Management of international transfer of innovative technologies in the enterprise

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Abstract

The objective is to clarify the concept of technology transfer and the accompanying components to deliver them to the reader.

The object of this paper is to study technology transfer.

The subject of this paper is to study the concept of international transfer of innovative technologies in the enterprise.

Methods (procedures) study. In the process of writing a thesis used method of comparing the use of technology transfer in various companies in different countries.

The results and their novelty. During the execution of this work has identified the concept of technology transfer, technological activity, barriers to technology transfer as the process of technology transfer, are examples of technology transfer. The results can be used by students and researchers of this field.

Recommendations for use of the work is the ability to use existing information and technology companies to improve their performance, output and increase profits.
Acknowledgement

This paper “Management of international transfer of innovative technologies in the enterprise” I write on an exchange program between my home university NTUU “KPI” and KTH in the Department of Real Estate and Construction Management.

I am very glad that I am able to visit Stockholm and see how it feels to “live” in the city, gain experience and training in the Scandinavian countries, communicate with other students on exchange, acquire new knowledge and broaden my horizons, I think it is “my personal transfer technology”.

I would like to thank my coordinator Carl-Axel Engdahl for assistance, support and understanding about writing a thesis and general life in Stockholm. Also thank you to all teachers and employees of the Department with whom I had the honor and pleasure to communicate. I thank my new friends from different countries (USA, Czech Republic, Germany, Cyprus, China, Turkey, France, Poland), who inspired me to study harder.

I thank my coordinator Karina Zhuikova from Ukraine, who offered to try to participate in this exchange project.

Living and studying in Stockholm has taught me many things, and I thank fate for this experience.

Olena Trofimchuk
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1. Introduction

Relevance of the research topic is that today there are significant changes in the global economy characterized by increasing globalization processes which remove barriers restraining the development of economic relations with other entities of the world economy. This opens new opportunities for enterprises of external factors, involvement with overseas financial and technological resources, the use of production and management practices, and expanding markets. I think using technology transfer will be helpful to businesses.

The objective is to clarify the concept of technology transfer and the accompanying components to deliver them to the reader.

This goal will address the following objectives:
- the theoretical basis of the concept of technology transfer;
- identify factors affecting the transfer of technologies;
- give examples of technology transfer.

The object of this paper is to study technology transfer.

The methodology used to answer the question brought up in the thesis is based on the theoretical fundamentals of technology transfer, technological activities, barriers to technology transfer and highlighted examples of the use of technology transfer found in the analysis of articles on the subject of technology transfer. So, the study has been performed through a literature review of current research.

No doubt there is huge potential for growth value of technology transfer for enterprises. In my opinion, the information provided in this paper can be very useful for students and researchers of the field to gain more knowledge and insight.
2. The concept of technology transfer

Technology is the use of machinery, tools and other corporeal artifacts to encounter personality needs and wishes (Svante Lindqvist, 1987) This means that technology is always defined in a human framework, because man uses the artifacts and man defines their purposes. Therefore, no technology can be given in isolation from community and cultural circumstances (Jan af Geijerstam, 2004, p.19).

The first safety car “air bag” had been successfully demonstrated in 1955 by its inventor, who boasted in movie news, that cars next year will have air bags as standard equipment features. However, the question arises why such an important safety device took almost 40 years to become a standard feature in the automotive industry, while at the same time, Dr. Jonas Salk discovered a cure for the dreaded polio virus. Polio shot was taken all school children in the country (for just a few months), as opposed to air bag innovation. Why are these two vital innovations so radically different in transmission speed from the developer to the user? This question considers two interdisciplinary areas of research: (1) technology transfer and (2) diffusion of innovations (Cottrill, Rogers, & Mills, 1989). These concepts provide the link between technology development and use, and move the work of development technology into the hands of end users. Without the successful movement of technology from research laboratories to users, potential new technologies cannot be fully realized.

While technology transfer typically “refers to the development of technologies in a single parameter, which is then transmitted for use in other contexts” (Markert, 1993, p. 231), diffusion is used to refer to the “spread” or use of technology in society, organizations, or group of individuals (Rogers, 1995). Transfer of technology tends to focus on producer technologies, while diffusion focuses on end-user technology. Additionally, the technology is not successfully transmitted until it is adopted and used by end users.

Transfer of technology is not new research. It began in the U.S. in 1940, and examples of technology transfer can be traced to the advent of the technology. Formal studies of technology transfer began with the spread of technology research conducted by European sociologists and quickly gained recognition in a number of disciplines as an important area of research (Rogers, 1995). This line of research began to grow in the United States in 1920 and was expanding rapidly by the end of the 1970s (Baker, 1991; Rogers, 1995). After a lull of almost ten years, the study of technology transfer again became the focus of researchers in the field of sociology, economics, technology, and education. It is estimated that the literature on technology transfer currently exceeds 10,000 documents (Baker, David, and Soucy, 1995).
In the present day, technology transfer is widely used by businesses, governments and academia. Professors who teach about technology should consider the transfer of technology a worthy and necessary area of study. Technology programs have traditionally focused on technological development and application of technology, but little attention has been paid to the adoption by the end of the transmission (Scott D. Johnson et al, 1997).

“Technology Transfer” is the spread of commercial technologies in the form of agreements on technology transfer, which may or may not be confirming agreement (legally binding) (Blakeney, 1989, page 136.). This concept also includes communication via whose knowledge can be transmitted to the recipient. Draft Code of TOT selected the following transfer agreements that may be used:

“(a) The assignment, sale and licensing of all forms of industrial property, except for trade marks, service marks and trade names when they are not part of transfer of technology transactions;

(b) The provision of know-how and technical expertise in the form of feasibility studies, plans, diagrams, models, instructions, guides, formulae, basic or detailed engineering designs, specifications and equipment for training, services involving technical advisory and managerial personnel, and personnel training;

(c) The provision of technological knowledge necessary for the installation, operation and functioning of plant and equipment, and turnkey projects;

(d) The provision of technological knowledge necessary to acquire, install and use machinery, equipment, intermediate goods and/or raw materials which have been acquired by purchase, lease or other means;


This list does not include non-profit technology transfer (in relation to education, transport, or employment) used in global agreements on collaboration between countries (developed and developing) (Blakeney, 1989, p. 3).

Technology transfer includes not only the process of delivery of equipment within one firm to another, the transfer of know-how and knowledge to understand the technology that the company can continue to use as innovative data (Bell, M. 1997). There are two steps involved in using international technology transfer (Figure 1): 1 - supply technology to recipient countries, 2 - construction of new capacity in recipient countries (Qian Shujing, 2012, p.1399) However, an important part of this process is the consumer.
Figure 1. The technological content of international technology transfer
Source: Qian Shujing, 2012, p.1399 with my modifications

Transfer of technology from the basic definition includes the transfer itself technology, manufacturer, technology, channels and receiver technology (Markert, 1993). Technology transfer is a process by which a technology connects seller and customer, seller transfers the technology through several actions to the customer (this will increase the technological capability of the customer). Technology transfer can happen between countries, geographic regions, economic sectors, industries, professions (Reisman, 1989).

Technology transfer is an important tool that allows the firm to develop its competitive advantage. This is accompanied by the transfer of equipment, but the consumer can not obtain the true skills of the equipment at once, so need human interaction (collaboration and supervision). Therefore, the trust relationship between the producer-customer and knowledge management, are necessary for technology transfer (Lee Amy H.I. et al, 2010, p. 136).

