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PERCEIVED IMPACTS OF GOVERNMENT REGULATIONS ON TECHNOLOGY TRANSFERS

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ABSTRACT

This paper examines the effects of government regulation on the technology transfer process. Technology transfer is an important component of an economic development effort in communities, states, and nations. Understanding the process used to transfer technology is needed to promote policies that develop an effective infrastructure to encourage technology transfer. This paper uses qualitative and quantitative methodologies to examine managerial perceptions of the effects of government policies on the technology transfer process. The impacts of tax policies, environmental regulations, health and safety regulations, labor regulations, international trade regulations, and the differences in regulations between countries are studied. Items used to measure the success of technology transfer are proposed.

INTRODUCTION

Technology transfer is an important source of economic development. The global competitiveness of nations depends on the level of technological innovation (Pang and Garvin, 2001; Porter, 1990). Technology transfers from abroad play a large part a country's technological and economic development (Kumar and Marg, 2000). Developing countries often

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use foreign direct investment (FDI) as a way to acquire foreign advanced technology (Yin, 1999).

The adaptation of technology from developed countries also drives long-term growth in most developing countries (Zattler, 2002). Developing countries experience increased international trade, increased economic growth, and increased levels of productivity from technology transfers (Okabe, 2002). Finally, technology transfers have a positive effect on consumers' welfare in both sending and receiving countries when both are developed markets (Petit and Sanna-Randaccio, 1998). Indeed, technological innovation benefits consumers and producers. The producer experiences lower costs and higher profits. Consumers benefit through lower prices in both the origin of the technology and the foreign country receiving the transfer.

Given the importance of technology transfers in both developing and developed economies, this study examines how public policies enhance technology acquisition. Following a review of potential roles of governments in technology transfer and a review of potential private sector firms' needs and motivators for conducting technology transfers, qualitative and quantitative analyses are presented that address managerial perceptions of factors that impact technology transfers, including government policies and regulations.

GOVERNMENT POLICY AND TECHNOLOGY TRANSFER

Because of the impact of technology transfers on their economies, government agencies encourage such transfers. The role of government in encouraging technology transfer can take

several different forms (Bozeman, 2000). The most conservative role is limited to removing barriers to the free market to allow the free transfer of technology.

A second role a government can take is developing well-specified industry and market development goals and supporting research and development to meet those goals. Japan, for example, selects industries in which the country wants to excel, such as telecommunications. The government then puts its resources towards technology development in that area. This role includes providing resources and creating policies to stimulate technology research and transfer.

A third government role is to provide a link between the public and private sectors, either by providing research itself, or by developing policies that affect research development and technological innovation (Bozeman, 2000). This role may include facilitating the transfer of technologies from public research universities to commercial organizations.

A fourth role is also highly influential in stimulating technology. Governments can stimulate certain kinds of research by partnering in the commercialization of technology (Bozeman, 2000). The government may create economic development programs and incubators to stimulate the research process. The link between government and the private sector usually takes one of two different forms: government agencies can produce the technology, and the private sector then receives the technology; or governments can stimulate the development of certain kinds of technology by the private sector through policies and regulations.

Both the first and fourth roles of government include the development or change of government regulations and policies. Some government policies that may affect technology transfers include placing restrictions on foreign equity holdings, licensing arrangements or joint ventures, and screening of foreign investments (Davidson and McFetridge, 1985). In addition, governments influence international technology transfers through trade policies, intellectual property rights protection, or policies that affect the attractiveness and character of foreign investment (Martinot, Sinton and Haddad, 1997). For a country-specific example, China amended its technology transfer rules in 2002 to facilitate its participation in the World Trade Organization (WTO) and increase transfers of technology (Adcock, 2003).

Currently, little is known about how government policies actually affect technology transfers. Muralidharan and Phatak (1999) found no support for the hypotheses that government requirements for technology transfers from multi-national corporations (MNCs) that enter their countries or that intellectual property protection laws were associated with increased levels of research and development activity. No published studies have adequately documented an empirical relationship between government policies and the success of technology transfers, nor is data readily available on the number or success of technology transfers to conduct such an analysis of the impact of government policies.

