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TECHNOLOGY TRANSFER MODEL FOR THE LIBYAN INFORMATION AND COMMUNICATION INDUSTRY

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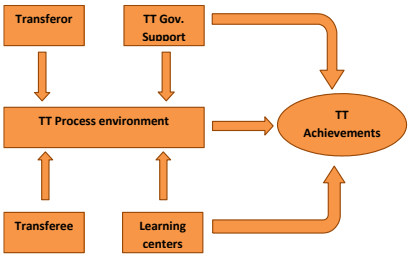
Graphical abstract



Abstract

This paper surveys the existing Technology transfer (TT) models developed across different industries. The aim is to develop and empirically test a model that describes the TT process of embracing foreign advanced technology by ICT and ICT-based SME projects in Libya. The developed model defines the following factors (enablers) that influence the ITT process, which is TT government support initiatives, transferor characteristics, transferee characteristics, TT environment, learning centers, and their respective sub-factors (variables). The outcome (achievements) factors are identified and explained through their relevant sub-factors. To verify the model and investigate the interrelations between the model's factors a questionnaire survey was conducted in Libyan ICT projects where the TT process was involved. Statistical analysis methods were used to analyze the data collected. The respondents indicated that transferee's characteristics were the most important factor with the highest impact that will result in an effective TT process. Moreover, the results showed that most factors chosen for this study are relevant towards an effective TT process. Economic development was perceived to be the most meaningful outcome of a successful TT process, followed by knowledge improvement, the firm's performance, and development as well as the survival of ICT-based SMEs. This paper is a part of an ongoing study to develop ITT model for the Libyan ICT industry.

Keywords: Technology Transfer, ICT industry, SMEs, Modelling

Abstrak

Kertas kerja ini mengkaji model-model Pemindahan Teknologi yang sedia ada (TT) yang dibangunkan merentasi industri-industri yang berbeza. Tujuannya adalah untuk membangunkan dan menguji secara empirikal suatu model yang menghuraikan proses TT apabila merangkul teknologi asing canggih oleh ICT dan projek berasaskan-ICT PKS di Libya. Model yang dibangunkan mendefinisikan faktor-faktor (pemboleh) berikut yang mempengaruhi proses ITT, iaitu inisiatif sokongan TT kerajaan, ciri-ciri pemindah, ciri-ciri penerima pindahan, persekitaran TT, pusat pembelajaran dan sub-faktor (pembolehubah) masing-masing. Faktor hasil (pencapaian) dikenal pasti dan dijelaskan melalui sub-faktor yang relevan. Untuk mengesahkan model dan menyiasat saling hubungan antara faktor-faktor model tersebut suatu kajian soal selidik telah dijalankan di projek-projek ICT Libya di mana proses TT terlibat. Kaedah analisis statistik telah digunakan untuk menganalisis data yang dikumpul. Responden menyatakan bahawa ciri-ciri penerima pindahan merupakan faktor yang paling penting dengan kesan yang paling tinggi yang akan mengakibatkan proses TT yang berkesan. Tambahan lagi, keputusan menunjukkan bahawa pada sebahagian besarnya kebanyakan faktor-faktor yang dipilih untuk kajian ini adalah penting ke

arah proses TT yang berkesan. Pembangunan ekonomi dilihat sebagai keputusan yang paling penting dari proses TT yang berjaya, diikuti dengan peningkatan pengetahuan, prestasi firma, dan pembangunan serta penerusan kehidupan PKS yang berasaskan ICT. Karya ini adalah sebahagian daripada kajian yang sedang dijalankan untuk membangunkan suatu model pemindahan teknologi untuk industri ICT Libya.

Kata kunci: Pemindahan Teknologi, industri ICT, PKS, Permodelan.

1.0 INTRODUCTION

Over last decades, technology has become one of the essential components of social and economic development in several developing countries. Technology is involving knowledge, equipment, and documents can assist firms to upgrade their performance [1]. Despite that, the international transfer technology ITT is a complex process, and it is influenced by several factors, the ITT is considered as an efficient method of obtaining the required resources and technologies to enhance management and technical competencies of the ICT institutions, and firms, as well as employees in developing countries [1].

The benefits of implementing advanced ICT in developing countries are often quite significant in different phases [2]. The ICT industry of Libya is not an exception, and it can be suggested in our proposed model as economic development, project performance, improvement in knowledge and technological capabilities, development, and survival of ICT-based SMEs.

While there are ample of empirical studies on the importance of technology transfer within the developed countries, yet, there is a paucity of such studies within the developing country (i.e. Libya). Very few authors had addressed the issue of desirable outcomes of TT process and what factors effects on such outcomes [3].

Indeed, the adopting of advanced ICT technology in Libya is recently happening; such TT process has been facing several challenges, and its success is influenced by some factors [4]. With the aid of existing scholarly models in this field, this study seeks to find out most influential factors on TT process and to evaluate the current progress from different perspectives (i.e. Transferors' and transferees' characteristics, government support, TT process environment, and the availability of learning centers). Afterward, the effects of these factors on the successful TT process outcomes are evaluated. Accordingly, The ITT process influential factors are identified as TT government support initiatives, transferor characteristics, transferee characteristics, TT environment, learning centers. On the other hand, the outcome (achievements) factors are identified and explained through their relevant subfactors as economic development, project performance, knowledge & tech. capability improvement, and the ICT survival and development.

2.0 LITERATURE REVIEW

A brief literature on relevant TT models is presented here to explore and classify the most influential TT factors. The extracted factors are verified upon formulating the TT model that addresses the TT process in ICT industry and its related SME's.

The Calantone *et al*. [5] model offers a system composed of five elements that describe the TT process (Environment - Actors- Structure – Process – Functions), the framework describes the relationship between the elements and the macro factors under the elements. The macro-level environment factors can serve as the backbone of this model because they influence all the other factors of the ITT framework. The macro-level environment factors are (Prior experience - Cultural factors - Economic factors - Political factors). The feedback of ITT process is the focus of this framework.

