

Process of technology inclusion in a forest SME

Proceso de inclusión de tecnología en una PyME forestal

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Abstract

Given the current need to have technology as a basis for economic development, acquiring technology appropriate to the needs of a microenterprise is a complex process that requires clear definitions, to ensure that both the bidder and the recipient of the technology clearly understand its implications. Traditionally, acquiring technology has been understood as the purchase of instruments, machinery or equipment, ignoring the acquisition of inherent knowledge, which is conceptualized as technology transfer, which is specifically what companies require to improve their production and competitiveness. In this context, it is urgent to change the paradigm of the process of acquiring equipment through the transfer of technology in its broader conceptualization. In the present work, a forestry SME acquires a technology applying a methodology based on the theory of open innovation (response to an identified need) and applying the concepts of continuous improvement, so that the technology to be acquired responds to its need, under the conditioning of "learning by doing", this so that users see "live" the benefits of the technology acquired, by creating new skills and new habits to consolidate changes based on the creation of new cultural values.

Process Technology Transfer, Continuous Improvement, Adoption Level

Resumen

Ante la necesidad actual de contar con tecnología como base del desarrollo económico, adquirir una tecnología apropiada a las necesidades de una microempresa es un proceso complejo que requiere definiciones claras, para asegurarse que tanto el ofertante como quien recibe la tecnología entienden claramente sus implicaciones. Tradicionalmente, adquirir tecnología se ha entendido como la compra de instrumentos, maquinaria o equipos, ignorando la adquisición del conocimiento inherente, que se conceptualiza como transferencia de tecnología, que es concretamente lo que requieren las empresas para mejorar su producción y competitividad. En este contexto, es urgente cambiar el paradigma del proceso de adquirir equipo por el de transferencia de tecnología en su conceptualización más amplia. En el presente trabajo, una Pyme forestal adquiere una tecnología aplicando una metodología basada en la teoría de la innovación abierta (respuesta a una necesidad identificada) y aplicando los conceptos de mejora continua, para que la tecnología a adquirir responda a su necesidad, bajo la condicionante de "aprender haciendo", esto para que los usuarios vean "en vivo" las bondades de la tecnología adquirida, mediante la creación de nuevas competencias y nuevos hábitos para consolidar los cambios sobre la base de la creación de nuevos valores culturales.

Proceso Transferencia Tecnología, Mejora Continua, Nivel Adopción

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Introduction

In the current globalization, the notion of competitive advantage based on access to resources at lower costs, has become obsolete. Nowadays, the most competitive companies are not those with access to lower cost resources, but those that use the most advanced technologies and methods when using their resources. The term technology is a word composed of Greek origin formed by the words tekne ("art, technique or trade") and logos ("set of knowledge").

There is a number, definitions of this. Herrera (2006) defines technology as the set of specific knowledge and processes to transform reality and solve a problem. For Córdoba (2015), technology refers to the set of theories and techniques that allow the practical use of scientific knowledge, and the set of industrial instruments and procedures of a specific sector or product. Martínez (2017) defines it as the set of knowledge that makes possible the creation of products and the design of the processes that make this possible. This definition implies the need for man to have the knowledge and skills to know-how and know-how to use technology.

Traditionally in the agricultural and forestry sector of the country, it has been understood to acquire technology such as the purchase of instruments, machinery or equipment and the transfer of its technology, such as dissemination events, generation of publications or training and technical assistance. in which the acquirer of the technology, is a passive receiver who must apply the "new" technology as it is offered.

However, technology transfer is a concept that acquires ever greater relevance, with more reason in the framework of a globalized society and should be understood as the process that allows the transfer of technical, economic and commercial knowledge, between one organization and another, as well as the learning that stimulates the capitalization of the generated knowledge, that is, the applicability of it to configure it in economic benefits (De Ossa *et al*, 2018).

Therefore, when talking about technology transfer we refer to all those processes necessary for the productive sector to access and take advantage of existing technology. It should be understood that the acquisition and transfer of technology does not always have to come from an external entity, it can occur within the receiving economic actor from a group that improves a part of the process and extends it towards the whole production.

Therefore, the introduction of a technology to the company not only refers to its purchase and installation, but also includes the identification of the technological needs of the future users, as well as the learning and assimilation activities related to the acquired technologies (Velásquez y Medellín; 2005).

In academic terms, the concept of technology transfer is defined as the process of knowledge transfer necessary for the manufacture of a product, the management of a process or the provision of a service (González and Fernández, 2008, De Ossa *et al*, 2018). And it must be understood as an interactive sequence of activities that lead to the adoption of a new technique or knowledge and that involves dissemination, demonstration, training and other activities that result in the reduction of the uncertainty of innovation (Batista, 2009; Manjarres *et al*, 2013).