Without such data, researchers need to use another approach to assess the effects of government rules and regulations on private-sector technology transfers. One approach is to study how MNCs react to government policies and regulations using executives within these organizations as expert key informants. Technology transfer is a means for an organization to

transfer intangible assets, or technological knowledge. The impetus to transfer technology arises out of a need to gain a competitive advantage in the marketplace. Usually, transfers take place only when there is 'an awareness of a profitable opportunity' to apply the technology in a different location (Hakanson and Nobel, 2001). Although this is the primary driving force behind international technology transfers in the private sector, government policies developed to protect local industries can lead to decreased foreign direct investments. Corporations have learned that they must establish foreign subsidiaries or enter into joint ventures to reach otherwise protected markets (Martinot, Sinton and Haddad, 1997), and thus avoid dealing directly with governmental policies that inhibit foreign direct investments.

DRIVERS BEHIND INTERNATIONAL TECHNOLOGY TRANSFER

In an increasingly competitive and global business environment, firms are under more pressure to operate efficiently. One of the greatest drivers for any strategic action is to use the firm's assets to generate the greatest economic impact (Osman-Gani, 1996). International technology transfer is often conducted to cut costs and to make production processes more efficient and to become more competitive in its industry. This arguably is one of the strongest private sector drivers that exists for any firm to conduct any strategic technological action.

Tax implications act as drivers during international technology transfer, affecting how the technology will be transferred between countries (Loewenstein, Klass, Hickey, Leek and Joseph, 1999). For example, accounting for profits that arise out of intangibles, such as a patent, affects the firm's taxes. Even value-added taxes need to be considered when planning for the transfer of

technology. Tax implications can affect the flow of technology and act as the driver behind transferring the technology in the first place. Both of these situations affect the strategic decision making to effectively manage technology transfers.

Socially responsible actions can also act as a driver behind the transfer of technology, but more often, government regulation is a stronger driver for a firm to incorporate technology to comply with health, safety, and environment regulations (Videras and Alberini, 2000). Although firms must participate in international technology transfer if it results in compliance with environment, health, or safety regulations, if a firm sees its transfer of technology as having a positive impact upon the environment or its own worker health or safety, the firm should have a greater motivation to participate in technology transfer, even on a voluntary basis. Although altruistic behavior on its own is rarely a motivator or driver for a firm, attention to its fiduciary responsibility should be of paramount concern to the general manager or CEO. Firms see voluntary participation in governmental programs as a way to transfer technology and to pay attention to its own environmental issues (Videras and Alberini, 2000).

THE CURRENT STUDY

This study combines exploratory qualitative and quantitative approaches to develop greater understanding of managers' perceptions of the impact of government policies and regulations on technology transfers. The research was supported by a grant from the Louisiana Board of Regents to study international technology transfer in the state. The grant was funded to help the state of Louisiana develop public policy that would enhance inbound technology

acquisition, and to inform business leaders, educators, and policy makers of the scope of international technology transfer in Louisiana.

The state of Louisiana developed an economic development plan in 1998 called "Louisiana: Vision 2020." Goal two of this plan actively sought diversification into emerging technology areas. Louisiana was particularly interested in fifteen technology-driven clusters as targets for its economic development efforts. Eight of these clusters were previously existing in the state and seven were emerging. Innovation and technology were identified as driving forces behind the growth and diversification of the state economy. Increasing the competitiveness of firms in Louisiana begins with understanding the flow of technology, including the knowledge to transfer technology. The state of Louisiana recognizes that, for Louisiana firms to be competitive in the global marketplace, they must be able to understand the drivers behind technology transfer, and the best practices for managing the transfer.

This study specifically examined the best practices and processes that create a competitive advantage for firms that practice international technology transfer. These best practices were determined by interviewing managers who had been involved in an international technology transfer during the prior five years. The people who are most aware of the success of technology transfers and the impacts of government policies and regulations on technology transfers are the executives who have participated in them. No published articles detail managers' perceptions of government programs and their impacts on technology transfers. Such knowledge is required to develop effective government programs.

