

THE CHALLENGE OF TECHNOLOGY TRANSFER IN A CROSS-CULTURAL ENVIRONMENT – FROM THE U.S. TO THE GREATER CHINA REGION

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ABSTRACT

The capabilities of technology transfer (TT) within organizations are the key elements of competition in the era of innovation. In the early 1990s, faced with the rapid growing of global competition, American companies were actively searching for opportunities of product outsourcing and technology transferring to Asia countries, particularly to the Greater China Region (Taiwan and PR China). However, those multinational corporations (MNCs) in the U.S. are confronted with a challenge – the impact of cross-cultural issues in TT. Even though the cross-cultural impact in TT gives rise to the influences in MNCs, a literature review indicates abundant related works dealing with this topic, only few addresses specifically to the effects of cultural differences affecting the effectiveness of TT and suggests complete and practical solutions. This investigation examines the impact of cross-cultural issues on managing TT from the U.S. to the Greater China Region and presents a validated model for those project managers who manage this type of projects in MNCs.

Key Words: *Cultural Differences, Multinational Corporations, Technology Transfer.*

1. INTRODUCTION

Cross-cultural communication has become a fundamental issue in managing TT where extensive exchange of ideas takes place between the sending and receiving parties of two distinct cultural backgrounds, and thus operations characteristics and management styles of MNCs have dramatically changed. Project managers in MNCs responsible for the TT must receive adequate trainings to understand the cross-cultural issues and concerns, to exercise sound judgment and to seek guidance from professionals possessing the multicultural expertise.

Competition in the global industries is becoming more knowledge-intensive and technology-intensive, and the ability of multinational corporate to leverage their competencies across dispersed subsidiaries forms increasingly important source of competitive performance (Morten *et al*, 2004). Since new technology is rapidly developing at an astonishing rate across countries in the world, the cross-cultural TT becomes a highly complex issue in developing countries and regions. In order to succeed in the TT, the effectiveness of communication between two technology-transferring parties plays a critical role. Lack of sufficient understanding of cultural differences, differences in management philosophy and styles and less effectively mutual communications usually cause problems during the process of technology transferring. Even though some measurement tools to evaluate the readiness assessment of TT, such as Cloverleaf Model (Heslop, 2001), project managers who manage TT in MNCs are still confronted with the challenge of intensive communication and interaction between two distinct cultures.

On the other hand, since globalization has dramatically made technological latecomers easier to access advanced technologies, it provides a unique opportunity for those low-income countries to raise their income (Mayer, 2000; Mayer *et al*, 2002). For example, in the early 1990s, American manufacturing companies attempted to reduce production costs and tried to only focus on the core of their high-profit-margin products (Ansberry, 2003); therefore, they were looking for outsourcing and transferring manufacturing technologies to the developing countries and regions. Western technology has been an effective vehicle to modernize Chinese industrial production, especially since the late 1970's when economic reform and opening up policy were firstly implemented (Chen *et al*, 2000). In China, both of the highly competitive labor costs and "unfrozen" technical policies in the 1990s (Jin, 1994) made China become one of the most attractive countries in the world for outsourcing and technology transferring of labor-intensive manufacturing country. In Taiwan, the R&D alliances were formed in the 1980s and have flourished in the 1990s as institutional forms. This trend encourages firms to cooperate in raising their technological levels (Mathews, 2002). Because of cost-effective product realization and rapid design-to-market rollout leading to volume manufacturing, it results in the fact that a significant part of emerging technologies transferred to the Greater China Region.

In addition to the lower labor costs mentioned above, another advantage of using overseas suppliers and partners falls into the "time is money" category. When a U.S. plant ends its day shift at 5:00 p.m., it is 8:00 a.m. in Taiwan and China, and the Chinese manufacturing partner is beginning the workday. Thus, the U.S.-based teams and overseas counterpart can work virtually around the clock, substantially shortening the product development schedule (Woods, 2002).

2. LITERATURE REVIEW

TT is common in modern academic literature. Researchers and practitioners in the world have realized the importance of effective TT. Many believe that TT is one of the critical elements in the global operations of an international corporation. Hamel (1989) reports that TT depends on the ease of technology transport, interpretation, and absorption. An analysis has revealed that the context and motives, particularly to the organizational level, reflect the effectiveness of TT (Kremic, 2003). Haghirian (2003) indicates that a successful TT is dependent to the dimensions of contextual transfer process faces. Further, Haghirian states Doz's and Santos's definition of knowledge transfer (or transfer of technology) in MNCs as follows:

"It is customary to speak of the 'transfer' of knowledge (or transfer of technology) between two distant units of a MNC or between two different functional units at HQ, between a vendor and a customer, even between countries. The use of 'transfer' implies (or, at least induces) an image of flow: knowledge 'flows' from its primary holder to the secondary holder."

