Administrative evaluation of the tannery José Ramón Martínez in the municipality of Guanajay, Artemisa Province

Evaluación administrativa de la Tenería José Ramón Martínez del municipio Guanajay, Provincia Artemisa

Avaliação administrativa da Curtume José Ramón Martínez no município de Guanajay, Província de Artemisa

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Abstract

The global leather industry is distributed in different countries. The production of different items is intensified by the introduction of different advanced technologies that can produce thousands of tons of products that can supply certain sectors of society. In Cuba, production is intensive and has focused on mass consumption of various products, where it is necessary to implement changes and adopt innovative technologies that guarantee efficient management, focused on environmental, social and economic sustainability. With the objective of developing a proposal for actions to improve the technology applied in the production process of the "José Ramón Martínez" Tenería, the research was carried out in the Guanajay municipality, Artemisa Province. It was developed in 2024 where interviews and exchanges with owners and managers, as well as direct observations, were used to compile the information. A methodological scheme was developed with the methods and techniques to support the development of the research, as well as for the analysis and identification of the internal and external characteristics of the scenario and classify them as opportunities, weaknesses, strengths and threats. To process the information, the automated system was used to use the SWOT matrix and the Excel program that automatically determined the type of action to follow. To develop the action proposal, the result obtained from the return or restitution of the diagnosis with the actors was considered, in addition, a set of substantial elements were considered that allowed actions to be carried out to resolve the difficulties encountered.

Keywords: Action plan, Technological process, skins, development

Resumen

La industria de cueros a nivel global se encuentra distribuida en diferentes países. La producción de diferentes artículos es intensificada por la introducción de diferentes tecnologías avanzadas que son capaces de producir miles de toneladas de productos que permite abastecer a determinados sectores de la sociedad. En Cuba, la producción es intensiva y se ha enfocado en consumo masivo de diversos productos, donde se necesita implementar cambios y adoptar tecnologías innovadoras que garanticen una gestión eficiente, enfocada en la sostenibilidad ambiental, social y económica. Con el objetivo de elaborar una propuesta de acciones para el mejoramiento de la tecnología aplicada en el proceso de producción de la Tenería "José Ramón Martínez", se realizó la investigación en el municipio Guanajay, Provincia Artemisa. Se desarrolló en el año 2024 donde se utilizó para la compilación de la información entrevistas e intercambio con teneros y directivos, así como mediante observaciones directas. Se elaboró un esquema metodológico con los métodos y técnicas como apoyo al desarrollo de la investigación, así como para el análisis e identificación de las características internas y externas del escenario y clasificarlas como oportunidades, debilidades, fortalezas y amenazas. Para el procesamiento de la información, se empleó el sistema automatizado para la utilización de la matriz DAFO y el programa Excel que permitió de forma automática determinar el tipo de

acción a seguir. Para desarrollar la propuesta de acción, se tuvo en cuenta el resultado obtenido de la devolución o restitución del diagnóstico con los actores, además se consideraron un conjunto de elementos sustanciales que permitieron realizar las acciones para resolver las dificultades encontradas.
Palabras clave: Plan de acción; Proceso tecnológico; pieles; desarrollo

Resumo

A indústria de couros a nível global está distribuída em diferentes países. A produção de vários artigos é intensificada pela introdução de diferentes tecnologias avançadas capazes de produzir milhares de toneladas de produtos, permitindo abastecer determinados setores da sociedade. Em Cuba, a produção é intensa e tem se concentrado no consumo massivo de diversos produtos, sendo necessário implementar mudanças e adotar tecnologias inovadoras que garantam uma gestão eficiente, focada na sustentabilidade ambiental, social e econômica. Com o objetivo de elaborar uma proposta de ações para a melhoria da tecnologia aplicada no processo de produção da Curtume "José Ramón Martínez", a pesquisa foi realizada no município de Guanajay, Província de Artemisa. Desenvolveu-se no ano de 2024, utilizando para a compilação das informações entrevistas e trocas com curtidores e gestores, bem como observações. Foi elaborado um esquema metodológico com os métodos e técnicas como apoio ao desenvolvimento da pesquisa, assim como para a análise e identificação das características internas e externas do cenário e classificá-las como oportunidades, fraquezas, forças e ameaças. Para o processamento das informações, foi utilizado o sistema automatizado para a utilização da matriz SWOT e o programa Excel, que permitiu determinar automaticamente o tipo de ação a seguir. Para desenvolver a proposta de ação, levou-se em conta o resultado obtido do retorno ou restituição do diagnóstico com os participantes, além de considerar um conjunto de elementos essenciais que permitiram realizar as ações para resolver as dificuldades encontradas.
Palavras-chave: Plano de ação; Processo tecnológico; peles; desenvolvimento.

Introduction

The global leather industry is spread across various countries, including China, Hong Kong, Indonesia, Taiwan, Mexico, Italy, Brazil, Germany, Turkey, South Korea, and India. Production of various goods is boosted by the introduction of advanced technologies capable of producing thousands of metric tons of footwear, handbags, stools, and other items (Álvarez and Zurita, 2020).