Figure 2 shows the basic elements that are important for successful technology transfer. This picture shows the complexity of technology transfer and the factors that influence the success of transmission (Szogs Astrid, 2010, p. 26).

Figure 2. Critical factors for successful technology transfer
Source: adopted by Szogs Astrid from Madu (1989, p. 120)
Figure 3 shows the transfer of technologies (conceptual model). This model includes (1) technological activity that contributes to the development and diffusion of innovations, (2) barriers to technology transfer and dissemination, and (3) the operation by which technology is transferred (Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks, 1997).

3. Technological Activity

The first step to establishing a technology transfer is the development of new technology or changes in existing technologies. This development process is to determine if consumers want or need the product after technological activities. Implementation of this activity leads to expansion of knowledge and human capabilities by creating new processes and artifacts. Any technological activities carried out in the social, economic, and psychological context (Figure 4). Technological activity in turn is a product (result) of ingenuity and available resources to meet human needs and desires (International Association of Technology, 1996, p. 11), using existing knowledge and mental activity (Johnson, Foster, and Satchwell, 1989). The final product of technological innovation is creating or modifying the existing technology.

Figure 3. Conceptual View of Technology Transfer
Source: Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks, 1997
In developing the new technology should be the end consumer and this is reason that the developers try to apply as much individuality and excellence in implementing technology. It is therefore necessary to focus on the needs of end users, so feedback between producer and consumer is required to complete the process of quality (Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks, 1997).

Structure and interaction process cycle shown in Figure 5 [8].

Manufacturing technology includes political, social, economic, and cultural values that may create barriers to the diffusion or transfer of technology (see Figure 3). Technology transfer barriers exist always, but affect different technologies differently.

4. Barriers to the transfer process
**Social barriers.** Transfer of technology is part of the social system that determines the extent to which innovations spread. For example, a person will not recommend the technology to their friends or neighbors if it is ineffective or harmful. Information about new technologies will not be published in scientific journals if its ineffectiveness is confirmed (Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks, 1997).

**Political barriers.** Example: the colonial government in India was interested solely in increasing the production and ignored the needs of the citizens but after new agent pushed of the new technology through the political barriers by creating partnerships between the government and research institutions he changed this situation (Parayil, 1992).

**Economic barriers.** The influence and role of this type of barriers to technology transfer can be described using the example of American cotton production in the textile industry (Feller, 1974). The new machine was received very slowly in the North because the industry had large investments in non-automatic looms. However, new looms were spread much more quickly in the South through the relatively new textile industry, which had not yet invested significant financial resources in non-automatic looms.

**Personal barriers.** All people have varying perceptions to new products, technology, and innovation, so they adjust to technology at different times as they worry about innovation and go through different periods of time to adapt to these changes. Transfer of technology also depends on certain characteristics of the consumer.

**Cultural barriers.** A key factor in the process of technology transfer is the impact of cultural barriers. Baranson (1963) stressed that manufacturers should take into account the peculiarities of labor and resources, the host country, and the equipment should be durable but not too bulky, and should require minimal training for successful operation.

National culture is an important part of the transfer of information technologies, as consideration of cultural values should be part of the transfer process (Shore B., Venkatachalam A.R., 1996, p. 31).

Transfer of technology depends on knowledge transfer. Kumaon Iron Works is a British company, which uses European technology. The factory employs Indians, Swedes, and Britons. The various nations differ in terms of economy, linguistics, and culture, so conditions for them were different, and it gives reason to believe that such differences make it difficult to transfer knowledge (Jan af Geijerstam, 2004, p. 326).

5. **The Technology Transfer Process**

Successful technology transfer depends on a number of steps. The figure below developed by the University of British Columbia represents the stages of the process (figure 6).
Despite the fact that different organizations produce a variety of technologies, they employ the same number of stages.

![Figure 6. The stages of transfer process](http://www.gdrc.org/techtran/tt-process.html)

Any technology transfer process has three important components that must be considered.

1) Science and technology: they contribute to a particular idea or invention used for production and its commercialization.

2) Marketing: used to assess the market and develop a business plan and marketing strategy (exit and consolidation of products on the market).

3) Funding: money investments for expansion and market penetration and return on investment.

These components are used together and are involved in a variety of resources and skills that contribute to the successful creation of technologies and products (The Technology Transfer Process web-site).

However, the success of technology transfer requires the development of infrastructure that will “fracture” the barriers that were presented above. Also, the degree of the desire of consumers to get this technology determines technological potential and speed of passage of innovations from producer to consumer.

The relationship between producer and consumer is a key element in the process of transmission. If the new product is available, but society is unaware of it, technology will never pay off. The use of channels as newspapers, magazines, books, letters, and media outlets should
be employed to inform the public. There may be other means of transfer for personal training (Hall, Luxi, Rutherford, and Newlove, 1975), open dialogue (Pacey, 1986), cross-sectional links between enterprises (Rosenberg, 1970), education and training (retraining, programs exchange) (Stern, 1992), use of new management techniques (Tyre and Orlykovskyy, 1993), a program of student exchange and joint scientific enterprise (Markert, 1993). Companies that hinder open communication and the dissemination process reduce the chances for successful use of innovations (Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks, 1997).

Technology transfer is the movement of technology between environments (technical, economic and cultural) in the implementation and adaptation of new technology and its acceptance. It requires long-term investments in human capital. The creation of production and service management takes a long time, a lot of resources, involvement of partners, which also requires attachment (Cromwell Godfrey, 1992, p. 979).

Here are examples of technology transfer in terms of its original size, and Table 1 provides a stylized example of each type of transfer process (Stock G.N., Tatikonda M.V., 2000, p. 726-727):

"Type 1 - the transfer arms length purchase. For consumer technology that has low complexity, novelty. Technology can be used almost immediately after receipt. The end user has almost all the information on the technology, and there is little to no uncertainty about how to use the technology.

Type 2 process transfer - help buyers. The technology has more complexity and secrecy than the technology in the above category. That is, the technology can be functional, but due to a lack of experience, the consumer does not know how to use it immediately and requires some assistance or training.

Communication, coordination and cooperation at the organizational interactions are at low and intermediate levels. The consumer receives technology from the manufacturer with a traditional market transaction. This manufacturer provides information technology for the consumer on how to use technology, so communication is stronger.

Type 3 transfer process - common hands-off. The technology of this type has medium or high degree of uncertainty. But due to coordination, there is a high level of information processing to meet the requirements of the consumer.

Type 4 the process of transmission - a joint development, accompanied by a high level of uncertainty of technology and organizational interaction. Technology may be poorly documented or not available in final form. Consumers are poorly informed about the technology. The relationship between the producer and consumer is closer to the high level of interaction, and coordination with organizational boundaries is blurred or even eliminated. Producers and
consumers can work together. An example of such interaction is strategic alliances, joint ventures, and joint R & D agreement. Interaction with the highest level of information technology requires high performance”.