METHODOLOGY

This research had two stages, the qualitative interview stage and the quantitative standardized questionnaire stage. A sensible way to understand a complex process where few constructs are already specified and little existing research exists at the focal level of analysis is the grounded theory approach (Eisenhardt, 1989; Glaser & Strauss, 1967; Strauss & Corbin, 1990). Following this approach, the initial part of this investigation involved depth interviews with managers in firms that had been involved in technology transfers. This qualitative technique was used to determine the relevant variables to include in the quantitative part of the study.

The depth or long interview is "a sharply focused, rapid, highly intensive interview process that seeks to diminish the indeterminacy and redundancy that attends more unstructured research processes" (McCracken, 1988). It is used to gather data related to cultural categories and shared meanings. It uses open-ended interview questions designed to probe specific areas of interest to the researcher. While standard questions were asked, depth interview techniques were used to probe for comprehensive answers as to the practices and processes and the variables that impacted technology transfers.

The qualitative study used the maximum variation sampling technique of purposefully picking a wide range of variation on dimensions of interest (Ragan, 1987). The stages of international technology transfer, and the variables that have an impact upon the process were used as a guide in developing the research protocol. The investigators were able to document diverse variations that have emerged given different conditions during the international

technology transfer process. The reason for using this particular sampling technique was to identify important common patterns that cut across variations.

All firms in the sample were U. S. firms that had experienced international technology transfers during the prior five years. Each firm is an international company that has divisions across the world. Table 1 provides a profile of the eight organizations that participated in the qualitative part of the study. Half of these business organizations had between 500 and 600 employees; three were smaller. Most were in the chemical industry, a reflection of the types of international business organizations in the state. The corporate structure varied widely.

Insert Table 1 here

Each depth interview took place in the offices of the selected firms with participating managers. The researchers used an interview guide to facilitate comparison of the interviews and to assure that all areas of interest were covered in the interview. The questions were open-ended and the participants were encouraged to go beyond the questions asked by the researcher in describing the technology transfer processes. All interviews were taped and transcribed. All eight firms requested, and were granted, confidentiality in reporting of results.

Data analysis was performed using two different forms of content analysis, (1) conceptual analysis and (2) procedural analysis. Using the two forms of content analysis allows the investigator to identify common themes among the managers' interviews, as well as to develop a general model of the process of technology transfer. Conceptual analysis refers to the

traditional technique of determining what words or concepts are present in a text (Carley, 1990). In this case, conceptual analysis identified the concepts most frequently mentioned by the managers in describing the technology transfer processes. Procedural analysis centers on the procedures that the author of a text uses to perform some task described in the text (Carley, 1990); in this case, the processes for accomplishing the technology transfer described by the manager in each interview transcript. Three different researcher evaluators, none of whom were involved in gathering the interview data, developed investigator triangulation by independently coding the data according to the research protocol, and then coding the data together, discussing differences. Each sentence in the interview data was coded independently and then together with all three evaluators.

To facilitate analysis of the data, the researchers used QSR Nud*ist 4© software. This program manages data and documents and allows the researcher to create, manage, and explore ideas and categories within the data. It is designed to allow researchers to discover themes, construct and test theories, generate reports (including both text and coding patterns), and build models by linking with graphical display software. Each of the interviews was loaded into the software package, and each sentence within each interview was coded according to the category or theme that it best represented. Once the interviews were coded, the researchers were able to look at one category across all interviews to determine trends and commonalities among the interviews. Word searches are possible with the software; for instance, the researcher could search for the word, “transfer,” and then be able to see among all the interviews the instances in which the interview subjects used that word.

Reproducibility, the extent to which classification produces the same results when more than one researcher codes the text, was the most important reliability issue in this study. The researchers addressed this problem by developing and using a dictionary of words, concepts, categories, and relationships in coding the qualitative data. Each of the three different researchers coded all eight of the interviews to allow inter-coder reliability checks. All the coders used the same computerized qualitative analysis software program. The coders discussed differences in coding and reached full agreement with respect to coding of the data.