TT is an organized conveyance of technology or domain know-how from the giving party to its receiving parties, according to a mutual agreement between these two parties. Mansfield (1975) presents an early and comprehensive categories and forms of TT. In his work, three different phases can be categorized of TT. The first phase is called 'material transfer', which involves the transfer of a new material or product to a recipient party. The second phase corresponds to the 'transfer of design and documents' that facilitates the manufacturing process of the material or product. The last phase is referred as 'capacity transfer', which involves adapting the new product to the specific conditions of the recipient party.

In order to have tightened interface and deeply involved long-term partnership for those giving and receiving parties, Chao (2003) proposes an extended phase of TT named “integrated transfer”. In the forth phase of “integrated transfer”, the transferor not only transfers its capacity to the transferee, but also treats the recipient as its “manufacturing division” or “product distributor”. The relationship between these two partners is virtually advanced and becomes a closer business alliance.

It is obvious that TT raises the question about the organization of technology processes within a company, and thus the problems and the challenges that companies usually encountered are to manage them in an effective way to increase their competitive advantages. Rauner *et al* (2003) mention that the more extensive the transfer of structures influenced by the cultures, the more difficult the new technology implemented through the TT. Therefore, the capability of MNCs efficiently combining knowledge from different locations around the world becomes increasingly important as a determinant of competitive success. Thus MNCs should be able to derive great competitive advantage by managing technology flows between their subsidiaries.

Since technology is diversely generated from different sources, it is naturally associated with different degrees of ease of TT. Gold *et al* (2001) report that since organizations may not be equally predisposed for successful launch and maintenance of knowledge management initiatives, a key to understand the success or failure of knowledge management within organizations is the identification and assessment of preconditions that are necessary for the effort to flourish and the context in which TT takes place.

Haghirian (2003) indicates that the influences factors within TT could be mainly specified as factors of knowledge, culture, organization, and person. Haghirian also states that the specific cultural influence is the primary element deciding the successfulness of the TT within MNCs. Lin (2001) mentions that several efficiency measures of TT were proposed by many scholars, and those factors of efficiency measures could be summarized as satisfaction, technical efficiency, costs, and schedule. Lin also uses factors of technology nature, international experience, and cultural difference to explain why the project performance of TT differs from one to another.

Generally, the content of the technologies transferred varies widely in each of the methods. Domestic demand, scale of production, trade-offs, machine capabilities, and costs influence the type, complexity, and extension of the TT (Liu, 1995). This study summarizes the influence factors of TT in Figure 1.

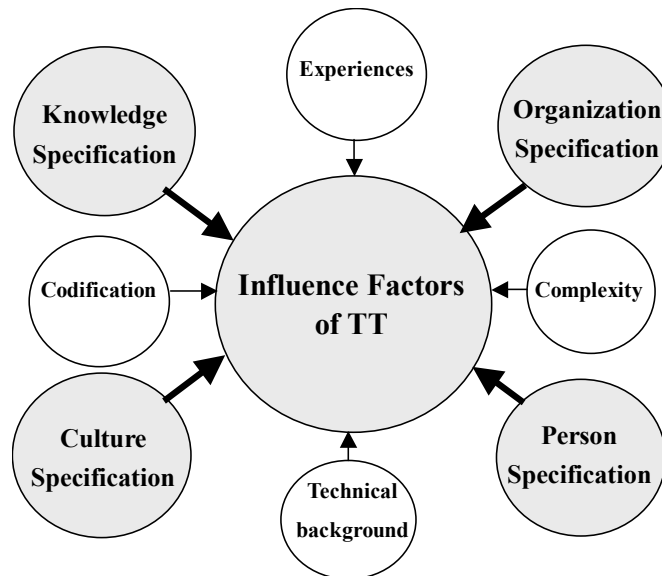


Figure 1. Influence Factors of TT

3. CROSS-CULTURAL ISSUES BETWEEN EASTERN AND WESTERN

Differences in approaches, values and expectations between customers, suppliers, and team members with different cultural backgrounds have led to many project failures in MNCs. Usually the cross-cultural conflict is stated as the perceived or actual incompatibility of values, norms, processes, or goals between a minimum of two cultural parties over content, identity, and procedural issues. Every culture has distinct characteristics and aspects that make it different from the other cultures (Hoffa, 1995-2002). Differences in culture reflect in language, communication style, religion, political organization, food, clothing and others. Western cultures tend to be more informal, expressive, louder, and more boisterous, and their counterparts from Eastern cultures are normally perceived as being formal, quiet, inexpressive, and polite.

