Strategic planning of the BIOMATIC research group for promoting innovation at SENA´s Leather Design and Manufacturing Center[1]

Planeación estratégica del grupo de investigación BOMATIC para el fomento de la innovación en el Centro de Diseño y Manufactura del Cuero del SENA

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Abstract

For Colombia's National Training Service (SENA, its Spanish acronym), innovation is a key strategy for consolidating the country's entrepreneurial and social sectors. Coherent with this line of thinking, the strategic creation of the BIOMATIC research group as well as its involvement in the action plan of SENA's Leather Design and Manufacturing Center were analyzed. The impact of innovation on the Center's training and capacity-building programs aimed at the production sector was initially analyzed and then used as basis to identify the needs for innovation and research for the leather and footwear industry, as well as for associated industries such as the rubber and plastics industries. Because of the strategic importance of knowledge building as source of radical innovation, BIOMATIC's knowledge management strategy is presented, also indicating how it relates to the Center's action plan to promote a culture of innovation and technological development not only within the academic activities held with apprentices, but also in its relationship with the entrepreneurial sector.

Key words: Innovation; technological development; strategic planning; research.

Introduction

The increasing interest in innovation and technological development has become a global trend, attributable to the evidence that productivity and innovation are directly related. In Colombia (Crespi and Zuñiga, 2012), political science, technology, and innovation have been defined as

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priority issues in the National Development Plan since 2000 (Departamento

Nacional de Planeación, 2000) and Colombia's National Training Service (SENA, its Spanish acronym) has played an important role in its implementation. This entity, ascribed to the Ministry of Labor, is oriented towards comprehensive professional formation and strives to promote the use and appropriation of technology and innovation by Colombian entities and people (Lugo and Lopez, 2013). To better manage innovation and technological development in the country, SENA has attempted to unify the criteria defining both of these concepts.

Although diverse disciplines have incorporated the concept of innovation into their terminology, its meaning is sometimes confusing. The etymology of the word "innovation" is associated with the Latin *innovare*, which means to change or alter things by introducing new features or novelties. In this study, novelty came from the interaction between scientific and technological knowledge, which is not necessarily simple (Medina and Espinosa, 1994). The complexity of this interaction generated two major models: the linear or technology-push model and the non-linear or market-pull model. (nota: sí, está bien que se haya agregado)

• **Technology-push model.** In this linear model, scientific research covers from basic to applied science and, in the case of engineering and development initiatives, leads to innovation and a new commercial product results as shown in Figure 1. Most of the research activities carried out by universities fall under this model (Jiménez *et al*., 2008). In the case of Colombia, universities have proven to be benchmark entities in terms of research. However, SENA's capacity-building centers cannot use the linear model as sole benchmark. Because these centers have a more direct contact with the industrial sector, they are aware of its needs and should therefore contribute to innovation.

