



## TECHNOLOGY TRANSFER BY MEANS OF SERVICE PROVIDERS IN REFRIGERATING INDUSTRIES: A CASE STUDY

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### Abstract

In order to improve their competitiveness some industries make use of technology transfer. Starting from this premise, this article aims to analyze the process of transfer of technology through a company providing technical assistance in equipment for refrigerators, determining their steps and difficulties of enforcement. The beginning of the research was a literature review on the study subject and, subsequently, direct observations were carried out in a company providing technical assistance to buyers of equipment imported from Italy, and interviews with individuals who had accumulated knowledge and are considered experts in terms of the aspects involving the issue in question and who work in the industry providing services. It was possible to verify that the effectiveness of technology transfer in this sector is hampered by difficulties in the training of manpower due to the level of personal instruction; however, the other steps in the process achieve the desired goals that contribute to the increase in the technological level of the receiving companies.

**Keywords:** Technology transfer; service provision; technological knowledge.

### 1. INTRODUCTION

The manufacturing industries are framed in a highly competitive environment in which costs, quality and differentiated products are essential for achieving greater market share or their stay. These companies aim to circumvent the competition in order to offer higher quality products at a reasonable cost and with a minimum waiting time.

The development of a region or country has in the technology transfer a significant portion of contribution because, when appropriate and efficient technologies act as driving forces for economic and social growth. Industries, especially meatpackers, import equipment and processes to meet specific needs, and from these acquisitions they generate solutions for new processes, reduce errors and increase productivity and quality (Kremic, 2003; Braga Jr. *et al.*, 2009).

The Brazilian beef industry has great importance in the economic activity, with regard to the volume of production and exports and the capacity to generate jobs, besides being among the largest producers of beef in the world (Oliveira *et al.*, 2009). However, for it to remain highlighted

on the market before the demands of the consumer market and the pressure from competitors, companies need restructuring, modernization and investments in new process technology.

The increase in technological levels is influenced by the relationship between the research centers, or technology providers, and the industrial sector. Low relationship between the development and application of technologies creates problems that are centered on the lack of proper systematic planning for technology transfer, adding that this process should be evaluated addressing basic concepts, actors, forms, barriers and facilitators of technology transfer and providing the basis for the systematization of this process (Martins *et al.*, 2011; Gilsing *et al.*, 2011).

Refrigerating industries seek the solution to improve the production system in terms of the acquisition of equipment with high technology; however, how is the process of technology transfer characterized? From this premise, this article aims to analyze the technology transfer process through a company providing technical assistance in equipment for refrigerators.



## 2. THEORETICAL FRAMEWORK

### 2.1. Technology transfer and technological knowledge

Technology transfer is a process of disclosure or acquisition of knowledge, experience, and related artifacts. While the transfer involves both the replication of knowledge regarding the physical things related to an innovation, diffusion refers to knowledge itself. In this respect, the transfer of technology can be viewed as a special case of broadcasting, since it creates possibilities for other innovations, not by way of imitation, but as a normal development process. The technological knowledge transfer is not a one-way phenomenon; however, it is a process in which the effect of information interference in both parts provides solutions and new knowledge (HAMERI, 1996). The technological knowledge transfer process is characterized by trial and error, mechanisms that are different in each industrial sector, which can be inhibited when knowledge does not have sufficient specificity to meet recipient's needs (Gilsing *et al.*, 2011).

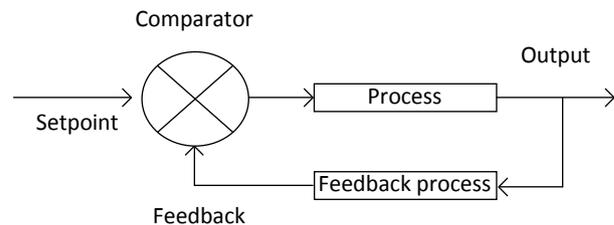
Technology transfer, namely the transfer of a set of knowledge, skills and procedures of an organization to another, is considered one of the main tools for companies to obtain new and better production processes, which is reflected in products with high added value, with the possibility of competing in global markets, in addition to satisfying customer needs. Reisman (2004) presents six groups of procedures so that the transfer may occur effectively, which are: information exchange; sales, which may be of equipment and services; cooperation agreements; licensing; franchise; and joint venture. Wisner (1994) mentions that the problems most frequently observed in technology transfer, especially between countries, refer to those related to geographical and industrial contexts, to the limitations of commercial and financial nature and human factors. To minimize difficulties in the transfer process, we need to build a partnership between the actors from prospecting external sources of technologies, so as to sustain their competitive advantage.