Table 1. Stylized examples of transfer process types

<table>
<thead>
<tr>
<th>Transfer process type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arms-length purchase</td>
<td>A small bakery must replace a general-purpose oven that has worn out. The technology is familiar, simple, and explicit. The oven is acquired through a market transaction, so there is little communication, coordination, or cooperation.</td>
</tr>
<tr>
<td>Facilitated purchase</td>
<td>The bakery wants to expand in both scale and in the variety of its product line. It decides to buy larger, more sophisticated programmable ovens, again through a market transaction. However, the bakery employees do not have experience with programmable cooking equipment, so there is a good deal of interaction with customer service representatives needed to get the ovens working properly. The technology is more complex and less familiar, although still low on tacitness. There are greater levels of communication, cooperation, and coordination in this instance than in the arms-length purchase above.</td>
</tr>
<tr>
<td>Collaborative hand-off</td>
<td>The bakery has become very successful, so it would now like to expand into producing a larger volume of products for retail sale in the local area. Therefore, the baker must install more sophisticated, automated baking equipment capable of producing larger volumes of goods. A food processing equipment vendor manufactures the needed equipment, but compared to what the bakery has previously used, this equipment is unfamiliar (novel), much more complex, and because it must be customized to some extent it is not in its completed form when it arrives at the bakery’s facility (somewhat tacit). The bakery has extensive discussions with the vendor about the bakery’s requirements, constraints and capabilities. The equipment supplier delivers the equipment, but it sends an engineer to work with the bakery over the course of several weeks to get the production line running properly. There is a good deal of communication, coordination, and cooperation in this case.</td>
</tr>
<tr>
<td>Co-development</td>
<td>The bakery has now decided to move into a different category of baked products — “thaw and cook” cookies. These cookies are delivered to supermarkets partially baked and frozen, and are then “baked” fresh for customers in their in-store bakeries. This is a very different type of product and so it requires a different type of production technology. This technology has been used in bread, cakes, and muffins, but not cookies. Great-tasting cookies are what the bakery has traditionally been known for, and the goal is to replicate the use of this technology for cookies. To accomplish this goal, the bakery enters into an alliance with a company that has produced thaw and cook bread products. The technology is novel to the bakery and very complex. It is also highly tacit because although the technology exists for the bread products, the technology is essentially simply a prototype that serves as a conceptual starting point for cookie products. The technology vendor has its production engineers work with the bakery production engineers to develop new technology for the production of thaw and cook cookies. There is a great deal of communication, coordination, and cooperation.</td>
</tr>
</tbody>
</table>

Source: Stock G.N., Tatikondar M.V., 2000, p. 727

In the above examples, the bakery uses a number of changes in its line of products and production processes, and therefore should receive and use different technologies, which increase the uncertainty (Stock G.N., Tatikondar M.V., 2000, p. 727).

Figure 7 developed by Bell (1987) describes the various processes of transfer taking place between the two organizations and the exchange of knowledge between the company and the exporter by the importer. However, in this case, the scheme has been adapted for technology transfer between universities and firms.

The first stream includes technology services and capital goods. This stream is part of many investment projects for the purchase of equipment and technology. Equipment was purchased to promote the growth of production capacity. The transfer operation requires using skills that are necessary for production activities, involving certain services for the production, maintenance, and repair of equipment. This stream also includes know-how. The main component of the flow of is the application and transfer of human resources, which require great effort on the part of the company that imports in order to acquire a set of necessary skills. It is
important to know that just buying new equipment does not lead automatically to increased technological capabilities. That is, flow B does not include all elements necessary for successful transmission. However, in stream C knowledge and experience necessary to create a technical change are transmitted. Thus, it is through stream C that the firm is able to creatively develop production (to improve product design, conduct organizational changes) (Szogs Astrid, 2010, p. 30-31).

Figure 7. Technological transfer process

6. The levels of technology transfer

Figure 8 presents the levels at which there is technology transfer.

1st level of technology transfer includes knowledge and resources flow from the parent company or subsidiary to client, which was established in the region which will be used this technology (Scott-Kennel 2004, p. 630). The parent company sends their child certain processes, organizational solutions and products of this technology. Transfer of technology is through the use of mechanisms such as capital goods, drawings and graphics of foreign representatives and experts of area (Carrillo et al. 1998) and Carrillo and Gomis (2004) Local staff do not always have to take part in this process, as it is often the major decision and a difficult technological activities that do the foreign personnel (Buitelaar et al. 1999) and Gallagher and Zarsky (2007).

2nd level - in foreign subsidiaries are local staff training for working with this technology. Staff can be trained formally (i.e. visiting lectures, programs, induction) or informal - learning takes place in the workplace. Informal learning is used if local employees perform work from simple assembly to product development activities in the foreign subsidiary (Padilla-Perez and Juarez-Torres, 2007). The difference between the first and second level of technology transfer is the varying degrees to which the importance of participation of local staff is essential to use new imported technology.
Figure 8. Technological impact of FDI on host regions.

Source: Padilla-Perez Ramon, 2008, p. 851

3rd level of technology transfer - foreign branches cooperate with local agents. Foreign subsidiaries are buying goods and services from local firms using feedback and technical assistance. Also, foreign subsidiaries cooperate with local innovation-oriented organizations (universities, institutions of technical guidance, research centers) (Lundvall (1992), Nelson (1993), and OECD (1999, 2002). Thus, the following mechanisms: joint research projects involving scientists in certain projects company, training and counseling staff, is also the mobility of personnel from foreign subsidiaries to local businesses (Cohen et al. (2002), Molas-Gallart et al. (2002), Mowery and Sampat (2005), Partida and Moreno (2003), and Rivera (2002). Four basic types are defined:

a) movement of highly qualified personnel from foreign subsidiaries to local firms. Local staff to acquire knowledge and skills (formal and informal) in foreign companies, and then return to local businesses and use the knowledge received (Contreras et al., 1997).

b) spin-off. Local staff receive new knowledge, skills, and contacts while working in foreign subsidiaries to create their own businesses who partner with new companies as well as with former employers providing goods or services (Görg and Strobl (2002) and Markusen and Venables (1999).
c) Local staff working in foreign affiliates work in other local organizations bringing with them new knowledge, skills and contacts. It is a highly qualified staff working in research centers, universities, in public institutions, and thus contributing to the industry because of their knowledge, contacts and understanding of the industry play a major role to develop and implement public policy.

d) local employees participating in the local private organizations (industry associations), contributing to the spread of technology.

4th level includes the indirect spin-off - private enterprise establishes entrepreneurs who work in private or public organizations (but not private company). These entrepreneurs acquire the skills and knowledge working with TNC (researchers in joint research projects with multinationals acquire knowledge by interacting with these foreign firms, then this knowledge can be used by researchers to create their own company (Padilla-Perez Ramon, 2008 p. 852).

7. Buyer–supplier relationship and knowledge management

Projects can be classified under the following headings: research and development; product development; construction; organization; marketing; maintenance; rationalization; information systems; education and training; adventurous, etc.

These projects may have local, national, or international scales. National and international projects are vehicles for the transport of knowledge and competence from one place to another (Skylark I. S. Chadha, 1981, p. 8-9).

High-quality transmission technology may allow the firm to improve the productivity of the enterprise and provide a sustainable competitive advantage (Cui A.S. and et., 2006). Companies often buy new equipment for new technologies, expanding production capacity and improving competitiveness. The purchase of equipment requires the transfer of technology from equipment suppliers to the consumer.