Misunderstandings resulted from the miscommunication, and an inadequate communication often leads to problems associated with the other party working on the wrong tasks, committing to an outdated schedule, or allocating the unwanted resources. As mentioned above, the miscommunication between two project management teams causes tremendous opportunities of schedule delays, wasteful efforts, reduced synergy, and complaints. Moreover, problems in communication between project managers and team members, if not properly dealt with, may evolve into hard feelings and conflicts jeopardizing project performance and even the cooperation between these two partners (Huang, 1993).

3.1. Technology Transfer Trends between American and Asian Business

Faced with rapidly emerging global competition, American companies are realizing the urgency of outsourcing their operations for reduced costs and improved delivery schedule (Palich, 1999). American companies in high volume industries are rapidly developing outsourcing strategies, characterized by various phases of product and TT. For example, major American corporations, such as Motorola, Intel, AT&T, General Electric, HP, IBM, Kodak, Dell and Apple Computers, ... etc., have adapted a policy of outsourcing a portion or entire manufacturing capacities to Asian countries, including Taiwan, China, India, Thailand, and Malaysia (Palich, 1999). A trend of a tenfold expansion of international ventures during the 1980's (Dussauge *et al*, 1995; Gomez-Mejia *et al*, 1991), and this trend even accelerated in the 1990's and early 2000s. Interestingly, a predominant technology recipient, Taiwan, has

pledged a total of \$139.4B investments, including joint ventures with product and TT encompassing more than 62,300 projects in China over the past decade (Kyodo, 2002).

Companies involving cross-cultural TT must understand their partners' needs, capacity constraints, as well as cultures, and assign a project manager to oversee the transfer (Andreosso-O'Callaghan, 2002). Knowledge is the key to effective cross-cultural communication since people understand the potential problems of cross-cultural communication and make a conscious effort to overcome these problems. Additionally, the usual technical and management concerns that a project manager normally has in a domestic TT, he must also understand the differences in culture and tackles this issue tactically and effectively in order to be successful (Hoffa, 1995-2002).

3.2. An Integrated Solution and Model

A successful integration is the prerequisite to successful cross-cultural teams, and successful team integration is the acceptance of cultural differences within the team while focusing on one common objective, forming an integrated, powerful and compelling whole. In order to operate effectively and successfully in cross-cultural projects, project managers increasingly require tools and skills which help them to be "interculturally professional", to amalgamate divergent cultural attitudes, beliefs and behavior, and, eventually, to forge a powerful and effective international team. Therefore, a cultural awareness training designed to indoctrinate the project managers and team members is thoroughly conducted. It is usually desirable that professionals provide the cultural awareness trainings, and these professionals are rich in multicultural experiences and have extensive hands-on project management experiences managing cross-cultural collaboration. Email writing and reading skills emphasizing preciseness and conciseness are also taught. Team members are encouraged to use Email as a preferred means of communication due to the merits of its speed, lower cost, and most importantly, written communication tends to be performed more cautiously with improved quality and traceability.

Similarly, in order to eliminate the troublesome narrative reports, Electronic Data Interchange (EDI) capability should be implemented to facilitate data and document transfer between the two cross-continent teams. Teleconference and/or videoconference attended by the key players of the teams are conducted on a weekly basis to bring up issues and problems to be discussed "face-to-face" and resolved on a timely basis.

The authors believe that one of the most powerful solutions to the cross-cultural project management issues is to establish a small subsidiary collocated inside the transferring company's premises. Depending on the size and complexity of the business, the organizational size of this subsidiary could vary from a single liaison to a multi-member team. Normally, a subsidiary consisting of a leader, usually an experienced project manager possessing strong cross-cultural background, a project engineer with bilingual capabilities, and a clerical support, is adequate to support a business with annual revenues of up to \$30M. Serving as a virtual bridge between two continents, this expatriate team dispatched from receiving company is primarily responsible for effecting a smooth daily communication between the transferring company and its headquarter (Chang, 1999). They also provide on-site assistance to the customer, help interpret contractual ambiguities, and clarify issues surfaced from every step in the course of the TT. Most importantly, they are the 'attaché' charged with the essential responsibility of building and enhancing relationship and cooperation with the middle and senior management of the technology provider. On the other hand, this subsidiary is also responsible for facilitating sales of the technology provider's products to its parent company for distributions.