This qualitative research design had two major limitations. First, the sample size was small, making generalization to the larger population of firms difficult, if not impossible. Second, the study used retrospective accounts by the managers that have sometimes been associated with errors of memory as its primary source of data. However, for purposes of determining the relevant variables to include in the second part of the study, the methodology is appropriate and highly recommended (McKennell, 1974). This methodology is similar to that used in identifying customer needs, where a sample size of eight was found to identify over 80 percent of the total needs identified from eight focus groups plus nine one-hour interviews (Griffin and Hauser, 1992).

Quantitative Standardized Questionnaire

Once practices, processes, and variables were elicited using depth interviews, following the counsel of McKennell (1974) to conduct interviews with members of the target population, they were used to create a standardized questionnaire. Variables were identified and categorized.

Then questions were developed to elicit information about the level and impact of these variables in organizations that had conducted technology transfers. Likert-type response scales were used for these questions.

A questionnaire was developed from the interview information provided in the qualitative part of the study. Items relating to government policies and regulations and the success items were developed from the qualitative data using Nud*ist software. Table 2 shows the questionnaire items that related to government and regulation or to success of the technology transfer. The questionnaire items were rated on a six-point scale, from strongly disagree to strongly agree.

Insert Table 2 here

The questionnaire was sent to companies that had completed an international technology transfer within the prior five years. The questionnaire was developed from the stage one qualitative research to cover the areas that emerged as being relevant to technology transfer (Joyner and Onken, 2002). Table 2 provides the questions used to measure government policies and the success of the transfer.

To find out what organizations had completed international technology transfers, a letter was sent to 3600 organizations from two mailing lists: German companies with subsidiaries in the U.S. and Louisiana Manufacturing Organizations with 50 or more employees (1999). The letter asked if the firm had completed such a transfer and if the manager would be willing to complete a questionnaire. Positive responses from 69 companies indicated willingness to

participate in the study. Questionnaires were sent to these companies. Follow-up phone calls were used to increase the response rate, resulting in the receipt of 36 completed questionnaires for a 53.6 percent response rate.

The sample data were analyzed using SPSS software. Means and standard deviations were calculated for all questions. Correlations were calculated between both the success scale and the individual questions that measured opinions about the impact of government policies and questions that measured the results of the technology transfers and are shown in Table 10.

RESULTS OF THE QUANTITATIVE SURVEY

Characteristics of Responding Organizations

Tables 3 to 8 provide information about the organizations that participated in the quantitative part of this study. The organizations that responded varied greatly in their number of employees, as shown in Table 3. Within this wide variation, the majority of the respondents to the survey were from units with less than 500 employees and organizations with between 1000 and 50,000 employees in total.

Insert Table 3 here

Experience with international technology transfers showed a U-shaped distribution, as can be seen from Table 4. A large number of the responding organizations (40 percent) reported that they had been involved in over ten technology transfers in the prior five years. On the other

end, 25.7 percent of the organizations had been involved in only one or two technology transfers over that period.

Insert Table 4 here

Many of the responding organizations (50 percent) were in either the chemical or manufacturing industry, as shown in Table 5. The only other industry category that was represented by more than one firm was "other." Since the respondents self selected to participate in the survey based on experience with technology transfers, these results suggest that technology transfers are more frequent in the chemical and manufacturing industries. This would be an expected characteristic of organizations participating in the study, since many oil and petrochemical firms do business in Louisiana.

Insert Table 5 here

The most common form of organizational structure reported by the respondents was centralization of core competencies and decentralization of other competencies, as illustrated in Table 6. Decentralized and nationally self-sufficient organizations were the least common among these respondents that had participated in international technology transfers.

Insert Table 6 here

No one role of overseas operations appeared significantly more often than the others for the respondents, as Table 7 shows.

Insert Table 7 here

The most common method of development and diffusion reported by the respondents was no diffusion, as shown in Table 8. More than half reported that the knowledge developed during the technology transfer was developed and retained within each unit.