The construction industry of developing countries was the research field in Simkoko [6] TT model. This study examines the effect of ITT programs and internal and external environment factors on construction project performance. The identified seven sets of factors that compose the model and characterize the construction project process are (Project delivery system - Project management teams - Transfer programs - Client characteristics - Project characteristics - Design and construction technologies - Project performance). This model provides adequate insights into possible enabling and outcome factors that can be used for the conceptual model of ITT in ICT projects.

Kumar [7] explores the impact of significant elements on the ability of a firm to improve its practical capability through imported technology from developed countries. This model shows the relationship between TT process, technological capability, and economic performance. However, a few factors explored in Kumar model may be suitable to be incorporated in the TT model of ICT-based SMEs.

Lin and Berg [8] primarily explore the major factors that affect the performance of the ITT process. This model categorizes three groups of identified factors: the nature of the technology, previous international experience, and cultural difference between the technology supplier and recipient. Lin and Berg [5] argue that the cultural difference may have an insignificant effect if the technology is easy to transfer. Nevertheless, cultural is defined as a critical factor when a complicated technology needs to be transferred. Some factors and associated variables identified in this investigation were utilized to develop the conceptual model for ITT in ICT projects.

Meanwhile, Malik [9] in his study investigates the complex issues involved in the efficient management of intra-firm TT in a multinational company (MNC) environment. Including most of the issues participating in the process, the precise contents of the transferred technology (instruments, knowledge, skills), the mode of transport, the primary barriers to TT, and the project's relative chances of success

A two-stage model that developed by Wang *et al*. [10] address the knowledge transfer process from MNCs to their subsidiaries. In the first stage, the model categorizes the factors that affect the level of knowledge contributed by the parent company to its subsidiary. In the second stage, the model proposes factors that influence the level of knowledge acquired by the subsidiary from its MNC parent. This study is concerned with the transfer of both management and technical knowledge.

Steenhuis and Bruijn [11] focus on aircraft production technology. They showed that the process of TT consisted of three phases: preparation, installation, and utilization phases. These three aspects are influenced by three sets of factors: technological, organizational, and environmental factors. This model emphasizes that the two individual parties (transferor and transferee) need to be balanced with each other for an effective transfer. If the two parties do not show significant similarities, the transfer process will be faced with several difficulties.

Thai construction projects were the common concern of Waroonkun and Stewart [12] Model as it consists of four process enablers: government influence, transferee characteristics, transferor characteristics, and relationship building. It also involves one outcome factor: the TT value added. The statistically verified research model distinguishes distinct, dominant variables. Some of these factors are contributed in the ICT TT model creation.

Mohamed *et al*. [13] categorized the influential factors into enabling and TT outcome factors. These factors include TT support, TT infrastructure, TT environment, local company learning capability, and TT performance. This model is especially significant for publicly funded petroleum projects, where the government concerns, whether or not advanced technologies are transferred to the local petroleum employees and professionals.

Lastly, Khabiri *et al*. [14] identifies the influential elements in the TT process when an SME wants to acquire a foreign technology. According to this study, the mechanism of TT seems to be a vital component in the TT process from the perspective of the host SMEs. Therefore, the SMEs as transferee should be able to assess and determine an appropriate mode of transfer among TT various mechanisms.

3.0 ITT MODEL FOR ICT INDUSTRY

The aim of this study is to develop and empirically test a model that describes the TT process of the implementation the foreign advanced technology in ICT companies and ICT-based SME projects in Libya. The model shown in Figure 1 defines hypnotized influential factors that influence the effectiveness of the ITT process and its outcomes (achievements).

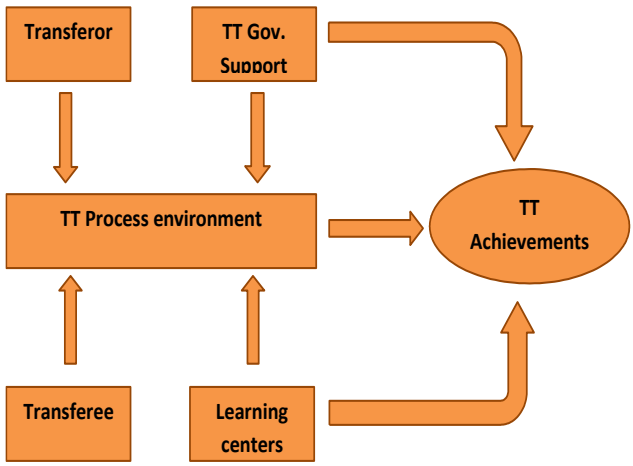


Figure 1 ITT model for ICT industry

The model presents five groups of identified factors and explains the interrelations between these factors and its influence on the outcome factor. These relevant factors are modified from the examined literature on TT phenomenon and technology adoption. Table 1 summarizes these factors and sub-factors as well as their supported literature.

3.1 TT Government Support Initiatives

As stated by Calantone *et al*. [5], the policies, regulations and enforcement practices of the host government can significantly influence the effectiveness of TT process. Several studies have

recognized the financial factor as a significant influence on the efficiency of the TT process. Lee *et al*. [15] and Waroonkun *et al*. [12] argue that the success of any TT process require adequate infrastructure, which is a government-related matter.

According to the literature, the government's support policy is strongly related to the capability of the firm to effectively source, evaluate, and adapt new technologies. Meanwhile, parent companies through sub-contracting can provide the sub-contractors (medium enterprises) with designs of the products and the required training [16]. Also, parent companies help in the emergence of entrepreneurs and skilled workers, who in turn can initiate similar industries on a smaller scale.

3.2 Learning Centers and ICT Entrepreneurs' Learning Capability

The learning capacity is concerned with the effects of the sub-factors that facilitate the learning capability of the technology being transferred between foreign and local companies [12].

According to the surveyed literature, the ability of developing countries to receive, transfer, accept, develop, and manage technologies depends on the development of local technological capability and human resources, local industry and university cooperation, and existing of technology incubators [13] and [17].

