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Assessment of Technology Transfer to Gulf Cooperation Council Countries

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Abstract:

Purpose: *In this research study, we seek to assess the framework of technology transfer process in Gulf Arab (GCC) countries and determine whether these countries have the necessary structure and foundation for successful technology transfer. In addition to identifying the obstacles and barriers that these countries experience in implementing TT as well as proposing ways to maximize its benefits to the community, as well as promoting them locally to help improve local and self-capacity.*
Design/Methodology/Approach: *We will present the various methods of technology transfer to the countries of the Gulf Cooperation Council and indicate the most important considerations that must be taken into account when initiating technology transfer and developing local capabilities and the effective methods that must be followed when dealing with technology exporting companies.*
Findings: *The GCC countries are adapting to changing global economic conditions, but are facing several challenges such as a still high dependence on energy sector related revenues in most states, and the ongoing reliance on the government sector to drive recovery in the post-pandemic era. A crucial driver of technology transfer was the GCC countries' rapid gain in income and power as a result of soaring oil prices in the 1970s, as well as their economic expansion.*
Practical Implications: *Technology transfer plays a crucial and essential role economic and technical progress, nevertheless, it is inhibited in some countries by a lack of finances to buy contemporary technology, while it is hampered in others by a paucity of local technical people; it is also affected by social and political difficulties.*
Originality/Value: *The article gives a thorough overview of the TT process in Gulf as well as necessary recommendations for enhancing its effectiveness and usefulness.*

Keywords: *Technology transfer, Gulf Cooperation Council, R&D.*

JEL Classification: *O2, O3.*

Paper type: *Research article.*

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1. Introduction

Technology transfer (TT) is a long, intricate, and diversified process that is influenced by a number of factors coming from a variety of sources. It includes the transfer of technological items, knowledge, and implicit knowledge from one organization to another, as well as the adoption and use of the technology in the receiving organization. Policymakers, practitioners, and academics around the world have shown a growing interest in technology transfer in recent decades.

TT has attracted researchers from a wide range of disciplines, including economics, marketing, history, ethnography, engineering, and political science. TT has been recognized by the United Nations as a tool for improving sustainability. Because modern technology is more economically viable, ecologically friendly, and has higher social potential for developing countries, it is a vital avenue to achieving sustainability.

The successful transfer of appropriate technologies is critical for developing countries' economic and social progress, as well as for their long-term viability. Technology transfer has been and continues to be a popular topic among academics, as well as managers and entrepreneurs looking for relevant information in academic journals. Technology transfer research discoveries and theoretical breakthroughs expand at a rapid rate, as they do in so many other popular study fields, particularly those investigated by academics from a variety of disciplines.

Transfer of technology is not a new phenomenon. The diffusion of technology is a natural occurrence. Techniques, technology, and abilities are passed down from one culture to the next as a result of commercial and military contacts. Technology and invasions were usually transferred from East to West previous to the colonial period. 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. Today's leading sources of technology are the United States, the United Kingdom, and China, with Japan, Western Europe, and Australia accounting for 80-90 percent of technological transfers.

Informally, technology is commonly handed on through personal relationships, literature reading, and professional meetings. These could be considered inputs to the techno-system framework's training and R&D subsystems, and hence not immediately important in productive operations.

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. Indirect approaches include establishing wholly owned subsidiaries of foreign companies, turnkey plant and facility development,

and collaborative ventures with local companies. A technical barrier between developed and developing countries is unavoidable, and it must be acknowledged.

Since the early nineteenth century, this gap has been expanding as a result of the European industrial revolution and the emergence of highly industrialized advanced countries. Less developed countries strove to close the technological gap after gaining independence, as superior technology is the foundation of economic growth.

A common definition of technology commercialization is the act of bringing an idea to market and generating financial value generally through the licensing of an innovation, the development of a new product or service, or the establishment of a new company. Commercialized products or services may be "new to the world," "new to the region," or "new to the country."

Technology transfer and commercialization (TTC) occur via, both, formal and informal channels. Formal channels include training and education, hiring students and researchers from universities and industries sharing of equipment and instruments, technology services and consultancy, sponsored research and R&D collaboration, and other mechanisms. Informal channels include the transfer of knowledge through publications, conferences, and informal exchanges between scientists.

Technology transfer and commercialization do not evolve naturally and linearly from research and the discovery of scientific solutions. Often, unfavorable economic conditions and inadequate supply of complementary services form obstacles for their completion, while their execution is a multi-actor and multi-stage process in which chance may also play a role. Furthermore, technology commercialization is a method of utilizing research-based technology in either production or consuming activities so that the researcher can profit from the activity (Sutopo, 2019).