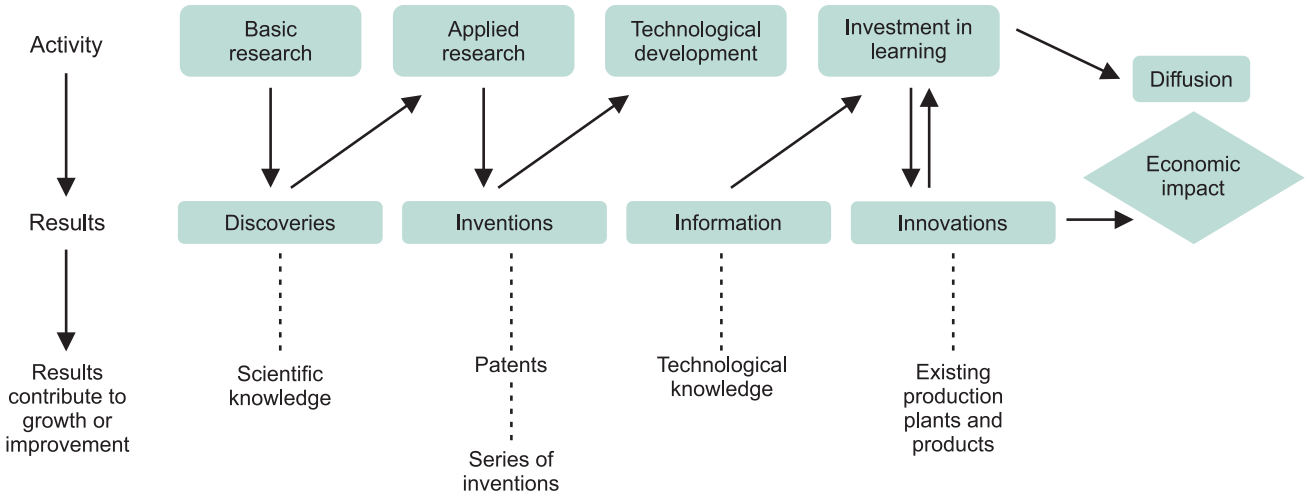

Figure 1. Linear innovation or technology - push model

• **Market-pull model.** This non-linear model considers market conditions as the starting point for technological development, regardless of whether the response comes from a scientific- or technology-type endeavor. In this model, entities use the knowledge that is available to respond to a changing market in a quick and timely manner. Figure 2 presents one of the most used non-linear models, attributed to Marquis (Martelo, 2005).

In both linear and non-linear models, the emergence of innovation is conditioned by the organization's ability to acquire new knowledge from external sources (Cohen and Levinthal, 1990), generate knowledge internally when staff members have that knowledge, or transform tacit knowledge to explicit knowledge, thus generating new ideas that can be shared (Nonaka and Takeuchi, 1995). Processes of convergence and divergence occur (Leonard and Sensiper, 1998), which allow a series of individual competencies to develop (Kogut and Zander, 1992; Leonard-Barton, 1998), which will, in turn, help the organization in the development of innovations.

The strategy adopted by SENA's Leather Design and Manufacturing Center consisted in creating

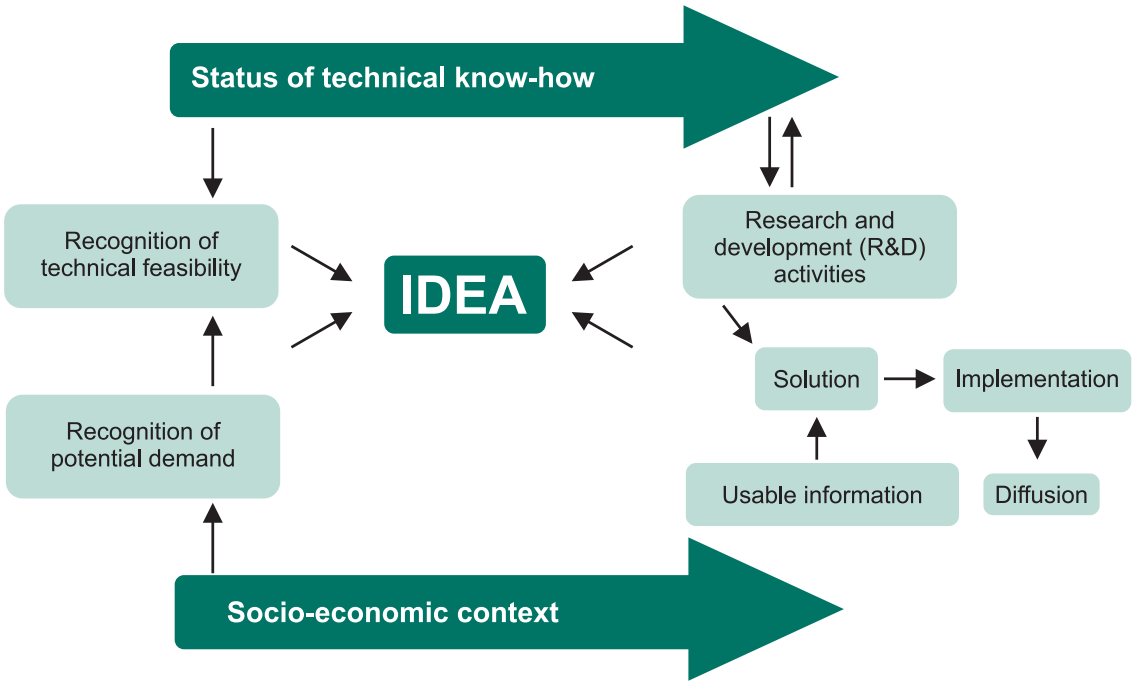

Figure 2. Marquis innovation model

and structuring the BIOMATIC research group to address aspects related to biomechanics, materials, ICTs, design, and quality of the production chains of leather goods and footwear, plastics, and rubbers, conducting research pertinent to the problems these sectors face while also promoting innovation within the Center's academic activities related to design and manufacture of leather articles and footwear and the productive sectors served by the entity.

