Technology Transfer and Sustainability - Adapting Factors: Culture, Physical Environment, and Geographical Location

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Abstract

In the development and sustenance of a community, state, or nation, the advancement of technology is vital for survival; here, the need for technology transfer arises and becomes a critical landmark. There are adapting factors in the process of technology transfer that must be addressed to ensure successful technological developments and their continued progress and sustainability.

Focused on the successful transfer of sustainable technology to Saudi Arabia, a methodology of measuring physical environments, cultural and infrastructural support, and geographical locations was thoroughly researched and developed. Using a survey instrument based on questions derived from available literature on factors affecting technology transfer, data was collected from private manufacturing industries in Saudi Arabia. Data analysis included person-product-moment correlations and simultaneous regression. The hypotheses were tested at the .05 level of significance.

In summary, the results indicated that culture, physical environment, and geographical location all have significant effects on technology transfer; necessary accommodations for these adapting factors then become vital to the success of technology transfer and will strongly facilitate the effectiveness of the technology.

Introduction

The strong interest for developing countries to expand their access to international technologies is understandable in light of rapid technological changes in the global economy. The ability to learn from foreign technology, adapt to, and import them into domestic competition is critical for achieving sustained economic transformation and productivity growth [1]. Developed and developing nations are constantly striving to keep pace with ever increasing advances in technological progress [2]. Demanding the undivided attention of both, technology transfer is becoming a primary component of international assistance [2]. Technology can be transferred in a variety of ways and for several reasons. The three most prominent situations in which technology transfer occurs are within the realms of science and technology themselves to further the cause of those disciplines within a societal level from one geographical location to another for economic gain and from one societal level, both nationally and internationally, ostensibly for development [3].

Saudi Arabia has placed great emphasis on the acquisition of new technology to enhance their capabilities in setting forth a new age of manufacturing products for local and export markets, with quality matching that of developed nations. This study will explore culture, physical environment, and geographical location as factors to be considered for effective technology transfer to Saudi Arabia.

Theoretical Foundation

Technology transfer was a multi-disciplinary area of research [4] in the 1970s; international technology transfer emerged as a separate field of inquiry as a consequence of the accelerating awareness of the economic interdependence of nations and of the central role of technology in international relations [5]. Recent research in the area of technology transfer has shifted from the economic and political impact of technology transfer to looking at constraining variables that affect the transfer of technology, such as cultural factors and physical aspects of the host nation [6, 7, 4]. Looking at the remote environment, government stability, economic volatility, sociocultural receptivity, and technological capability of the host nation influences the mode of technology transfer; a simple process of exporting the technology becomes a more complex operation of establishing a wholly-owned subsidiary within another country [4]. A conceptual model was developed describing the role of cultural constraints on the transfer of technology, which considered both national and organizational differences in culture that influence technology transfer [6].

Success of Technology Transfer

The literature regarding the success of international technology transfer is extensive. The majority of the research compiled is concerned with diffusion, modification, and improvement of the existing technology [8, 9, 10]; while others have explained success as a measure of the economical value found through the amount of sales of the product(s) [11, 12], a measure of the operation of the technology [13, 17], and the acquisition of the knowledge and skills associated with the technology [14]. Measuring the success of technology transfer could be approached from a variety of ways, according to previous research. The simplest measurement was the ability of the recipient firm to operate the technology, and the most complex method was to measure the ability of the firm to invent a new technology.

Cultural Factors

Cultural barriers were the greatest challenge to the successful transfer of technology [15]. By analyzing the culture of the host nation, the donor would be able to identify factors to motivate higher efficiency and production from the workforce, thus enhancing the success of technology transfer [17]. When the social environment of the technology recipient includes government policies and economic, political, and cultural characteristics, the impact would be significant on the acceptance of the technology [18]. “Culture is one of the most powerful factors affecting the success of technology transfer”

[19] (p. 694). Tradition, religion, historical habits, and personal aspirations for a new life were important factors facing technology digestion and absorption [19]. Barriers to a successful technology transfer include cultural and language gaps, low technical and other capabilities in developing countries, inadequate infrastructure in developing countries, and insufficient investment in research and development, particularly relating to technology adaptation [20].