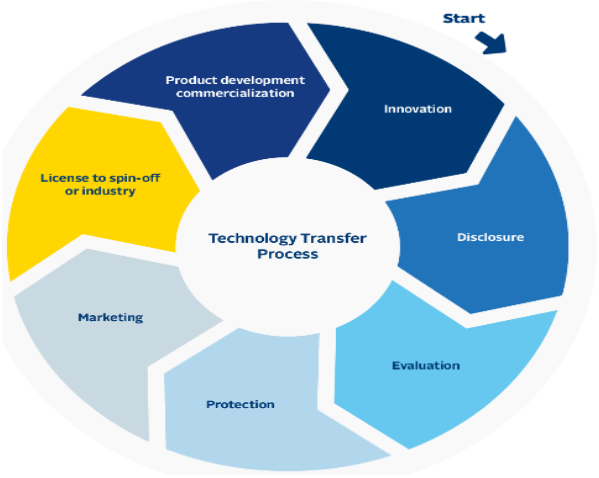
Many technology products developed as a result of research have failed to reach the market as a result of the hurdles that frequently arise during the transition from technology development to technology commercialization. As a result, urgent action is required to speed technological commercialization in order to ensure that the commercialization potential of research output does not become trapped (Kusuma *et al.*, 2015).

The importance of university-based research and R&D research institutes in the innovation process is significant. The foundation of applied technology is basic research that leads to fundamental discoveries. Understanding how to make it easier to translate research into marketable products is a difficult task. Experts recognize that research translation is both an art and a science that necessitates a delicate balancing act between research, its funding mechanisms, government, and industry.

Furthermore, identifying gaps in processes, incentives, and support systems is crucial for building on research translation's accomplishments as well as future growth prospects. Because they are technology developers and providers, and their activity is linked to science and academia on one side of the R&D process, and industry on the other, R&D Centers and institutions play an important role in ensuring the quality and efficiency of R&D activities.

The proper selection of technologies to acquire and develop is one of the most important actions in achieving the above-mentioned goals. This is critical for every technology-related firm, but especially for R&D centers (FDI, 20121). A Detailed description of the TT process and the different stakeholders are being given in Figures 1 and 2, respectively.

Figure 1. *Technology Transfer life cycle.*



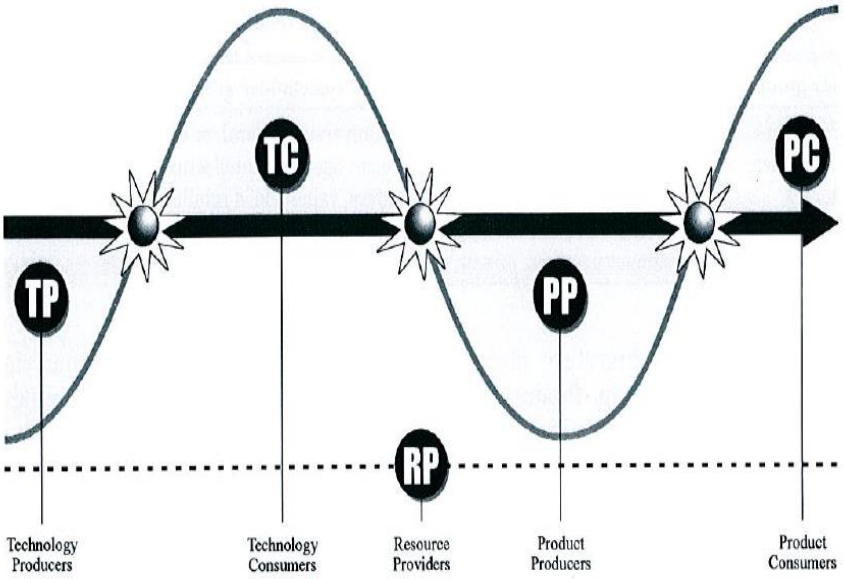
Source: *Own study.*

2. Literature Review

The transfer of technology is a critical stage in the scientific and technical development process because, when completed successfully, it adds economic and social value to the resources available for development. Technology transfer is an important part of the innovation system and one of the characteristics of academic entrepreneurship.

There are numerous publications in the literature that highlight various elements of technology transfer. Several authors offered a thorough analysis of the literature; for example, Battistella *et al.* (2015) provided a summary of the key features of technology/knowledge transfer. Meanwhile, Sazali (2012) examined the various concepts utilized in technology transfer in depth.

Figure 2. *The five stakeholder groups involved in Technology Transfer*



Source: *Own study.*

This evaluation also offered suggestions for future scholars interested in learning more about transfer technology theories. Bozemana *et al.* (2015), on the other hand, conducted a review of the literature on the effectiveness of technology transfer, focusing on empirical studies on technology transfer in the United States.