3.3 Transferor Characteristics

This factor is concerned with transferor's willingness to transfer technology, knowledge base and transfer capacity, and prior experience. The transferor that is willing to transfer the appropriate technology is one of the essential elements in achieving successful technology [9] and [18]. Knowledge is difficult to transfer when motivation is lacking and when transferors are highly protective. The capacity of the technology provider to transfer refers to the firm-specific knowledge and the ability to impart that knowledge [19].

3.4 Transferee Characteristics

Among the recipient characteristics that have been acknowledged in the literature as influencing TT are absorptive capacity, prior knowledge and experience, and learning capacity [20] and [21]. The previous international experience of the transferee is expected to improve the learning capability and efficiency of the transferee in the technical communication process [22]. The operational capabilities, dynamic learning capacities and investment capabilities of transferees, as well as intent to learn and learning capability, are supposed as critical issues in the transfer process [23].

3.5 TT Process (TT Environment)

This factor is concerned with the technology to be transferred and covers the following: technology characteristics, TT mechanism, management of the TT program, the relationship between the supplier and the recipient, culture differences, TT agent, and relationships between the transferor and the transferee.

Several dimensions are proposed to characterize the nature and transferability of technology. The three common categories include complexity, maturity, and codification [24].

The mode of TT can have a critical role in the TT process and may affect the performance of such process [14]. Therefore, the nature and means of the TT mechanism can take different forms and may be appropriate or inappropriate. TT mechanism supposed have significantly affected the performance of transferring technology process [12].

Continuous management and evaluation procedures are required for an efficient long-term utilization of the transferred technology. The collaboration between the host and foreign project management teams is a primary concern when technology is transferred to the host country's projects. [6] and [15]. The information needs to be conveyed clearly and effectively in a full error-free communication setting and a proper cultural relationship between the host, and foreign partner must be determined in advance [13]. Effective communication was given a very high rating by Devapriya & Ganesan [25], Malik [9], and Ganesan & Kelsey [26]. The role of the entrepreneurial agent middleman is also considered in ITT process management. Harvey *et al*. [27] suggest that the agent middlemen can assist in ensuring that the TT is efficient and effective for both parties and according to the transfer agreement.

3.6 TT Achievements

Based on the objectives, the present study identifies four main areas where potential benefits may be derived from ITT initiatives. These advantages are represented as achievement sub-factors: economic development, project (firm) performance, knowledge and technological capability improvements, and development & survival of ICT-based SMEs. According to the literature, firms in developing countries can increase productivity through access to technological expertise, management techniques, and technical skills from industrial countries [6] and [12]. TT process also could enhance the utilization of natural and human resources. Knowledge, techniques, and skills of the local industry employees can be improved through the TT process [28] and [29]. Mastering the imported technology by the recipient has been suggested by

Madeuf [30] as a measure of the effectiveness of the TT process. The improved project performance results from the effective TT [6].

Regarding the technology acquisition of SMEs, the literature shows that the technology can be transferred to SMEs through various mechanisms [10]. For instance production linkages in the form of sub-contracting arrangements with large enterprises (LEs) or MNCs, technical licensing arrangements between parent companies and SMEs, importing intermediate and capital goods, training, technical consultancies by consulting firms, or simply the migration of expert workers from LEs to SMEs.

Table 1 ITT Model's factors and sub-factors

Factors	Sub-factors	References
TT government support initiatives	- Government policy and enforcement practices. -SME government support. -Parent organization support.	Calantone *et al*. 1990; Ganesan & Kelsey 2006; Waroonkun *et al*. 2006; Lin & Berg 2001; Wang *et al*. 2004; Mohamed *et al*. 2010.
Learning centers (ICT entrepreneurs' learning capability)	-Training and R&D, entrepreneurship and entrepreneur development. -Local industry and university cooperation. -Technology incubators.	Lee & Win 2004; Osemeke 2012; Karadal *et al*. 2014; Link & Rees 1990;; Mittelstadt & Cerri 2008; Mohamed *et al*. 2010.
Transferor characteristics	-Willingness to transfer technology. -Knowledge base and transfer capacity. -Prior experience.	Malik 2002; Benedetto, Calantone, & Zhang 2003; Wang *et al*., 2004; Wei 1995; Lin & Berg, 2001; Rogers 2010.
Transferee characteristics	- Absorptive capacity or ability to absorb. - Previous experience and knowledge base. - Intent to learn and learning capability. - Technological capability.	Davenport & Prusak 2000; Sazali *et al*. 2009; Lin & Berg 2001; Wang, Tong, & Koh 2004;
TT process (TT environment)	-Technology characteristics. -TT mechanisms. -Management of TT program. -Relationships between provider and recipient -Culture differences. -TT agent.	Simkoko 1992; Ramanathan 2008; Sazali *et al*. 2009; Tho 1993; Lin & Berg, 2001; Michie & Sheehan 2005; Stewart & Waroonkun, 2007; Michael Harvey *et al*. 2000.
TT Achievements	-Economic advancement. -Project (firm) performance. -Knowledge and technological capabilities improvement. -Development and survival of ICT-based SMEs.	Calantone *et al*. 2003; Gilbert & Cordey-Hayes 1996; Sazali *et al*. 2009; Waroonkun & Stewart 2008; Kumar et al. 1999

4.0 MATERIALS AND METHODS

This study aims to investigate the TT process solitary in Libyan ICT industry. This study uses a quantitative cross-sectional survey method to collect data from the respondents. More specifically, a questionnaire with close-ended questions is used to achieve the mentioned objectives, and to answer the specified research questions. A questionnaire survey was carried out on the sample targeting ICT companies' employees who have involved in TT processes. The survey was conducted in the second quarter of the year of 2015. In total, 80 questionnaires were distributed, and 54 were returned, representing a response rate of 67.5 %. The target sample respondents were asked to rate their opinion about some statements (factors) related to TT process and evaluating the impact of these factors on TT process. Based on their experience respondents were requested to provide a rating for their opinion, and the perceived impact on a five-point Likert scale ranged from strongly disagree (1) to strongly agree (5) at the opinion perspective, while the factor impact assessment ranged from very high (5) to very

low (1). In addition, the respondent's was required to rate their opinion on TT process achievements and to assess the degree of improvement observed of the number of factors related to a TT process.