The research group accordingly developed a strategic plan based on the sectors' identified needs, and implemented an appropriate management model that promoted innovation in both the academic community and the productive sectors.

Methodology

National and regional development plans were used as reference documents to carry out this study, as well as the guidelines defined by Colombia's Administrative Department of Science, Technology, and Innovation (COLCIENCIAS, its Spanish acronym) for the actors of the National System of Science, Technology, and Innovation (SNCTI, its Spanish acronym) and the action plans of SENA as governmental entity and those of the Leather Design and Manufacturing Center.

A study carried out by Velasquez and Castro (2013) at the Leather Design and Manufacturing Center on the status of the plastics and rubber industries, as productive sectors linked to the manufacture of footwear, was used as reference document to analyze trends in the leather and footwear industries.

Rodríguez-Anton and Trujillo-Reyes (2007) indicated that leadership, teamwork, innovation, organizational change, knowledge management, and structure are the foundation of what they called "an organization that learns". These results were used as basis to diagnose the Leather Design and Manufacturing Center, which was selected for this case study because it is a capacity-building entity that aims to strengthen innovation and technology development through organizational learning.

The following four variables were considered when developing the strategic plan of the BIOMATIC research group as source of innovativeness of the Leather Design and Manufacturing Center:

- Innovation (as a multiplier of organizational learning).
- Organizational structure (SENA's organizational model in research and innovation management and project-based capacity-building method).

• Teamwork (interdisciplinarity between capacity-building programs).

• Knowledge management (as educational institution).

The scope (number of technical and technological programs offered) of the Leather Design and Manufacturing Center was another factor considered.

An informal empirical and subjective methodological approach (Aktouf, 2001) was applied, and the strategy was defined based on the experiences of SENA, a public educational organization oriented toward capacity-building that forms part of the national research, technological development, and innovation system that aims to respond to the needs of the sectors it strives to serve.

Diagnosis

Colombia's National Development Plan 2010–2014 (Departamento Nacional de Planeación, 2010) and Antioquia's Departmental Development Plan 2012–2015 (Gobernación de Antioquia, 2012) were used as reference documents at the national and departmental levels. Both coincided that innovation and technological development are strategies that can improve the competitiveness of Colombia and the department of Antioquia. SENA plays a strategic role in supporting innovation nationwide, and it is therefore coherent to find that the strategic plan of SENA's Leather Design and Manufacturing Center recognizes innovation as a tool to address the problems faced by the Colombian leather and footwear industry during the last decade.

Despite the difficulties faced by this sector, different entities—such as the Governor's Office of Antioquia—have shown interest in supporting it and, aware of its potential impact and contribution to local economic growth and development, have accordingly incorporated it into one of their strategic clusters, that of clothing, design, and fashion (Cámara de Comercio de Medellín para Antioquia, 2009). To fully understand the context in which the strategic plan of the BIOMATIC research plan was developed, it should be pointed out that the Leather Design and Manufacturing Center is ascribed to SENA's Regional Office of Antioquia, which aims to strengthen work-related capacities, innovation, and technological development pertinent to the leather, footwear, and leather goods industry.

The BIOMATIC research group' s responsibilities are as follows:

• Lead SENA's research activities taking into account the global trends and policies defined by Colombia's SNCTI.

• Improve competitiveness taking into account the challenges faced by the Colombian industry.

• Incorporate processes of innovation, research, and technological development into academic activities offered by the Leather Design and Manufacturing Center as work-related capacity building entity aiming to actively involve both instructors and trainees.