Transfer of technology can be complex depending on the complexity of technology, ability to teach the receiver manufacturer, and abilities to the latest study, the complex interaction bilateral cooperation. Relations between the buyer and supplier require trust and address the long term. When the transfer of technology in an international context more considering the environment, cultural differences, as otherwise these factors can create big problems (Cui A.S. and et., 2006). That is, the transfer of technology, requires an awareness of environmental factors and their impact on the ability of the company to transfer technology in an international environment. When a firm gets new technology, it tries to transform this expertise into new knowledge that will be used by employees. The relationship between buyer and
supplier, management skills are very important in technology transfer and acquisition of new high-tech equipment (Lee Amy H.I., Wang Wei-Ming, Lin Tsai-Ying, 2010, p. 136).

To purchase new equipment customers need good cooperation with equipment manufacturers because it is important for the transfer of technology, knowledge, and skills of the equipment. Prerequisites for such cooperation between buyers and suppliers are trust, long-term orientation, commitment, and sharing of information (Lee Amy H.I., Wang Wei-Ming, Lin Tsai-Ying, 2010, p. 136). In collaboration interpersonal trust facilitates the efficient operation and investment (Jap S.D., 1996). In turn, long-term orientation indicates that the parties are ready to make efforts to develop long term relationships (Dyer J.H., 1996). Commitment to customer service can also play a role in future cooperation (Bensaou M., Anderson E., 1999). Reliable communication is essential since it facilitates the exchange of information (Mohr J.J., Fisher R.J., Nevin J.R., 1996). Sometimes companies are willing to share confidential information, which has a positive effect on relations between firms (Cannon J.P., Perreault W.D., 1999).

Cooperation also must take into account different environmental conditions, which play a major role as already mentioned above, cultural differences and communication channels (different languages and geographic features). Good understanding of these factors may help to increase opportunities for companies to transfer technology in an international environment. One should also consider how transfer of technology will help to help facilitate communication between suppliers and customers in transferring high-tech equipment (Lee Amy H.I., Wang Wei-Ming, Lin Tsai-Ying, 2010, p. 137).

Knowledge management is an important aspect of technology transfer, as knowledge, experience, and skills are the driving forces for action (Grover V., Davenport T., 2001). Knowledge management is a process of selective application of knowledge and past experience for present and future decision-making to promote growth of enterprise efficiency (Jennex M.E., 2005). Successful transfer of knowledge is to share information among stakeholders with common interests (Hansen M.T., 1999, Carlile P., 2004). Long partnerships contribute to the formation of strong bonds and acquisition of new knowledge.

At a time when technology is rapidly developing, the application of new high technology is one of the most effective means of obtaining competitive advantage. The transfer of complex technology and knowledge of new equipment from supplier to buyer may be through training and technology transfer activities. However, high-tech equipment usually has different features, so skills acquired in learning, understanding technology, and precise control of each unit of equipment to can lead to higher productivity. Quality learning is also dependent on staff and its ability to assimilate knowledge and to educate others (Lee Amy H.I., Wang Wei-Ming, Lin Tsai-Ying, 2010, p. 137).
7.1. **Buyer, relationships with suppliers to Ericsson**

In the article “The Ericsson Group Partners with Capgemini Procurement Services to Reduce Spend” (2010) describe the interaction of consumers and producers, and how important it is to establish this process:

“One common problem for companies is the issue of expansion, with the opportunity to track and manage overall costs.

SAP customers are Ericsson Group faced this problem when they began to implement standardized electronic procurement platform based on IBX e-procurement solution from Capgemini.

In early 2000, Ericsson (known worldwide for its Sony Ericsson mobile phones)- SAP customers in Sweden have a very high level of procurement and increased costs. Therefore, managers Ericsson came to the conclusion that companies need to streamline their accounts and credentials.

Ericsson turned to procurement services Capgemini, which uses a system based on four principles: a process, a platform, a system, and a single interface. This implementation was to standardize and automate the procurement process, working with suppliers.

Ericsson Buyer was launched around the world in 2001 for each unit of Ericsson business. Today this the business units is in 100 countries Ericsson introduced the buyer, because most of the global operations of the company are on a system of electronic procurement. Today more than 40,000 orders go through each month. Implementation of this system was receiving such advantages for Ericsson:

- Completion of more than 90% of orders for indirect materials;
- Reduction of the number of suppliers by 60%;
- Zoom to capture savings from the comments on the bottom line;
- Improvement status for customers and understanding their strategic function, due to less administrative work.

Ericsson customers not only increased its maturity company as part of the area SAP Ericsson, but he confirmed the strong conviction that the management of the e-procurement system is the most effective way to control spending.

“The driving force when it comes to electronic invoicing reduces our costs at the expense of 40%,” says Anders Paulsson, Director of Sourcing at Ericsson. “We see this as a very realistic goal”.

8. **Examples of Technology Transfer**

8.1. **Swedish example**

The authors Andersson Lars G., Per Lundequist, PhD, Oskarsson Bertil, Aring Monika Kosmahl in the article “Volume I - Competitiveness and Science and Math Education in Central America: Comparing Costa Rica, El Salvador and Brazil (Recife) to Sweden” (2006) were described by the activities of the cluster Kista, which is prime example of technology transfer:

“The Kista ICT cluster is internationally recognized as one of the world’s leading ICT technology clusters. Only knowledge products, (no physical products) are produced at Kista. Firms provide a range of software-related knowledge products in the area of Mobile, Wireless, and Broadband services. The Swedish ICT and electronics industry, with a yearly export volume close to 140 Billion SEK (19 Billion USD; 2004), is one of the most important industrial sectors in Sweden. In Kista there is a large concentration of high-tech companies, ranging from university spin-offs to world-leading corporations. Companies such as Ericsson, Nokia, TietoEnator, HP, Microsoft, Sun Microsystems, Intel, and Oracle have offices in Kista. A number of important research studies, including a major study by Sweden’s National Institute for Working Life, (Sandberg 2005) document that technology transfer occurs inside social networks. Networks are defined as formal and informal connections between people in their own and different organizations. Technology transfer is embedded in the process of conversations and related activities within a context of specific individual, firm, and supply chain objectives. The most common activities include consulting, followed by production of software, R and D, sales, marketing, and distribution. More than half of Kista’s ICT companies exchange information with each other, and almost half cooperate strategically in the areas of product development, production, and marketing. A large number of firms outsource IT activities to other companies and work as subcontractors to larger firms. The actual networks are not limited to Kista, but expand to include regional and international areas. Technology transfer flows along two dimensions: in spaces of place (hubs, such as a person, or group in a firm), and in spaces of flows (channels, including virtual communities) (Lundmark 2004).

The research institutes in Kista – Acreo and SICS – are important intermediaries facilitating technology transfer between corporations in joint projects as well as between industry and research in the Kista area. In addition to these two research institutes, there are a number of formalized firm networks that have been formed by Kista Science City Ltd over the past few years. There are also a number of research centers working as “tech-transfer intermediaries” between research and ICT-corporations.
Recently, Sweden developed a coordinated, headed by the government agency VINNOVA. To strengthen the inventiveness of Swedish industry and to facilitate the transference of knowledge and technology between corporate and academic research, VINNOVA runs cooperative programs and projects. In total, VINNOVA administers nine programs for research, development and demonstrations related to information and communications technology and IT usage. In the case of Kista, Vinnkubator is a project supported by VINNOVA with the purpose of developing the volume and quality of business ideas from universities.