This study uses the non-probability sampling method instead of using probability sampling. The choice of the non-probability sampling method is due to the absence of the sampling frame of the expert's workforce in Libyan ICT industry which meets the criteria of this study. In such case, a convenient sampling method, as part of the non-probability sampling technique, is deemed an appropriate choice. The target population was experts (technicians, engineers, supervisors, managers) who have a solid background on technology transfer (TT) process and who had participated in TT projects in association with international companies. In this study, the TT process was defined as some form of ICT equipment, materials, or knowledge is transferred from a foreign party (organization) to another local party (Libyan organization). Thus, respondents from Libya's ICT industry were considered the appropriate respondents to evaluate the adoptions and importance of factors affecting the TT process and the outcomes that can be gained. In addition to the respondent background information, the questionnaire consist of four sections, the first section was concerned with the respondent's opinion about a number of statements related to TT process. The second was related to rating the impact of some factors on a TT process. Whereas the third and fourth sections concerned with the respondent's opinion on TT process achievements and assessing the degree of improvement observed of the number of factors related to a TT process. Statistical analysis methods that include mean, standard deviation, correlation, regression, to be used to analyze the data received from the conducted questionnaire survey.

4.1 Data Analysis Method

The research approach followed in this study is implemented according to these stated sequences phases: questionnaire survey utilized as a data collection instrument. Before starting data analysis, the collected data will be screened. The respondent profile report contains their positions; experience, education as well as the number of TT processes they have been worked on will be presented. This descriptive information on individual respondents was necessary to validate the results obtained and to develop an understanding of the background of the respondents. The model's factors and subfactors profile contained descriptive Statistics, details the mean value and standard deviation for each enabling and outcome variable in the developed international TT conceptual model will be stated followed by correlation and regression analysis. The regression results helped to confirm the structure of the model to be used in the study.

5.0 RESULTS & DATA ANALYSIS

The selected respondents were asked to give their opinions concerning the relevancy of several factors for the TT process.

The received data were analyzed and arranged in four separate profiles as respondent profile, model factors profile, TT Process achievements profile, and model reliability and regression analysis profile. Creating a respondent profile to gathering the personal characteristics of the respondents was essential to develop a good understanding of their perspective on the TT process and their field of specialization.

The accuracy of data entry in SPSS was checked. Several incorrect values were detected, and they were amended. The maximum and minimum values were checked to make an inference on such false entry.

5.1 Respondent Profile

Figures 2 and 3 reflect the demographic characteristics of the targeted sample. According to the position of the respondents, the majority is engineers with a 40%; followed by administrative officers 25%; managers with 15%; academic staff consultant and technician with 10% and 5% respectively. The highest frequency of respondents had a bachelor degree (75%) while the Master and Diploma holders come with the same percentage (10%) and the doctorate (5%). This results reflected that the respondent sample has a high education and makes the survey results in more robustness.

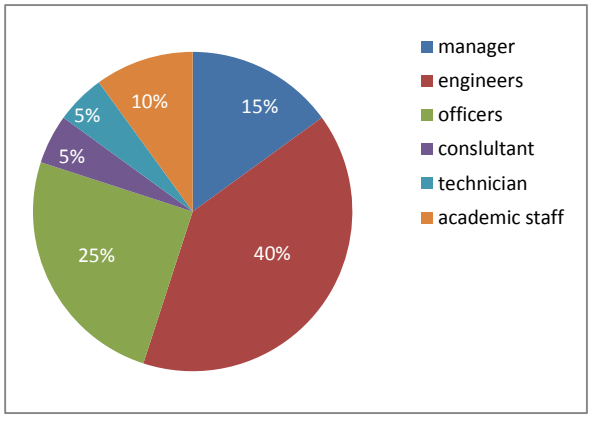


Figure 2 Position Pie Chart

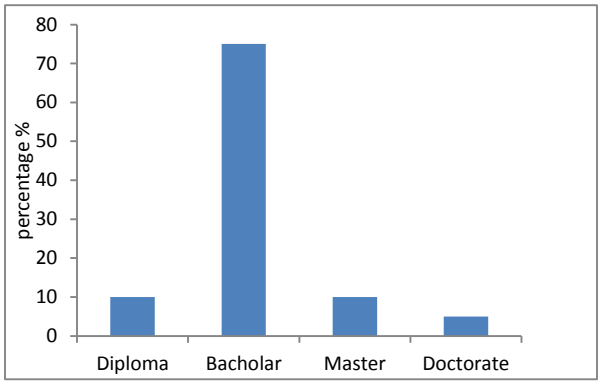


Figure 3 Respondent's education Level

The statistics of the respondents working experience in the ICT sector shows that the respondents have various working experience ranging from less than five years to more than 20 years. The respondents with experience of 6 to 10 years got the highest frequency (35%). The respondents with experience of 16 to 20 years and less than five years got the same rate (20%). (15%) Of the respondents had experience of 11-15 years while 10% of them with more than 20 years of experience. The results indicate that the sample encompasses qualified people, as shown in Figure 4

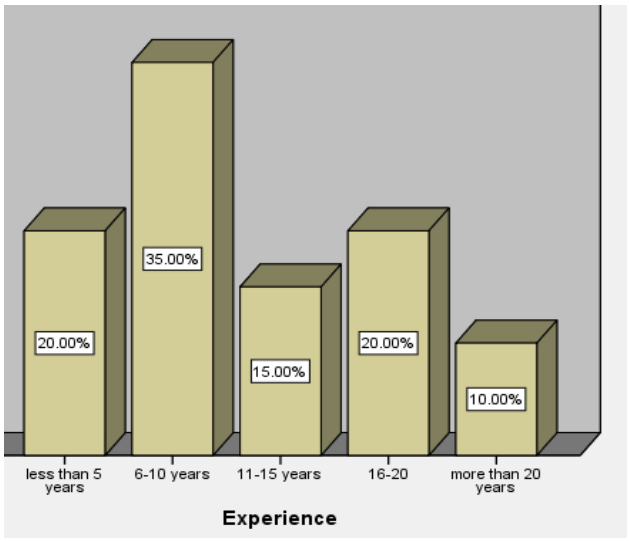


Figure 4 Respondent's working experience

For results that are more reliable, the respondents were requested to detail the number of projects they have been involved with where TT was incorporated. The results show that 60% of the respondents had participated in between 2 to 5 TT process. The percentage of the participants, which are involved in 6 to 9 TT process, is 15%. Only 5% of them are involved with more than 10 TT process. On the other side, there are 20% of the respondents have been involved in only one TT process (Figure 5). Overall, these percentages indicated that the sample encompasses experienced people, and it is sufficient to develop an informed perspective on the TT process.

