Technology transfer from the University to a Cooperative of Craft Producers in Amblayo (Argentina). Approaches to a case study

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ABSTRACT
This paper presents an experience of a technology transfer process from a public university to a cooperative in a peripheral territory in the province of Salta (Argentina), which owns a medium-scale factory for the industrial production of dairy goat milk cheese. For a long time, its inhabitants have been recognized for their great quality in the artisanal elaboration of cheeses. The objective of this work was to support the transfer of theoretical and practical knowledge and technologies that contribute to the adaptation and use of the new technology implemented in the new plant in the area, which contrasts with previous artisan practices. The technology transfer to cooperatives with ancestral knowledge represents a great challenge and a field of study with little history. The methodology and process of the transmission experience are detailed, as well as a series of recommendations to be considered in promoting the growth of enterprises in territories with a relatively low level of socio-economic development.

Keywords: management, technology transfer, cheese producers, cooperative of producers, university.

1 INTRODUCTION

The objective of this work is to describe the course of an experience of a technology transfer process from a public university to a cooperative of artisan producers, located in the Amblayo Valley in the Province of Salta (Argentina). Therefore, it is an applied research project whose main objective is to identify good practices in tech transfer to generate sustainable management models in the recipients of the technology.

As pointed out in Vilas Seoane et al. (2013), few works analyze and systematize the experience of transfers from the academic world to actors in the social economy. In our case, technology transfer has a social facet, because the knowledge and instruments to be transferred differ greatly from previous knowledge bases, which are rooted in very long-standing cultural and social practices in the Amblayo
Valley. This discontinuity implies not only technological innovation processes but also changes in the social organization of production and marketing. In the long term, it will also generate substantial modifications in the capital accumulation model for local actors.

For this reason, this project is organized by describing the specific context of the intervention in the following section. Then, the Research Methodology is addressed first, and second, the section called Case Study of the Sol de Amblayo Agricultural and Forestry Cooperative. Next, the tech transmission is reported in the section called Technology Transfer Process in the Cooperative. Finally, a summary of the conclusions is presented to be considered in future experiences based on the case study.

2 CONTEXT OF THE INTERVENTION

The intervention framework for this work is located in the Valles Calchaquíes region, in the province of Salta. In these valleys and arid ravines, an intense activity of artisanal production of goat’s milk cheeses is concentrated.

The special flavor and artisanal quality of these cheeses have made the territory famous, almost since the time of the Spanish colony, both locally and regionally. Until now, the sale has been informal and constitutes a habitual form of commercialization in the different markets and fairs of the Salta capital and surrounding regions.

Goat cheese is marketed under the name of artisanal production, based on a culture, and generational heritage that is transferred as knowledge from parents to children in the family (Chávez & Chávez, 2018; Cuellar, 2020).

The sale of products, on a small scale, is carried out by the direct distribution of family members in nearby places and towns or through intermediaries who buy the products in the Amblayo Valley and later resell them.

The following aspects characterize the traditional cheese-making technology of the area: ancestral practices in primary production; proprietary technology for obtaining enzymes (rennet); manual production of cheese with its own rennet and in small batches; and informal marketing of its products. All these aspects are linked to traditional technology use practices and cultural factors.

Regarding the first aspect mentioned, in the management of small livestock, the breeding of native-Creole animals stands out, and crosses with Anglo Nubian and Saanen biotypes; the way of raising is natural, at the foot of the mother and both males and females are raised; grazing of natural grasslands is used and milking is done manually in the corral. They receive the assistance of veterinary professionals. However, the permanence of animal health programs is not assured (Chávez, Orozco, Sánchez, Martinez, & Torres, 2011).
In the second aspect to consider, the enzymes were obtained from the natural rennet from the stomach of ruminants. Currently, this practice is being displaced using chemical rennet of bovine origin (Chávez & Müller, 2020).

Cheese making begins immediately after manual milking, at the temperature of raw milk in the kitchen of the family home using homemade utensils. As a usual practice of the elaboration, hot water is added in a small proportion to provide the necessary heat required by the manufacturing process. Milk pasteurization is absent in artisanal production.

Once molded and pressed, the cheeses are sold fresh (4 to 5 days), without a commercial brand, in paper wrappers and/or plastic bags (Arenas, 2019).

