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Technical and Vocational Education and Technology Transfer: Departments of Civil Engineering Technology at the Public Authority for Applied Education and Training, PAAE&T, Kuwait, As A Case Study

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Abstract. Technology transfer is the main ingredient of technical and vocational education. The transfer of know-how and know-why can take several forms either within technical and vocational institutions boundaries such as: transfer of technology from research and development department to other academic departments or interactions and exchange of technology between academic departments. The transfer of technology can transcend technical and vocational institutions boundaries to allow a free transformation and exchange of technology with local and international industries and business. The main objective is to enhance the quality of technical and vocational graduates as well as to provide industries and business with the require skilled and semi-skilled manpower able to managing, maintain, adapt, and monitor the technology applied in various production processes. Therefore, for a successful transfer of technology, a mutual interest has to be achieved for both parties (the provider of technology and the recipient of technology). The management of technical and vocational education must exert their time and efforts to gain the best fruitful results from the transfer of technology in enhancing their academic capabilities (e.g., upgrading the standard of workshops and laboratories, applying and effective scheme for reviewing and assessing curriculum development, enhancing staff competencies) in order to meet the quality assurance standard in producing a high quality of graduates. In this paper, **I present some of the empirical results and observations which describe the interactions between the supplier of technology (Civil Engineering Technology) and the recipient of the technology (PAAE&T) in the field of technology transfer.** In other word, whether the PAAE&T have taken the opportunity, while building its new headquarter, in the transfer of technology from the supplier Civil Engineering Technology to its academic staff in its various **Civil Engineering Academic Departments** in its various colleges and institutions. The paper argues that, for effective and efficient transfer of technology, the recipient (PAAE&T) must ensure that the agreement with the supplier of **Civil Engineering Technology** include calluses that would allow the PAAE&T academic staff in the **Civil Engineering Academic Departments** in its various colleges and institutions to acquire the technology embedded in the agreement. The paper concludes that the transfer of technology and the building of a local scientific and technical infrastructure must be viewed by Kuwaiti decision-makers as a complementary to one another. Thus, reducing, to great extent, the level of dependence on expatriate, particularly in essential sector of the economy.

Keywords. Technology Transfer, developing Indigenous Manpower, **Civil Engineering Technology**, Kuwait

1. Introduction:

The transfer of technology must be perceived as an essential ingredient in the context of technical and vocational education. It is through which knowledge, skills, and attitudes can be exchange between both parties (the providers of technology and the recipients of technology). Unless there is a mutual interest between both parties, no tangible and satisfactory outcomes would be achieved in technology transfer. Add to that, the philosophy that are being adapted and applied by the management of technical and vocational education. It is not a formal education as universities, it is rather a unique type of education where graduates, nowadays, are more important and needed than universities graduates. Industries and business are more eager to employ technical and vocational education graduates who have interpersonal skills rather than a theoretical knowledge.

The transfer of technology would have a positive contribution on technical and vocational education such as: updating workshops and laboratories, enhancing research and development, creating an effective students' assessment schemes, providing an effective technique for reviewing, updating, and assessing curriculum, enhancing academic staff competencies, ensuring a better learning and teaching environment, and eventually producing a high quality of graduates. Technical and vocational education would permit a significant integration of apprentices into the workforce arena that reduces the level of youth unemployment and increase skills acquisition that are compatible with industrial and business requirements. In fact, technical and vocational education can provide skills for self-employment and reduce obstacles to the world of work. It is an education system that enhance industrial ability in diversifying products and services that are aiming in promoting countries economic progress. It is an opportunity to open a gate to labour market and tackling unemployment, particularly among youth. The number of employment youth increased by 4.4 million to 17.5 million. (U.S. Bureau of Labor Statistics report, 2020). However, due to the pandemic and its consequences, employment fell sharply and unemployment is higher than expected. The labor force of youth has significantly increased despite the global increase of youth population from 1 billion to 1.3 billion. (International Labour Organization, 2020) Many countries, particularly developing countries, have strengthening technical and vocational education to respond to the urgent demand of skilled manpower in labour market. Their aim is to create a strong linkage between youth competencies and related industries. Technical and vocational education and training has the potential to encourage employment of youth, diversify in productivity, and livelihoods of younger workers in developing countries. (World Bank, 2021, UNESCO, 2016) Several studies have emphasis of important role of industry in the success of technical and vocational education, TVET. The interaction between technical and vocational education and the enterprises economic division are eminently essential for the both the TVET and industries and job seekers. (UNEVOC, 2020) The impact of the pandemic and the rapid change in the country's economy creating a gap between TVET and industries and business that require an extensive and urgent effort to close the existing widening gap by preparing a highly skilled workforce ready for the present and future job market. (Australian Government, 2020) Employers in industries and business can interact with TVET institutions in a diverse and fruitful methods, that includes, hiring TVET graduates, apprentices training programs, providing training completion qualifications, and forecasting future skills requirements. (Department of Education, 2020). One of the main advantages of a strong collaboration between TVET and industries is that, through win-win situation. (Syamhanim, et. al. 2021), facilitate work-based learning (Jabatan. et., al, 2019), and enhancing work experience. (Watisin, 2019) The importance of teachers in the area of technical and vocational education is also noted in related literature. The competencies of TVET graduates will be influence by the quality of