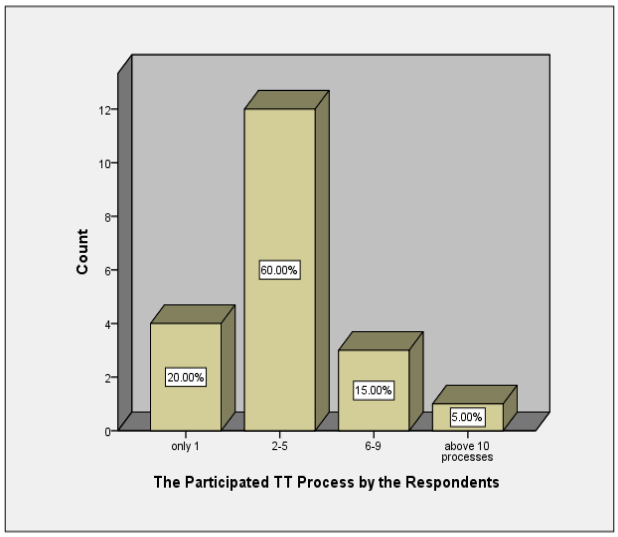


Figure 5 Number of the TT process participated by respondents

Most of the respondents' companies were the main contractors on the joint venture projects, as shown in Figure 6. In addition, the respondents are belong to various ICT sectors, ranging from ICT infrastructure companies to Internet Telecommunication services companies, whereby a substantial amount of the respondents belongs to the latter companies, as depicted in Figure 7.

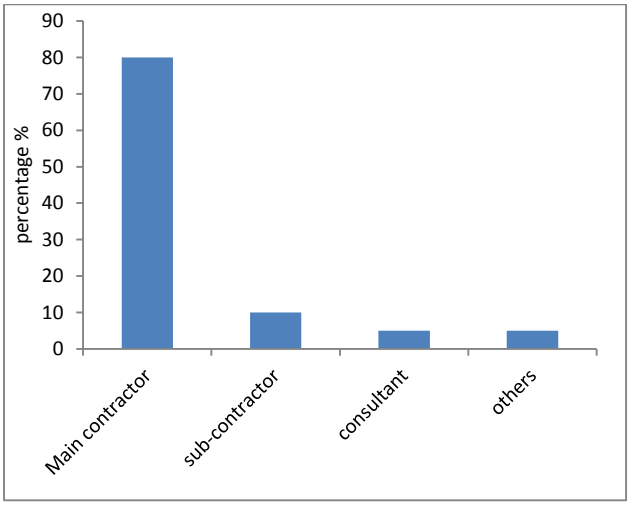


Figure 6 the company type

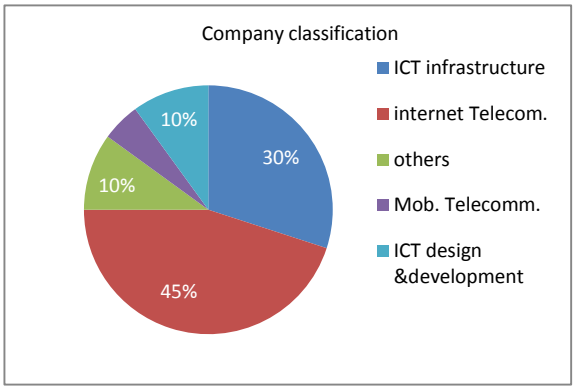


Figure 7 Respondent's Company Type classification

5.2 Model Factors Profile

The intent of examining the TT variables in two different considerations was to affirm both the importance of individual TT enablers and outcome factors in the overall TT process and to institute a rating on their effectiveness on entire ICT industry operations where TT was integrated. The mean and standard deviation value for all the conceptual constructs and TT achievements for perspectives, opinion, and impact are displayed in Tables 2, 3, 4 and 5 respectively. Mean scores are computed by equally weighting the mean scores of all variables.

As shown in Table 2 the respondents indicated that transferee's characteristics are the most important factor that will result in effective TT process. However, respondents had agreed largely that the factor chosen for this study is important towards active TT process. For instance, the respondents agreed (as the means were 4 or near to 4) that government initiative/support, learning centers, transferor's characteristic and TT process to be substantial towards TT effectiveness.

Additionally, the respondents were asked to rate the impact of several factors on TT process. The transferor's characteristics factor was perceived to be with the highest impact on TT process. The rest of the factors were rated to have a substantial impact on TT process, with transferee's characteristics was evaluated to have the second largest impact on TT process, as shown in Table 3.