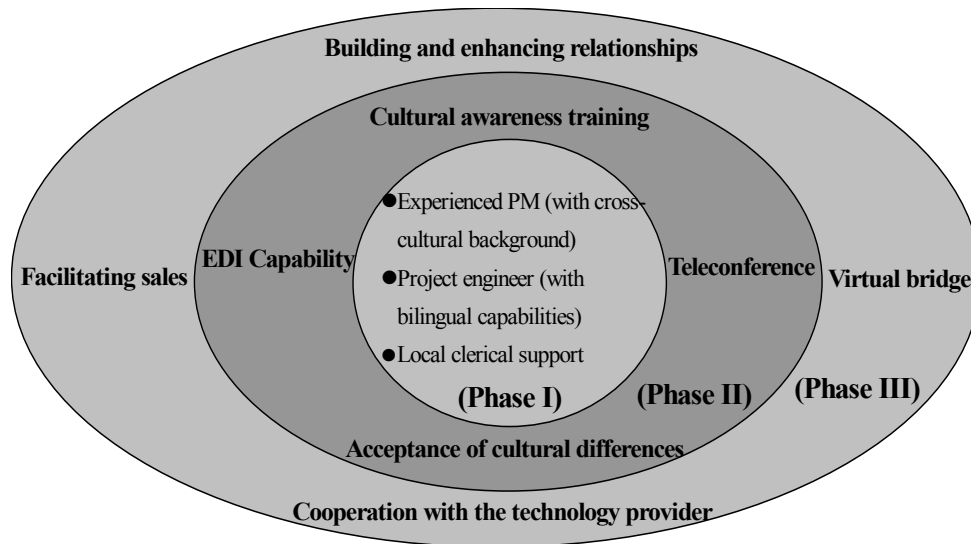


Figure 2. A Model of Successful Subsidiary Team Integration

4. HOW AMERICAN FIRMS MANAGE CHINESE MANUFACTURING PARTNERS

To understand how American companies manage their Chinese TT projects, the authors developed and performed the following research instruments and procedures:

- (a) A pilot survey of 15 American companies transferring manufacturing technologies to China (this pilot survey served as the “pathfinder” for the main survey),
- (b) A more comprehensive survey on 30 American companies transferring manufacturing technologies to China, and
- (c) Six interviews with American and Chinese executives who have the responsibilities of overseeing the TT projects.

4.1 Survey Design

These surveys were designed and based on extensive literature review and the authors’ personal experience managing U.S. to China TT projects. Each 10-question survey was constructed with the purpose of understanding and assessing followings:

- (a) The cross-cultural awareness of the American firms transferring technologies to China
- (b) How these American firms managed their transfer projects or businesses.

A total of 150 survey letters containing the developed questionnaire were distributed to U.S. headquarters of American firms operating subsidiaries, sales offices, joint ventures, or working with manufacturing partners and suppliers in China. These American firms were selected randomly from the U.S. headquarters of companies listed in the U.S. A total of 31 responses were received, representing a return rate of 20.78%. 30 out of 31 respondents reported having been actively engaging in TT to China. Subsequently, the useful survey data collected were reduced, analyzed, and presented in their entirety. Statistical analysis of the data consisted of graphic presentation, correlation analysis, and tests of the hypotheses to verify the validity and reliability of the survey data.

4.2 Limitations of This Research

The limitation of this study is that it addresses only the cultural differences between the American and Chinese cultures and their impact on managing technology transfer projects between these two cultures. This study, however, was not intended to generalize its

applicability to other cultures and not to address the distinct corporate cultures and cultural differences within an organization.

4.3 Survey Findings

Half of the 30 respondents participating in TT described their Chinese partners as having either assigned an on-site representative or operating a subsidiary nearby the American technology transferors. A cross-examination of these 15 firms with respect to their rating of project performance indicated a rating between successful and very successful ($M = 4.27$). Those firms whose Chinese partners did not have assigned representatives or subsidiaries in the United States indicated a rating between somewhat successful and successful ($M = 3.22$). Table 1 shows the results of survey findings.