The philosophy of the Leather Design and Manufacturing Center was that innovation comes either from R&D activities stemming from a scientific discovery made by the projects carried out by the BIOMATIC research group or in response to the needs of enterprises for new products, processes, or information to serve their lines of business. It involved a combination of linear and nonlinear models, with the understanding, however, that in the case of SENA innovation cannot emerge solely from the research conducted in-house because of its mission to support the industrial sector, but neither can its research lines be defined solely based on the needs expressed by the industrial sector. This is why the BIOMATIC research group, when defining its strategic development, centered its innovation process on an inclusive bilateral approach as described by Schmookler (1966, quoted by Freeman, 1974) to generate technical know-how as a result of original research. In this approach, identifying a need is part of the R&D process so the technology developed is ultimately transferred to whoever initially expressed said need.

Leather and footwear industry's needs were identified during the innovation process, complementing those identified during the Center's own research activities. The relationship between organizational learning and innovation was taken into account because, as a work-related capacity-building institution, it's fundamental that trainees acquire innovation-related skills to become either

innovative staff members of an already existing organization or innovative entrepreneurs working on their own.

BIOMATIC strengthened the organizational learning process of the Leather Design and Manufacturing Center by applying the strategic management model , focusing on four factors: strategic management, role of senior management, resource management, and efficient use of human resources, always within a culture of innovation—a characteristic that differentiates this model from other strategic management processes.

The strategic development of the BIOMATIC research group was also defined and involved establishing alliances with universities so these could convert the scientific research conducted by the group into applied research for the leather and footwear industry.

Strategic planning

The strategic planning of an organization involves addressing not only senior management requirements, but also the difficulties arising from the complexity of the organization itself. If strategic planning addresses problems attributable to this very complexity but has been based on a poor assessment, its implementation will lead to serious weaknesses in resource management, which in turn could be reflected in poor organizational performance and loss of competitiveness. As a result, planned objectives will not be reached. Senior management must therefore set aside their own needs, interests, and criteria, and prioritize the effective implementation of the strategy by taking into consideration organizational constraints and ensuring the objectivity of the strategic development from the prescriptive approach and even in its descriptive postulates.

In addition, resources can significantly reduce or leverage the organization's managerial capacity, explaining why key management attributes are undervalued so many times during strategic planning. According to Dess and Lumpkin (2003), in these cases management does not respond or plan strategically; long-term objectives are subordinated to short-term endeavors and outcomes; subjectivity and individual interests prevail as validation criteria, without taking into account the position of other stakeholders; and efficiency is sacrificed in name of efficacy.

Human talent must also be considered. Theoretically, strategic management considers staff participation, importance given to human talent and human resource management, and the value given to intellectual capital—aspects that have always been considered important in the study of human relationships and accordingly consolidated in different motivational, organizational development, and organizational behavior theories (Robbins, 2004).

Innovativeness

The innovativeness of products, processes, and services developed by SENA's Leather Design and Manufacturing Center was analyzed as well as their potential commercialization. The existing capacity-building study plans were also revised to select relevant elements that could be used to develop a strategic management system that would optimize the Center's innovation process through the BIOMATIC research group. A survey was also conducted to identify factors hindering the Center's innovation process and those factors identified were addressed in the strategic plan prepared by the BIOMATIC research group.

As reference tool, the head instructors of each of the Center's capacity-building programs were surveyed, and the data obtained were used as basis to conduct a descriptive analysis. In all five capacity-building programs for technicians and technologists, capacity-building projects were identified that had the potential to develop innovative products but hadn't done so. In addition, the Leather Design and Manufacturing Center has five research lines to generate technological innovations and developments: biomechanics, materials, design, ICTs, and quality. Based on the information gathered in the survey, the BIOMATIC research group prioritized these research areas as shown in Figure 3.

Organizational structure

The most important organizational trends and models at the national and international levels