Technology transfer is defined as, "a transmission of knowledge which enables the recipient firm to manufacture a certain product or to provide a particular service" [21] (p. 155). Problems encountered in technology transfer center on differences in technological infrastructure, language, level of economic development, culture, and attitudes of the home and host countries [21]. The transfer of technology is not a movement of idle machinery/equipment from place to place, but rather a transfer of knowledge and information [19]. In addition, the recipient must be trained thoroughly to operate, make use of, and understand/absorb the technology transferred. The barrier of culture and language differences would affect the transfer of training [14].

Different countries have different cultural values, environments, work ethics, and motivation, and the capabilities of these differences have to be considered to successfully transfer technology [17]. Machinery and equipment portions of the technology to be transferred must be scrutinized with great care before they can be transferred [15]. Machinery has to be adapted to the needs and prevailing conditions of the host country; that lack of adaptability may be due to numerous factors, which may include difficulty of repairs, lack of adaptation to climate, lack of equipment/machinery sturdiness, and incompatibility with other equipment [15]. The adaptation of equipment to the host country is the acclimatization or influence of the climate on the functional operation and lifetime of the equipment [21].

Environmental Factors

Technology transfer requires a certain environment (physical, economical, industrial) to be of commercial value [22]. There were no assurances that a form of technology well-suited to one culture and/or physical environment would be equally effective when transplanted to a different culture and/or environmental setting [23]. Local environmental factors were important in conditioning technology transfer [24]. When technology is transferred to a foreign country, suitable adaptation to the local environment is usually required [7]. The physical environment factor can influence the success of the technology transfer from the point of the topography of the country—the climate, the weather (for example, typhoon season), all of this needs to be considered for technology transfers [25]. The process of ideal conditions for the transfer of technology is by providing the ideal physical environmental qualities that included a temperate climate (natural or artificial), favorable working conditions, and sufficient supply of materials [26]. In other words, providing the ideal physical environment for technology transfers was the only way to accomplish a successful transfer [26].

Geographical Location Factors

Geographic proximity can enhance technology transfer, and the cost associated with maintaining the technology in operation will be less if the transacting parties are in close geographic proximity to one another [18]. The effects of geographical location on technology transfer can be seen from two different perspectives. First, if natural resources or new materials needed to produce certain products through the application of the new technology do not exist because of geographic conditions, this will directly affect the applicable technology. Second, the geographical location lacks one or more key ingredient(s) necessary to make the technology transferable, such as the lack of a plentiful water supply vital to the technological process, even though all of the other necessary raw materials are available [15].

The theoretical base for this research derived from international technology transfer literature, which notes the influence of culture, geographical, and physical environment on the effectiveness of technology transfer. From this theoretical base, hypotheses were developed to test the extent to which culture, physical environment, and geographical location influence factors to the success of technology transfer from the point of view of the manufacturing industries in Saudi Arabia (as the recipients of the technology). Figure 1 graphically depicts the international technology transfer literature review and the proposed relationship between the perception of culture, physical environment, and geographical location to the success of technology transfer.

All of the research and literature reviewed seemed to be specific to countries other than the Arabian countries in the Middle East, including Saudi Arabia. There have been many dramatic changes that have taken place (and are continuing to take place) in Saudi Arabia's political and social settings, directly and indirectly related to the oil wealth, and technology transfer issues continue to be raised. For Saudi Arabia to remain a player in the global marketplace, new technologies must be implemented because the reliance on oil for wealth must be replaced eventually. Therefore, answers for successful technology transfer remain at the forefront.