TVET teachers and their competencies. (Jia., et. al. 2014, Andersson and Kopsen, 2015) Teachers would success in achieving TVET objectives if they have a high commitment and values (Gomendio, M. (2017). Teachers who have a positive attitudes and high degree of intelligence will contribute significantly in work place. (Fiftyana, 2018)

The gulf states governments acknowledge the need to equipped indigenous manpower with the necessary knowledge, skills and attitude to enable them to work in local industries and business.

Therefore, attention was diverted into technical and vocational education to respond to the need on skilled and semi-skilled national manpower particularly in essential sectors of the gulf states economy (e.g., oil and electricity and water, health sector, infrastructure). However, the success of technical and vocational education would depend on the management sincere willingness to tackle any ethical misconduct that might have a negative implication not only on learning and teaching but also on the reputation of the institution. Kuwait, a developing country, has high economic potential as a result of its oil resources. It has also been undergoing a process of technology transfer for about the last decades. Kuwaiti key figures have also appreciated the curial role of technical and vocational institutions in providing essential sectors of the economy with the skilled and semi-skilled indigenous manpower in order to reduce, to great extent, the dependence on expatriates. The Kuwaiti government has forged the Public Authority for Applied Education and Training, PAAE&T, in 1982 to respond to the urgent of essential sectors of the economy from semi and skilled indigenous manpower. The PAAE&T aims include interaction with major institutions in the labour market, training national manpower, joint research with local industries, and linking programs to society's needs and requirements. In another word, the Kuwaiti government attention is not only to prepare students to the world of work but also to closing the gap between technical and vocational institutions and local industries. The PAAE&T has five colleges and eight training centers. The aim of the PAAE&T is to **"to provide the national technical workforce that meets the requirements of social and economic development in terms of quantity and quality... and taking into account the general indicators of the needs of the labor market and the variables it carries that govern the labor market needs of graduates of applied colleges and training institutes"**. (The PAAE&T Website) The research examines whether the management of the PAAE&T has invested the opportunity in building its head quarter building which cost around 63 million Kuwait Dinar equal to approximately 190 million USA dollars, in the transfer of technology to its academic staff at Civil Engineering Academic Departments in its various colleges and institutions. (Al-Anbah News Paper, 2021) In other word, whether the management of the PAAE&T has allowed and encouraged those who are specialized in Civil Engineering Technology in its various colleges and institutions to gain the know-how and know-why embedded in the imported technology. It hopes that the results of this research would guide the management of the PAAE&T in setting and implementing a proper and efficient plan that ensure the technology transfer agreement include clauses that enable its staff in its **Civil Engineering Academic Departments** in its various colleges and institutions to interact positively with the supplier of technology. Indeed, this would have a significant implication of the reduction of the level of dependance on expatriates and the enhancement of local capabilities in the area of **Civil Engineering Technology**.

2. Research Objectives:

The research examines whether the management of the PAAE&T has invested the opportunity in building its head quarter building which cost around 63 million Kuwait Dinar equal to approximately 190 million USA dollars, in the transfer of technology to its

academic staff at Civil Engineering Academic Departments in its various colleges and institutions. In other word, whether the management of the PAAE&T has allowed and encouraged those who are specialized in Civil Engineering Technology in its academic departments in its various colleges and institutions to gain the know-how and know-why embedded in the imported technology. It hopes that the results of this research would guide the management of the PAAE&T in setting and implementing a proper and efficient plan that ensure the technology transfer agreement include clauses that enable its staff in its **Civil Engineering Academic Departments** in its various colleges and institutions to interact positively with the supplier of technology. This would have a significant contribution in the reduction of the level of Kuwait's dependence on expatriates, particularly in essential sector of the economy.