Table 2 respondents' opinion towards factors

Factors and Sub-Factors	Min.	Max.	Mean	Std. Deviation
A TT government support initiatives	3.20	5.00	4.1300	.44615
A1.1 government policy	3.00	5.00	4.3000	.73270
A1.2 availability of adequate infrastructure	3.00	5.00	4.4000	.59824
A1.3 government support	2.00	5.00	4.1000	.91191
A1.4 parent company role in initiate small new ICT projects	3.00	5.00	4.1500	.81273
A1.5 parent company supporting to SMEs	1.00	5.00	3.7000	1.03110
B Learning Centers	2.75	5.00	4.0875	.55769
B1.1 educational system & training programs	1.00	5.00	4.1000	.96791
B1.2 ICT entrepreneurial development	3.00	5.00	4.1500	.67082
B1.3 ICT incubators role	3.00	5.00	4.0500	.68633
B1.4 collaboration between ICT industry and universities.	1.00	5.00	4.0500	.94451
C Transferor's characteristics	2.50	5.00	4.0000	.70244
C1.1 Transferor's willing's to transfer.	3.00	5.00	4.0000	.79472
C1.2 Transferor's knowledge base.	2.00	5.00	4.1000	.78807
C1.3 Transferor's ability to transfer	2.00	5.00	4.0500	.94451
C1.4 Transferor's international experience.	2.00	5.00	3.8500	.98809
D Transferee's characteristic	3.00	5.00	4.1375	.48986
D1.1 Transferee's absorption capability.	3.00	5.00	4.1500	.58714
D1.2 Transferee's international experience.	2.00	5.00	4.0000	.72548
D1.3 Shortage of a skilled workforce.	3.00	5.00	4.2500	.71635
D1.4 Transferee's motivation.	2.00	5.00	4.1500	.87509
E TT environment	2.17	5.00	3.9000	.71615
E1.1 Nature of transferred technology.	2.00	5.00	3.9500	.88704
E1.2 Mode of technology transfer.	3.00	5.00	4.0000	.64889
E1.3 TT agreement.	2.00	5.00	4.0000	.91766
E1.4 Relationship between transferor and transferee.	3.00	5.00	4.4000	.68056
E1.5 Culture traits	2.00	5.00	3.8500	.74516
E1.6 Entrepreneurial agent middleman.	2.00	5.00	4.0500	.88704

Table 3 The factors and sub-factors impact on TT process

Factors and Sub - Factors	Min.	Max.	Mean	Std. Deviation
A2 TT government support initiatives	2.20	5.00	3.8600	.78163
A2.1 government policy	1.00	5.00	3.8500	1.22582
A2.2 availability of adequate infrastructure	2.00	5.00	4.0500	.75915
A2.3 government support	3.00	5.00	4.1000	.71818
A2.4 parent company role in initiate small new ICT projects	1.00	5.00	3.6500	1.13671
A2.5 parent company supporting to SMEs	2.00	5.00	3.6500	.98809
B2 Learning Centers	2.25	5.00	3.9625	.67995
B2.1 educational system & training programs	2.00	5.00	4.2500	.96655
B2.2 ICT entrepreneurial development	2.00	5.00	4.1000	.78807
B2.3 ICT incubators role	2.00	5.00	3.7000	.92338
B2.4 collaboration between ICT industry and universities.	2.00	5.00	3.8000	.69585
C Transferor's characteristics	3.00	5.00	4.1000	.54652
C2.1 Transferor's willing's to transfer.	3.00	5.00	4.0000	.72548
C2.2 Transferor's knowledge base.	3.00	5.00	4.1500	.67082
C2.3 Transferor's ability to transfer	3.00	5.00	4.3500	.67082
C2.4 Transferor's international experience.	2.00	5.00	3.9000	.91191
D2 Transferee's characteristic	2.75	5.00	4.0250	.62776
D2.1 Transferee's absorption capability.	2.00	5.00	4.0500	.82558
D2.2 Transferee's international experience.	2.00	5.00	3.8500	.74516
D2.3 Shortage of a skilled workforce.	2.00	5.00	4.1500	.81273
D2.4 Transferee's motivation.	2.00	5.00	4.0500	.82558
E2 TT environment	2.17	5.00	3.9000	.71615
E2.1 Nature of transferred technology.	2.00	5.00	3.9500	.82558
E2.2 Mode of technology transfer.	2.00	5.00	3.8000	.76777
E2.3 TT agreement.	3.00	5.00	4.1000	.78807
E2.4 Relationship between transferor and transferee.	2.00	5.00	4.1500	.87509
E2.5 Culture traits	1.00	5.00	3.7000	.92338
E2.6 Entrepreneurial agent middleman.	1.00	5.00	3.7000	.97872

5.3 TT Process Achievements Profile

Furthermore, the respondents requested to assign their opinion on the contribution of successful TT process on the economic development, firm performance, knowledge and technological improvement, and development and survive of ICT SMEs. As shown in Table 4, economic development was perceived to be the most meaningful outcome of successful TT process, followed by knowledge improvement, firm performance, and development and survive of ICT technology.

Alternatively, the respondents were requested to rate the observed improvement after the TT process project. As shown in Table 5 the respondents have seen significant growth, mostly on the knowledge and technological capabilities and on economic development, as indicated by means score for both factors.

Table 4 TT Process Outcomes

Factors and Sub - Factors	Min	Max	Mean	Std. Deviation
A3 Economic development	2.40	5.00	4.2300	.64978
A3.1 Libyan industrialization development	2.00	5.00	3.9000	.78807
A3.2 Libyan ICT firms competitiveness	2.00	5.00	4.2000	.76777
A3.3 Financial outcomes & performance of the Local firms	3.00	5.00	4.6000	.68056
A3.4Utilization of local natural & human resources.	2.00	5.00	4.4000	.82078
A3.5 Diversification and expanded business activities.	2.00	5.00	4.0500	.88704
B3 Project (firm) performance	2.40	5.00	3.9700	.65943
B3.1 Libyan ICT industry overall performance.	3.00	5.00	4.1000	.64072
B3.2 Efficiency, services cost and quality of host firm.	2.00	5.00	4.1000	.85224
B3.3 Quality standard in Libyan ICT firms.	2.00	5.00	4.1500	.81273
B3.4 Mastering the new technology.	2.00	5.00	4.1000	.91191
B3.5 Functional performance of the products.	3.00	5.00	4.3000	.57124
C3 Knowledge & tech. capability improvement	2.50	5.00	4.0375	.67995
C3.1 ICT local firm's tech. Capabilities and skills base.	2.00	5.00	4.0000	.85840
C3.2 Operate, learn, absorb and apply new tech.	3.00	5.00	4.3000	.65695
C3.3 Local workers' development.	2.00	5.00	3.9000	.85224
C3.4 Libyan ICT sector working practices.	2.00	5.00	3.9500	.99868
D4 development and survive of ICT technology SME's	2.50	5.00	3.9667	.75432
D3.1 Develop and surviving of ICT SMEs.	2.00	5.00	3.8000	.95145
D3.2 Improve productivity for ICT SMEs.	2.00	5.00	3.8500	.81273
D3.3 Providing an opportunity for entrepreneurial development.	2.00	5.00	3.9500	.94451
D3.4 Mastering new process techniques by ICT SMEs.	2.00	5.00	4.0000	1.02598
D3.5 Initiate a small scale ICT enterprise.	2.00	5.00	3.9500	.82558
D3.6 Increasing tech. capabilities and capacities for ICT SMEs.	3.00	5.00	4.2500	.71635