As a synthesis of the current forms of cheese production1, according to the organization of work and the technological devices used, the following classification2 of activities developed in the provincial territory can be applied:

a) Artisan production in rooms of the family farm in a small scale.
b) Artisan production in small-scale cheese rooms, built specifically for this purpose, and located on the land of the houses of producing families.
c) A rural production system (RPS), with new technology and on a medium scale (300 liters of milk processing per batch), which is managed by a cooperative made up of local artisan processors.
d) A private, medium-scale industrial production system that produces high-quality gourmet-type cheeses.

The venture under analysis exploits a market for products already known in the Province of Salta, although it has substantially increased its scope to other economically more dynamic areas such as Buenos Aires, mainly in health food stores (Arenas, 2021). The product goes from being a commodity to being a differentiated product, with varying logistics, and distribution channels. Systems (b) and (c) are innovations in process in the territory of Valle de Amblyayo, during the last decade.

Due to the important discontinuities between the artisanal knowledge base and the new industrial bases of the transferred technology, the changes brought about during the execution of the project have had a wide impact. The transferred technology then brought about not only a process of modernization of

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1 The production of goat cheese, until at least a decade ago, only occurred in the family home, in a combination of daily work activities with those of the family's daily life. The manufacture was generally carried out in the kitchen or another equipped room of the family home. In 2009, an experience of change began with the installation of cheese rooms in five family houses in the Amblyayo Valley, through projects promoted by funds from the national government and the participation of several institutions located in the province (National Institute of Agricultural Technology, Undersecretary of Family Farming, National Goat Law).

2 This classification was derived from the study of cases in the Amblyayo Valley of the Province of Salta. However, at the national level there are other forms of production with different actors and characteristics; in several of them, the interaction of private, governmental and university institutions is combined.
production processes, but also important commercial innovations (moving from informal to formal commerce, and new territorial scope). Both generate profound impacts on the capital accumulation model of the economic actors of this Valley.

Therefore, the changes have not only been technological but also economic, organizational, and social. Therefore, we are in the presence of a true social technology, transferred to an organization of the social economy, which requires an interaction with the community for which it is intended to produce effective solutions for socio-economic transformation (Dagnino, 2014; Arciénaga Morales, 2009).

Connected to these changes, another important contextual piece of information is the type of organization that receives the technology, which, as already mentioned, is a cooperative. By pointing to it as an actor of the social economy, it is intended to emphasize that there is no separation between the economy and society, a characteristic that contrasts with the neoliberal paradigm (Coraggio, 2003). Belonging to the social economy implies an associative nature of people and groups, including democratic control of actions, which tends to make more horizontal the dissemination, assimilation and use of knowledge and information in this type of organization (cf. Vilas Seoane, 2013: 200).

In this context, the changes observed at different levels (of micro-organizational factors within the cooperative, at the level of behavior and strategy of the organization as a whole, and of a meso-economic nature in the region) take on new nuances: the change it arises from a social construction in which the diverse interactions of the informal and horizontal organization play a key role in its conception and implementation.

3 RESEARCH METHODOLOGY

This study used qualitative and quantitative paradigms3 with the application of the mixed method (MM), also called total research or methodological triangulation4 (Borda, 2013, p. 2.7; Perelló Oliver, 2011, p. 52; McKernam, 2001, p. 205; Stake, 1998, p. 99). The mixed method is multidisciplinary, multidimensional and applies different strategies to reveal empirical reality (Vasilachis de Gialdino, 2019, pp. 243-245).

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3 A paradigm is here an accepted model or pattern. It is composed of a network of theoretical and methodological beliefs that allow the selection, evaluation and criticism of topics and a network of commitment between the members of a scientific community. It is also, in general, the theoretical and methodological framework accepted by the scientific community to interpret the processes that are the object of investigation, in a certain period, and in a certain society. Research paradigms, in time and history, provide the scientific community with different models of problems and their solutions. They offer the perspective of a particular vision of reality from a holistic perspective or from fragments of it (reductionism) (Borda, 2013, pp. 33-34).