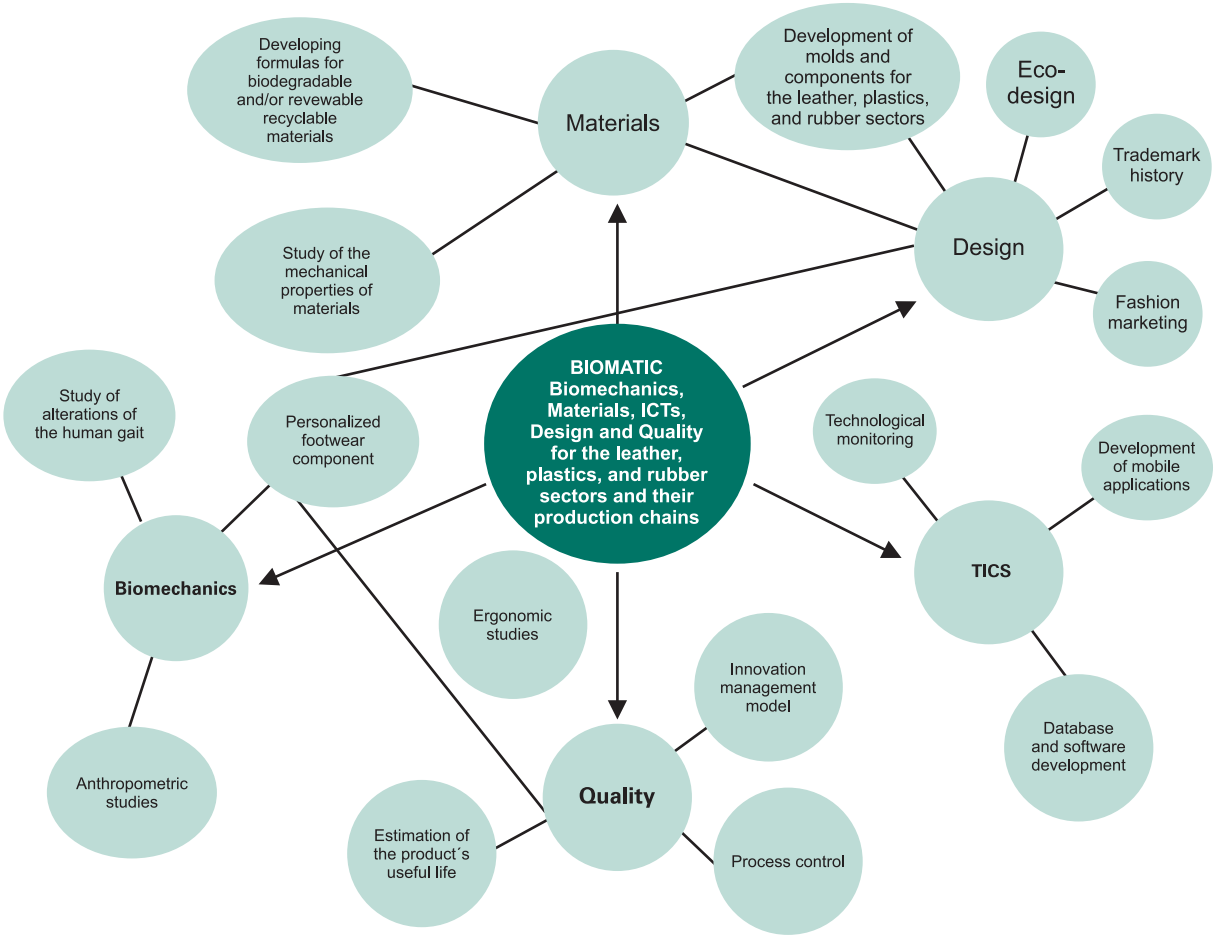

Figure 3. Prioritizing research lines based on diagnosis results

were reviewed to define the most appropriate organizational structure for research and innovation management and then used as basis to identify the trends of SENA's Leather Design and Manufacturing Center (Figure 4). The BIOMATIC research group used the information compiled to develop a process to carry out research and innovation.

The process involves the following four phases: (1) descriptive (what the facts are); (2) explanatory (explain why events occur the way they were described) or interpretive (interpret what the underlying symbolisms are) depending on the approach; (3) contrastive (evaluate the theories developed in the previous phase); and (4) applied or applicative (theories that have already been evaluated are used to impact ongoing situations) (Figure 5).

Additional to the institutional guidelines in place when the BIOMATIC research group was created, SENA created a research, technological development, and innovation system called SENNOVA in 2013, which aims to strengthen standards of quality and relevance in the areas of research, technological development, and innovation and thus impact the capacity-building efforts carried out by SENA. Through this strategy, the entity was able to comply with lines, programs, and projects of organizational culture and innovation, which include techno-academies, techno-parks, applied research, research in professional formation, programs to promote business innovation, and technological extensionism

Since the creation of the BIOMATIC research group in 2012, the Leather Design and Manufacturing Center has been linked to SENNOVA through BIOMATIC as research group registered before COLCIENCIAS.