Insert Table 8 here

Government Regulations and Technology Transfer

To examine their perceptions of the effects of government policies on the technology transfer process and the success of the technology transfer, respondents were asked to respond to the questions shown in Table 2. A scale of one to six was used to measure the degree to which they agreed with each statement, where one equaled strongly disagree and six equaled strongly agree.

Table 9 provides the means, standard deviations, and percent of respondents who agreed or strongly agreed with the statement for the government and regulation items and the success items. The means to the government and regulation items were all 3.00 or below, indicating some amount of disagreement with these items. The lowest mean and lowest percent agreement were for "Tax policies had an impact on the decision to transfer this technology" and for "Policies and regulations regarding international trade affected the technology transfer process." The highest means and percent agreement were for "Government policies and regulations that differed between countries posed a problem to the technology transfer" and "Existing government policies and regulations increased the cost of the technology transfer." More than one-third of the respondents agreed with these two statements.

The means to the success items were all above 3.00, indicating some amount of agreement with these items. The highest mean scores and percent agreement were for "The firm is more competitive since the technology transfer" and "Our customer base has increased because of the technology transfer." The lowest mean and percent agreement were for "The technology transfer has had a positive impact on the firm with respect to taxes."

Insert Table 9 here

A success scale was created by summing the responses to each of the questions measuring success. The Cronbach's alpha for this scale was 0.7687, indicating that the items in the scale were measuring the same underlying concept. Table 10 gives the Pearson Product-Moment correlations between the questions measuring government and regulatory factors and the success scale and the individual questions measuring success of the transfer.

The only items showing significant positive correlations with the success scale were "Policies and regulations regarding health and safety affected the technology transfer process" and "Policies and regulations regarding labor affected the technology transfer process." Both of these were significantly positively correlated with the overall success scale. Health and safety seemed to impact the customer base and the firm with respect to taxes, while labor regulations had a significant impact on the organization's taxes. Another item, "Tax policies had an impact on the decision to transfer this technology," was negatively correlated with "Our customer base has increased because of the technology transfer." The results using Spearman's rho and Kendall's tau-b showed the same patterns of significance and are not separately reported.

Insert Table 10 here

DISCUSSION

Do managers perceive that government regulations impact their technology transfers? Perhaps the biggest perceived impact upon the firms' success was for the item concerning health and safety policies and regulations, which was positively and significantly correlated with the international technology transfer success scale. The higher the managers rated the impacts of policies and regulations regarding health and safety on the transfer process, the greater was the success of the transfer. This health and safety item was also significantly positively correlated with two of the individual success items: the increase in the firm's customer base and the positive impact of the transfer upon the firm's taxes. Perhaps some managers pay attention to health and safety concerns during the process as a significant issue, and this attention may have a positive effect upon the success of the transfer.

Two other government-regulation items were positively correlated with some of the items that make up the success scale. The managers' ratings of the impact of government tax policies on their technology transfers were negatively correlated with their perceptions of an increase in the firm's customer base from the transfers. Finally, the item that measured managers' perceptions of policies and regulations regarding labor's effect upon the technology transfer process was significantly correlated with positive impacts of the technology transfer on the firm with respect to taxes.

Individual Items

More than one-third of the respondents felt that existing government policies and regulations increased the cost of the technology transfer. Governments are perceived as negatively impacting the cost of technology transfers, which could keep the number of such transfers down.

The policies and regulations thought to have a positive impact by the lowest percentage of respondents were those related to the environment, health and safety, and international trade. Less than 20 percent of respondents thought that tax and labor policies had a positive impact on technology transfers. Governments probably should not consider these types of regulations when they are trying to increase technology transfers.

Respondents felt that differences between government policies and regulations among countries posed a problem for their technology transfers. Decreasing or eliminating these differences should be a goal of all governments, especially those of developing countries. Perhaps these regulations should be part of the discussions between countries on trade and tariffs, if not already so. Further research is needed to determine which government policies and regulations differ and detrimentally affect technology transfers.