4 Triangulation requires the researcher to know the usual characteristics of the setting and the participants. The researcher must identify the cause-effect linkages, the beliefs and relationships, and, above all, the practices (McKernam, 2001, p. 208). Triangulation is a strategy that allows the combination of different research methods and is used in areas of knowledge such as topography, navigation, education, logistics, and social research (Perelló Oliver, 2011, pp. 50). It began in the fifties in the field of social research using surveys and fieldwork.
In the application of the MM, on the one hand, the investigated person becomes the subject of the investigation and actively participates in it (Borda, 2013, pp. 49-50). On the other hand, the researcher is involved in the action and is an agent of a participatory process between the subject to be investigated and the researcher, through an interactive approach to research (Arciénaga Morales, 2017).

The MM methodology combined the following methods:

1) Qualitative Research Method: qualitative approach tools are used to study the phenomenon and its subjective dimension. The qualitative method captures the perspective of the subjects, their experiences, and the meaning they give to their actions in the natural environment in which things happen. That is to say, it captures the process in its real context. This method specified results through the methodology applied in a witness case: the cooperative of artisanal producers.

2) Quantitative Research Method: focused on the knowing subject (researcher), he investigates the facts from a distance, correlating variables and studying the causality of phenomena. In the search for causality, he uses the construction of instruments for the measurement of the variables or aspects that allow the explanation of the reasons for the phenomena. This activity materialized in the development of a simulation tool in order to establish a projection of the industrial and rural production systems of the case studies.

3) Case study for the experience of a knowledge and technology transfer process between a university and a cooperative: a technology transmission process is developed from the academy to a Rural Productive System (RPS) of the goat sector.

The MM becomes effective in the dimensions of data, researchers, theories, and methods, as shown graphically in Figure 1.

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Figure 1: The multiple approaches in the Mixed Method. Source: own elaboration.

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5 A case analysis is an in-depth study or investigation of a class of phenomena that have distinctive and unique elements that occur in an event, an individual, a group, an activity, or a community. This method uses six sources: documents, archives, recordings, interviews, direct observation, participant observation, and physical artifacts as case evidence (Yin, 2009, p. 98; Scott, 2014, pp. 60-61).
Regarding data, the MM makes use of various data sources through interaction with the individual (producer, government agent, agent from other institutions), with groups of individuals (producers and associated producers), with agents of government, business, and other institutions.

The data were obtained through in-depth or unstructured and open interviews (Valles, 2007, pp. 92-111; Trindade, 2017, pp. 1-7), held with the president of the cooperative, the field technician, individual producers, government agents, among other actors.

Regarding the multidisciplinary aspect, the research is carried out with several researchers from the same discipline as well as from different areas of knowledge, overcoming the work logic of a single researcher on the same problem. Researchers from industrial engineering, chemical engineering, agronomy and communication sciences participated in the study.

The MM combines theoretical perspectives on the same problem, to avoid theoretical ethnocentrism and broaden the focus for analysis to a greater number. The conceptual perspectives provided by National Innovation Systems, Technological System, Innovation Models, among others, generate a theoretical reference framework that often does not fit in particular environments. These concepts allowed contrasting the existing theories with the reality of the environment under study, in order to find the adaptations of said theories to the observed reality of the object -the technological transmission- and with the subjects -the local actors and agents- that interact in the investigation.

In relation to the methods, the MM procedure refers to convergence, from different methods (not similar) for the measurement of the same unit of analysis. The measurement with different methods gives strength to the validity of the findings, these being, to a certain extent, independent of each other.

Qualitative and quantitative methods were applied. In the first case, the non-traditional case study research method was used and, secondly, a mathematical modeling was carried out based on the variables that have been captured from the exploitation of industrial and rural production systems to study the projection of production and the economic benefits of these systems.

4 CASE STUDY: SOL DE AMBLAYO AGRICULTURAL AND FORESTRY COOPERATIVE

The case study was conducted in industrial and rural productive systems of the goat sector and the witness case personified in the Amblayo producers' cooperative was selected as the unit of analysis, since the stagnation of the development of cheese production in the province was revealed as a central problem. Amblayo cooperative due to the lack of assimilation and use of the new technology installed in the industrial plant.