4. Materials and Methods

4.1 Design

This research consisted of a descriptive survey designed to identify and examine the type of interactions between the Public Authority for Applied Education and Training, PAAE&T, and the supplier of technology (Civil Engineering Technology) while building its new headquarter. The PAAE&T has five colleges and eight training centers. **The research examines whether the management of the PAAE&T has invested the opportunity in building its head quarter building which cost around 63 million Kuwait Dinar equal to approximately 190 million USA dollars, in the transfer of technology to its academic staff at Civil Engineering Academic Departments in its various colleges and institutions. In other word, whether the management of the PAAE&T has allowed and encouraged those who are specialized in Civil Engineering Technology in its Civil Engineering Academic Departments in its various colleges and institutions to gain the know-how and know-why embedded in the imported technology.**

4.2 Sample

The research encompassed interviews with (2) heads and senior engineers representing the supplier of technology (Civil Engineering technology). The recipient of the Civil Engineering Technology is the PAAE&T which has five colleges and eight training centers. They are namely: Faculty of Basic Education, Faculty of Business Studies, **College of Technological Studies, College of Health Sciences, College of Nursing, the Institute of Nursing, Higher Institute of Communications and Navigations, the Higher Institute of Energy, the Sabah Al-Salem Industrial Institute, and Shuwaikh Industrial Institute, Structural Training Institute, Vocational Training Institute, and Higher Institute of Administrative Services.** **The aim is to examines whether the management of the PAAE&T has invested the opportunity in building its head quarter building which cost around 63 million Kuwait Dinar equal to approximately 190 million USA dollars, in the transfer of technology to its academic staff at Civil Engineering Academic Departments in its various colleges and institutions. In other word, whether the management of the PAAE&T has allowed and encouraged those who are specialized in Civil Engineering Technology in its Civil Engineering Academic Departments in various colleges and institutions to gain the know-how and know-why embedded in the imported technology.**

4.3 Instrumentation

The target population for this research consists of interviews with (2) heads and senior engineers representing the supplier of technology (Civil Engineering Technology). The

recipient of the Civil and Engineering Technology is the PAAE&T, which has five colleges and eight training centers.

4.4 Statistics and Parameters

The statistics pertain to the sample. The parameters pertain to an entire population.

4.5 The research parameters/sample are as follows:

a) Interviews were conducted with (2) heads and senior engineers representing the supplier of technology (Civil Engineering Technology).

b) **The selected colleges and institutions at the PAAE&T are:** Faculty of Basic Education,

Faculty of Business Studies, **College of Technological Studies, College of Health Sciences, College of Nursing, the Institute of Nursing, Higher Institute of Communications and Navigations, the Higher Institute of Energy, the Sabah Al-Salem Industrial Institute, and Shuwaikh Industrial Institute, Structural Training Institute, Vocational Training Institute, and Higher Institute of Administrative Services.**

5. Research Findings:

5.1 The Characteristic of the Research Sample.

Interviews were conducted with (2) heads and senior engineers representing the supplier of technology (Civil Engineering Technology). **The aim is to examines whether the management of the PAAE&T has invested the opportunity in building its head quarter building which cost around 63 million Kuwait Dinar equal to approximately 190 million USA dollars, in the transfer of technology to its academic staff at Civil Engineering Academic Departments in its various colleges and institutions. In other word, whether the management of the PAAE&T has allowed and encouraged those who are specialized in Civil Engineering Academic Departments in its various colleges and institutions to gain the know-how and know-why embedded in the imported technology.**

5.2 Measuring the level of collaboration between the supplier of technology (Civil Engineering Technology and the recipient (PAAE&T).