Kista Science Gymnasium provides an example of how both the content and process of math, science, and technology education support technology transfer between a high school and cluster firms. Sweden’s educators believe that subject knowledge must be understood in the context of core competencies in three levels: 1) how to solve a problem, 2) how to solve the problem so it is not repeated, and 3) how to solve the problem so that it leads to the development of improved products or production processes. Swedish education policy aims to provide all students with all three levels of these core competencies in math, science, technology, language, and the social sciences. Computers and IT are routinely used by students in school from 3rd – 4th grade on. 95 percent of the education system is financed by the state.

There is a notable degree of interaction between cluster firms and the ICT Gymnasium (a secondary school) located at Kista. ICT gymnasium students learn entirely in teams, in spaces that were designed to simulate an ICT company. Each semester, ICT students take on projects generated by Kista companies. Students consult with companies and are mentored by students in the IT University. Subject matter is learned inside project activities, graduates meet the requirements for graduation, and students easily find jobs while some start their own IT companies’.

8.2. Russian example

In the article “Expanding the Content Base of Technology Education: Technology Transfer as a Topic of Study” by Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks (1997) describes an unfortunate example of technology transfer in Russia: “Researcher Dalrimple described an example of attempts to transfer technologies in Russia in the early 20th century for the development of heavy industry (Dalrimple, 1964). Russia could only import the required number of tractors to meet their needs, but because of depressed economic environment, the Russians decided to import a small number of tractors, disassemble them in order to study their structure, and then make exact copies of tractors manufactured in the U.S. in its factories. However, this attempt to reverse engineering (Markert, 1993) failed because there were
injstitutional constraints (Dalrimple, 1964). There were three problems that prevented the success of Russia’s plan: they could not copy the exact specifications of materials for the tractor parts, they did not teach end users the right way to use the tractor, and their service facilities were inadequate. That is, some technology transfer was successful, but the use of new technology was interrupted because the Russians could not perform all the processes of technology transfer itself. Technology can be used only when it can be adjusted to the needs (cultural, ecological) of the population (Parayil, 1992)

8.3. Appropriateness of Technologies. India and Mexico

In the article “Expanding the Content Base of Technology Education: Technology Transfer as a Topic of Study” by Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks (1997) is also induced an example of technology transfer in India and Mexico: “Purcell (1993) states that the transfer of innovation affects appropriateness of technology. Technologies should meet the needs and desires of the population or user group. Requirements for appropriateness of technology include an inexpensive cost, easy storage, and a short period of training to learn how to use the technology. A good example of such technology is the "green revolution" in India from 1960 -1970. Agriculture in India introduced new varieties of wheat to meet the conditions of production and consumer tastes (Parayil, 1992). At the same time, Mexico also successfully applied the appropriate technology after learning from certain mistakes (DeWalt, 1978). The government had a number of measures in order to provide tractors for farmers to promote the productivity of their farms. However, transfer of technology to farmers was not successful because the tractors were too expensive overall, not convenient for planting seeds in small plots of land, maintenance was not available, and fuel was expensive and difficult to access. It was therefore proposed another technology that was appropriate for farmers. This technology is reducing labor costs for planting, but also to improving conditions to control the mechanical landing drills that pull animals. Thus, this technology was adapted to the farmers and quickly became widespread throughout Mexico”.

8.4. Fraunhofer TEG (Germany)

In the article Harding Rebecca (2002) “Competition and collaboration in German technology transfer” is an example of a German company that is engaged in technology transfer: “Fraunhofer Technology Development Group (Technologie Entwicklungsguppe - TEG) was founded in 1982 (interestingly, as the spin-off of FhG / IPA) with the idea of creating synergies between different institutes. Fraunhofer took a holistic approach to industrial contracts. His «technology transfer» codified knowledge of scientists in product development and implicit knowledge systems and management consultants to support the development process. 43
employees came from different disciplinary backgrounds to facilitate this transfer and, if TEG cannot provide expertise, he would subcontract or collaborate with partners around the FhG to obtain this expertise.

There are five main areas in TEG: planning product and business processes, product development, manufacturing processes, project management, and business strategy. The organization includes engineering and design studio that specialize in sensor technology. Using this structure as a basis, it offers support for manufacturing and automation, material flow and logistics, production planning and control, monitoring and testing, IT management, environmental technology and quality management and reengineering.

However, while it may seem to cover a wide range of issues, most of the TEG is in cooperation with other Fraunhofer and other partners. Technology transfer programs and presentations observed covered various aspects, including material flow, the system re-design and product development. Examples of types of projects on technology transfer conducted by Fraunhofer TEG are presented in Table 2.

Table 2. Examples of Projects Undertaken by Fraunhofer TEG

<table>
<thead>
<tr>
<th>Project</th>
<th>Client</th>
<th>Partner</th>
<th>TEG’s role</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Skywash’ aircraft cleaning system</td>
<td>Lufthansa</td>
<td>Fraunhofer Institutes: IPA and IPK, IAP, IPM,</td>
<td>Development of sensor technology on wash brushes</td>
</tr>
<tr>
<td>Railway ultrasonic wheel testing</td>
<td>Deutsche Bahn AG</td>
<td>Fraunhofer Institute for Non-Destructive Testing (but derived from knowledge acquired during work with Russian railway)</td>
<td>Sensing techniques to detect cracks and lesions in monobloc and tyred wheels</td>
</tr>
<tr>
<td>‘Bubble Jet’ leak detection system</td>
<td>Various: this technology is designed as a prototype to enable automation of leak detection systems</td>
<td>Fraunhofer Institute for Biomedical equipment (BMT)</td>
<td>Senior technology to detect very small leaks using ultrasound</td>
</tr>
<tr>
<td>Carbon fibre reinforced Carbon (CFRC) high temperature heating systems</td>
<td>Various: prototype stage — designed for use in production where components are heated to high temperatures</td>
<td>Fraunhofer Institute for the Mechanics of Materials (WMM)</td>
<td>Construction, design and marketing</td>
</tr>
<tr>
<td>Shortening lead time on shop floor</td>
<td>RIDI lighting(SME near Stuttgart: 200 employees)</td>
<td>None</td>
<td>Materials Flow and Process Engineering Consultancy Process Engineering and systems design consultancy</td>
</tr>
<tr>
<td>Re-engineering</td>
<td>MINMAX(Local SME but part of Mannesman)</td>
<td>None</td>
<td>Materials Flow and Process Engineering Consultancy Process Engineering and systems design consultancy</td>
</tr>
</tbody>
</table>

Source: Harding Rebecca (2002) Competition and collaboration in German technology transfer, p. 483

A critical factor in the common approach TEG on transfer of technology is that it must always know enough to correct any errors. For example, in a project to develop tracks for vehicles in Siberia (works with Russian partners and Fraunhofer) the extremely cold weather had to be taken into account. Some systems were abandoned as there was no oil for them that would endure temperatures ranging from +45° to -35°. TEG provides control and management knowledge and combines it with close attention to customer requirements in order to ensure that
projects are successful. Table 3 is not a complete list of projects undertaken, but serves to illustrate the diverse nature of TEG”.

8.5. Technology transfer in China

In paper Wang Xing Ming, Zhou Xing, (1999) “A new strategy of technology transfer to China” describes the features of the technology transfer in China and government focus on facilitating the expansion of spheres of innovation:

“Research on technology transfer in China focuses on two areas:
(1) Making comparisons with technology transfer in different countries.
(2) Investigating the effect of government policy on technology transfer.