The authors Nonaka and Takeuchi (1997) state that the ability of a company to create new knowledge, disseminate it in the organization as a whole, and incorporate it into products, services and systems shows their degree of innovation, and the creation of knowledge occurs through their conversion by means of socialization, externalization, combination, and internalization. They also propose a model of the process of creating knowledge provided by several phases: sharing tacit knowledge, creating concepts, justification, building archetypes, and interactive dissemination of knowledge, which are linked in a cyclical and iterative process.

The knowledge generation is configured as a necessary condition, but not sufficient, for organizational competitiveness. It is increasingly important for the company to generate knowledge and engage in the deliberate management of transfer of such knowledge processes, so that it can be matched with others and be converted to incremental or radical innovative processes, products, or services, thus increasing the likelihood that the company will obtain competitive advantages (Azevedo *et al.*, 2009).

### 2.2. The effectiveness of the process of transfer of technology and knowledge

When a technology is deployed in a different location from their place of origin, it is necessary to consider all the features that can affect the transfer process. To measure the effectiveness of a transfer process technology and know the characteristics of this we can use tools for the basic control of the system, as provided by Kremic (2003), which is illustrated in Figure 1.



**Figure 1** - Classic process control for a system  
 Source: Adapted from Kremic (2003)

This process control includes a set point, which is what you want to process; a feedback, which is a sample of production, that is, a process of information return; and a comparison function that looks at the set point and feedback and make an adjustment when the two do not agree. By applying this control concept in the technology transfer through authorized agents, when the company that implemented such technology has a result, it communicates to the agent, and the result obtained is compared with the desired results. In case these are similar and the two agree, no action is performed. However, if both do not agree, or if the results are different, some adjustment is required. The process control analogy illustrates that everyone should be aware of the desired results, so they can make the necessary adjustments.

So that the transfer of knowledge effectively occurs, it is necessary that organizations are in line, in addition to the characteristics of the actors involved: a receiver (and its absorption capacity) well aligned to the transmitter can determine the proper transfer comprising the steps of preparation, implementation, and initial integration phase. In any case, the level of difficulty to transfer knowledge is



proportional to the degree of complexity of the transferred knowledge (Szulanski, 1996).

The technological, social and economic contexts of the receiving organization are paramount in the technology transfer process. The effectiveness of transfer requires, in addition to motivation, good personal communication between the transfer agent and the receiving organization as it relies heavily on tacit knowledge. The physical transfer of technology through the agent is not sufficient. This action must be accompanied by a support that is capable of training receivers so that they fully use the acquired technology. That is, if receivers are not fully able to absorb all the information and properly use it on their specific needs, we need to create mechanisms to establish a face to face interaction (Braga Jr. *et al.*, 2009).

For demonstrating the quality, it takes competence in services, and this includes the dependence on skilled labor. The service provided by human beings varies more than the machines, not only between people who differ from each other, but the same service provider can provide different levels of quality of service, depending on the client, the requested service and its complexity, or even their personal problems (Silva *et al.*, 2011).

In the technology transfer context and knowledge by service providers, quality service is given by the effectiveness of the transfer, in which customers and suppliers carry out their activities with excellence. The assistant should be able to sell, install the equipment successfully and leave it running efficiently, since the client must achieve their goals relating to productivity and profitability.

### 2.3. Service Provision

There are three characteristics that differentiate the services of other economic activities, which are: flow, variety, and intensive use of human resources. The flow characteristic is due to the fact that the process is triggered only when there is a request from users, so that the service is provided in the form of flow. Variety, on the other hand, is related to the diversity of production techniques and the differences in size and profit margins of service companies. The third characteristic, which relates to the intensive use of human resources, means that, despite the increasing incorporation of technical progress through equipment, human resources represent the predominant productive factor in the service delivery process, mainly because the service is a deeply interactive activity and thus depends essentially on human resources to interface with consumers/users (Meirelles, 2006).

The sector of services is increasingly playing an important role in the Brazilian economy (De Negri *et al.* Kubota, 2006).

In 2010, the tertiary sector contributes 67.4% of the Gross Domestic Product (GDP), with a decrease compared to 2009, when the sector recorded 68.5% of GDP. The tertiary sector is the one with greater participation in job creation, with over 75% (Brasil, 2011). This happens because of the great opportunities for the provision of services, especially in the post-sale; however, the entrepreneur must be prepared to capitalize on them (Tether *et al.* Bascavusoglu-Moreau, 2012).