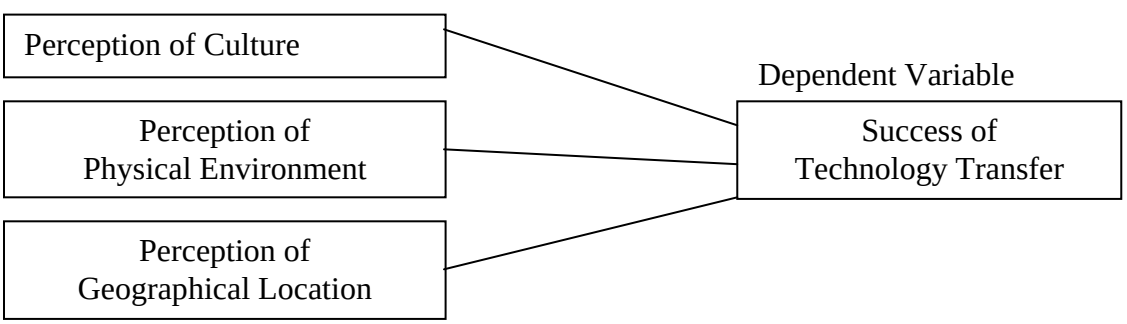

Figure 1: Conceptual framework for studying the relationship between culture, physical environment, geographical location, and the success of technology transfer

This study will extend previous research compiled from other countries that have used similar methods and relate the published information to show the extent to which these factors have a major influence on the success of technology transfer for other regions. By considering these factors, it is possible to establish developmental policies that are in harmony with the environment, relating to social needs and those that foster self-reliance [27].

Research Questions and Hypotheses

This study addressed the following research questions:

1. What are the demographic characteristics of Saudi private manufacturing industries?
2. To what extent does Saudi private manufacturing industries' top management perceive culture to be a factor in the success of technology transfer to Saudi Arabia?
3. To what extent does Saudi private manufacturing industries' top management perceive geographical location to be a factor in the success of technology transfer to Saudi Arabia?
4. To what extent do Saudi private manufacturing industries' top management perceive physical environment to be a factor in the success of technology transfer to Saudi Arabia?
5. Are there significant relationships among the perceptions of factors and the success of technology transfer to Saudi Arabia?
6. What are the most frequent operational problems encountered among these industries?

From these questions, the following research hypotheses were derived:
H1: There is a significant relationship between top-level management's perception of culture, physical environment, and geographical location as barriers/factors to the success of technology transfer.
H2: There is a significant relationship between top-level management's perceptions of culture as a barrier/factor to the success of technology transfer.
H3: There is a significant relationship between top-level management's perceptions of physical environment as a barrier/factor to the success of technology transfer.
H4: There is a significant relationship between top-level management's perceptions of geographical location as a barrier/factor to the success of technology transfer.

Research Design

The research instrument was developed by the researcher and derived from the literature concerning technology transfer impediments to the success of technology transfer. The instrument was tested for validity and reliability through a pilot study. A consensus approach was used for validity and internal consistency for reliability. The instrument consists of three sections. The first section was designed to gather data about the industries' demographic characteristics. The second section was a scale measurement of

the participating industries' perception of the success of technology transfer, culture, physical environment, and geographical location as factors affecting technology transfer. The third section was intended to measure frequency distributions of problems associated with normal operation of the industries and opinion feedback questions.

Samples

Forty manufacturing industries in Saudi Arabia who participated in this research were randomly drawn from a sample purposefully selected from the Saudi Industrial Directory (1995) published by the Ministry of Industry and Electricity [28]. The criteria for selecting the sample were private manufacturing industries; companies manufacturing a product or products made from raw materials; and companies comprised of a workforce of 120 or more persons. A survey was personally delivered to top-level management in selected industry offices. The rationale for using personal delivery was to ensure that the survey was not ignored—something that would be likely if the surveys were mailed. Therefore, personal delivery was used to guarantee a maximum rate of industry participation. Top-level management was selected to complete the surveys because they are the decision makers for these industries, and their decisions would include any/all technology transfer processes, as well as the type of technology used in their industries. These individuals also have a greater knowledge of the overall performance of their industries, are very well educated, and in general, are fluent in English. All 40 surveys were returned in usable condition for analysis.