These companies worldwide have high-tech infrastructure that reduces the environmental impact of their production processes. This, in turn, enables industrial hubs to make use of resources and waste generated during production, treat both liquid and solid waste, and conserve energy, among other benefits (Rodríguez et al., 2014).

In Cuba, the tanning industry transforms hides into leather for the manufacture of various items; it has undergone a transformation, and as a result, its product is considered an intermediate good and a primary input for other industries. Its tradition of artisanal leather goods production, combined with the availability of raw materials and labor, has fostered the development of the tanning industry, which has found in this sector a means to reduce imports and meet both domestic and export demands (Paz et al., 2023).

Leather production involves transforming hides into leather for the manufacture of durable products that are widely used and consumed by humans. The initial preservation process takes place at collection centers, either inside or outside slaughterhouses. The most common preservation technique is wet salting. The tanning industry is significant to the economy, both for its contribution to the gross domestic product and for job creation, as it utilizes hides - a byproduct of meat production. (Acosta et al., 2020).

Guanajay is a province that was one of the first settlements in western Cuba, founded in 1650, to engage in this type of production. Currently, more than 85% of the hides produced are destined for the production chain, and the remaining 15% go to other sectors. For several years, the theoretical perspective in this sector has been to establish a framework for analysis focused on the reuse of waste and the improvement of technical capabilities through technological innovation (López et al., 2006).

The José Ramón Martínez tannery faces problems stemming from technological inefficiency; however, with the development and introduction of more advanced technologies, this situation could improve through modernization and the use of innovative engineering methods. In turn, the application of science and technology provides alternative management strategies for producing higher-quality tanned leather.

The objective was to propose an action plan to improve the technology used in the production process at the "José Ramón Martínez" Tannery, Guanajay Municipality, Artemisa Province.

Materials and Methods

The research was conducted in the municipality of Guanajay, Artemisa Province, in 2024. To carry out the study, an assessment was conducted that served as the basis for developing an appropriate proposal based on causes and effects. A qualitative research approach was used (Hernández-Sampieri et al., 2018). A methodological framework was developed, as shown in Figure 1.

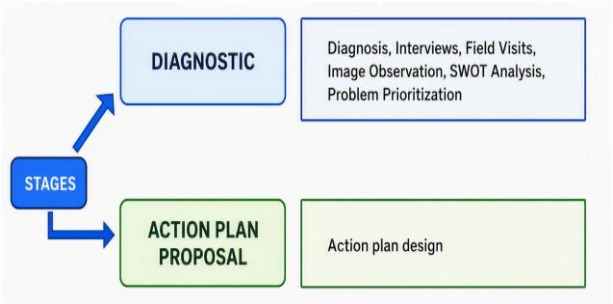

Figure 1. Methodological Framework of Research

Results and Discussion

Assessment of the "José Ramón Martínez" Tannery, Guanajay Municipality, Artemisa Province

Establishing a baseline for the proposal - based on the assessment - is of vital importance as a starting point for understanding the sociocultural, economic, and productive conditions of the work environment.

Sociocultural Dimension

Organizational Structure of José Ramón Martínez's Tannery.

To facilitate the tanning process, the tannery features a specific infrastructure tailored to its unique characteristics. According to Marzin et al. (2014), conducting this type of analysis requires a process of awareness-raising and engagement with the farmers directly involved in the processes; this information should then be used to develop a plan of action for each aspect that may be subject to evaluation by those participating in the research.

In this regard, Sabourin et al. (2017) argue that coordination among institutions is crucial for supporting the staff associated with the organization, while Tallon and Valette (2008) explain that institutions must have tailored to workers to understand their needs.

This confirms the need for inter-institutional collaboration to coordinate support services (technical, financial, organizational, etc.), which, as Camou and Quelin (2010) note, are often scattered. One solution for fostering connections between institutions could be to leverage established forums for interaction with workers, such as member assemblies, discussions of production plans, and training workshops (Peña et al., 2019), to work collaboratively.

Table 1. Resources available at the tannery at the time of the study.

No.	Equipment / Resources	Quantity
1	Fleshing Machine	1
2	Fleshing Pump	1
3	Squeezing Machine	1
4	Tanning Drums	2
5	Splitting/Shaving Machine	1
6	Squeezing and Stretching Machine	1
7	Softening Machine	1
8	Sanding Machine	1
9	Satin Finishing Machine	1
10	Measuring Machine	1
11	Retanning, Dyeing and Fatliquoring Drum	1
12	Knee-Type Painting Machine	1
13	Vertical Vacuum Dryer	1
14	Air Drying Chamber	1
15	Forklift	1
16	Drum for Technological Testing	1
17	Submersible Pump	1
18	Desalting Drum	1

From an organizational standpoint, this entity is led by a director, who oversees a sales

manager, a finance manager, a human resources specialist, and a production manager. At the same time, the finance manager oversees an accounting assistant, and the production manager oversees a department head and all the technicians.

