as residents' resistance to new technology. According to Aljawareen (2017), innovation entails the creation of higher-quality products and services that, when combined, result in a higher quality of life.

In his article, Shkvarya (2019) presented a historical overview of the TT process in the GCC countries. The author emphasized that the GCC countries are making significant efforts to acquire high technology with some success in the petrochemicals industry, telecommunications systems, and medical devices, but they face many challenges. According to the author, these nations should work together with the rest of the world to find solutions to the problems they are currently facing.

2. Technology Transfer in The GCC Countries

The six nations were established in 1981 and comprise the Gulf Cooperation Council—Kuwait, Qatar, Saudi Arabia, the United Arab Emirates, Oman, and Bahrain—all border the Arabian Gulf and have demonstrated annual growth and fiscal surpluses—. GCC GDP total: $1,418 billion (2021). The GCC countries are adjusting to shifting global economic conditions but are up against several obstacles, including a continued reliance on government sector spending to spur recovery in the post-pandemic era and a high dependence on energy sector-related revenues in most states.

The GCC countries' quick rise in income and power because of skyrocketing oil prices in the 1970s and their economic expansion were significant drivers of technology transfer. Only a few of the numerous obstacles included reliance on oil, a lack of adequate infrastructure, a shortage of workers with technical skills, and regional political and social tensions and conflicts.

The GCC began transferring technology to their nations at the beginning of the 1970s of the previous century, believing that doing so would enable them to quickly achieve their goals of economic growth while also overcoming some of the challenges faced by industrialized nations. The companies exporting this technology concentrated on their interests, what benefited their aspirations and financial gains, and did not give much thought to the extent of their impact on importing nations. As a result, things were not as straightforward as they might have been.

The GCC countries have adopted several technology transfer approaches. Early-stage development projects frequently adopt a turnkey structure. The contract for implementing this method stipulates that the executing company will provide engineering designs for the project, supply machinery and equipment, carry out installation works, and provide other legal means by which the foreign company is ready to deliver a complete factory per the agreed-upon performance standards.

The method of joint projects is advantageous to both the technology's suppliers and consumers. In this case, the local nation is involved in the management and supervision of the project in conjunction with a foreign company, and the local partner staff gains extensive experience in both technical and administrative knowledge. Furthermore, since the foreign partners avoid losses brought on by the project's implementation ~~being~~ delayed, it will facilitate implementation, management, supervision, and financing.

Another method of TT is foreign direct investment (FDI), which is a type of cross-border investment in which an investor from one country acquires a substantial amount of control and a long-term interest in a business from another country. Contrary to other forms of capital flow, FDI always brings more resources, technology, administrative and regulatory know-how, and access to the export market. Another area of TT is capital goods imports. Capital goods are

assets to produce the goods and services used by businesses and that include businesses use/ or operating, including structures, machinery, tools, and equipment (Table 1).

Table 1. FDI inflow distribution among ~~Arab~~ countries in 2020

Destination Countries	Number of Projects	Capital Investment (million USD)	Average Capital Investment (million USD)	Jobs Created	Average of Job Created	Number of Companies
UAE	347	9,139	26	14,729	42	336
Saudi Arabia	73	10,411	143	8,780	120	64
Morocco	54	2402	45	11813	218	49
Egypt	43	1387	32	6096	141	42
Oman	23	6,119	266	2,396	104	22
Qatar	20	915	46	1,000	50	19
Bahrain	15	883	59	1,547	103	15
Tunisia	9	482	54	3707	411	9
Kuwait	9	200	22	511	56	9
Algeria	6	77	13	251	41	6
Jordan	6	248	41	225	37	6
Lebanon	3	84	28	84	28	3
Sudan	2	319	160	2572	1286	2
Djibouti	2	101	51	109	54	2
Iraq	1	1063	1063	97	97	1
Somalia	1	94	94	72	72	1
Mauritania	1	11	11	14	14	1
Libya	1	0	0	7	7	1
Total	**616**	**33,935**	**55**	**54,010**	**87**	**529**

Source: FDI Markets (Investment in the Arab World 2021)

3. Analysis and Evaluation

The GCC nations initially embraced the turnkey method before switching to alternative technology transfer strategies like joint ventures, foreign direct investment, importing capital goods, management, and licensing agreements. We'll assess these methods and see how they affect the Gulf region's economy.

- Among economic experts, the Turnkey method: has many critics, the main reason is that major companies with a turnkey contract bring their entire equipment along for assembling their projects, limiting and restricting participation by national institutions and local labor. Turnkey contracts also stifle the expansion and development of local engineering services. Turnkey method deprives and denies domestic and national citizens of the GCC countries to benefit from learning and gaining skills and knowledge from a foreign company. These industrial projects are ready-made, which will obstruct progress. Helpless in the face of issues involving transferred technology forced the GCC countries to rely on the support and assistance of foreign experts. In a nutshell, this approach minimizes and ignores the contribution of regional scientific research to technology development.