Data Analysis

The responses on the questionnaires were coded numerically and entered into a computerized data file; they were added for each of the independent variables and the dependent variable. The data for each statistical hypothesis were analyzed using regression analysis. The statistical analysis was processed using SPSS Version 9 (1999) [29]. SPSS was chosen because it is a universally recognized computer program for analyzing data. All the variables were analyzed for normality, linearity, and homoscedasticity. Normality was analyzed graphically using a histogram. When reviewing the graphs, most of the scores fell in the center of the bell curve, and normality was assumed. Linearity is a straight-line relationship between two variables [30]. Using bivariate scatter plots between the dependent variable on the Y-axis and each of the independent variables on the X-axis, the plots showed that the relationships between the variables were linear. The assumption of linearity was met.

Homoscedasticity is the assumption that the variability in scores for one variable is roughly the same at all values of the other variables [30]. Homoscedasticity was assessed by plotting the data on the X-axis and the residuals on the Y-axis. The residuals were evenly spaced across all of the predicted scores. The data is homoscedastic if the residuals are evenly spaced [30].

The data were analyzed simultaneously, and all independent variables were entered in an SPSS regression program at once. Standard or simultaneous models of regression are appropriate for small to medium sample sizes [30]. This allows the researcher to examine each independent variable as if it had entered the regression equation after all other independent variables had been entered. Thus, each independent variable was evaluated in terms of what it added to the prediction of the dependent variable above and beyond what was predicted by all other independent variables. Figure 1 presents the conceptual framework for the relationship between the perception of culture, physical environment, and geographical location as factors to the success of technology transfer.

Findings

The first and second parts of the demographic characteristics present industry types as they were categorized from the Saudi Industrial Directory (1995). The workforce numbers ranged from 130 to 3,500 employees, and the median number of employees was 300. The percentage of Saudi employees ranged from 1 to 36 percent; the median percentage of Saudi employees was 9 percent; and all Saudi employees were working in management positions, personnel, or support areas. These industries' intended markets included local markets and exports to Gulf Corporation Countries (GCC), North America, Europe, various East Asian countries, and other Arab countries in the Middle East. From the sample, 30 industries fully used the same approaches and methods of manufacturing as the source of the technology, nine partially used the same methods and approaches, and one industry had its own methods and approaches. Twenty-three of the 40 industries perceived a greater advantage if their employees were Saudi, and 17 industries indicated that it would not make a difference if their employees were Saudi or not, if the sources of the technology were North America, Europe, and East Asia.

When respondents answered "yes" to the question on industry modification and/or adaptation to imported technology in relationship to the physical environment and geographical location of Saudi Arabia, a submitted written explanation was requested. Regarding the question relating to physical environment, 10 of the 40 industries mentioned that there were modifications and/or adaptations made in the technology to provide extra cooling, ventilation modifications due to dust, and special heavy-duty equipment necessary to suit the environment. Thirty industries mentioned that there had been no modifications or adaptations required for their technology.

Regarding the question on geographical location, four of the 40 industries replied that it was necessary to adapt their technology to provide extra storage space for spare parts and materials. The remaining industries stated that there were no modifications or adaptations needed for their technology. The question of language translation found 13 of the 40 industries reporting that modifications/adaptations were made regarding language and translation of all information associated with the technology to either Arabic or English. The remainder of the sample stated that no modifications or adaptations were necessary.

Participants were also asked to rate the frequency of occurrences within normal operations of their industries on problems regarding equipment failure, lack of skilled technicians, spare parts shortage, raw materials shortage, and/or lack of outside support. Figure 2 shows that the lack of skilled technicians appeared to be the most frequent problem, followed by spare parts shortages. Equipment failure and raw material shortages tied for the third most frequent problem. The lack of outside support was listed as the least frequent problem.