The producers of the cooperative have experience in artisan production, which does not comply with current health standards and which allows them to achieve a subsistence economy (small scale) by selling products locally, or selling to intermediaries with a low bargaining power with them, or the use of
barter mechanisms. In all three cases, marketing failures usually occur due to the practice of the informal economy, such as breaks in the payment chain or meager prices.

The producers obtained training after the start-up and inauguration of the factory, installed with funds mainly from the state. However, technological training showed a short period of time that was not enough for the adaptation and assimilation of the new technology. In order to fill this vacancy, the university proposed a technology transfer experience based on the specific needs raised by the partners.

One of the models that allows the analysis of the TT and that allows the dissection in the processes that compose it is the Contingency-Effectiveness Model (Bozeman, 2000), selected for its characteristics to understand the unit of analysis of this project.

The conceptual model contains two parts. The first, called Contingency, which describes the TT process; and the second, Effectiveness, which refers to the ways of evaluating whether the TT has been successful and/or has been effective.

- The Contingency unit is divided into five elements: Transfer Agent, Transfer Medium, Object to Transfer, Transfer Recipient, and the Transfer Requesting Environment.
- The Effectiveness unit includes six criteria for analysis that are used to assess the success of the results once the TT has been carried out.

These criteria are defined as:

I. Outside the Firm’s Doors (the success of the TT is measured after it is completed).
II. Market Impact (assessed based on the commercial success of the transferred object).
III. Economic Development (measures the effects on the regional economy or instead of taking a company or industrial sector as the unit of analysis).
IV. Political Reward (consists of measuring the expectation of political gratification).
V. Opportunity Cost (Bozeman states that the TT agent analyzes the cost-opportunity of using a choice of resources, to compare the time and economic benefits of projects other than those of the TT and the TT itself).
VI. Human Capital in Science and Technology (assesses the impact of the TT on scientific and technical skills and technical relevance, built and upgraded).

Next, Figure 2 shows the Contingency-Effectiveness model with its components. In the original figure, slight modifications have been added because of the course of this investigation, in the Use of the Transference Object, which is described as a process that requires evolving in practice; and in the Demanding Environment.

This last process unfolds in turn in sub-processes when it is interpreted that the demand can be initiated by sectors that belong to the formal economy as well as the informal one, and that require sub-processes for an adequate consideration of the conditions -formal/informal- of the context. Finally, it is
considered the vision from the perspective of Use of the Transferred Object. An evolution takes place on the agents-institutions-environment that participate in the transmission; i.e., there is a feedback that promotes changes and/or improvements in the performance of the agents, causing feasible Effectiveness results in the dimensions proposed by Bozeman (2000).

In relation to transformations, the following evolutions are proposed that involve the recipient, agents, and environment:

- Transformations in the recipient: in the case of the cooperative, a gap is opened towards what the recipient of the transfer does with the resources\(^6\) it receives. That means how it deploys and dynamizes these resources in its environment, through the diffusion of the innovations in the immediate environment, through the use and productive service derived from these resources (Penrose, 1995). It includes, as well, promoting local development in the immediate environment, due to the presence of new technological components, the articulation of a new value chain, and the appearance of new forms of practices and services, which add and capture value locally.

- Transformations in the agents and the environment: it is additionally proposed, the feedback towards the other actors and the environment, given that after the Use of the Transferred

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\(^6\) George Richardson proposes to use the concepts of activity and capacity: “... It would be convenient to think of industry carrying out a large and indefinite number of activities related to the discovery and achievement of future desires, to research, development and design, to the execution and coordination of physical transformation processes, the commercialization of goods, etc. carrying out a large and indefinite number of related activities that these activities must be carried out with skills, or, in other words, with appropriate knowledge, experience and skills” (Richardson, 1972, p. 888). In his view, from the capabilities perspective, he imagines the development process (evolution) of the industry, not as islands in the sea but as a network of cooperation and affiliation in which firms are interrelated (Richardson, 1972, p. 883).
Object. There is learning and the gain of experience of institutions/research groups/environment. These mechanisms in turn promote the creation of new knowledge and activities. Following, there is a brief description of the five components of the Contingency part of the Bozeman model.

4.1 DEMANDING ENVIRONMENT

Technology transfer took place in Amblayo Valley, where the local economy is a rural one, based on the cultivation of vegetables, cereals, fodder, and pastures. It also includes extensive animal production with the breeding of cattle and goats.