Table 1. List of Survey Findings

Questions	Factors	No.	%	Figures												
The number of years participants at the executive level	< 3 years	11	35.48%	<p>The number of years participants at the executive level</p> <table border="1"> <caption>Data for Executive Level Years</caption> <thead> <tr> <th>Years</th> <th>Number of Participants</th> </tr> </thead> <tbody> <tr> <td>> 9 years</td> <td>8</td> </tr> <tr> <td>6-9 years</td> <td>7</td> </tr> <tr> <td>3-6 years</td> <td>5</td> </tr> <tr> <td>< 3 years</td> <td>11</td> </tr> </tbody> </table>	Years	Number of Participants	> 9 years	8	6-9 years	7	3-6 years	5	< 3 years	11		
	Years	Number of Participants														
	> 9 years	8														
	6-9 years	7														
3-6 years	5															
< 3 years	11															
3-6 years	5	16.13%														
6-9 years	7	22.58%														
> 9 years	8	25.81%														
The engagement in TT from the U.S. to China	Operating a subsidiary in China	19	63.33%	<table border="1"> <caption>Data for Engagement in TT</caption> <thead> <tr> <th>Factor</th> <th>Number of Participants</th> </tr> </thead> <tbody> <tr> <td>Engaging in multiple working relationships</td> <td>8</td> </tr> <tr> <td>Having a joint venture relationship with Chinese firms</td> <td>7</td> </tr> <tr> <td>Procuring parts or services from Chinese suppliers</td> <td>8</td> </tr> <tr> <td>Working with Chinese manufacturing partners</td> <td>7</td> </tr> <tr> <td>Operating a subsidiary in China</td> <td>19</td> </tr> </tbody> </table>	Factor	Number of Participants	Engaging in multiple working relationships	8	Having a joint venture relationship with Chinese firms	7	Procuring parts or services from Chinese suppliers	8	Working with Chinese manufacturing partners	7	Operating a subsidiary in China	19
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Working with Chinese manuf. partners	7	23.33%														
Procuring parts from Chinese suppliers	8	26.67%														
Having a joint venture relationship	7	23.33%														
Engaging in multiple working relationships	8	26.67%														
The magnitude of U.S. to China TT projects	<= \$15 million	14	46.67%	<p>The magnitude of U.S. to China TT projects</p> <table border="1"> <caption>Data for Magnitude of TT Projects</caption> <thead> <tr> <th>Category</th> <th>Number of Participants</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>> \$15 million</td> <td>16</td> <td>53.33%</td> </tr> <tr> <td><= \$15 million</td> <td>14</td> <td>46.67%</td> </tr> </tbody> </table>	Category	Number of Participants	Percentage	> \$15 million	16	53.33%	<= \$15 million	14	46.67%			
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> \$15 million	16	53.33%														
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> \$15 million	16	53.33%														
The levels of cross-cultural awareness	No or very limited awareness	5	16.67%													
	Adequate	11	36.67%													
	Very Good	7	23.33%													

	Expert-level awareness	7	23.33%	<p>Expert-level awareness (23.33%) Very Good (23.33%) Adequate (36.67%) No or very limited awareness (16.67%)</p> <p>Numbers of Firms</p>
The levels of cross-cultural training	No or brief training on cross-cultural issues	7	23.33%	<p>Chinese expatriate At least 6 months of on-the-job training No or brief training on cross-cultural issues</p> <p>Numbers of Firms</p>
	At least 6 months of on-the-job training	5	16.67%	
	Chinese expatriate	18	60.00%	
The success levels of cross-cultural TT	Not successful	2	6.67%	<p>Very successful Successful Somewhat successful Not very successful Not successful</p> <p>Numbers of Firms</p>
	Not very successful	4	13.33%	
	Somewhat successful	8	26.67%	
	Successful	7	23.33%	
	Very successful	9	30.00%	
Experienced obstacles (multiple choices)	Miscommunication/misunderstanding	24	80.00%	<p>unfamiliar with cross-culture unfamiliarity with laws and regulations Had witnessed cross-cultural issues Miscommunication and misunderstanding</p> <p>Numbers of Firms</p>
	Had witnessed cross-cultural issues	20	66.67%	
	Unfamiliarity with laws and regulations	18	60.00%	
	Unfamiliar with cross-cultural issue	9	30.00%	
TT type and complexity	Procuring parts	12	40.00%	<p>New product introduction Participating in engineering activity build-to-specification mode Procuring services Procuring parts</p> <p>Numbers of Firms</p>
	Procuring services	8	26.67%	
	Build-to-specification mode	11	36.67%	
	Participating in engineering activity	6	20.00%	
	New product introduction	3	10.00%	