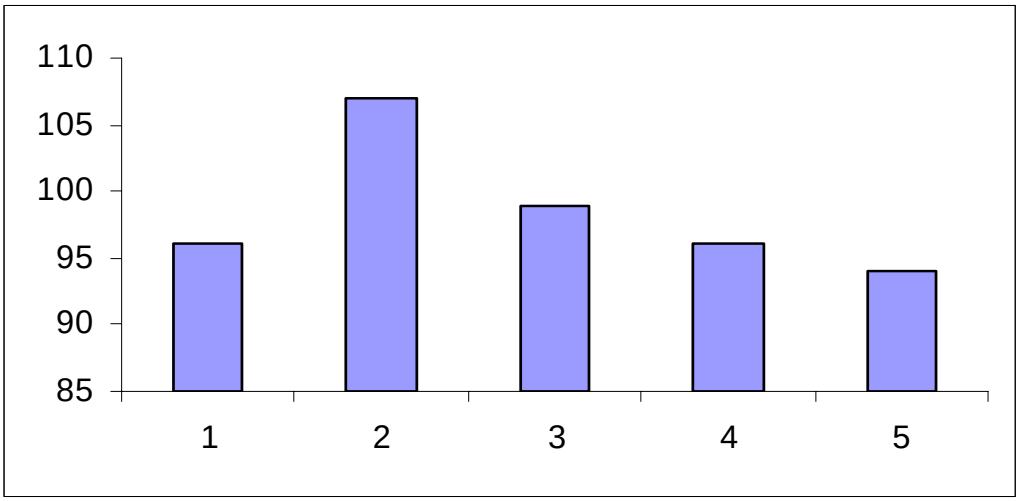

Figure 2: Frequency of problems associated with normal industries operations
Note: 1 = Equipment failure, 2 = Lack of skilled technicians, 3 = Spare parts shortages, 4 = Raw materials shortages, 5 = Lack of outside support.

Multiple Regression of the Data

The mean and standard deviations for the 40 industries regarding the success of technology transfer and the summarization of the finding are shown in Table 1. The mean of the dependent variable was 27.02, and the standard deviation was 8.701. For the independent variable of culture, the mean was 36.00, and the standard deviation was 11.14. For physical environment, the mean was 30.75, and the standard deviation was 9.73. For geographical location, the mean was 19.62, and the standard deviation was 8.37.

Table 1: The mean and standard deviation of culture, physical environment, geographical location, and success of technology transfer

	No. of Items	M	SD	N
Culture	14	36.0000	11.1401	40
Physical Environment	13	30.7500	9.7369	40
Geographical Location	8	19.6250	8.3779	40
Success of Technology Transfer	11	27.0250	8.7016	40

Table 2: Correlation

	1	2	3	4
1. Culture	--	.522**	.503**	.693**
2. Physical Environment		--	.650**	.570**
3.Geographical Location			--	.674**
4. Success of Technology Transfer				--

** Correlation is significant at $p<0.01$

All data were entered simultaneously for the correlation and regression analysis. As shown in Table 2, there was a significant positive relationship at $p<.01$ between the success of technology transfer and culture ($r=.693$), physical environment ($r=.570$), and geographical location ($r=.674$).

The simultaneous regression, as shown in Table 3, indicates that culture, physical environment, and geographical location significantly affect the success of technology transfer F (3, 36) = 20.01, $p<.01$. Together, the three independent variables accounted for 62.5 percent of the variance and the adjusted $R^2 = .59$. The regression coefficient for unstandardized B, standardized B, and t (test of significants) are shown in Table 4. Results found in Table 4 indicate that culture ($t=3.67$, $P<.01$) and geographical location ($t=2.86$, $P<.01$) were significant unique predictors of the success of technology transfer. Square semi-partial correlations indicate that culture accounted for 14 percent of the variance, while geographical location accounted for 9 percent of the variance. Physical environment was not a unique predictor. The results indicated that culture, physical environment, and geographical location significantly affected the success of technology transfer at a 99 percent confidence level (F (3.36) =20.01, $p<.01$), and they accounted for 62.5 percent of the variance. This provided support for the first hypothesis, which stated there would be a significant relationship between culture, physical environment, geographical location, and the success of technology transfer. Culture significantly affected the success of technology transfer at a 99 percent confidence level ($t=3.67$, $p<.01$) and accounted for 14 percent of the variance. This provided support for the second hypothesis that stated there would be a significant relationship between culture and the success of technology transfer. Physical environment was not found to be a significant factor affecting the success of technology transfer. This did not provide support for the third hypothesis, which stated there would be a significant relationship between physical environment and the success of technology transfer at the .05 level. Geographical location significantly affected the success of technology transfer at a 99 percent confidence level ($t=2.86$, $p<.01$) and accounted for 9 percent of the variance. This provided support for the fourth hypothesis that stated there would be a significant relationship between geographical location and the success of technology transfer.