Table 5 the Observed Improvement of Various Outcomes

Factors and Sub - Factors	Min.	Max.	Mean	Std. Deviation
A4 Economic development	2.20	5.00	4.3200	.60558
A4.1 Libyan industrialization development	2.00	5.00	3.8500	.87509
A4.2 Libyan ICT firms competitiveness	2.00	5.00	3.7000	.97872
A4.3 Financial outcomes & performance of the Local firms	3.00	5.00	3.9000	.64072
A4.4 Utilization of local natural & human resources.	2.00	5.00	3.8500	.87509
A4.5 Diversification and expanded business activities.	2.00	5.00	3.8000	.83351
B4 Project (firm) performance	2.40	5.00	3.9700	.65943
B4.1 Libyan ICT industry overall performance.	2.00	5.00	3.9500	.82558
B4.2 Efficiency, services cost and quality of host firm.	3.00	5.00	4.1000	.64072
B4.3 Quality standard in Libyan ICT firms.	2.00	5.00	3.8500	.93330
B4.4 Mastering the new technology.	2.00	5.00	4.0500	.88704
B4.5 Functional performance of the products.	2.00	5.00	3.9000	.85224
C4 Knowledge & tech. capability improvement	2.00	5.00	4.5875	.16568
C4.1 ICT local firm's tech. capabilities and skills base.	2.00	5.00	4.1000	.91191
C4.2 Operate, learn, absorb and apply new tech.	2.00	5.00	4.0000	.97333
C4.3 Local workers' development.	2.00	5.00	4.0000	.97333
C4.4 Libyan ICT sector working practices.	2.00	5.00	3.7500	1.01955
D4 Development and survive of ICT technology SME	1.67	5.00	3.8083	.80072
D4.1 Develop and surviving of ICT SMEs.	2.00	5.00	3.9000	.91191
D4.2 Improve productivity for ICT SMEs.	2.00	5.00	3.9000	.96791
D4.3 Providing an opportunity for entrepreneurial development.	1.00	5.00	3.6500	.98809
D4.4 Mastering new process techniques by ICT SMEs.	1.00	5.00	3.7500	1.06992
D4.5 Initiate a small scale ICT enterprise.	1.00	5.00	3.7000	.86450
D4.6 Increasing tech. capabilities and capacities for ICT SMEs.	2.00	5.00	3.9500	.75915

5.4 Model Reliability and Regression Analysis Profile

An internal consistency test was used to verify the reliabilities of the factors under investigation, which refers to the Cronbach Alpha test. A factor is said to have good reliability if the Cronbach Alpha has the value of 0.7 and above [31]. As shown in Table 6 the reliabilities findings are indicated all the factors under investigation have adequate reliabilities, as their Cronbach alpha fell within the desirable range (above the 0.7). Therefore, it could be concluded that all factors had internal consistency. Furthermore, there were no deletions of items, to improve the reliabilities further, as all the factors had adequate reliabilities collectively without dropping any items. Such findings will serve as an indication that the items included in the questionnaires are fine-tuned, and they were not ambiguous to the respondents.

Table 6 Reliabilities

Factor	Reliability (Cronbach Alpha)	No. of items	Deleted items
The government supports initiatives	0.852	5	None
Learning Centres and ICT entrepreneurs learning capabilities	0.812	4	None
Transferor's characteristics	0.703	4	None
Transferee's Characteristics	0.788	4	None
TT environment	0.910	6	None
Economic development	0.921	5	None
Project performance	0.850	5	None
Knowledge and technological capabilities	0.961	4	None
Development and survive of ICT technology SMEs	0.929	6	None

A two-tailed Pearson correlation was employed between the sub-factors of the study. The correlation (r) indicates the strength and the direction of the relationship between these sub-factors. There are significant relationships either at 1% of confidence intervals or at 5% of confidence interval. The highest score of correlation (r = 0.898) exists between A4.5 and 4.6, that is between the diversification into new products or markets, and expanded business activity and Increasing technological capabilities and capacities for ICT SMEs. Such relationship is a positive, as the rise in the diversification into new products/markets will lead to further development of and survive of ICT technology SME's, regarding more technological capabilities and capacities.

In addition, the correlation results suggest that the sub- factors of TT government support correlate on average to TT environment more strongly than sub-factors of transferor's and transferee's characteristics. Whereby the highest correlation exists between the sub-factor A2.3 and E2.4 (r equals to 0.896). This implies that government supports regarding advising and with suitable resources are strong enablers of successful TT process, as such, it strengthens the effective communication and facilities the relationship between the transferors and transferees.

Also, as hypothesized, it was found that the subfactors of the TT government support are the strongest to correlate with the achievement various dimensions, compared to the sub –factors of learning centers. This gives an early indication of the importance of the TT government support as an enabler to result in a conducive TT process and leads to favorable outcomes for the companies and the overall economy. The depicted conceptual model was tested using a single linear regression. Each proposed path was analyzed, and some indicators were reported as part of determining the explanatory power of which the independent variables can explain dependent variable, for such purpose the use of the determinant of the coefficient R^2 is an indication of the explanatory power. A higher value of R^2 represents the higher value of explanatory power and indicates that particular independent variable is vital in explaining a dependent variable [32].

Besides, for determining the single relationship as proposed in the table shown below, the t-value is used to indicate whether the proposed hypothesized link between independent and depended variable is significant. The higher the t-value, the more significant is the relationship between the two variables. Usually, t-value above 1.96 at 95% confidence of interval will lead to a significant relationship between the independent and the dependent variable [33].