The symbiotic interaction between technical and vocational education institutions and industries and business is highly stressed in related literature. (GLD, 2021, OECD, 2018, Australian Government Productivity Commission, 2021, Triki, 2008, Yorke and Knight, 2019) The contribution of a strong linkage between technical and vocational education and local industries and business is manifest itself in the contribution of employers in the academic program design, implementation and assessment (GLD, 2021), reducing rate of unemployment, particularly in youth unemployment (Simone, 2020), enhancing students' knowledge and skills (The World Bank, 2017), and strengthening teachers' competencies and personality (OECD, 2021, Gabriela, 2016), reviewing and monitoring curriculum to respond to industrial needs (Bohmann, 2007), forming proper policy and strategy for future manpower needs analysis (Khawla 2011, Ministry of Education and Sports, 2019), enhancing and upgrading the learning process to be compatible with industrial requirements (OECD, 2021), maintaining a strong partnership for ensuring a continuing future successful collaboration (Florinda, 2021), and strengthening academic-industry collaboration which is essential for the purpose of research and development, innovation and building human capital for economic growth. (Jummu, et.al., 2021). An effort has been exerted to interview (2) heads and senior engineers representing the supplier of technology (Electrical Engineering System). **The aim is to examines whether the**

management of the PAAE&T has invested the opportunity in building its head quarter building which cost around 63 million Kuwait Dinar equal to approximately 190 million USA dollars, in the transfer of technology to its academic staff at Civil Engineering Academic Departments in its various colleges and institutions. In other word, whether the management of the PAAE&T has allowed and encouraged those who are specialized in Civil Engineering Technology in its Civil Engineering Academic Departments in its various colleges and institutions to gain the know-how and know-why embedded in imported technology. The types of collaboration between both parties are revealed below.

Identifying whether the academic staff at the Civil Engineering Academic Departments at the PAAE&T in its various colleges and institutions received the know-how and know-how embedded in the Civil Engineering Technology.

<i>Elements</i>	Yes	No
Initial Idea Generation for the New Headquarter Building.		X
Initial Idea Generation for the Design of the New Headquarter Building.		X
Determining the Criteria for Design of the New Headquarter Building.		X
Determining Criteria for New Headquarter Buildings Materials.		X
Determining the Types of Testing Materials.		X
Preparing Initial Architectural Design.		X
Reviewing and Evaluating of the Initial Architectural Design.		X
Setting Criteria for Approving Final Architectural Design.		X
Setting Criteria for Selecting and Evaluating New Headquarter Building Contractors.		X
Setting Building Plan/Action Plan.		X
Determining of Supervisions and Implementations Assessment Methods.		X
Conducting Soil and Infrastructure Testing.		X
Preparation of Leveling.		X
Excavation and Plain Cement Concert.		X
Building Foundation Construction.		X
Designing and Building Plinth Beam and Slab.		X
Constructions of Colum's and Ceilings.		X
The Lintel over Doors and Windows Gaps.		X
Designing high of Ceiling, Ventilation, and Lightening system.		X
Floor Slab and Roof Structure.		X
Door Windows Framing and Fixation.		X
Electrical and Plumbing.		X
Exterior Finishing.		X
Terrace and Roof Finishing.		X
Internal Finishing.		X
Waterproofing.		X
Painting Work.		X
Door and Windows Glass Fittings.		X

The above (approximate responds) is obtained from (2) Senior Engineers who are in charge of providing Civil Engineering Technology for the new building.

The importance of Architecture design is highly noted in related literature. It connects people with their environment, society, culture, place of origin, and overall, all create a physical comfortable place for living. (Zach, 2019, IMPOFF, 2021) Architecture design would respond to the needs of people in term of designing an appropriate hospital, university, colleges, residential areas, shopping centers, recreation centers, and other facilities to add a significant element of extra comfort and entertainments for human life. Architecture design would also encourage tourist interest to visit main attractions such as: visiting royal places, museums, ancient pyramids, high towers, and giant aquariums. New technologies have a positive direct impact on architecture, design and engineering, “the increase in popularity of cloud computing transformed BIM (building information modeling) into reality, offering architects, engineers and construction professionals the tools to work more efficiently when planning, designing, and managing infrastructure buildings”. (Share Architects, 2019) The interaction between academic staff at Civil Engineering Academic Department at the PAAE&T colleges and institutions and the supplier of Architecture Engineering Design would indeed would enrich academic staff knowledge and skills in the latest architecture technology. This would also have a positive implication on the quality of the civil engineering graduates who would acquire the recent technology that enable them to apply practical and theoretical knowledge to the engineering design of buildings and building systems.