Knowledge management

The Leather Design and Manufacturing Center,

Figure 4. Major research and innovation trends

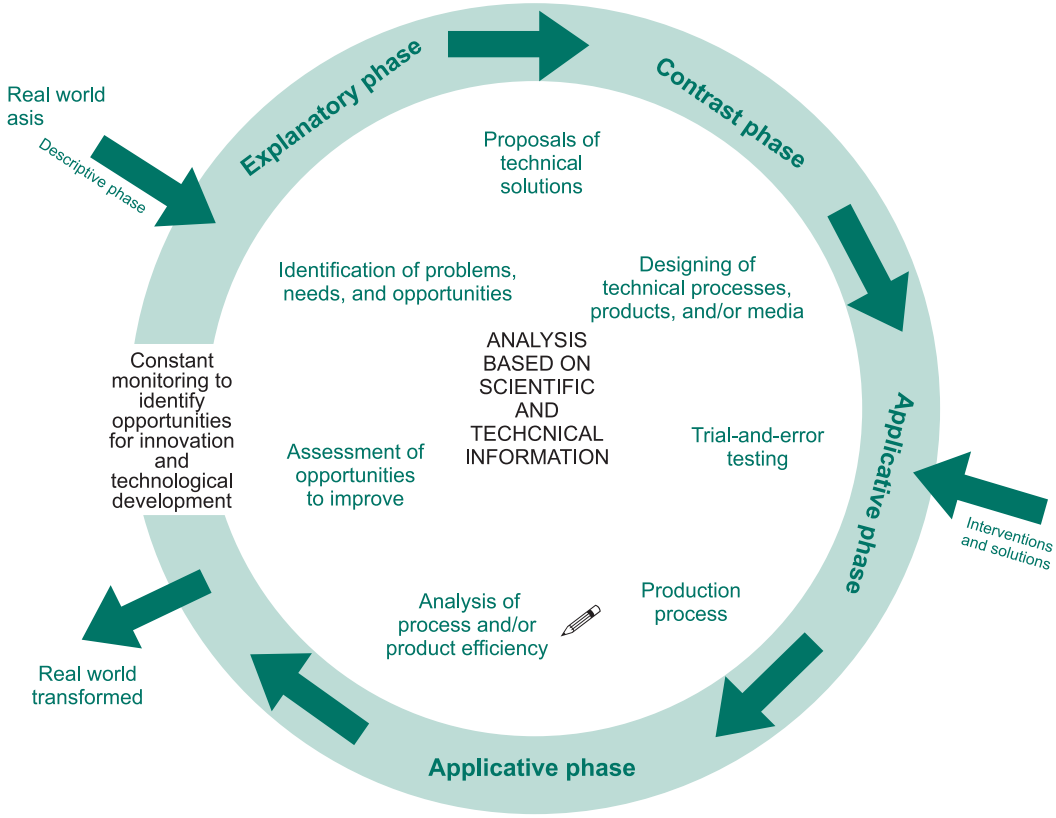

Figure 5. Innovation and technological development process of the BIOMATIC research group

as one of SENA's capacity-building components, conducted the knowledge management process based on project-based learning methodology, developing structures to promote and identify creativity groups that lobby the development of technological innovations. The analysis of study plans, however, has primarily favored trainee performance and, as a result, the generation of technological innovations is still pending consolidation. This situation cannot be attributed to the lack of a good methodological approach in each capacity-building program, but rather to the need to actively promote the creativity of trainees within multidisciplinary working groups. A culture of promoting science, technology, and innovation among trainees should continue, but trainees must be incorporated into multidisciplinary groups.

Based on the analysis of the factors identified in the diagnosis, the Leather Design and Manufacturing Center must streamline its educational processes so that the projects forming trainees are harmonized with research lines that seek to conduct interdisciplinary work between different capacity-building programs.

The strategic plan proposed for the BIOMATIC research group is outlined in Figure 6 and aims to promote innovation throughout the entire organization. For its final validation, the plan should be socialized with the senior management of the Leather Design and Manufacturing Center.

Study results had an immediate impact on the Center's activities because they implied that the Center should promote an organizational culture that fosters new and original approaches to address the needs of trainees and entrepreneurs, while becoming an opportunity to differentiate institutional processes through the BIOMATIC research group.