Table 3: Analysis of variance of regression and residual

	Df	F
Regression	3	20.014**
Residual	36	
Total	39	

**p<0.01

Table 4: Summary of simultaneous regression analysis

Variables	B	*B*	T
Culture	0.355	0.454	3.671**
Physical Environment	0.066	0.075	0.531
Geographical Location	0.413	0.398	2.865**

**p<0.01

Discussion

Research suggested culture, physical environment, and geographical location as factors related to the success of technology transfer [1, 4, 19] and addressed these factors as barriers to technology transfer. However, they did not address the perception of the technology transfer recipient regarding these variables. Data for this study was collected through a survey that was completed by 40 top-level managers working for Saudi Arabian private industries, representing a relatively diverse group of manufacturers (foods, textiles, wood, papers, chemical and plastics, construction materials, metals, fabricated metal products, etc.). The data was analyzed using the Statistical Package for the Social Sciences (SPSS Version 9, 1999).

The findings from the demographic characteristics of the participant industries indicated that they rely heavily on expatriate workers, with a range of 64 percent to 99 percent. This lends credence to research that holds that a lack of sufficiently skilled labor force unable to assimilate and adapt new knowledge, know how, and technologies to local conditions is an impediment in technology transfer [31]. Their sources of technology were a blend of technologies from Europe, North America, and East Asia; and, their products were then marketed locally and exported to neighboring countries, Europe, North America, and East Asia. Of the 40 participating industries, 23 perceived it was to their advantage to have Saudi employees to be more competitive, 10 indicated modifications and/or adaptations were necessary due to the physical environment, four indicated modifications and/or adaptations were necessary due to geographical location, and 13 indicated that the translation of documents into Arabic or English were necessary. The problems cited by the participant industries as occurring most frequently were the lack of skilled technicians, spare parts shortages, equipment failure, and raw materials shortages. The top managers cited the lack of outside support as the least frequent problem.

When looking at the overall perceptions of culture, physical environment, and geographical location as adapting factors on the success of technology transfer as used by the Saudi Arabian private manufacturing industries, the findings indicated that these factors have a major effect on technology transfer. The simultaneous regression showed that all the independent variables combined significantly, which affected the success of technology transfer F (3.36) =20.02, P<.01. When combined, the three independent variables accounted for 62.5 percent of the variance. These findings added support to the proposal that culture, geography, and environment were factors to be overcome in technology transfer [15], as well as studies that determined that culture, physical environment, and geographical location were adapting factors to the success of technology transfer [17,19].

The cultural factors showed statistical significance t=3.67, P<.01 with the success of technology transfer accounting for 14 percent of the variance. Cultural factors, as noted, included training of the workforce, employee attitude, language, norm and customs, personnel and family life, punctuality, and ethics. These were perceived by the surveyed industries as problematic to the success of technology transfer [32]. Supported by these findings were the proposal that cultural differences produce barriers to technology transfer, since national culture and social norms often create problems to the success of technology transfer [33], the models on cultural barriers to technology transfer [20, 27], and the study on the importance of culture on the effectiveness of technology transfer across nations [33]. Research results also explained why technology transfer led to change, with change being inevitable to the entire society when introduction of new production methods, procedures, and techniques led to new production relationships, class disruption, and adoption of a new culture [19]. This is also affected by the concept that the wider the cultural gap between two societies, the more resistance will be found to new technology [34]. As noted from the literature, culture, in general, is viewed by scholars and researchers as the most powerful factor in the success or failure of technology transfer. These results added an empirical value to the previous research on technology transfer from the point of view of the recipient nation.

The physical environmental adapting factors, such as machinery breakdowns, tool usage, efficiency of operations, working conditions, and worker performance were not supported. Clarification of the lack of support for the physical environment hypothesis may be explained by the industries' awareness of Saudi's environment and adapting the technology to suit the environment prior to the transfer. Consideration is usually made prior to the acquisition of the technology and by providing a working environment suitable to supporting the technology and workers through the addition of air conditioning and/or extra ventilation. The main explanation for rejection may rest on the individual's interpretation of factors related to physical environment questions provided in the survey, as there is often a limitation of perceptions in research.