Antwi-Afari (2014) discussed the various types of enabling factors for technology transfer, such as the transfer environment, learning environment, transferor characteristics, and transferee characteristics, as well as their contributions to economic advancement, knowledge advancement, and project performance. Technology is considered as an essential precondition for improving productivity, attaining industrial development, and promoting export growth (Lakhera, 2016).

Mazurkiewicz and Poteralska (2015) reviewed a number of classifications of technology transfer barriers found in the literature, as well as the analyses cited. Technical, organizational, and legal constraints, as well as system barriers were identified as the most major impediments to technology transfer. Whereas, the most significant system barriers to technology transfer for R&D organizations appear to be those resulting from poor financing mechanisms for implementation procedures.

According to Vick and Robertson (2017) and Mascarenhas *et al.* (2018), European legislation has made it simpler for academics and businesses to collaborate, resulting in more patent registrations as well as technological and organizational breakthroughs in this complicated process. Universities and industry, on the other hand, share a range of formal and informal transmission mechanisms.

As a result, informal transfers are more common than formal patent licensing, such as employing a fresh graduate or reading scholarly publications. 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.

Research funded and supported by the government has a significant impact on economic and social development. It aids in the development of innovative methods, imparts practical information, produces qualified and skilled graduates, and enhances instruments and experimental methodologies. The economic benefit of publicly funded research, according to Dalton and Guei (2003), is many times more than the annual investments.

As the relevance of academic science on economic growth, competitiveness, and innovation has been acknowledged, the importance of technology transfer from science to the industry has grown significantly (OECD, 2003). A company's access to complementary information through technology transfer can lead to game-changing advances in the private sector (Pham *et al.,* 2022). Furthermore, technology transfer generates new ideas, answers, or treatments for current technical issues (Bercovitz and Feldman, 2006).

The process of transferring technology in order to strengthen the ties between research and the economy is known as commercialization. Knowledge and technology are transferred from universities and research institutes to industry through this method. Infrastructure, technical, social, and political challenges, among other things, all have an impact on commercialization.

According to Shaverdi and Baghdadi (2010), a good commercialization team should have experience in invention, investment, technology, and entrepreneurship. The economic impact of patenting and licensing as a source of technology transfer and job creation is one of the incalculable benefits of patenting and licensing. Because patenting and licensing are directly observable and accessible, they are the focus of the literature (Markman *et al.,* 2008).

The policy system has a significant impact and a decisive role on the efficiency and effectiveness of technology transfer (Mowery *et al.,* 2015). It is difficult for technology transfer lt to succeed in an environment within a country or region where the government intervenes frequently and places substantial limitations on foreign-funded businesses (Higgins, 2015). Policies of technology-importing countries or regions have a direct impact on the technology transfer in the scientific and technical content and quality (Alam *et al.,* 2016).

Human resource availability, knowledge level, productive force development, and technology have a considerable impact on the transfer of technology (Sanchez *et al.,* 2015). Technical competence is the foundation for technical development, and worldwide technical talent transfer is the most common, with a favorable impact on

all technology development (Eliasson, 2012). More technical staff exchanges are needed in developing nations. Managing technology transfer from universities to the private sector necessitates highly trained personnel and multidisciplinary teams with legal, business, scientific, and licensing skills (Mowery *et al.*, 2015).

The role of technology in achieving sustainable socioeconomic development in the twenty-first century is emphasized in literature. Planning for technology transfer in foreign-funded projects is a vital issue, according to Ganesan and Kesley (2006). Within construction joint ventures, opportunities for collecting knowledge about designs and construction planning, education, and training programmers should be designed in order to train local enterprises on newly formed construction technologies and knowledge.

Stefan *et al.* (2020) studied the current status of transfer technology in Romania identifying the enablers and challenges. For this purpose a questionnaire-based survey was designed to determine the intensity with of the enablers/barriers among industrialists and other technology based organizations, and NGOs. Alizadeh *et al.* (2018) used structural equation modeling to conduct an empirical study to identify factors impacting technology transfer in Iran.

According to the findings of a questionnaire poll of experts law and policy, company capabilities, competent human resource, technological localization, and technical features were identified as having a substantial impact on technology transfer. Meanwhile, Awosusi and Awolusi (2014) investigated the long-run equilibrium link between numerous factors and Nigerian economic growth, as well as the short-term influence of foreign FDI, trade, and economic growth on international technology transfer to Nigeria.