Table 7 Regression Analysis

Independent Variable	Dependent Variable	R^2	Adjusted R^2	t - value	Sig
A2	E2	0.714	0.698	6.703	0.000**
B2	E2	0.581	0.557	4.992	0.000**
C2	E2	0.631	0.611	5.551	0.000**
D2	E2	0.641	0.622	5..676	0.000**
E2	Achievement	0.21	0.166	2.188	0.0*
A2	Achievement	0.267	0.227	2.563	0.0*
B2	Achievement	0.236	0.187	2.318	0.0*

** Sig <0.01, * Sig < 0.05
A2: TT government support initiatives impact
B2: Learning centers and ICT Learning Capability
C2: Transferor's characteristic impact
D2: Transferee's characteristic impact
E2: TT process. (TT environment) impacts
Achievement: the average of A4, B4, C4 and D4

As shown in Table 7, the study conducted by employing a single regression model suggests that all the proposed relationship is significant; however, the explanatory power and the level of significance are different.

The TT process environment was significantly predicted by TT government support initiatives, learning centers, and ICT entrepreneur's capability, transferor's characteristics and transferee's characteristics. However, the strongest predictor of TT environment (successful TT process) is the TT government support initiatives with the t-value equivalent of 6.703 at a significant level of lower than 0.01 and ability to explain 71.4% of the changes in the successful TT process environment. Moreover, all the important relationship with the TT process are active, this in line with the hypothesized direction, in the sense that the factor A2, B2, C2, and D2 have a positive impact on the TT environment.

Furthermore, as shown from regression analysis result that the successful TT environment process has a positive effect on the overall achievement. These findings mean that a successful TT environment will lead to favorable outcomes. The TT process environment factor was able to explain 21% of the changes occur on the achievement upon successful transfer. Additionally, this study hypothesizes that there are direct relations between the government support and Learning Centers, and Learning Centers has an impact on the TT achievement. The result indicates that there are positive effects of these direct relations on the achievement. It is further to be noted, that TT government support initiatives have the strongest direct impact on achievement, as this was indicated by the highest R^2 (26.7%) and t – value of 2.563.

To further justification of the previous discussion, another statistical indicator was used, Standardized Beta Coefficient (β) that will inform about the strength and direction of the relationship between the single hypothesized paths. As shown in Table 8 it is further justified that the TT government support initiatives have the strongest positive impact on the TT process, and transferee's characteristics have the second most substantial impact on TT process. Such beta coefficient findings are in line with what has been said earlier with the aid of t- value and R^2.

Table 8 the relationship between the single hypothesized paths

Relationship	Standardized Coefficient (β)
TT government support → TT process environment	0.845
Learning centers → TT process environment	0.762
Transferor's characteristic → TT process environment	0.795
Transferee's characteristic → TT process environment	0.801

Moreover, the Beta coefficient was determined for the rest of path analysis (single path). The result of the use of Beta coefficient confirmed the previous findings too, whereby the TT government support has the strongest impact on the achievement (β= 0.517), followed by the learning center impact on the TT achievements (β= .458) and the impact of the successful TT environment process (β= 0.48). The entire Beta coefficient indicates that all the relationship with achievement is positive, this concurs with theories. Nevertheless, the prediction power of the direct relationship with achievement varies in its strength, as shown in Table 9.

Table 9 direct relationship of enablers with TT achievement

Relationship	Standardized Coefficient (B)
TT government support → TT Achievement	0.517
Learning centers → TT Achievement	0.458
TT process environment → TT Achievemen	0.480

6.0 DISCUSSION OF THE RESULTS

The results showed that the sample encompasses highly educated well-experienced and qualified people. Most of the respondents' companies were the main contractors on the joint venture projects. In addition, the respondents belong to various ICT sectors.

The model factors profile results show that the transferee's characteristics factor are the most important factor that will lead to effective TT process, and the transferor's characteristics factor had the highest impact on TT process, whereas the rest of the factors were rated to have a significant effect on TT process also. However, respondents had agreed largely that the factors chosen for this study are important towards effective TT process. Furthermore, the findings reveal that the economic development was perceived to be the most meaningful outcome of successful TT process, followed by knowledge improvement, firm performance, and development and survive of ICT technology. Alternatively, the respondents have seen tremendous improvement, mostly on the knowledge and technological capabilities and on economic development, as indicated by means score for both factors.

The reliabilities test findings are reported all the factors under investigation have adequate reliabilities, as their Cronbach alpha fell within the desirable range (above the 0.7). Therefore, it could be concluded that all factors had good internal consistency. Such findings will serve as an indication that the items included in the questionnaires are fine-tuned, and they were not ambiguous to the respondents.

The regression analysis result shows that all the suggested relationships were significant as guided by the theoretical framework. However, the successful TT environment process has a positive impact on the overall achievement, which means that a successful TT environment will lead to favorable outcomes. Additionally, this study hypothesizes that there are direct relations between the government support, and Learning centers affect the achievement. The result indicates that there are positive effects of these direct relations on the achievement. It is further to be noted that TT government support initiatives have the strongest direct impact on achievement.

7.0 LIMITATION

As earlier stated, the results of this investigation study are a part of the ongoing study. Therefore, the current results are not finalized. Larger sample size Incorporation allowing further investigation of the factors interrelations. Nevertheless, these findings are in the line with theories and logic. Hence, the current results provide the trends and opinion on the part of the sample.

8.0 CONCLUSION

This work reviewed the existing models developed across different industry sectors and come with a conceptual ITT model endeavors to transfer technology to Libyan ICT companies as well as ICT-based SME projects.

This initial study revealed a significant remark that is the chosen factors for this study are critically relevant in explaining the TT process with desirable outcomes. According to the experts who worked and were involved in such projects, the selected factors were perceived to be very important. Furthermore, the initial study showed that these selected factors were exerting a positive influence on the successful outcomes of TT process projects.

Taken collectively, the overall results showed how important are these factors to the successful implementation of TT process. Stakeholders (i.e. government, transferors, transferees, and managers) should evaluate their practices and address the challenges, to further enhance the outcomes of implementing TT process.

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