Reviewing technology transfer theory is necessary before discussing the strategies. There are many contributions to this theory, the important ones here being:

Product life cycle. According to Vernon (1966), the product life cycle can be divided into three stages: new product stage, mature product stage, and standardised product stage. In the new product stage the product is manufactured in the home country and introduced into foreign markets through exports. In the mature product stage, as technology becomes sufficiently routine to be transferred and a firm's export position becomes threatened, the firm is induced to produce abroad, generally in other advanced countries. Finally, as the product becomes completely standardised, production will be shifted to low-cost locations in developing countries. Vernon pointed out that due to globalisation the environment has changed. This change has weakened the power of the life cycle theory, although the age of technology may be correlated with the form of transfer, especially for large-scale projects. Firms invest large amounts of resources in research and development (R & D) with the intention of creating a unique competitive advantage. Their first move will be to export goods having the technology content of the latest generation. It appears that brand new technologies may be positively related to foreign direct investments and mature technology with licensing. From the theory of the product life cycle developing countries can mainly obtain standardised technology through licensing agreements. Dunning (1995) points out that the only way in which developing countries can obtain advanced technology is through foreign direct investment.

Eclectic theory of international production. Dunning (1979) developed the eclectic theory of international production. According to this theory three conditions must be met for foreign direct investment through multinational enterprises (MNEs) to occur. First, MNEs must have ownership-specific advantage and be competitive. Second, FDI must be preferred over trading and licensing. This will be the case when market imperfections create additional transaction costs associated with trade and licensing. Third, the location advantages of particular
foreign countries should make FDI into these countries preferable to making direct investments in other potential host countries. The eclectic theory contributes to building both necessary and sufficient conditions in which FDI can exist and be conducted.

**Moving back up the product cycle.** Amsden (1989) pointed out that industrialization first occurred in England on the basis of the invention, and it happened later in Germany and the United States on the basis of innovation, it is now “back” between the countries on the basis of learning. Students do not innovate (by definition) and have to compete primarily on the basis of low wages, government subsidies, additional productivity and quality improvement related to existing products. Workshops are usually strategic direction of firms that compete on the basis of borrowed technology. It seems that the life cycle of the product in developed countries is on this route: research, development, design, production. In developing countries: production, design, development, research. The basis of the first requires innovation. It needs a large number of highly qualified scientists, engineers and technologists and support large R & D costs. The second route consists of learning and storage, which is based on the transmission, absorption and adaptation of existing knowledge. Training is also possible to create new technologies and products for contentment market needs. In this way, R & D is mainly to facilitate the learning process, and focuses on technologies that excluded foreign firms.

In general, technological progress in developing countries is largely based on imported technology and, therefore, the domestic capacity to absorb foreign knowledge. The main channels for importing technologies are foreign direct investments (income from foreign companies and joint ventures) and licensing agreements.

**The mechanism for technology transfer-digestion-absorption-innovation-dissemination.** China is a huge country, and its modernisation is dependent largely on its own efforts. The transfer of advanced technology from developed countries is essential. However, the capacity to create and market new technology is more important than straightforward technology transfer (Wang, 1995). The traditional mechanism for transfer is shown in Figure 9.

This cycle of transfer-production-lag-transfer cannot create the capability for innovation and development. Therefore, the Chinese Government will pay more attention to creating a positive cycle of “TDAID” which is show in Figure 10.

Lack of sufficient technological capability is a major inadequacy at the firm level for implementing this cycle. The restructuring of the Chinese R&D system from a centrally planned mechanism into a flexible system is an attempt to solve the problem. The restructuring includes:

- Creating R&D centres within large enterprises. The Government is supporting R&D and innovation activities in the six biggest enterprise groups to provide examples and obtain experience of enterprises' R&D activities. The six centres are located in: Baoson Iron & Steel
Corporation, North-East Pharmaceutical Corporation, Hier Electronics Corporation, Zhanghong Electronics Corporation, Jiangnan Shipyard and Fangzhen Electronics Corporation of Beijing University. These large firms are leaders in technology development because they have the greatest concentration of innovation activities.

Figure 9. Traditional mechanism for transferring technology to China

Figure 10. New mechanism for transferring technology to China

- To combine the forces of institutions conducting scientific studies and R & D units of enterprises and universities through structural adjustment. Not long ago, 85 per cent of scientific research was carried out in isolation from enterprises, so efforts have been made to encourage their combination. There are two ways of doing this: through contracts; and with institutes (or universities) that have their own production locations.

- Some institutes with independent capabilities will be transformed into high-technology enterprises, while others will be turned into scientific research units for public service, such as technical information consultancies.

- Creating incentive systems for innovation activities. Incentives are both “spiritual” and material. Many provinces, major cities and ministries have created foundations for providing awards to inventors, excellent innovators and entrepreneurs. Innovators who make a major contribution towards the development of new products may share the profits from those products.

- Preparation engineers and managers. The growth of Japan as an economic power was not due to its being a pioneer in technology but by becoming a leader in management. In the short term, technology transfer could improve Japan's economic situation. However in the long term, investment in human capital was more important for the advancement of the economy.
Chinese universities and institutes can provide different kinds of training such as part time courses, distance learning packages and MBA programmes in companies”.

8.6. The new technology transfer approach of the Kingdom of Saudi Arabia

The article Alshumaimri Ahmed, Aldridge Taylor, Audretsch David B. (2010) “The university technology transfer revolution in Saudi Arabia” described the development strategy of innovation in Saudi Arabia and the application of its technology transfer:

“Given the limitations of the traditional technology transfer regime in facilitating knowledge spillovers and technology transfer, a new approach had to be forged in order to address the goals mandated in the eight Development Plan of the Kingdom of Saudi Arabia. In March 2010 the Saudi Cabinet approved licenses for the first three university companies in the kingdom. Riyadh Techno Valley (Wadi Al-Riyadh Technology Co) in King Saud University, Wadi Jeddah in King Abdulaziz University, and Wadi Al-Dhahran in King Fahad University.

One example of the new technology transfer approach of Saudi Arabia is provided by the development of the technology park at one of the most important universities in the country, King Saud University. The Riyadh Techno Valley (RTV) project was initiated at the King Saud University in order to accelerate and promote knowledge spillovers from the large and rapidly growing in knowledge investments at the university for commercialization and innovative activity, which in turn, should spur economic growth and job creation.

The vision of the Riyadh Techno Valley Park is to provide ‘‘leadership in research, development and technology transfer’’ (RTV KSU 2010, p. 5) In order to realize that vision, the mission of RTV is «To provide a stimulating and attractive environment for research and development, which will contribute to achieving sustainable development and enhance competitiveness of the national economy based on knowledge» (RTV KSU 2010, p. 5). The Riyadh Techno Valley Park has the explicit goals of (1) developing human resources to excel in research and development (2) contributing to the development of a sustainable economy, and (3) facilitating an environment that is conducive to research and development.