Aiming at facilitating the transfer of low carbon technologies to the country, Talaei *et al.* (2014) aspired to identify existing low-carbon energy technologies that are compatible with Iran's energy sector and prioritize them using MCDM techniques and SWOT analysis to discover the most promising ones in order to promote low-carbon technology transfer to Iran. The role of technology in achieving sustainable socioeconomic development in the twenty-first century is emphasized in literature.

Ganesan and Kesley claim that (2006) a crucial necessity in foreign-funded projects is technology transfer planning. Within construction joint ventures, opportunities for collecting knowledge about designs and construction planning, education, and training programmers should be designed in order to train local enterprises on newly formed construction technologies and knowledge. Early involvement of local design and construction businesses will aid in the adoption and implementation of appropriate construction technology.

Stefan *et al.* (2020) studied the current status of transfer technology in Romanian identifying the enablers and challenges. For this purpose a questionnaire-based

survey was designed. To determine the intensity with of the enablers / barriers among industrialists and other technology based organizations, and NGOs, academics, businessmen, and entrepreneurs continue to find technology transfer to be a very interesting and intriguing issue.

On this topic, Bradley *et al.* (2013) gave extensive descriptions and bibliographies. The main factors of technology transfer, according to Reisman's taxonomy (2005), are the players' involved groups and areas, scientific groups, transaction types that cover various aspects, motivation for transferring technology, and whether the transfer is for economic, managerial, or other reasons.

The importance and difficulty of social relationships between actors in facilitating resource exchange and knowledge transfer was highlighted by the transfer of technological items, codified information, and tacit knowledge from one organization to another, as well as the adoption and deployment of technology in the receiving organization (Bozeman, 2000).

Between the first interaction between the technology originator and the adopter and the final deployment of the technology, the process of technology transfer is defined by Teece (1977). Universities and other research institutions routinely create breakthroughs with the objective of ultimate commercialization in mind.

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 as a whole, understanding technology transfer from research organizations, particularly universities, to industry is critical (Good *et al.*, 2019). The models presented by Kalnins and Jarohnovich (2015) emphasized the presence of an intermediary because the “emitter” of technology has different objectives, policies, and behaviors than the receiver.

Technique, knowledge, organization, and product are the four components of technology, according to Li-hua and Khalil (2006). Technology and knowledge transfer occur when foreign and local management work together on international joint venture projects, and technology transfer is impossible without knowledge transmission. According to Hirt (2012), technology is a critical strategic tool for both developed and developing countries in accomplishing their strategic goals.

Technology transfer is viewed as a huge market opportunity in industrialized countries, while it leads to the creation of wealth and development in developing countries.

This means that emerging economies that receive appropriate technology are on their road to wealth and economic advancement, and hence should be aware that their markets are considered as having a lot of promise for technology transfer, and prepared to take advantage of this potential.

Governments, according to Al-Ali (1991), must play a critical role in providing an acceptable legal framework to abolish any restrictions imposed by foreign enterprises. Developing countries must urgently establish laws and regulations on technology transfer in order to improve their own capacities.

Since R&D is tied to high technical and labor needs, and issues regarding its acquisition by a potential manufacturer may arise, technical hurdles are the most important and occur the most in an R&D organization's work. Furthermore, technology development is time-consuming, which may deter potential clients who want the technology built as soon as feasible.

In addition, their production is quite expensive due to the acquisition of breakthrough technology, making them less competitive (Mazurkiewicz *et al.,* 2015). Last but not least, the most crucial at the operational level is the implementation of specific initiatives.

The successful deployment of breakthroughs to economic applications is hampered by a number of hurdles to effective technology transfer. These impediments are defined as any limits that obstruct the efficient operation of a technology transfer system and, as a result, disrupt R&D organizations' collaboration with businesses in the implementation and commercialization stages.

Universities have progressively integrated their relationships with industry and society, as well as the continuation of technology transfer, to their traditional missions of teaching and research (Guiri *et al.,* 2019). Due to the vast amount of information created by universities, according to Battaglia *et al.* (2017), university technology transfer (UTT) plays an important role in bringing new technologies to a higher degree of economic advancement.

Furthermore, as a result of university-industry partnership, scientific knowledge has increased. According to Fischer *et al.* (2019), increased university participation in technology development in Brazil significantly increased the intensity and breadth of technology upgrading and innovation activity in the Brazilian national innovation system.

Additionally, Dagiliute and Liobikiene (2015) pointed out that higher educational institutions make a significant contribution to environmental sustainability in Lithuania by helping to shape an environmentally healthy society.