As far as the success of the technology transfers, the respondents were overwhelmingly positive. These results could be due to a respondent bias; those that did not feel their transfers were successful may not have responded to the questionnaire. Of those who did respond, most felt that the transfer made the organization more competitive, increased their customer base and

decreased costs. Less than half agreed that the transfer had a positive impact on the firm with respect to taxes. The strong perceived impacts of technology transfers on the success of organizations should provide additional impetus for governments to encourage technology transfers.

Success Measure

One of the strongest contributions of this study is the success measure of technology transfer. The Cronbach's alpha indicated that organizations tend to respond similarly to all items measuring the success of their technology transfers. The overall success scale could therefore be used to determine which regulations were significantly related to success. The correlation results showed the highest relationship between overall success and policies regarding health and safety, the same item that had the highest level of agreement and highest mean. This area is the first one that governments should investigate when trying to determine what they might do to increase the number of technology transfers.

The other policy area that was significantly correlated with overall success was labor, an item that had one of the lowest mean scores and lowest agreement percentages. When looking at specific success items, labor was significantly correlated with only one item, positive impacts on taxes. Interestingly, this success item had the lowest mean and percent agreement. This one aspect of technology transfers, tax effects, would seem to be impacted by labor regulations and to be the only aspect impacted by these regulations.

One final significant correlation found was the negative correlation between impacts of tax policies on the decision to transfer technology and increase in customer base as a result of technology transfers. Apparently, if tax policies were perceived to have a major impact on the transfer decision, then the customer base did not increase as much as if the perceived impact was less strong. Perhaps the transfers were undertaken to impact the firm's taxes rather than to increase its competitiveness. This could well be a situation where governments created an unnatural incentive to pursue technology transfers. Organizations may then have conducted the transfers even though they were not particularly beneficial to the organization in other ways.

This study suggests that government regulations and policies can have an impact both on the number of technology transfers and on the success of those transfers. This is certainly a result that is worth further investigation. If technology transfers create more competitive business firms with lower operating costs and larger customer bases, then governments should certainly want to encourage them through effective policies and regulations. On the other hand, artificial tax incentives may encourage businesses to conduct technology transfers that are not particularly beneficial to the firm in other respects.

There are some limitations to the study. First, studying technology transfer is not easy, not only because establishing the boundaries of 'technology' is difficult, but because the process of technology transfer is nearly impossible to delineate into distinct steps (Bozeman, 2000). However, this paper examines the relationships between government laws and regulations and the successful transfer of technology transfer by the firm, a narrow part of the entire technology transfer process. Second of all, the study's results are difficult to generalize to a larger

population because of the size of the sample. However, by using a combination of qualitative and quantitative techniques, this study is a thorough exploration of some of the key success factors a firm needs to possess to successfully transfer technology across national borders.

Implications

This study reinforces the resource-based view of the firm by emphasizing that the intangible resources, the knowledge and technology, are what makes a firm most competitive. The success of international technology transfer depends upon the firm's ability to leverage government policies when creating its strategies. This study suggests that a firm should be giving due diligence to health, safety, and labor regulations, especially with respect to the impact upon the firm's tax situation. However, if a firm's objective is to increase its customer base, taking into account the government's tax policies should not be done during the firm's strategic analysis. Rather, the managers of the firm should be focusing upon cutting costs and increasing its customer base to increase revenues, the basic tenets of business. Navigating the government's policies and regulations is a necessary part of the business, but it is not what will create a competitive advantage for the firm. Only by leveraging the firm's intangible assets, its knowledge and technology, will the firm be able to create a competitive advantage that is not imitable by its competitors.

Lessons for Organizations

Firms that intend to participate in international technology transfer should first evaluate the policies and regulations by examining health and safety codes that could be involved, as well

as labor issues. A formal process that incorporates an evaluation of the laws and regulations should result in the firm to successfully transfer the technology. Firms with no prior experience in technology transfer may not have the managerial experience in place to successfully complete the transfer. Therefore, they need to incorporate a formal process of evaluating the government laws and regulations to ensure a successful transfer.