In Kuwait as in many gulf states (e.g., United Arab Emirates, Bahrain, Oman), The shortage of skilled and semi-skilled is highly noted in essential sector of the economy. Expatriate form approximately 88.5% of the United Arab Emirates population, 70% in Kuwait, and 53% in Bahrain. The Kuwaiti government, as in other gulf states, has realized the importance of enhancing indigenous capabilities, particularly in essential sectors of the country’s economy (e.g., oil, electricity and water). As a result, the Kuwaiti Government has established the Public Authority for Applied Education and Training, PAAE&T, which has five colleges and eight training centers.

The interaction between the supplier of Civil Engineering Technology and the recipient of technology (the academic staff working at the Civil Engineering Academic Department at various colleges and institutions at the PAAE&T), would facilitate the transfer of know-how and know-why among academic staff. Regrettably, no concrete evidence has been allocated to confirm the participation of academic staff at the Civil Engineering Academic Departments at various colleges and institutions at the PAAE&T in all stages relating to the architecture design, testing, installation, and evaluation the efficiency of the PAAE&T headquarter building. Bearing in mind, that the new PAA&T headquarter building which cost approximately **63 million Kuwait Dinar equal to approximately 190 million USA dollars. It is worth mentioning that, the only department who was actively involved with the supplier of civil engineering system technology was the Engineering Department at the PAAE&T who play a vital role in determining the requirements of the building. However, their role was to supervise, assess, follow, and ensure whether the supplier of architecture civil engineering technology have met the PAAE&T requirements. When asked if the Engineering Department staff at the PAAE&T involve in the architecture design and implementations stages, the answer was unclear. An attempt was made possible to investigate whether the PAAE&T included a transfer of technology calluses in the agreement that would allow the transfer of know-how and know-why to their academic staff at its various Civil Engineering Academic Departments in its various colleges and institutions, and the answer was unfortunately “not specified”.**

6. Summary & Conclusions

Technical and vocational education is a special type of education that involve theory and practice in order to meet industrial requirements. The philosophy and strategy of technical and vocational education is entirely different from formal education (e.g., formal colleges and universities). The interaction of technical and vocational institutions with industrial is considered significant in the success of technical and vocational institutions in meeting its objectives and spiration. The contribution of technology transfer in enhancing the quality of technical and vocational education is highly noted in related literature. It is through which, students, academic staff, and the head of the technical and vocational education institutions can obtain the updated knowledge, skills, and attitudes that are in urgent need of industries and business. Technology transfer must be a significant and affective para of technical and vocational education most listed objectives. The exclusion of technology transfer from the objectives of technical and vocational education would have a negative implication of the quality of teaching and learning, curriculum development, research and development, workshops and laboratories, students' assessment scheme, apprenticeship, and overall affecting the quality of graduates. It is purely a management responsibility to truly and sincerely involve academic staff as well as students in the future projects so that both (students, lecturers and trainers) can gain the actual knowledge and skills. Technical and vocational education cannot work in a "vacuum" anymore. Kuwait needs indigenous skilled and semi-skilled manpower able to manage, adapt, maintained, and assess the imported technology to suit local work environment. In addition to, reducing the level of dependence on expatriate in essential sectors of the country's economy. However, the findings of this research indicated without doubt, that the academic staff and students at the Civil Engineering Academic Department were not involve with the supplier of Civil Engineering Technology in the new headquarter building of the PAAE&T nor in acquiring the embedded technology in the assigned agreement which cost millions of USA dollars. Academic staff at Civil Engineering departments at the PAAE&T in its various colleges and institutions have not participate with the supplier of Civil Engineering Technology in acquiring the know-how and know-why in technology transfer such as: initial idea generation for the new headquarter building, determining the criteria for designing of the new headquarter building, determining the criteria for the new headquarter buildings materials, and determining the types of testing materials. The only department who was involved in technology transfer is the Engineering Department at the PAAE&T head office. The management of the PAAE&T must perceive the future projects with the internal or external supplier of technology as a real "workshop" or a real "training courses" that would allow both academic staff in its Academic Civil Engineering Departments in its various colleges and institutions as well as students to acquire the real "knowledge, skills, and attitude". Technical and vocational education cannot perform within a "black box". The management of the PAAE&T must "break" the "black box" and adapt a new philosophy that enable all part in the education and training system to activity interact with the supplier of technology. Through which, Kuwait would move a forward step into the process of reducing dependence on expatriate, otherwise, the country would continue to rely on expatriate for years ahead.

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