Universities are hampered by different university technology transfer hurdles as a result of the process's complexity (Mazurkiewicz, and Poteralska, 2017). Lack of resources (De Beer *et al.,* 2017), insufficient rewards for university academics (Belkhodja and Landry, 2007), a lack of appropriate collaborators, and the possibility of knowledge leaking are some of these impediments (Tartari *et al.,* 2012).

By interviewing expats working for multinational corporations, Elmuti and Abou-Zaid (2014) explored the benefits and challenges of exporting technology to GCC countries. These countries, according to the research, have a variety of resources and incentives available to investors, but they lack industrial management and technical skills among the country's small population, as well as local 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.

Despite their tremendous wealth and high per capita income, the Gulf Cooperation Council (GCC) countries suffer with innovation, according to his research. He attributed this to a number of factors, including low R&D spending as a percentage of GDP, a lack of people working in knowledge-intensive businesses, and a tiny proportion of high-tech exports compared to manufactured exports.

According to Al-Mubaraki and Busler, innovation, entrepreneurship, and technology commercialization (IET) are important aspects of economic diversification and development (2012). The impact of IET on developing countries like the Gulf Cooperation Council (GCC) has not been properly studied. The impact of IET on the economy, policy, and industry is examined in this article, with a focus on the GCC states and developing countries.

Using a questionnaire sent across the various organizations Panmaung *et al*. (2020) attempted to identify the elements and indicators that contribute to the success of technology transfer programs in Thai SMEs. The ability to recognize marketing demands, grasp scientific and technical elements in actual patents, and translate technical data from patents to actual production are the most essential success factors, according to the research.

To discover the factors that influence successful technology transfer, 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.

Arenas and González (2018) conducted a systematic analysis of the literature on technology transfer generated by university-industry collaboration and presented the technology transfer (TT) models. They provided a definition of the common elements in a transfer process, as well as a description of how the elements interact.

Direct transfer channels include the direct acquisition of capital goods and equipment, national training in specific technologies, and the engagement of foreign specialists and consultancy firms. Establishing completely owned subsidiaries of foreign enterprises, turnkey plant and facility construction, and joint ventures with local businesses are examples of indirect techniques.

According to Looney (1988), the principal source of concern in Saudi Arabia is the difficulties involved in transferring inventions from developed countries to a labor-rich environment. He also looked into the productivity patterns that have emerged as a result of modern technologies being imported into the industrial sector.

It is unavoidable that a technical barrier exists between developed and developing countries, and it must be respected. As a result of the European industrial revolution and the advent of highly industrialized advanced countries, this gap has been widening since the early nineteenth century. After attaining independence, less developed countries worked to narrow the technological gap by acquiring superior technology, as this is the foundation of economic prosperity.

Furthermore, there are two classes of technology transfer: vertical and horizontal. Vertical technology refers to the use of scientific output to develop new technology, and it is commonly encouraged in advanced and advanced industrial countries (Ramanathan, 1989). In essence, it is R&D organizations, universities, and laboratories are examples of organizations that move technology from fundamental to applied research, development, and manufacture in order to commercialize it or make it available to meet a social need.

Meanwhile, horizontal technology, which is widespread in developing countries that buy technology from advanced industrial countries, refers to the cross-industry or cross-country transfer of a commercialized technology, with reverse engineering and technology licensing as examples.

3. Technology Transfer in GCC Countries

The Gulf Cooperation Council (GCC) was established in May 1981, it comprises six countries including Kuwait, Qatar, Saudi Arabia, the United Arab Emirates, Oman, and Bahrain all located in the Arabian Gulf– had posted strong annual growth and fiscal surplus. GCC combined GDP $1,418bn (2021).

The GCC countries are adapting to changing global economic conditions, but are facing several challenges such as a still high dependence on energy sector related revenues in most states, and the ongoing reliance on the government sector to drive recovery in the post-pandemic era. A crucial driver of technology transfer was the GCC countries' rapid gain in income and power as a result of soaring oil prices in the 1970s, as well as their economic expansion.

Oil dependence, insufficient infrastructure, a scarcity of technically qualified workers, and regional political and social tensions and conflicts were only a few of the many roadblocks. The Arab Gulf states, after correcting oil prices in the middle of 1973, attempted to adjust their economy in line with the requirements of the times, so as to achieve the development of technology and narrow technology gap that separates them from the industrially advanced countries.

Therefore, the Gulf Cooperation Council countries (GCC) at the beginning of the seventies of the last century to transfer technology to their countries, where it is believed that the transfer of technology from the industrialized countries is enough to achieve their aspirations of economic growth in a short period to overcome some of the difficulties experienced by the industrial countries.

Things were not so simple because the companies exporting this technology focused on their personal interests and what served their aspirations and financial benefits without much regard for the extent of their impact on importing countries.