The segment "services to companies" involves wide range of intensive activities in labor, namely, activities that work with incurred costs are higher than the cost of plant or equipment. The professional technical services are important intermediate inputs in the production of goods. These service providers usually offer creative and non-standard advanced services, using manpower with high levels of knowledge. Its fundamental importance to other sectors of the economy comes from the fact that these services provide strategic information, which allow enterprises to adapt to technological development, internationalization, and an increasingly complex society (CNC, 2008).

Companies that outsource services such as technical assistance, found in cold storage industries a niche market, due to the demand for new technologies, the increasing acquisition of advanced equipment, and the growth of this industrial branch.

### 3. METHODOLOGY

The beginning of the research took place with a literature review on the subject matter, in order to direct and guide the search from the examination of the relevant literature to the question posed. This step allowed the construction of a knowledge base for the contextualization of the theoretical and practical problems.

This is a qualitative research, and hence descriptive, seeking a detailed understanding in terms of the technology transfer phenomena and technological knowledge through interviews with actors of the case study researched.

Direct observation was made in a company providing technical assistance to buyers of equipment imported from Italy. Later, there was the intentional selection of research subjects, and as a criterion, it was considered individuals who had accumulated knowledge and were considered experts regarding aspects involving the issue at hand and who worked in the service industry, so as to understand and identify the stages of the technology transfer process conducted by these individuals, as well as the skills and competencies that serve as the basis for this process. For data collection, an interview was used as an instrument. The choice was based on the Bryman's (1989) assertion,



which argues that the interview allows informants to be spontaneous and to enrich the interpretation that seeks to describe and understand the occurrence of the variables of a particular phenomenon.

### 3.1. The company in study

The company studied is located in the city of Medianeira, Paraná, is operating in the market for five years, and has approximately 10 employees. It operates in the market as an authorized agent of an Italian industry that produces equipment for the processing of pork meat and provides technical assistance to companies that purchase these technologies from installation to operation of the equipment. Its customer base is spread across the country, with nearly 250 customers, and some customers abroad, such as in Bolivia and Argentina. In this paper, this service provider is classified as company A.

The technology transfer process originated in Italy starts with the training of employees of the service provider so that they learn to operate the equipment, perform its maintenance, as well as all requirements for its proper functioning, such as adjustments to the physical and climatic facilities, and the understanding of operating manuals etc.

The sale of equipment in Brazil is performed by a third company, which accounts for commercialization. However, before the trade is made, the service of the Company A is requested, as it will consider production process of the meatpacking company that will receive technology so as to identify the possibilities of introducing new machines on the line and for choosing the equipment appropriate to the buyer's needs.

Company A is responsible for the technical assistance, which covers from preventive and/or corrective maintenance to unforeseen events related to failure in terms of technological knowledge transfer or misuse of the equipment in question.

## 4. RESEARCH RESULTS

### 4.1. The process of technology transfer in Brazilian refrigeration industries

Given the demands of the market, the frigorific industries are seeking strategic solutions to remain competitive. To meet the demand, valuing consumer demand for quality and variety, the frigorific industries are opting for the acquisition of technologies that fit the reality of the industry and

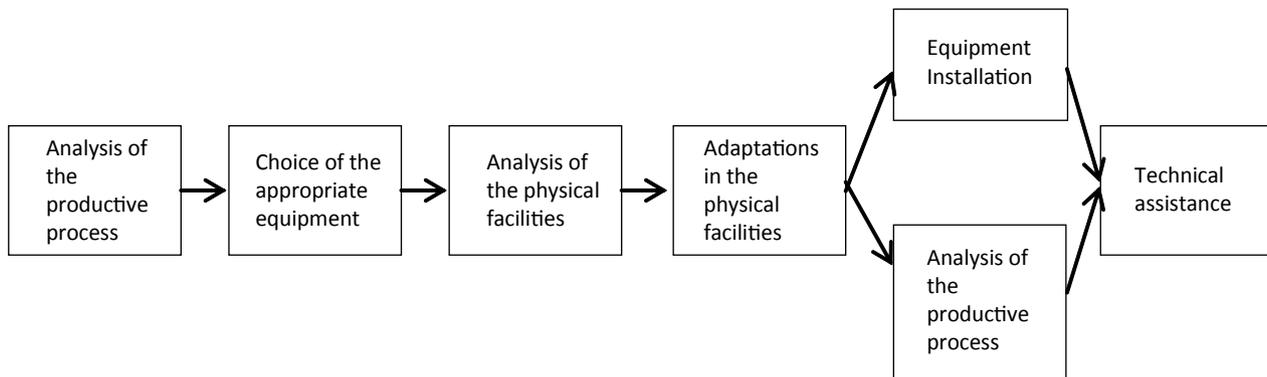
achieve the stipulated goals. In most cases, these technologies are from foreign markets; however, the world's largest suppliers of both equipment and inputs are represented in the country to provide simple and sophisticated technology, to the processing of small or large quantities.