Amblayo is located in an arid zone, with Valleys and Ravines that include heights between 2000 m and 3000 m high, with an average annual temperature of 12 ºC and low annual precipitation. In the summer months, the average rainfall is between 200 and 400 mm. The region has a favorable climate (low temperatures) for artisan production adapted to the low or null use of conventional energy sources. The conservation of elaborated products like cheese is carried out in the rooms of the farms and the natural environment that they possess. There is a high dependence on scarce natural resources; natural grazing and overgrazing are practiced on public lands.

It is an area with difficult access. From the paved provincial route, Amblayo Valley is reached through consolidated gravel roads, by crossings through riverbeds, which sometimes become impassable during the rainy season in the summer. The homonymous town is located in a mountainous rural environment, has low socioeconomic development and limited access to training, education, research and transportation resources.

4.2 OBJECT TO TRANSFER

The object to be transferred was some theoretical knowledge and, above all, practical knowledge\(^7\) (know how) for the operations of the cheese making factory. Industrial plants are production systems that contain different physical devices, procedures, and work methods. This also includes the need for other knowledge of an intangible nature.

An Industrial Productive System integrates, among others, the following components: the set of methods, procedures, technology, activities and/or processes for the development of functions of

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\(^7\) The concepts of knowledge and their associated practice are taken in this study, in terms of learning-action (Lave, 2019, pp. 135-147) because they are rooted in problems/difficulties that need to be resolved in the field of work, and because it is interpreted that it is in practice where people learn. Centrally, it consists of mastering industrial art, for the realization of their collective interests. Learning is not only the obedient imitation of activities, or the mere transmission of knowledge or the acquisition of skills. However, it is a more complete and complex version, in which identity with practice, knowledge and skill, and purpose are integrated, both for the individual and for the community (Lave & Wenger, 1991, pp. 29-30).
provision of raw materials and inputs, processing -which constitutes the transformation of raw materials and inputs-, and distribution to the markets of the physical goods or services produced.

4.3 TECHNOLOGY TRANSFER AGENTS

The design of the plan was carried out through a research project of the National University of Salta, which has economic resources for the mobility of researchers and support from the administrative and economic infrastructure of the university.

The use of material resources, the inclusion of individual work, and an interdisciplinary team of the research project for the practice of the transfer process were projected. Likewise, the training stages and the transfer of technical knowledge necessary for the start-up and management of the factory were planned.

Here it is worth mentioning that the start-up of the industrial plant is considered a central process in technology transfer due to the need to solve different types of problems in the plant as a consequence of the discontinuity of its operation over time.

The gaps are identified in the need to acquire technological capabilities for the operation of the rural production system, in relation to the knowledge of the actors who have skills in artisanal technologies. Likewise, territory is another important factor, given that knowledge circulates in a region of difficult access, of less socioeconomic development and distance, relative to centers of greater economic development.

4.4 TECHNOLOGY TRANSFER RECIPIENTS

The recipient of the technology transfer was the Cooperativa Agropecuaria y Forestal Sol de Amblayo (Salta), initially constituted with seventeen associates. However, during the transfer process, seven producers and four young people from cheese-producing families participated in it, interested in being part of the association.

The research revealed that the associated producers have marked needs for supporting the adaptation, diffusion, and use of the new technology (Katz & Kosacoff, 1998). Besides, they require adequate periods for the appropriation of knowledge, learning, and acquisition of technological capabilities (TC), and its application in the operations of the productive system. Most of the artisan producers have complete or incomplete primary education.

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8 Within the cooperative, individual learning was revealed and connected with collective learning. This form of social fact characterizes communities of practice: mutual commitment; the one who knows shares with others, the shared company. The community shares common needs and interests, which are not necessarily homogeneous, and produces a shared repertoire (language, skills, and the intrinsic way of doing things in the community) (Villada, 2021).

9 From a resource-based firm theory, Edith Penrose defines the resources of a firm as homogeneous; instead, she describes the idea of productive services as heterogeneous: "...the resources themselves are never the inputs in the production process, but
Technological capabilities\textsuperscript{10}, according to Kim (1997, p. 142) are the skills to make effective use of technological capabilities to assimilate, use, adapt and change existing technologies. It also includes the ability to produce new technologies and to develop new goods and processes in response to changes that occur in the economic environment.