In the following, we seek to assess the extent to which the GCC countries has benefited from these technologies, adapting them to serve the community, and promoting them locally in ways that contribute to strengthening local and self-capacity. Unfortunately, it has contributed to the generalization of economic and technology dependence on the industrially advanced countries.

Next we will present the various methods of technology transfer to the countries of the Gulf Cooperation Council and indicate the most important considerations that must be taken into account when initiating technology transfer and developing local capabilities and the effective methods that must be followed when dealing with technology exporting companies. The main transfer technology means are:

A: Turnkey method:

Projects in the early stages of development frequently take a turnkey format, which includes a comprehensive regulation of some legal means under which the foreign company is prepared to deliver a complete factory according to the agreed-upon performance standards, and the contract for the implementation of this method stipulates that the executing company will provide engineering designs for the project, supplying machinery and equipment, carrying out installation works, and then delivering the project ready for operation.

In some cases, the foreign party undertakes the project management process, its operation, and the preparation of technical and administrative staff until full production (the commodity by hand), implying that the technology is transferred in accordance with a complete technology package with no participation from the local party. The process of choosing a licensor is determined by the nature of the project and the technology used.

The licensor could be the technology's owner, a major supplier, or a foreign consulting office. The oil and petrochemical sector accounts for approximately 50% of turnkey projects, followed by cement, steel, iron, and aluminum factories, the majority of which rely on importing raw materials from abroad and re-exporting them to other countries.

The majority of the executing companies are American, Chinese, or Japanese, with a few Western European, Asian, and Australian companies thrown in for good measure.

***B: The method of joint projects*:**

Not being swayed by the feasibility of the turnkey approach in the implementation of industrial projects in the 1980s and 1990s, the GCC countries turned to a new technique of project execution, while concurrently accomplishing the following; obtaining extensive experience in both technical and administrative knowledge from a foreign partner in the establishment and management of industrial projects:

- Obtaining extensive experience in both technical and administrative knowledge from a foreign partner in the establishment and management of industrial projects.
- The large production capacity of industrial projects, which transcends the needs of the local Gulf market, as it benefits from the markets of foreign companies, as external marketing operations are carried out in accordance with an agreement that requires the foreign partner to market approximately half of the joint venture's total production in the foreign partner's markets, and in exchange, the partners agree to market their products in both the Gulf and the international markets.
- The time required to conduct economic and technical feasibility studies and implement projects is characterized by completion on time; in a shorter period than other project implementation methods, since the foreign partner avoids losses arising from the project's delay in implementation, he will provide ease of implementation, management, supervision, and financing, besides presenting reasonable justifications for future success in management, operations, and marketing.

The GCC countries prefer this equality, in which a local party and one or more foreign companies agree to implement a specific project with a joint capital agreed upon by the two parties, after which each partner's share of the project capital is agreed upon, and the foreign partner also provides all expertise required to establish the project, its operation, maintenance, and participation in management.

These projects demand a high level of investment management experience and competence, and as a result, they are high-risk. This was centered on forming a type of joint ownership partnership between an international and a local company to boost profits and gains. The ownership stake of the multinational corporation ranges from 10% to 90% with the majority of shares being between 25% and 75%.

Furthermore, the short time between the date of incorporation and the actual start of production, which is usually less than three years, leads in lower costs and a faster payback for the value of the projects completed. The GCC countries employed the

joint project method to implement several diverse cooperative projects throughout the first ten years of this century.

C: Foreign Direct Investment (FDI):

The GCC countries benefit from several factors that attract foreign direct investment, the most important of which is the presence of a large investment stream, particularly in the energy fields, which is expected to reach around 34 billion US dollars by 2020, in addition to the possession of energy sources, which serve as a strong incentive for foreign investment and have among the lowest operating costs in the world among other production areas.

A complete set of systems and methods for planning, organization, production, marketing, technical knowledge, and capital is presented to transfer technology. The size and components of the package vary depending on the foreign company's ownership share of the branch, which increases as the foreign company's share of the branch's capital increases until the package is complete with full ownership of the branch. In light of economic globalization, the Gulf Cooperation Council countries' efforts to encourage foreign direct investment aim to profit from superior technology controlled by multinational firms and vast capital, some amounting to thousands of billions of dollars.

Table 1 depicts a detailed breakdown of FDI allocation among Arab countries, including those in the Gulf Cooperation Council (GCC). FDI, unlike other types of capital flows, always brings additional resources, technology, administrative and regulatory knowledge, and access to export markets, all of which are supremely needed in developing countries (FDI, 2021).