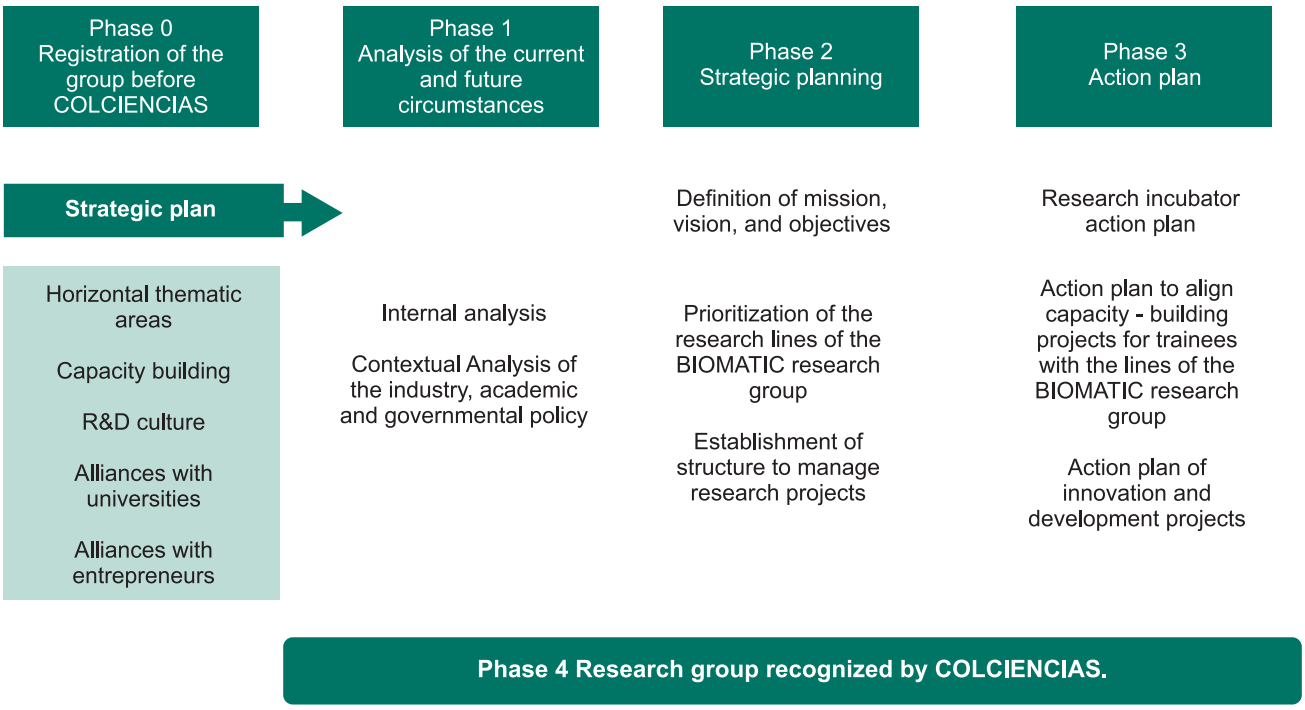

Figure 6. Strategic plan of the BIOMATIC research group pertinent to the Leather Design and Manufacturing Center

Conclusions

The strategic plan of the BIOMATIC research group was defined based on current research trends worldwide, the action plans of both SENA and the Leather Design and Manufacturing Center, national and regional development plans, and the production context, always using as reference innovation and technological development strategies to meet the challenges faced by the leather, plastics, and rubber sectors, while promoting a knowledge-sharing culture among trainees and entrepreneurs to improve the latter's competitiveness.

The BIOMATIC research group supports the capacity-building processes carried out at the Leather Design and Manufacturing Center and seeks the generation of learning environments with higher levels of innovation, which in turn foster creative interdisciplinary work, as indicated in the survey held with the heads of the Center's capacity-building programs. Fostering a culture of innovation at the Center means having an action plan in place that involves strengthening and developing the study plans of the different programs for technicians and technologists in which innovation is considered an important strategy for economic development, while also generating a culture of innovation among trainees, trainers, and entrepreneurs using principles of organizational learning so all stakeholders are committed to improving capacity-building processes and strengthening relationships with enterprises

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