In addition, results did not provide any support for research that indicated physical environment factors have an impact on the success of technology transfer [15, 21, 24],

etc. The participating industries all agreed on the issues associated with adapting technology to suit the local environment. To provide the needed conditions for the technology to be effective for their operations, Saudi Arabian industries installed air conditioning, extra ventilation, cooling systems, and other necessities required to overcome the problems associated with the local environmental conditions.

The geographical location factors that included access to markets, tool usage, spare parts, raw materials, and resources and were found to be statistically significant, $t=2.86$, $P<.01$, counting for 9 percent of the variance. These findings support the model on technology transfer which proposed that different geographical regions have different needs and support for technology, with emphasis on the current market, given that market conditions are different in all countries and market size directly supported or hindered technology transfer [15].

The significance of geographical location might also be related to the industries' ranking of spare parts and raw materials shortages as second and third, respectively, as the most frequent occurrences of problems within normal operations of the industries. The influence of geographical location on the availability of spare parts and raw materials is twofold. First, the industries had to maintain significant amounts of spare parts and raw materials for their operations due to the time required to transport these needed materials. Second, the cost associated with maintaining these stocks (warehouses/storage space required, etc.) was a significant factor. This result lends credibility to the findings regarding the resources availability [15], as well as research that showed geographical proximity increased the level of technology transfer success [18].

The results of this study will help management and various decision-makers regarding the importance of cultural, physical environment, and geographical location barriers/factors on the success of technology transfer. The results of this study also provide a greater understanding for top-level management of Saudi Arabian private industries regarding cultural, environmental, and geographical factors as being vital to the success of the transfer of technology to Saudi Arabia. This information will enhance the effectiveness of the decision-making process for these managers and, perhaps, increase their efficiency and success of technology transfer.

Conclusions

Technology transferred to Saudi Arabian industries would most likely come from Europe, North America, and East Asia, and it would be operated mainly by expatriate workers. Adaptations and/or modifications are likely to be necessary due to the local environment. The most frequent problems facing these industries are the lack of skilled technicians and the shortage of spare parts. The reliance on an expatriate work force will affect technology transfer; the workers acquire the knowledge, but they are not a permanent fixture of the countries infrastructural network; therefore, their leaving creates a void in the technological process. In addition, culture, physical environment, and geographical location all have significant effects on the technology; necessary accommodations of

these factors are vital to the success of the technology transfer and will facilitate the effectiveness of the technology.

This study was exploratory in nature and based on the deductive method of investigation. Due to the non-experimental design of this research, causal inferences should be limited to the findings of this particular study. The findings from the statistical analysis incorporated in the study are, in some respects, intuitively easy to understand and explain. The clearest explanations for how culture, physical environment, and geographical location affect the success of technology transfer are directly related to factors associated with the technology. Thus, the following factors—culture (knowledge, skills, training, etc.), physical environment (adapting to local conditions), and geographical location (availability of parts and raw materials) are directly linked to the success of technology transfer and its sustainability. These theories were noted in the literature and supported by this research. The greater the gaps in culture, physical environment, and geographical location between the recipient and the provider, the less likely it is that the technology transfer will be successful. There is an abundance of literature that documents technology transfer as an exceedingly complex construct, a complexity that requires much more rigorous, long-term, in-depth, and multi-dimensional research. This study has provided the springboard for ongoing research in determining the relationship between perceptions of culture, physical environment, geographical location, and the success of technology transfer.

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Biography

Rashed M. Al Thawwad, Ph.D., received a B.A. from California State University in Fresno, an M.S. from Illinois State University, and a Ph.D. from the University of Missouri in Columbia. He retired as Director for the Technology Department in Government Industries in Saudi Arabia, serving 25 years in numerous areas, including Senior Researcher and Production Manager. He served as consultant to King Abdul City of Science and Technology, different government agencies in Saudi Arabia, as well as numerous private industries in the area of technology transfer.