A review of the survey data revealed the following findings:

- (a) Expatriate project managers had a very high level ($M = 4.25$) of cross-cultural awareness, whereas non-expatriate project managers possessed below adequate cross-cultural awareness ($M = 2.88$).
- (b) The expatriates enjoyed a successful to very successful rating ($M = 4.42$) compared with their counterparts' less than somewhat successful rating ($M = 2.88$).
- (c) Participants rated the typical business relationship with their Chinese partners good to very good ($M = 4.50$) for projects managed by expatriates and only fair ($M = 3.13$) for projects managed by non-expatriates.
- (d) Twelve (40%) of the TT projects managed by expatriates had Chinese partners who assigned on-site representatives or operated subsidiaries in the U.S., compared with 10% for the projects managed by non-expatriates.
- (e) The participating firms having expatriate project managers most likely engaged in the level that Chinese partners design, produce, and deliver to American specifications and participate in product requirement/specification definition ($M = 2.83$). Non-expatriate-managed projects tended to be at the level that participations were most likely designing and producing to specification without being involved in specification definition.
- (f) Expatriates encountered an average of 5.33 types of obstacles, whereas their counterparts reported encountering 6.88 obstacles or 29% more.

4.4 Statistical Analyses of the Findings

A series of statistical analyses were performed to determine any correlation between cross-cultural awareness and project success. Correlation analysis computed the coefficient of correlation between the independent variable, project manager's cross-cultural awareness, and dependent variable, project success. Additionally, coefficient of correlation was calculated between the independent variable and dependent variable, business relationship with the Chinese partner.

4.4.1 Correlation Analysis

For the analysis of the data collected, independent variable X was assigned for the cross-cultural awareness, and dependent variable Y was assigned for the extent of project success. \bar{X} and \bar{Y} are the means of variables X and Y , which were computed to be 5.800 and 5.800, respectively. Concurrently, S_x and S_y the standard deviations of variables X and Y , were computed to be 3.271 and 3.114, respectively. Hence, the correlation coefficient:

$$r = \sum [(X - \bar{X})(Y - \bar{Y})] / [(n - 1) S_x S_y] = 0.895$$

The correlation coefficient of 0.895 is fairly close to 1.00 (perfect correlation), suggesting a strong correlation between the cross-cultural awareness and the extent of project success.

4.4.2 Tests of Hypothesis

Since only 30 project managers were sampled in a large population, the correlation in the population might be zero, and the correlation coefficient of 0.895 may have been due to chances. To resolve the question of whether the computed correlation coefficient $\Gamma_{4,6}$ came from a population of paired observations with zero correlation, let " ρ " represent the correlation in the population and test the following null hypothesis and alternate hypothesis:

$H_0: \rho = 0$ (The correlation in the population is zero.)

$H_1: \rho \neq 0$ (The correlation in the population is different from zero.)

From the manner H_1 is stated, this is a two-tailed test formulation. The t is the coefficient of correlation $t = [r \times \sqrt{(n-2)}] / \sqrt{(1-r^2)}$ with $n-2$ degree of freedom. The computed t using this formula is 3.477.

Using a 0.05 level of significance at the 95% confidence intervals, the t distribution shows that if the computed t falls between -2.160 and +2.160, the null hypothesis is not rejected. The computed t of 3.477 falls in the reject region. Thus, H_0 is rejected at the significance level of 0.05. This indicates that the correlation in the population is not zero, or a correlation exists in the population of project managers with respect to the level of cross-cultural awareness and the extent of success of the TT project.

Similarly, the aforementioned statistical analyses were applied and an equally strong correlation of 0.896 was proven to exist between the level of the project manager's cross-cultural awareness and the technology transferor's relationship with its Chinese manufacturing partner.

4.4.3 Interviews with American and Chinese Executives

Three face-to-face and three telephone interviews were conducted concurrently with the survey activities. Interviewees were senior executives from Agilent Technologies in Beijing, IBM Consulting Services in Beijing, Lucent Technologies in Qingdao, P-Com in Santa Clara, Stratex Networks in San Jose, and an office security equipment company in Milpitas, California. These firms transfer sophisticated telephone transmission and distribution systems, advanced office automation, technical and financial consulting, state-of-the-art telecommunication, and office security technologies to China. All but one have maintained a significant presence in China for at least 10 years and are profitable and considered successful by top management. All of these executives had been involved actively in U.S. to China during the past 3 years, including 3 executives who had complete responsibility. Half of the individuals interviewed were expatriates with the Chinese background, and half were non-expatriates.