This is consistent with the resource-based view of the firm in which the firm uses its intangible resources to develop a sustainable competitive advantage (Teece, 1977; Barney, 1991). A firm can develop organizational knowledge that will help it complete international technology transfer through codification. Although some of the laws and regulations are of a technical nature and need a professional, such as a lawyer, to interpret them, managers can gain experience by iteratively completing international technology transfers. This strengthens organizational learning and helps the firm gain an expertise so that it can successfully complete even more complex international technology transfers in the future. The development of managerial experience is one of the most important intangible resources that a firm can develop to create a sustainable competitive advantage that other firms are not able to imitate (Barney, 1991).

In fact, by applying a resource-based view of international technology transfer, the firm can view the entire process as a learning experience to develop its skills and to enhance its overall strategy (Tsang, 1997). Part of the learning curve for a firm is to be able to effectively assess each project's effectiveness, and this needs to be done on a case-by-case basis. Despite a firm's attempts to codify its learning, such as codifying other country's laws and regulations

regarding health and safety, into a database, the overall strategy of the firm needs to be considered. Planning for the effective use of the technology often requires a more detailed and customized plan than an 'off the shelf' version that might have already been applied in another international technology transfer case (Contractor and Sagafi-Nejad, 1981). Customizing the firm's actions to the specific needs of the other country that is involved in the transfer will enhance the ability of the firm to successfully transfer technology.

Once the knowledge has been formally codified into a database, a structured training program can take place. Most of the firms in the qualitative sample described in this paper used computer databases as a way to store knowledge, but fewer firms used computer-based training as a method of disseminating the information. However, an e-learning system can enhance a firm's ability to manage the information and to conduct training (Nagle, 2002). Using a learning management system to train the workers about the key components of the technology transfer, the codified knowledge suddenly becomes a key resource that can be applied consistently and added to with each additional international technology transfer project. Again, the leverage of an intangible resource can be used to gain a sustainable competitive advantage, especially if competitors cannot imitate it (Barney, 1991). Experience and knowledge, if codified correctly, is a key factor in successful international technology transfer.

Further research needs to be done that ties the resource-based view of the firm, international technology transfer, and organizational learning. International technology transfer is clearly a process of transferring an organization's learning across firm and national boundaries, whether it is the technological database, process, or even the know-how of the

operation of a piece of hardware. Bartlett and Ghoshal (1989) describe an organization's competence in being able to successfully do business globally as its ability to manage knowledge and learning. The knowledge and learning competence translates into a resource that needs to be managed for a competitive advantage. Future research in international technology transfer should examine the process of organizational learning and how to best manage knowledge to gain a competitive advantage.

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Table 1. Organizations in the Qualitative Study

Firm	Size	Corporate Structure	Product or Process
A	300 employees	Business units	Infrared testing materials
B	500 employees	Business units	Intermediate chemical product
C	135 employees	Joint venture	Polymers
D	500+ employees	International units	Synthetic materials
E	N/A	International units	Polymers
F	500 employees	Team-based structure	Abrasives
G	600 employees	Team-based structure	Chemical materials
H	5 employees	Subsidiary of large foreign firm	Waste conversion

Table 2. Questionnaire Items

Government	Tax policies had an impact on the decision to transfer this technology.
	Existing government policies and regulations increased the cost of the technology transfer.
	Government policies and regulations that differed between countries posed a problem to the technology transfer.
	Policies and regulations regarding the environment affected the technology transfer process.
	Policies and regulations regarding health and safety affected the technology transfer process.
	Policies and regulations regarding labor affected the technology transfer process.
	Policies and regulations regarding international trade affected the technology transfer process.
Success	Our customer base has increased because of the technology transfer.
	Operating costs have gone down because of the technology transfer.
	The firm is more competitive since the technology transfer.
	The technology transfer has had a positive impact on the firm with respect to taxes.