In relation to organizational capabilities in formal settings, Fayol pioneered in 1916 (Fayol, 1917, pp. 7-12; Fayol, 1961) the six essential functions\textsuperscript{11} to successfully manage a company and achieve maximum efficiency\textsuperscript{12}.

However, these theories frame functions that arise from the process of command delegation, and that take place in formal and vertical organizations in relation to power. In our case study, the structure of the organization is not clearly defined, decisions are democratic as in any cooperative, there is a tendency to horizontalize information and decisions, and work roles are established by experience or by the affinity with the task, according to their knowledge, traditional practices and the knowledge built with the new incorporated technology.

The formal business administration theory includes different actions inherent to the administrative function\textsuperscript{13} (Fayol, 1917, pp. 11-12) that are not outlined in the cooperative. Labor relations have another type of matrix, which is influenced by family relations, and personal and social ties in the territory.

In this sense, the diffuseness between the economic and social relations within the organization is an outstanding feature, since the cooperative\textsuperscript{14} has the distinctive features of a social economy actor.

\textsuperscript{10} Several authors define the learning, acquisition and accumulation of technological capabilities as the ability of companies to use technological knowledge and make investments in learning, as a basis for the development and accumulation of capabilities (Bell & Pavitt, 1995, pp. 77-84; Lall, 1995, pp. 109-112).

\textsuperscript{11} Fayol (1917, p. 13) categorizes operations (functions) into six [... All operations that take place in companies are divided into six groups: first technical operations (production, manufacturing, and transformations), second commercial operations (purchase, sale, trade), third financial operations (research and capital management), fourth security (safety of goods and people), fifth accounting operations (inventory, balance sheet, resale price, statistics, etc.), and sixth administrative operations (direction, coordination, planning, organization and control) [...]. Own translation of Fayol's work in French Administration industrielle et générale (Fayol, 1917, pp. 13-14).

\textsuperscript{12} Emerson (1912), cited in Fernández-Ríos & Sánchez (1997), uses the phrase efficiency engineering, to configure the specialty and maximum benefit of it. He stated that efficiency is the relationship between what is achieved and what could be achieved. Its direct consequence is productivity.

\textsuperscript{13} The administrative function has basic actions for an effective organization (Fayol, 1961, pp. 11-12; Bartolomé Pérez, 2018, pp. 17-18): a) the organization (to create a work structure); b) management (supervision and guidance of the work team); c) coordination (organization of procedures to achieve general objectives); d) control (review and verify that the company's activities are carried out); e) planning (development of activities according to the processes to obtain results according to the organization's policy).

\textsuperscript{14} Companies can be established on an individual or social basis. In the first, a single person is the one who assumes responsibility and operation of the company; in the second, it is a group of people. Social companies are founded in different ways: Collective Company, Partnerships, Limited Liability Company, Corporation, and Cooperatives. The latter do not pursue profit; they seek the benefit of a group, be they workers, producers, or consumers (Bartolomé Pérez, 2018).
presents a matrix based on the family unit as a labor pillar, friendship relations and cultural ties that are integrated into the labor force available in the territory, and of mutual social recognition among artisan producers. These are long-standing relationships, which provide a human and personal scale to said relationships in the territory and in the organization.

On the other hand, it is important to notice that this cooperative association adds to the territory new labor form as a source of qualified work; a new form of organization, and new demands for inputs for the realization of socioeconomic aspirations in Amblayo.

4.5 TRANSFER MEDIUM

The experience of the transfer process combined a theoretical section with a practical one, divided into stages. The theoretical aspects were transmitted through digital presentations in the factory. The practical part of the transfer was also carried out in the field, in the facilities for primary production, and in the industrial plant.

Learning actions (learning by doing) took place in a research-action framework. They were carried out from the combination of activities of different nature: training for the acquisition of knowledge and skills for laboratory practices, preparation of laboratory supplies, calibration of laboratory equipment, implementation of physical-chemical tests for determination of quality of raw material, commissioning of the industrial plant, and elaboration of a production batch jointly between the producers and the research team of the university. The joint implementation processes of these activities have been of great importance for personal and organizational learning (Katz, 1976), because it is here when the real problems appear, and their solution is crucial to make effective changes, learning, and innovations.