D: Imports of capital goods:

The GCC countries transferred technology by importing capital goods directly from other countries. This strategy was one of the industrial demonstrations and applications utilized to aid the development of the Gulf economies. This is owing to the characteristics of these commodities, making them one of the most significant tools for technological advancement.

Where capital goods contribute to the development and multiplication of the source of social wealth and the flow of social income as a result of their contribution to capital formation. As a result, it performs the economic function of capital investment, and these commodities can produce both themselves and the means of production.

Capital products, such as machinery and tools, are key components of fixed capital in Gulf Cooperation Council countries, and play a critical role in the capital accumulation process.

Capital goods, on the other hand, are based on the manufacture of means of production and serve as a stimulant for technical advancement, and development in this industry demands access to a varied range of scientific know-how and news, as well as encouraging discoveries and inventions.

Table 1. *A detailed breakdown of FDI allocation among Arab countries*

New FDI projects distributed among Arab countries- year 2020						
destination countries	No of projects	Capital investment (USD m)	Average of Capital investment (USD m)	Jobs Created	Average of Jobs Created	No of Companies
UAE	347	9139	26	14729	42	336
Saudi Arabia	73	10411	143	8780	120	64
Morocco	54	2402	45	11813	218	49
Egypt	43	1387	32	6096	141	42
Oman	23	6119	266	2396	104	22
Qatar	20	915	46	1000	50	19
Bahrain	15	883	59	1547	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	33935	55	54010	87	529

Source: *FDI Markets, Investment in the Arab World 2021.*

***E: Management method*:**

This technology transfer approach comprises the transfer of organizational and administrative capacities to the industrial project through training programs and hands-on experience for administrators and technicians. This strategy requires overseeing overall production and maintenance, as well as technical and marketing

services, procurement, financial management, and issues related to safety, security, and training. This is accomplished by hiring foreign professionals on an individual basis to supervise industrial initiatives, allowing the local parties to gain the requisite skills.

F: Technology licensing:

Technology licensing is a contractual arrangement in which the licenser sells or makes available to a licensee the licenser's patents, trademarks, service marks, copyrights, trade secrets, or other intellectual property for a fee agreed upon in advance by the parties. A technology license agreement enables your business to enter a foreign market swiftly. The manufacturing industry isn't the only one that licenses the technology. As a kind of "exporting," technology licensing has various potential downsides.

Transferring the technology to a third-party corporation, will diminish the role of the original owner. Furthermore, licensing often generates lesser proceeds for your organization than genuine products or services export. In some poor countries, there may also be challenges with appropriately securing licensed technology from unauthorized use by third parties.

Licensing has several advantages: it allows generating revenue from unused portions of its intellectual property; permits exploiting new markets by allowing the licensee to apply existing technology to a new market; enables licensing out its technology to other industries; and it allows a company to advertise itself better and make improvements. In chosen to licensing a specific technology, a company should consider whether the property in question meets its production and marketing needs; whether the license terms are the most important aspect for the future licensee; and how the licensing program will fit into the company's overall business plan.

The business should assess whether the contract is lengthy or short term, as well as whether it is mutually beneficial. Exclusive and non-exclusive agreements are both possible. When possible, the parties should endeavor to engage into a non-exclusive license to avoid or limit risk.

4. Analysis and Evaluation

The Gulf Cooperation Council (GCC) countries adopted the turnkey technique initially then shifted to alternative technology transfer methods such as joint ventures, foreign direct investment, importing capital goods, management, and licensing contracts. We'll evaluate these approaches and see how they impact the Gulf economy.

Among economic experts, the Turnkey method has many critics, the main reason being that most 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 for the expansion and development of local engineering services. This in turn denies and deprives the GCC countries to benefit domestic and national citizens from learning and gaining skills and knowledge provided by a foreign company.

These industrial projects are referred to as ready-made, which will impede development. This rendered the GCC countries helpless in the face of transferred technology problems, and hence necessitating the support and aid of foreign experts. In a nutshell this method disregards and diminishes the role of local scientific research in technology development.

The GCC countries' joint projects method, which involves local participants in the establishment of industrial ventures, hasn't proven to be very effective. As previously indicated, the local partner pales in comparison to the foreign spouse, who broadens his knowledge and talents.

Allowing foreign corporations to directly participate in projects will have a substantial beneficial impact on the quality and efficacy of future investment, according to some economists, while others feel it will have a negative impact.

According to the opposing viewpoint, it justifies the investment's negative characteristics, which prevent it from assisting developing countries in achieving technical independence. Because the degree of correlation between business unit plans and R&D activity is a decisive factor in the development of technology, such a vital and pivotal relationship is missing in the GCC countries.