What Are the Most Important Factors for Project Success?

On the U.S. side, an American executive responded that:

“The single biggest factor for project success is to have a program manager who is cross-cultural, preferably Chinese national background, who is technically competent, has high integrity, and has the adaptability to recognize the self-interests and needs of the partners.”

On the Chinese side, an expatriate Chinese executive responsible for receiving TT from the U.S. headquarters claimed that:

“The most important issue determining project success and failure is the leadership, including recruiting, coaching, and developing trustworthy and capable leaders being capable of conversing in English and understanding the American business forum.”

Importance of Personal and Governmental “Guanxi” in China

Emphasizing the criticality of personal “guanxi” (relationship) with partner executives, an American executive commented, “Our relationship with our Chinese partners has been developed over the past 20 years. During this extended period, there have been times when the relationship was excellent and times when it was less so.” This participant explained that the relationship depends solely upon the individuals with whom the firm dealt, and when the management team changes, “we will have to start it all over again.” The executive stated that

both companies understood the long-term benefits to both companies by continuing to support and expand the relationship.

Executives pointed out the necessity for Americans in China to avoid participating in discussions involving political issues. Establishing and maintaining excellent “guanxi” with influential Chinese government officials at all levels, regardless of rank, are critically important. Reported impacts of “guanxi” included the number of years of tax exemption granted, processing time and return rate of license or permit applications, plant site allocation, and road and public utility connection. Additionally, a less than satisfactory governmental relationship can trigger a business tax audit.

Proactive vs. Reactive and Open Discussion vs. Private Discussion

During the course of interviews, some participants described dealing with reactive rather than proactive Chinese managers. One executive spent an average of 3 years transforming a “reactive manager” into a “proactive leader” in his China plant by constantly encouraging local staff to ask questions, take initiatives, make independent reasoning and judgment, make decisions on their own, and simply make mistakes and learn from those mistakes. These observations are consistent with the researcher’s experience working with Chinese managers.

Communication, Cross-Cultural Issues, and Project Success

Effective communication with Chinese partners at management and employee levels can be a real challenge. According to interview participants, the language barrier was a much lesser factor than cultural differences affecting communication effectiveness. Cross-cultural issues were cited frequently during the interviews.

On the other hand, Chinese executives complained that their management and engineering staff often had encountered difficulties communicating with their American counterparts, especially the research and development and marketing personnel in the product divisions in the United States. Respondents pinpointed a serious lack of cultural understanding and communication skills on the part of the Americans. In general, the executives interviewed affirmed a direct correlation between cross-cultural awareness and work experience and project success as well as business relationship.

Is there a solution to managing the communication issues and cross-cultural impact? The answer offered by a well-seasoned American executive was “training, training, and training.” A Chinese participant recognized the significant value of cross-cultural training; however, he also cited transferring and receiving parties working closely together over an extended period of time to develop “matured cultural understanding and mutual trust.” The predominant Chinese manufacturing partner frequently had sent its managers to the United States to work closely with their counterparts for 3–6 months. Reciprocally, he had invited his American partner to dispatch its product development program managers and engineers, usually native Americans, to work at his plant in China. Interestingly, whereas many of his personnel being trained in the United States complained that the training period was too short, a number of Americans wanted to return to the United States prematurely.

5. CONCLUSIONS AND RECOMMENDATIONS

Facing stringent competition in the world of growing multi-nationalization (Chang, 1999), many American firms have outsourced product manufacturing and transfer technologies to China. Further, an increasing number of U.S. corporations are collaborating and sharing resources with their Chinese partners in new product introduction (NPI), the newest phase of TT. A major TT project managed by professionals proficient in cross-cultural management issues can be executed successfully to minimize negative attributes (Huang, 1993). A well-

managed Chinese subsidiary located within its American technology-transfer partner can build and enhance the business relationship between the companies, leading to successful TT.