5 TECHNOLOGY TRANSFER PROCESS IN THE COOPERATIVE

The beginning of the process was constituted by the technical visits and interviews in the field; these were key for the knowledge of the real context and to know the characteristics of the activities of the artisan producers in the territory.

It is included within the execution of the transfer process to the phase necessary to carry out the administrative aspects in the institution of belonging and the coordination with the Cooperative. The former refer to obtaining material resources and the mobilization of human resources towards the manufacturing facility.

The transfer process consists of several stages that are described below:

- The beginning of the transfer: the technical visits to the field, meetings and interviews with the president of the Amblayo cooperative and the field technician formed the basis for the work agreement between the cooperative and the university. In meetings with the president, a draft of
the activities that were necessary in the factory was drawn up. Next, the administrative and technical actions were carried out in the academic institution to materialize the planned activities.

- **Planning:** the activity plan was designed based on technical missions to the Amblayo factory and other productive systems of the goat sector in the same territory. The plan was agreed with the president of the cooperative and it was agreed to carry out activities in the industrial plant. The information collected in the preliminary meetings gave rise to the elaboration of a plan of theoretical and practical activities that is described below.

- **Execution of planning:** the first of the activities was organized as a full day of education and training in theoretical aspects at the plant's facilities. This additionally served to find out on the ground the specific needs and difficulties of the environment. Theoretical training was carried out through digital presentations to transmit knowledge in various areas.

They gave rise to a dialog between actors, with consultations between associates and researchers about the productive activities and specific demands related to the management of the factory. At the end of each day, simple surveys appropriate to the profile of the associates were carried out in order to consider and analyze what were other difficulties that had not been expressed during the workshops and/or future topics of interest to the producers.

The theoretical part was integrated with issues of heat transfer, steam and hot water generators, water treatment, safety and hygiene at work, boiler management, food science, milk quality parameters, and laboratory tests to assess quality of the raw material.

The second day, of a practical nature, was the start-up of the factory laboratory. The laboratory facilities of the industrial plant had not been used, due to both lack of supplies, training, and experienced qualification for it. The set-up of laboratory equipment, the preparation of supplies and calibration of the equipment, the procedures to carry out the practices, and the training instances for the associates were carried out.

It is worth mentioning here that, through the formulation and execution of a national project with the intervention of the Provincial government, an interaction between the three entities, cooperative-government-university, was carried out in parallel to this study, for the assistance and provision of information by the university for the supply of supplies and purchase of equipment for the cooperative's laboratory. After this interaction, supplies and equipment for the laboratory were purchased.

The third day was also intrinsically practical. It was carried out in three stages; the first consisted of participation in the field to learn about the functions of raw material supply and the management of primary production. The second stage consisted of the start-up of the industrial plant. This constituted a challenge for the research project, since the industrial plant had, until that moment, approximately five years of inactivity. The resolution of technical problems of different nature, were activities that demanded
a full day. The third stage took place once the technical problems in the factory were resolved. A batch of production was developed jointly between associates and researchers, making use of the concept of learning by doing and with the implementation of theoretical training and capacity-building instances.

The fourth day of the research was constituted by the organizational diagnosis under the observer subject approach of the research. Investigators’ meetings were held prior to the TT as well as after it. In them, the organization's ways of doing things were analyzed and the different situations investigated were noted. At the end of the theoretical training and the practical activities of the transfer, interdisciplinary teamwork was carried out to collect a comprehensive vision of the organizational dimensions of the cooperative, fed with the different points of view of the researchers and a representative of the cooperative.

It should be noted that, in all these days, the activities were carried out in a pleasant socio-technical dialog that was enriching for both parties, with knowledge that circulated horizontally, with emphasis on the practical part of the transmission. An issue that deserves to be highlighted is that associates need these practical actions; that is, a space for experimentation and work in which the resolution of practical problems is effectively provided.