To accomplish the mission of the Riyadh Techno Valley Park, seven stated main objectives must be met:

1. Develop a viable system of technology transfer,
2. Promote cooperative activities between the research activities at the universities with counterparts both locally and globally,
3. Create an environment that attracts investment from both Saudi Arabia as well as abroad to facilitate the creation of specialized R&D companies,
4. Attract and develop the creative class and innovative workers, both from within and beyond the Kingdom,

5. Generate high quality human capital and scientific capabilities in students in order to meet the corresponding demand from private industry,

6. Facilitate high wage employment opportunities in the emerging knowledge economy,

7. Provide revenues for the university to facilitate financial stability.

Just as the development of Research Triangle Park (RTP) in North Carolina was based on leveraging key knowledge assets in the region, Riyadh Techno Valley Park is also based on leveraging key knowledge assets in Saudi Arabia. In particular, the King Saud University provides a world class university offering research and higher education. Studies have found that the effectiveness of knowledge spillovers and technology transfer depends on the geographic proximity between the knowledge source, in this case, King Saud, and the private and non-profit organization benefitting from the knowledge spillovers. Because King Saud University is located in the capital of Saudi Arabia, Riyadh, its location is conducive to knowledge spillovers and technology transfers.

While the research profile of King Saud University is broad, and spans more than 186 specialties, over 4,500 faculty members (80 percent with degrees with degrees from the top twenty universities in the world), an infrastructure valued over 70 billion Saudi Riyals ($18.7 billion), certain priority technological areas, such as nontechnology, will benefit from the high research profile already present at King Saud University (RTV KSU 2010).

The King Abdullah Institute for Nanotechnology provides a strong platform for both research and commercialization. Similarly, the state-of-the art Prince Salman Entrepreneurship Institute is conducive to research, innovative activity and commercialization. Given the research strengths and research profile of King Saud University, along with the mandate posed by the Strategic Plans of the Kingdom, three areas of research and technology provide the focal points of Riyadh Techno Valley Park (RTV KSU 2010, p. 19). These are:

- Chemical technology and materials
- Biological, agricultural and environmental technologies
- Information and communication technologies

In the area of chemical technology and materials, there are four specific priority subareas—petrochemicals technology, chemical technology, material technology, and energy and alternative energy technologies. In the area of biological, agricultural, and environmental technologies, there are three important sub-areas—pharmaceuticals technologies, environmental technologies, and food science and agriculture technologies. In the area of information and
communications technologies, there are three important sub-areas— information technology, communications technology, and information security technology.

While Research Triangle Park (RTP) in North Carolina can be considered to be a pioneering effort, or a first generation research park, Riyadh Techno Valley Park can be viewed as a fourth generation science park, in that it has short-term goals as well as longer term goals. The short-term aims comprise (RTV KSU 2010):

1. Attract anchor companies to the Valley
2. Obtain stable and sustainable financial support
3. Keeping in contact with local and international research institutes
4. Acquire intellectual property of high value
5. Create an attractive eco system in the valley
6. Establish international alliances
7. Optimize the use of smart outsourcing

Longer term goals are considered to involve strategies for sustainability (RTV KSU 2010):

1. Build a technology incubator
2. Create an entrepreneurship program
3. Attract venture capital
4. Encourage support from angel funds
5. Market patents in a professional and commercial manor
6. Build a solid base of highly skilled and competent human resources
7. Establish a knowledge-based community.

Research (Feldman and Audretsch, 1999) has shown that geographic proximity among firms working on similar technologies based on the same areas of basic research exhibit the highest performance, measured in terms of innovative activity. The Riyadh Techno Valley is designed to take advantage of such spatially constrained knowledge spillovers and consists of five zones. The first is the Biotechnology Valley, which contains the leading companies in research and development in the fields of pharmacology, environment technology, and food science.

The second zone is the Chemical Technology and Materials Valley, and contains the leading companies in research and development in the fields of petrochemical materials, chemical materials, and energy. The third zone is the Informatics Technologies and Communications Valley, and consists of the leading companies in research and development in the areas of information and communications technology and information security.
The fourth Zone is the Scientific Village, which contains residential units and recreational facilities. The purpose of this zone is to provide a high quality standard of living for employees of the science park, as well as accommodations to visitors to The Riyadh Techno Valley Park. The fifth zone is the Central Core, which includes the incubators and the Centre for Entrepreneurs, the Office of Support Services of Operations Research and Intellectual Property, as well as laboratory space to serve the local market, along with governmental and semi-governmental centers for research and development.

To facilitate technology transfer and knowledge spillovers from King Saud University, or what is referred to as the «RTV Eco System», a new legal framework for managing intellectual property had to be developed that was commensurate with the goals and mission of Riyadh Techno Valley Park. A Public Private Partnership (PPP) was established to managed and operate Riyadh Techno Valley Park, which consists of a Board of Directors supervising a professional team of executive managers.

In order to serve as a conduit of technology transfer and knowledge spillovers, an appropriate intellectual property regime had to be put in place. The Intellectual Property Program of King Saud University was initiated with the explicit mission of protecting the rights of the intellectual property of affiliates of King Saud University. Such intellectual property ranges from patented inventions, to licensed technology, and to copyrights. The Intellectual Property Program facilitates the registering of patents by University affiliates and identifies opportunities for licenses and other modes of technology transfer that yield revenues for the University. The mission of the intellectual Property Program is (Ministry of Higher Education 2010):

1. Facilitate patent applications by University researchers
2. Evaluate and identify potential patent opportunities from the research started at the university
3. Evaluate and identify licensing technology developed at the University. The decision whether to pursue a license is based on a licensing and marketing strategy, «taking into consideration technological and marketing risks, and seeking interested firms and individuals within firms wanting to adopt the technology and advertise it» (Ministry of Higher Education 2010, p. 3)
4. To make revenues accruing from licensed technologies applicable to scientific research at the department in which the inventor works, which will obtain a major part of the financial rights to the intellectual property developed in the academic department
5. To assist the inventor in finding commercialization opportunities.
In addition, the Intellectual Property Program is assigned the responsibility of protecting the copyrights associated with publications by researchers and scientists at King Saud University.

Under the Intellectual Property Program of King Saud University, 10–15 percent of the revenue accruing from licensed technology remains with the Program, which is intended to cover registration, administrative costs, and legal expenses. The remaining rights are distributed as follows (Ministry of Higher Education 2010):

1. The inventor receives one-half of the residual financial rights
2. The department where the inventor is affiliated receives one-quarter of the residual remaining financial rights
3. The college where the inventor resides receives one-quarter of the residual remaining financial rights.

The Riyadh Techno Valley Park is designed to evolve through several stages of development. The first stage aims at creating and enhancing the abilities and capabilities of the knowledge workers at King Saud University, which includes professors, researchers and students. In addition, private industrial and research companies should be provided access to and integrated into research activities at King Saud University and at the Riyadh Techno Valley Park. As the Park evolves, it is expected that later stages will focus on enhancing the skills and research and development capabilities of the community, which in turn will help transform the entire region into an entrepreneurial knowledge cluster”.

9. Specific strategies for technology transfer

The use of specific strategies for technology transfer contributes to its successful transmission. In the transition of technology from producers to end users, one should use the strategic plan. Complexity of technology transfer means that even if the transfer has begun, it may take days, weeks, even decades, and may not succeed.

To increase the likelihood of transfer of technology to effective use of understanding of technology transfer and use the right strategy The following classification of strategies for technological readiness of design considerations and the needs of end-user.

So, Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks (1997) determine the strategies:

“1. Technological readiness issues (initial review or «scanning» the environment of the consumer). Answers to these questions will help understand whether the consumer is ready to accept and apply their knowledge:
• Who will use the technology?
• What is their current level of technology?
• Who are the stakeholders? People who make decisions? Influential people?
• Do end users have the education they need to make technology?
• Will the training I need?
• What are the available financial resources? Will they be sufficient to support the technology?
  • Will the existing infrastructure support technology and its expected growth?
  • What other issues might affect this transfer?
  • Is the full benefit of the technology limited by other bottlenecks in the system?

2. The question of design - design considerations for appropriate technologies and the factors that describe important role in ensuring a transfer of materials and technologies.
  • Develop technology and infrastructure so that it can grow with the user.
  • Develop and adapt technology, so it is suitable for culture, and intermediate, if society's needs dictate.
  • Present demonstration programs for the little success and keep the end user in the loop during the development process to ensure that needs are met.
  • Document technology procedures (in terms of the user can understand), so the user has as much information as is necessary to work with the technology itself.
  • Provide research and/or training support to facilitate knowledge transfer.
  • Support of view. Recognize that technology is not independent, but affect other parts of the system.

3. Considerations of the End User - play an important role in the design process, so may do so by studying their needs and try to meet them:
  • Evaluation of end-user needs and available resources.
  • Consider how large a system the user will be able to staff and maintain.
  • Identify influential people, stakeholders, and decision-makers. The power of the change agent may dictate a technology's success or failure. Facilitate communication among those involved, and foster a cooperative relationship.
  • Treat the end user's values and culture with respect. Develop technology solutions that are fitting for that environment.
  • Do not impose status and education on the receiving culture. Maintain two-sided innovative dialogue and establish communication channels”.

So, by Scott D. Johnson and other collaborators the transfer of technology should include the needs of the consumer, his/her interests in the technology, how much he/she is willing to use it. This means that a key person in technology transfer is the consumer.
10. Conclusions

The economic potential of all industrialized countries is determined by a substantial increase in the role of science and technology in social production. Therefore, the innovative factor promotes economic development and the formation of competitive advantages of an enterprise by bringing them the latest technology. It is through the use and application of new technologies and by increasing the innovation potential of the enterprise and winning him best position both in domestic and foreign markets.

If a modern company plans to achieve a competitive advantage by improving their production technologies, its leadership must question where to find information on technologies to improve the efficiency of its activities.

International technology transfer is one of the advanced forms of technology transfer, occurs rapidly, attracting an increasing number of countries with promising businesses and organizations. Technology transfer is one of the sources of increasing innovation potential of the enterprise, as it provides business entities with a number of strategic opportunities, including: development of the domestic market, the development of ascending branches, adapting and transferring achievements of developed countries, and entering the transnational infrastructure.

A successful technology transfer should include components such as science and technology, marketing and finance. You must also take into account the barriers which impede technology transfer, such as social, political, economic, personal, and cultural. An important role is played by the consumer of this technology, affecting his/her readiness to accept, understand and use technology. Therefore, manufacturers need to answer such questions as: Who will use the technology? Who are the stakeholders? Will training be required? and others.

Another important aspect of technology transfer is knowledge management, the ability of the manufacturer to transfer knowledge and skills to the consumer.

There are 4 levels of technology transfer. The first level of technology transfer occurs at the expense of the parent company or clients in the subsidiary, and the second level takes place in foreign subsidiaries, where local staff are trained in new technologies. The third level of technology transfer is that foreign affiliates interact with local agents (cooperative research projects, attracting scientists). The fourth level includes the indirect spin-off, which is defined as a private company created by entrepreneurs who work in private or public organizations.

In the implementation of technology transfer trust is an important aspect of cooperation between buyers and suppliers, which promotes long-term orientation.

This paper provides some striking examples of the use of technology transfer and promotes innovation. For example, in Sweden Innovation Cluster Kista cooperates with many
well-known Swedish companies (Ericsson, Nokia, TietoEnator, HP, Microsoft, Sun Microsystems, Intel, and Oracle) promoting the development of innovative activity in the country. Cluster Kista interacts with gymnasium and institutions. This activity is beneficial to both businesses and students, who then easily find work.

A bad example of the transfer of technology can be seen when Russia imported tractors, dismantled and wanted to produce their own, but ultimately failed. This technology was transferred but not successful because the transfer process contained a number of disadvantages, primarily that the Russians could not teach consumers how to use the tractors. Since the consumer plays an important role in technology transfer, it was one of the biggest mistakes Russia made.

The example of technology transfer in India and Mexico demonstrates the importance of providing relevant technology which meets the needs of consumers. India proposed a new variety of wheat quality, which met the preferences of consumers and had been implemented. In turn, farmers in Mexico were introduced to tractors, which were expensive and not in demand.

An example of Germany is Fraunhofer Technology Development Group (Technologie Entwicklungsgruppe - TEG), which deals with planning and product development, production processes, project management, business strategy, and technology transfer. TEG has a wide range of activities, but always focused on the consumer. For example, the project to develop tracks for vehicles in Siberia took into account the extremely cold weather.

If we consider China as an example of country that promotes innovation and brings in new technologies, we can see that this country that creates a lot of R & D centers in large businesses, joins forces with organizations engaged in research and R & D units of companies and universities, creating incentives for innovation.

For Saudi Arabia, the government also promotes innovation. These promotions include: developing a viable system of technology transfer, promoting joint activities between research institutes, creating an environment that attracts investment, attracting and developing a creative and innovative class of workers, creating technology incubators, attracting venture capital and more.

Thus, based on information obtained during the study of the nature of technology transfer, I can say technology transfer contributes to the development of innovation potential of enterprises and the whole country in implementing the transfer of technology to use knowledge management, target customers, try to eliminate barriers. Also, I think it would be good practice to attract students to the innovation as it occurs in a cluster Kista (Sweden), since many students have diverse ideas and suggestions, but in most cases are unable to share them, especially in Ukraine.
11. References

Books


Printed material


Grover V., Davenport T. (2001), General perspectives on knowledge management: fostering a research agenda, J. MIS 18 (1) p. 5–21


Ministry of Higher Education, King Saud University, Kingdom of Saudi Arabia. (2010). Intellectual Property Program at KSU. Riyadh: King Saud University


RTV DSU (Riyadh Techno Valley at King Saud University). (2010). Riyadh Techno Valley. Riyadh: King Saud University

Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks (1997) Expanding the Content Base of Technology Education: Technology Transfer as a Topic of Study Journal of technology education, spring 1997, Volume 8, Number 2


Svante Lindqvist (1987), Vad är teknik? (What Is Technology?), in Bosse Sundin (ed.), I teknikens backspegel [In the Rear- View Mirror of Technology] (Stockholm), p. 11–33


Woo, G. (Eds.), La Industria Electronica en Mexico: Problematica, Perspectiva y Propuestas. Universidad de Guadalajara, Mexico, p. 411–440

**Web**

Sidibe Michael (2012) UNAIDS Chief Urges Technology Transfer to Africa

The Ericsson Group Partners with Capgemini Procurement Services to Reduce Spend (2011)
Article Archives 2011(Volume 2), October (Issue 4):
http://insiderprofiles.wispubs.com/article.aspx?iArticleId=6120

The Technology Transfer Process web-site http://www.gdrc.org/techtran/tt-process.html