- The GCC countries' joint projects strategy, which involves establishing industrial ventures with local partners, hasn't worked well, as previously mentioned. The foreign spouse broadens his knowledge and talents, while the local partner narrows his skills.
- While some economists believe it will have a negative effect, others believe / think it will have a significant positive impact on the quality and effectiveness of future investment. The opposing view asserts that this justifies the investment's drawbacks, which prevent it from aiding developing nations in achieving technical independence.
- Such a crucial relationship is absent in the GCC countries, despite the degree of correlation between business unit plans and R&D activity being a deciding factor in technology development.
- The GCC countries only spend a small portion of what developed nations budget for R&D. For instance, the GCC Countries spent just 0.3% of their GDP on scientific research in 2021, compared to 3.1%, 2.21%, and 3.3% in the US, China, and Japan, successively.
- As the leading consumer of innovations resulting from research and development, the GCC industrial sector typically engages in little to no research and development. Moreover, the local scientific research institutions are still under scrutiny ~~from~~ the business community. Furthermore, The Industrial sector does not provide any grants to conduct research or collaborate with the universities
- Government-funded R&D teams have not produced enough economically and commercially viable technologies.
- The GCC countries did not cooperate in any way, i.e., they did not have a consistent plan for sharing technology with other Arab nations.

4. Conclusions

In recent decades, technology has been the primary factor defining a nation's scientific capacity and, as a result, its capacity to maintain national security. The mere transfer of technology represents only the transfer and use of particular machines; the transfer of technology goes beyond that and involves the possession of technology by influencing its constituent elements.

The countries of the Gulf Cooperation Council have adopted a range of technology development strategies, from turnkey projects to industries that depend on imported raw materials like iron, steel, aluminum, cement, steel, and rebar. The market required petrochemical projects and production disposal, known as technology-free transportation. If the GCC countries benefited from the joint venture method, it seemed to be marginally superior to the first method due to the foreign partner marketing half of the product, the quick setup of the project, which in the best cases did not take longer than three years, and the training of local human cadres to be able to manage projects, but this is not necessarily the case.

The GCC nations have not developed their scientific and technological capacities despite more than four decades of technological warfare, at least in producing spare parts and using alternative production techniques. The GCC countries have been and will continue to rely on foreign expertise because they relied on importing the best Western technology rather than adapting and developing their industries.

External dependency can be seen in the promotion of a product, the use of foreign checks to fund projects, and the acquisition of organizational skills, experience, and knowledge. Multinational firms were able to impose their terms and reap enormous profits through direct investment, regardless of the capabilities of the recipient countries to do so. The ability to breed and adapt technology in a manner that makes foreign investment react to disparities in marginal productivity, i.e., capital flows from abundant to scarce locations.

5. Recommendations

1. Launching a Gulf Center for Technology Transfer. The function of this center is to be an information base for all types of technology, such as providing the center studies on the nature of technology suitable for economic sectors. The center can also conduct future studies on energy and its alternatives, especially in light of fluctuating oil prices and instability. Studies of investment plans projects setting up a system for exchanging information with governmental and non-governmental institutions.
2. Establishing a separate organization to coordinate science and technology at the level of the GCC nations and fostering collaboration between funding sources and those who will benefit from the research necessitates an efficient administrative framework at every level of scientific policy. University science departments are

the first stop, followed by organizations that conduct scientific research, and finally a Supreme Authority for Scientific Policy and Technology.

3. Developing a technical unbundling strategy to enable the use of local talent and input from other industries, fostering the growth of local capacities and expertise. Thus forming a precise and thorough payment plan that outlines the sources of the costs for the various components and activities of the technology package is necessary. Local stakeholders should be involved in the makers' decision-making processes at different levels and increase their participation at each stage of project implementation at each stage of the project. A thorough and intensive training program should be designed, including operations and maintenance, and fostering and promoting local community involvement during the detailed engineering stages.
4. Developing new technology, encouraging and motivating scientists and researchers to conduct serious scientific research, patent registration, and application is one of the most important requirements for developing a national technology.
5. Encouraging research and development organizations to work closely with businesses and industries to gain businesses' confidence and increase their willingness to spend money on R&D. Several methods exist for achieving this.
6. Providing support .and incentives to researchers who conduct projects in applied research with industry

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Biographies

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Mohammed Hajeeh is a research scientist in the Techno-Economics Division (TED). He Holds a Bachelor of Science (BS) degree in Nuclear Engineering, Master of Science (MS) in Mechanical/ Nuclear Engineering and a Ph.D. in Operations Research. During his employment at KISR, he has participated in and contributed to several research projects. He has published papers in various topics in different international referred journals and conference proceedings. He has conducted courses inside and outside KISR in the areas of Statistics, Statistics, Linear Programming, Operations Management, Design and Analysis of Experiments, and Mathematical Analysis.