GCC countries spend a fraction of what developed countries allocate for research and development. For example, in 2021, the GCC Countries invested 0.3 percent of its GDP on scientific research, compared to 3.1 percent, 2.2 percent, and 3.3 percent in the United States, China, and Japan, respectively.

In most cases, the industrial sector in the GCC countries, which is the primary user of innovations emerging from research and development, conducts little or no research and development.

The scientific research institutions in the area continue to be questioned by the industry. As a result of their operations, government-funded R&D groups have failed to develop enough economically viable technologies.

The Industrial sector does provide any grants or collaborate with the universities to conduct research. The GCC countries transferred technology without any form of coordination, i.e., without a cohesive strategy among themselves or with other Arab countries.

5. Conclusions

Technology has been the key determinant defining a nation's scientific capacity, and consequently its ability to ensure national security, in recent decades. The mere transfer of technology use represents only the transfer and use of specific machines, whereas the true transfer of technology goes beyond that to the possession of technology by influencing its constituent elements, in other words: not only receiving and using technology, but also attempting to identify its constituent elements

The Gulf Cooperation Council countries have adopted a variety of technology development strategies, ranging from turnkey projects to sectors that rely on imported raw materials, such as iron, steel, aluminum, cement, steel, and rebar. In addition to petrochemical projects, the market demanded production disposal, which was referred to as technology-free transportation at the time.

In terms of the joint venture method, it appeared to be slightly better than the first method if the GCC countries benefited from it by the foreign partner marketing half of the product and the short time required to set up the project, which in the best cases did not exceed three years, as well as the training of local human cadres to be able to manage projects, but this is not a sufficient reason to acquire technological ability.

Despite more than four decades of technological warfare, the GCC countries have failed to establish scientific and technology capabilities, at least in terms of spare component manufacturing and alternative production methods. Instead of adapting and developing its own industries, it relied on importing the finest of Western technology, and as a result, the Gulf Cooperation Council countries have been and will continue depending on foreign expertise.

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 such a way that foreign investment reacts to disparities in marginal productivity, i.e. capital flows from abundant to scarce locations.

6. Recommendations

Establishing a Gulf Center for Technology Transfer. The main 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 hence instability Studies of investment plans projects. And

setting up a system for exchanging information with governmental and non-governmental institutions to study the impact of establishing foreign companies on economic development in the Gulf Cooperation Council countries.

A technology transfers office (TTO) should also formulated in each GCC country with the aim of assisting the different industries within the country. The should forge aa strong and lasting connection between universities, R&D centers and local industries and business.

Creating a separate authority at the level of the Gulf Cooperation Council countries to plan science and technology, as well as cooperation between research agencies and research beneficiaries. This demands a well-organized administrative structure at all levels of scientific policy. Starting with university science departments, going on to research and development institutions with scientific research units, and lastly to the Supreme Authority for Scientific Policy and Technology.

Developing a mechanism for transferring results obtained by researchers in universities and scientific research centers to the beneficiary sectors, particularly industry, which requires combining the expertise of engineers, technicians, and economists to determine which studies can be funded by industry, and TTC plays a role in this critical role in coordinating this type of joint studies.

A technical unbundling plan should be developed, based on the experiences of many nations, to allow for the use of inputs from other industries as well as local talents, thereby developing local capacities and expertise.

- Developing a detailed and accurate payment plan that illustrates where the price of the technology package's elements and activities comes from, such as scientific know-how, detailed and basic engineering, equipment, resources, fixtures, construction, installations, operation, and delivery testing.
- Increasing local stakeholder participation at each stage of project implementation and involving them in decision-making processes at various levels.
- Developing a comprehensive and detailed training program for each project stage, including operations and maintenance.
- Encouraging and promoting local community participation during the basic and detailed engineering stages.

Encouraging and motivating scientists and researchers to conduct serious scientific research, patent registration, and application, as this is one of the most important prerequisites for developing a national technology, as knowledge currently plays a significant role in the creation of new technology.

Adapting science and technology for industrial use is a multi-step process that begins with creating an enabling environment within the institution that prioritizes the application of science and technology as a key component of its mission and ends with the development of high-level technology competencies through technical collaboration with technology owners.

That the Cooperation Council work hard to encourage research and development institutes to collaborate closely with industry in order to acquire the sector's trust and increase its willingness to invest in R&D. This can be accomplished in a variety of ways, including:

- Seminars, conferences, and seminars held jointly.
- Two examples are technical committees and training programs.
- Providing specialized and high-level technical services to industry.
- Local and regional scientific finance initiatives can always assist R&D centers in funding their projects for the benefit of industry.

The value of promoting and motivating scientists and researchers who work on applied research projects for industry.

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