The survey found that one third of American executives directing TT from the U.S. to China had less than 3 years of experience. Possible causes include: (a) an increasing number of American firms outsourcing and transferring technology to China in the last 3 years, and (b) the attrition rate or responsibility change of American executives involving China projects. Low levels of experience may pose a challenge to relationship building in a cross-cultural environment intensified by distance and time difference. Additionally, survey results confirmed a significantly strong direct correlation between the project manager's cultural awareness and project success as well as business relationship. It takes time and efforts to build and sustain personal and company relationships between two dissimilar cultures (Alston, 1997), and the successful business relationship is long term and continual. Therefore, American companies are recommended to conduct structured cross-cultural training for their TT managers (Chao, 2003; Cushner, 1995).

American firms operating subsidiaries in China seem to enjoy more success than companies working with suppliers and manufacturing partners. American firms benefit from assigning Chinese expatriates to head up their subsidiaries in China. Further, American firms with Chinese partners who assigned liaison offices or operated subsidiaries within or adjacent to their premises in the United States benefited from improved communications and an enhanced business relationship.

To realize the positive effects of cross-cultural TT awareness to a U.S. to China, American firms involving outsourcing and technology transferring to China should develop and implement on-the-job training programs focusing on cross-cultural subjects for their executives and project managers (Hinkelman, 1994). Based on the researchers' years of experience, a well-structured cross-cultural training program for American project managers of U.S. to China should include understanding Chinese cultural "dos" and "don'ts" and Chinese management style and learning:

- (a) How to effectively communicate with the Chinese,
- (b) How to train Chinese partners in the U.S. business forum and TT process,
- (c) How to become sensitive to major political issues in China,
- (d) How to use communications technology and detailed meeting agenda to improve intercontinental communication,
- (e) How to establish and enhance friendship and business relationships with Chinese,
- (f) How to handle Chinese business negotiation tactics, and
- (g) How to team up with Chinese liaison or subsidiary personnel.

Furthermore, employment of expatriates to manage the TT project substantially increases the possibility of project success. On the other hand, many successful applications of fuzzy set theory were found in the utilizations of decision-making. In the last decade, research in fuzzy set theory extended to the field of Fuzzy Logic Decision Systems (FLDS), employed especially for management decision-making (Yu, 1999). In order to strengthen the potentials of innovation, not only international strategic alliances by TT should be taken into account, but also industrial alliances by strategic technology transferring and licensing should be further planned. The study developing a diagnosis process of TT efficiency is recommended to help companies in the industry understand their characteristics of TT and their relative positions in the industry, and further to provide Key Performance Indicator (KPI) making necessary improvements in the future. Figure 3 shows the proposed research diagram of efficiency of TT using Fuzzy Logic Theory.

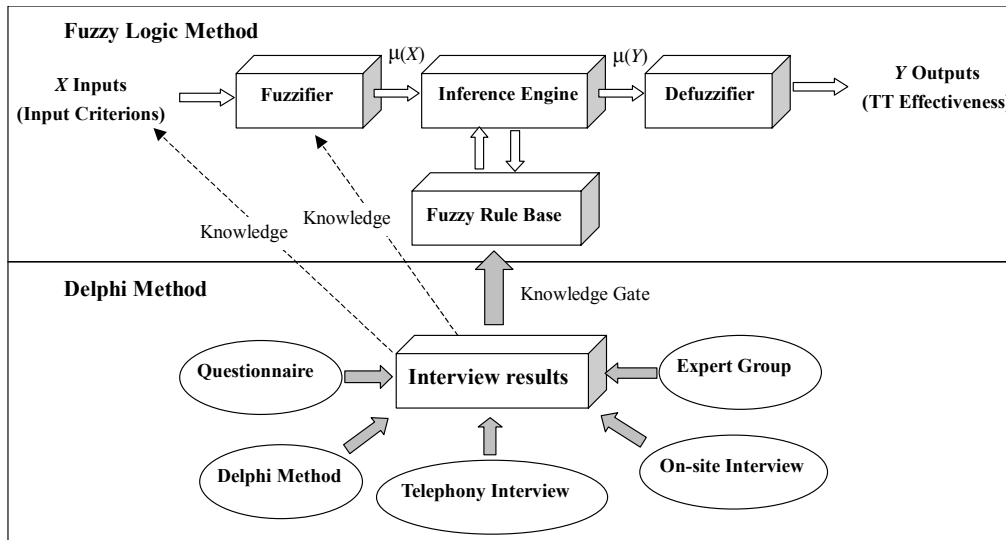


Figure 3. The Proposed Research Diagram of Efficiency of TT Using Fuzzy Logic

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