- Documentation of education and training: support documentation was developed for the activities of the factory related to the laboratory and the management of the industrial plant. Additionally, the activities carried out in this study were recorded by submitting reports to the cooperative and the institution to which it belongs. At the request of the cooperative, the technical report was also sent to the provincial government for the closure of the aforementioned project, in which the activities carried out during the transfer are described.
- Follow-up of the actions: finally, after the technology transfer, communications were maintained with the president of the Cooperative, in order to continue the link and obtain information about the results of the transmission. Currently, the factory continues its production (year 2020 and year 2021) after the transfer, and has produced production batches and placed its products for sale.

6 CONCLUSIONS AND CONSIDERATIONS FOR FUTURE EXPERIENCES

The course acquired by the technology transfer constituted an important experience since it allowed a better understanding of cheese production activities and understanding the problems of artisanal producers in an economically peripheral territory. Likewise, it made possible the creation of a participatory space between actors and researchers, based on an active practice between both agents by the applied methodology.

The development of the TT required a multidisciplinary team and new learning emerged that could be disseminated within the academic system, and in addition, it has promoted changes in the participating
association for the promotion of future agreements with institutions. Additionally, the case study promoted a joint work between the university, the cooperative, business actors, and the provincial government, which can serve as a boost for initiatives of technological diffusion and the articulation of value chains in less developed environments.

From this interaction process, it was possible to identify a set of aspects that can act as promotion and/or restriction keys for TT processes and their positive execution, among which the following stand out:

- **Institutional aspects:** it was necessary to have agreements and resources at the different institutional levels and those of the organization, to achieve the objectives and satisfy the interests of the whole. The combination of support and institutional infrastructure at different levels of government and the respective agreements with the organization constituted key aspects to allow the development of the observed TT activities.

- **Economic and investment aspects:** the availability of academic resources and complementary government resources allowed the TT to materialize effectively. The provision of economic funds and physical assets were necessary to give rise to the actions, since the producers could not afford the investments in equipment and supplies that they need in the factory on their own. Consequently, the presence of external resources for investments in physical and working capital is a necessary condition to generate an environment conducive to TT. However, intangible knowledge assets are also required, which allow an effective endogenization of the transferred technology. The latter is one of the sufficient conditions.

- **Public-private interaction:** physical investments and knowledge are not enough to innovate and launch development processes. Social actors in peripheral areas have restrictions for the development of innovations in knowledge and technology. For this reason, another sufficient condition is the generation of multiple interactions of the different public-private entities in such a way as to enable local innovation through the adaptation and effective use of a new technology, as was the case observed. In this sense, the achievement of relationships of trust with the government and agents of private companies benefited the TT, since they favored mutual learning, generated innovations through said interactions and institutional efforts, and this interactive dissemination of knowledge led to the effective realization of the TT process.

- **Socio-cultural aspects:** the idiosyncrasies of the actors can be a stimulus or a limitation for the introduction of technological changes and facilitate (or hinder) beneficial innovations in the socio-economic sphere at the local level. In the case studied, mistrust and fear of failures with economic losses discouraged the social group after the inauguration of the factory. Short-term training and solo producer operations resulted in production failures. This was overcome through
training and learning through participatory start-up processes, with live and collaborative practices that have a duration appropriate to the needs of artisan producers. These actions encourage and promote the adaptation and use of new technology, acquiring effective experience in the use of new equipment and leaving behind the fear of failure.

- Creation of new capacities: the generation of technological and organizational capacities are important for the transition of the organization towards the effective management of its new technological resources and its organizational changes. It highlights the importance and sense of purpose that prompted local producers to build and install the factory in a territory with difficulties, peripheral in relation to developed centers, and with a lack of infrastructure and articulated value chains that support industrial entrepreneurship.

- Political aspects: the scientific-technological agenda of the national system has challenges that are expressed in the disintegrated action of the institutions (national and provincial) in the territories, particularly in the peripheral ones, through stagnant, individualistic, and non-synergistic actions. Overcoming these fragmented actions towards systemic approaches could contribute to enhancing the value of the physical and cognitive resources available from the different institutions in environments in which a more dynamic development is required, with integrated and complementary efforts, to solve structural issues of poverty and informal economies.

To conclude the analysis, different aspects were indicated that could impact better rates of progress for renowned cheese production in the Province, to the extent that changes could be adopted in the aforementioned ways.
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