In addition, the definition of technology transfer differs substantially from one discipline to another. Economists tend to define technology based on generic knowledge, focusing on variables related to design and production. On the other hand, sociologists tend to unite technology transfer to innovation, including social technology. Anthropologists tend to consider the transfer of technology within a context of cultural change and the way in which technology affects this change.

It is also essential to distinguish between technology transfer and technology diffusion. The transfer is inherent in the existence of an agreement and an economic transaction, which is not included in the dissemination process, which consists of the disclosure of potentially innovative technological knowledge (Guede, 2011).

According to the above, and identifying that the Mexican forestry sector is of a traditional type, characterized by the low proportions of use of advanced knowledge in production and that seeks to use those technologies that are in circulation even when they are not appropriate to the technological needs of their own development, rather they are technological packages of generic type and largely incorporated in equipment and / or productive processes (Quintanar, 2012). The objective of this study is to describe the process used by a forestry SME to acquire and include a new technology in its production process, from the moment the technological need was determined to its adoption.

Technology inclusion model

The model that was applied to acquire and include a process technology in a small wood furniture manufacturing company, located in Manzanillo, Colima, combines a series of proposals made by different authors (Halty and Martínez, 1973; Velásquez and Medellín, 2005). González, 2009, Suárez et al, 2012, Tejera, 2013, Rincón y Peláez, 2013, Sarmiento et al, 2018) and consists of six basic steps according to the sequence presented in Figure 1 and described below:

Step 1. Evaluation of the need to acquire a new technology. The process of acquisition and transfer of technology began with the determination and characterization of the current technology in use and evaluating the need to replace it with a new technology, foreseeing the costs of the replacement process. Also, the possibility of improving current technology was valued, with this the risk, scope and type of technology required was dimensioned.

Step 2. Detection of technological offer. As traditionally available technology is acquired, either by its proximity or by the novelty it represents, without an exhaustive search of options or offer of available technologies to cover or solve the detected need. In this step, the characteristics and costs of the possible technologies to be acquired should be clearly analyzed, in order to decide on the most appropriate, based on the principle that it should be better than the technology in current use.

There must also be clarity that these technologies must be "finished" technologies, *that is, that they are not a simple idea to be developed or tested.*

Step 3. Evaluation and selection of an appropriate technological alternative. For the selection of the technological alternative the following fundamental criteria must be taken into account:

- The technology selected as an alternative to be transferred must be a "finished" technology.
- The new technology must surpass the technology that is currently being used or that dominates the acquirer.
- Take into account the costs of the existing technological options.
- Have a budgetary provision for the application of the new technology.
- Take into account the new technological alternatives that are perceived in the short term.
- Find out what technologies are being developed or acquired by competitors.

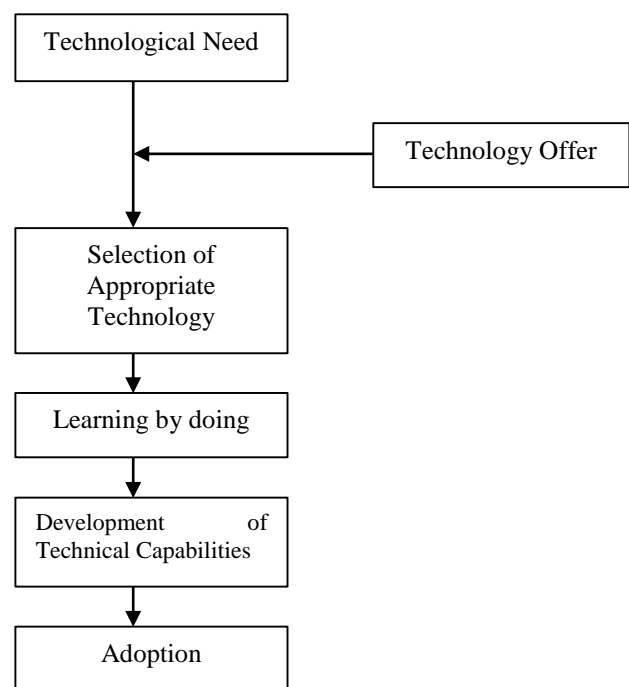


Figure 1 Model for acquisition and transfer of technology in the forestry industry

Step 4. Adaptation and implementation of the technological alternative. Once the appropriate technological alternative to current needs has been selected, for its implementation it is recommended that participants who receive the new technology analyze and determine the training needs, basically the critical variables of the new practice and that require immediate attention, generating a commitment to start improving those variables. Which, later will be evaluated by themselves, under the principle that small changes generate incremental achievements in traditional practices, optimizing the process over time.

Step 5. Development of new technical capabilities. As a fundamental part for the implementation of the new technology that is acquired, they must carry out training courses related to the knowledge and practice related to the technology acquired, in order to develop and strengthen the new technical capabilities required to operate it.