Table 3. Number of Employees in Organization				
	Employees at Unit		Employees in Total Corporation	
Range	**#**	**%**	**#**	**%**
1 – 100	13	36	8	22
101 – 500	12	33	1	3
501 – 1000	3	8	6	17
1001 – 5000	8	22	7	19
5001 – 10,000	0	0	4	11
10,001 – 50,000	0	0	8	22
Over 50,000	0	0	2	6
Total Responding	36	100	36	100

Table 4. Number of Technology Transfers Unit Was Involved in During Prior Five Years		
Number	**Frequency**	**Percent**
1	5	14.3
2	4	11.4
3	3	8.6
4	2	5.7
5	2	5.7
6-10	5	14.3
11-50	7	20.0
Over 50	7	20.0
Total Responding	35	100

Table 5. Organization's Industry Type		
Industry	**Frequency**	**Percent**
Government/military	1	2.8
Retail	1	2.8
Utility	1	2.8
Computer-related	1	2.8
Medical	3	8.3
Chemical	8	22.2
Manufacturing	10	27.8
Other	11	30.6
Total Responding	36	100.0

Table 6. Organizational Structure		
Structure	**Frequency**	**Percent**
Decentralized and nationally self-sufficient	6	16.7
Centralized and globally scaled	12	33.3
Sources of core competencies centralized, others decentralized	18	50.0
Total Responding	36	100.0

Table 7. Role of Overseas Operations.		
Role	**Frequency**	**Percent**
Sensing and exploiting local opportunities	10	37.0
Implementing parent company strategies	9	33.3
Adapting and leveraging parent company competencies	8	29.6
Total Responding	27	100.0

Table 8. Method of Development and Diffusion of Knowledge.		
Method	**Frequency**	**Percent**
Knowledge developed and retained within each unit.	17	51.5
Knowledge developed and retained at headquarters.	3	9.1
Knowledge developed at headquarters and transferred to overseas.	13	39.4
Total Responding	33	100.0

Table 9. Means and Standard Deviations for Questionnaire Items.			
Item	Mean	Standard Deviation	Percent Agree or Strong Agree
Tax policies had an impact on the decision to transfer this technology.	2.33	1.53	12.9
Existing government policies and regulations increased the cost of the technology transfer.	2.87	1.67	36.7
Government policies and regulations that differed between countries posed a problem to the technology transfer.	3.00	1.77	35.7
Policies and regulations regarding the environment affected the technology transfer process.	2.55	1.48	21.9
Policies and regulations regarding health and safety affected the technology transfer process.	2.72	1.46	25.8
Policies and regulations regarding labor affected the technology transfer process.	2.37	1.19	16.7
Policies and regulations regarding international trade affected the technology transfer process.	2.41	1.36	25.0
Our customer base has increased because of the technology transfer.	4.59	1.24	87.5
Operating costs have gone down because of the technology transfer.	3.72	1.63	65.7
The firm is more competitive since the technology transfer.	4.86	1.07	94.4
The technology transfer has had a positive impact on the firm with respect to taxes.	3.18	1.47	40.9

Table 10. Pearson Correlation Coefficients between Government and Success Questions.

	Success Scale	Our customer base has increased because of the technology transfer.	Operating costs have gone down because of the technology transfer.	The firm is more competitive since the technology transfer.	The technology transfer has had a positive impact on the firm with respect to taxes.
Tax policies had an impact on the decision to transfer this technology.	.021	-.378**	.017	.038	.197
Existing government policies and regulations increased the cost of the technology transfer.	.213	.075	.003	.127	-.273
Government policies and regulations that differed between countries posed a problem to the technology transfer.	.201	.160	.040	.101	-.196
Policies and regulations regarding the environment affected the technology transfer process.	.328	.145	.096	.183	-.074
Policies and regulations regarding health and safety affected the technology transfer process.	.478**	.518***	.019	.203	.406*
Policies and regulations regarding labor affected the technology transfer process.	.430*	.102	.163	.219	.464**
Policies and regulations regarding international trade affected the technology transfer process.	.365	.027	.269	.157	.142

* Significant at alpha = .10
** Significant at alpha = .05
*** Significant at alpha = .01