It is observed in the interview with the technical assistance of the company's managers that the refrigerating industries choose to purchase new technology in a reactive manner when something needs to be improved, both to monitor the market and to increase productivity. The process of acquiring new technology starts by contacting the representative companies of the commercialization area and, subsequently, by the technical assistance, the latter being responsible for the diffusion and the implementation of the technology acquired by means of the training of the people involved.

### 4.2. Steps of the technology and knowledge transfer process by authorized agents

The technology transfer process begins with the sale of technology to a frigorific industry through a company representative. Then the work of Company A begins as a technical assistant to the meatpacking industry. Figure 2 illustrates the steps of the technology transfer process conducted by company A for refrigerating industries in general.

Company A starts its work with the analysis of the production process of the refrigerating company that requested the new technology in order to know the reality of the industry, including its goals and needs. Thus, by means of such information, it is possible to choose the right equipment that meets all requirements. Subsequently, a survey of the characteristics of the physical facilities available is carried out, in order to check whether there are operating conditions, and case of negative aspects, it performs the necessary changes in installations such as in electric, hydraulic and others. Next, the equipment installation process begins and, in parallel, the training of the refrigerating company employees who work directly with equipment, as well as the maintenance teams, which carry out simple repairs for the proper functioning of the equipment. It also conducts training with the production management teams in order to minimize possible operating errors. After all the stages of implementation of the new technology, Company A provides technical assistance when requested or on pre-scheduled dates to perform preventive maintenance. This service offered after the implementation of the technology builds a partnership and increases the company's competitive advantage by solving problems related to the transfer process, reducing the difficulties with the new technology.



**Figure 2** - Steps of the technology and technological knowledge transfer process for the company A  
Source: Field Research (2013)

### 4.3. The difficulties of the process

It can be seen with the assistance of interviews with the manager of Company A and the technology transfer agent, that manpower training is one of the most important factors when it comes to failure in terms of the technology transfer process within the refrigerating industry. This is due both to the low level of education of the employees working on production lines as the lack of incentive by the industries themselves to systematic training.

The managers of Company A reported that, during training, they had difficulties to spread technical knowledge, and one of the reasons is the foreign terminology used in equipment control panels and manuals, which are usually written in Italian, language of the country producer of the technology, or in English. Another reason is the difficulty of assimilation of information, which many times is not absorbed and subsequently generates damage to the equipment, which can be damaged due to misuse. Because of this factor, in most cases where technical assistance is requested, the problems encountered arise from the incorrect use of the equipment.

In the 1990s, the technology transfer was problematic due to the lack of infrastructure for the use of the technology acquired. The areas that make up this infrastructure are the manpower training, production planning, and trading, as well as organizational systems, and support equipment (Braga Jr. *et al.*, 2009). Therefore, one should give importance to these areas, in order to obtain success in the transfer process, primarily by the difficulty encountered with the training of the workforce, specifically in cold production lines.

## 5. CONCLUSIONS

To remain competitive, manufacturers need to constantly improve their technologies in order to keep up with tech-

nological development and consumer needs. Moreover, it is necessary to invest in manpower, as the proper functioning of the equipment is directly linked to a good performance of the operator.

The technology transfer process conducted by the service company studied presents different results at each stage, due to the specific characteristics of each receiving client. When this client has employees who are able to receive and deal with new equipment, this process becomes simpler and has greater chances of success. The opposite occurs when the manpower that will use the new technology presents low level of education, and the training stage results are not as expected. Therefore, it is necessary for industries to develop mechanisms to exploit the tacit knowledge of its employees so that they are not restricted only to operate the equipment, but to understand it.

However, even before the trouble reported, the process has been successful. The results achieved by the recipient industries point out that the other analysis stages of the process – choice of equipment, analysis of the physical structure, adaptations, installation, and technical assistance – are being successfully carried out, providing refrigerating industries the anticipated results and the rise of its technological level, when compared to the state they were in before the realization of the technology transfer process.

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