Step 6. Adoption of technology. Finally, to show the degree of mastery of the technology acquired, the participants demonstrate their new skills and competencies in situ through a public demonstration. Thus, the acquisition process and its transfer of technology ends at the moment that the recipients of the same, "apply" it on a routine basis. All under the premise, that the technology that is acquired or transferred must surpass the technology currently used by the acquiring company (Quintanar, 2015). In addition, it has passed the test of economic practice under the criteria of efficiency and profitability (Mendoza, 2010).

Results of the model application

The process of acquisition and inclusion of technology in a forestry microenterprise faces a series of problems or barriers. It should be considered that the introduction of a technology in a microenterprise not only refers to its purchase and installation, but also includes the identification of its technological need and the possible solutions of suppliers, as well as learning and assimilation activities for the use of the acquired technologies (Kearns et al, 2005).

The micro manufacturer of furniture with wood located in Manzanillo, Colima, for years has had a problem in the finished pieces, either furniture or white works (Table 1). Therefore, their need is the acquisition of a technology that allows them to reach and manage a moisture content in their raw material, appropriate to the final use of it (step 1).

When searching for specialized information on technological options for the wood drying process (step 2), the results show several options for managing wood moisture, from sophisticated vacuum technologies, conventional drying or solar drying technologies, between them there is a very high differential in the cost of infrastructure and its operation.

Step	Description	Assessment of activities
1	Needs assessment	Need to achieve appropriate moisture contents in raw material
2	Detection of technological offer	Feasible drying methods: - Conventional - Solar - Fresh air
3	Evaluation and selection	Appropriate drying method for low volumes and low cost
4	Adaptation and implementation	Construction of solar dryer and testing with the type of raw material of the acquirers.
5	Development of capabilities	Training related to the handling of the dryer and the humidity in the wood.
6	Adoption	Demonstration and routine use of technology

Table 1 Process of inclusion of solar drying technology

Thus, once assessed their need, and given the low volumes of consumption of dry wood that normally have and not having financial resources for the acquisition of a conventional dryer, the proposal of appropriate solution to their current needs, was the acquisition of solar wood drying technology, through the installation of a solar dryer and its respective advice for its implementation (step 3).

Once the technological option to be acquired was defined, a greenhouse-type solar dryer was built and installed. A course-workshop was also held on basic concepts and practical issues of wood drying (step 4).

This was done to provide the necessary knowledge to the producers about the drying of the wood and that the participants have the same level of information about it and not to raise expectations higher than those inherent to the process itself.

Once built and installed, we proceeded to test it with wood that users provide. In addition, a new training was carried out for the user personnel, on the principles of solar drying, in addition, practices were carried out on stacking the wood, taking and recording the temperature and relative humidity data. Basic data to later propose drying routines with which the user can manage the dryer more efficiently (Step 5).

With the solar dryer in operation, a demonstrative event of the solar drying process was carried out, with an invitation to the general public (step 6).

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According to the sequential application of this methodology, the results are consistent with the analysis of the implementation of technology as a functional strategy to strengthen productive and competitive quality in SMEs (Córdoba, 2015). However, before starting the process of evaluating the need for technology in the microenterprise, the need to implement technology in entrepreneurs to improve profitability, reducing costs and increasing their productivity must be aroused (Zamora, 2013).

On the other hand, when the methodology is applied correctly and the technological need is dimensioned in a concrete way, this facilitates the selection of that technology that covers practically in its entirety the need of the acquirer of this technology (Figure 2). In addition, its use is immediate because it is a technology tailored to its requirements, therefore, the result of learning and adopting such technology is high and in a short period of time, it is used routinely in the productive process of the acquirer.

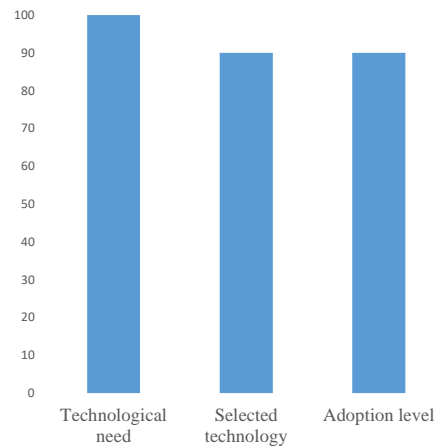


Figure 2 Expectation level of adoption of a selected technology using this methodology in relation to a technological need

Conclusions

- The transfer of technology applied under a methodical process, generates improvements in the productive processes of those who receive the transfer of a new technology.
- The appropriation of a technology requires the participation of the personnel that will use it, so that when selecting it, it will satisfy their technological needs.
- The process of technology transfer ends until the receiver of the same, "applies" it routinely or adopts it.

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