Quantity and Quality of the Workforce

This production system employs a total of 50 workers, 40 of whom are directly involved in the production process, to tend an area equivalent to 1 ha, which amounts to an average of 0.3 ha per worker. Of the total workforce, 18% are women (9) and 82% are men (41).

Furthermore, of the total workforce, 35.19% are between the ages of 18 and 50, and 64.81% are over 51. This means that most of the workforce consists of older workers, who do not ensure a succession plan for the older operators - a factor that will prevent the continuity of the production process if the stability of this workforce is maintained.

The educational level of the workers is average, as only three workers have a college degree, and the rest have completed between ninth grade and high school. From a technological standpoint, the workers have received some training from the company's expert teams on topics related to machinery operation, the condition of the hides, and the functioning of the technology used in each process.

The sustainability of an organization can be characterized by a set of attributes that describe its essential behavior and implies a demand for action in local communities and the nation. Astier et al. (2008) and Gómez et al. (2015) argue that achieving sustainability requires fostering a shift in people's mindset; this makes operator autonomy, the cultural acceptability of technologies, and equity in the distribution of benefits vital (González et al., 2007).

Within organizations, generations commit future resources (Dasgupta, 2010) and production takes place, which implies the optimization of the system (Grajales et al., 2005). However, to achieve the organization's sustainability goal, the productive approach must change because it encompasses production, distribution, and accounting aspects (De Schutter, 2012).

Economic Dimension

Figure 3 illustrates the total economic and financial revenue in thousands of pesos at the tannery level, as well as the profit generated from 2019 to 2023, highlighting a decline in revenue in the last year compared to the first year analyzed.

Table 2. Trends in total economic indicators and revenue by year.

No.	Year	Production Volume
1	2019	338,56
2	2020	337,92
3	2021	229,391
4	2022	235,854
5	2023	293,94

The tannery's total economic and financial revenue is shown in thousands of pesos, highlighting a decline in revenue over the past

year compared to 2019. In line with total revenue, financial income showed an unstable trend and a decline; this may have been associated with the deterioration of the tannery's equipment, which hindered its ability to meet the various demands of each case, as well as the lack of implementation of more advanced and innovative technologies.

In general, from an economic standpoint, there are issues related to the adoption of more appropriate technologies capable of meeting the population's demands, which prevents assessment in terms of economic efficiency. This reveals a lack of knowledge among the staff responsible for determining economic and efficiency indicators. Similarly, there are no records of production and sales levels for other established products, which prevents the organization from achieving full productive diversity with minimal losses - a diversity that would serve as a reserve to meet the population's needs (Krikser et al., 2019).

Environmental Dimension

Based on historical meteorological data for the study region over the past twenty years (2000 - 2025), the climate has shown an average annual precipitation of 2,088.7 mm, with higher values during the region's rainy season (October–December). Furthermore, the average annual temperature ranged from 25.7 to 30 °C, with relative humidity between 80 - 82%. According to studies conducted by Suárez (2013), 43% of the total area of the municipality of Guanajay has optimal conditions for the development of industrial zones, which will benefit both the province and the country.

Technological Characteristics of the Tannery

Figure 2 shows positive responses regarding the technological level of the equipment, based on the technology survey conducted by workers in the study area. The responses revealed important aspects of the technological and productive situation that highlight limitations to productive development.

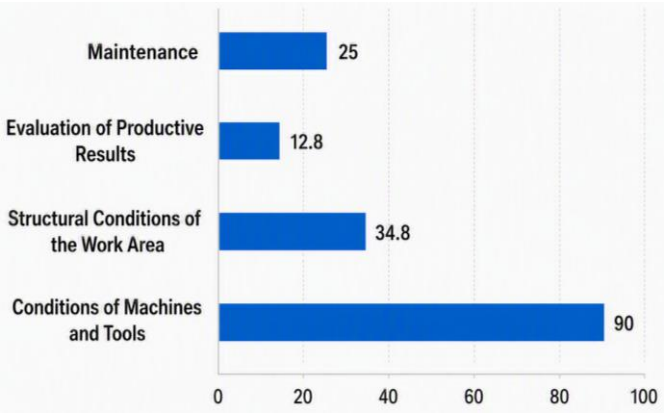

Figure 2. Responses from business owners regarding the organization's level of technology

The study found that more than 50% of workers have knowledge of how to use existing technology, as evidenced by their practices in the operation, improvement, maintenance, and management of machinery. However, it is important to pay attention to these practices, as they constitute viable alternatives for the sustainability of the organization, with a view to meeting basic production needs and ensuring sustainable working conditions through various forms of implementation, depending on the natural characteristics of the environment.

Technological principles must be suitable for any organization, including large-scale operations, as noted by Sarandón (2014) and Sarandón (2009). In other words, the goal is to understand and apply the general principles that govern the operation of tanneries and their components.

In this regard, Sarandón & Flores (2014) argue that implementing different management approaches involves correctly applying practices to carry out technological principles, and that experimentation should be conducted together with workers to find the best alternative.

In studies conducted by Rodríguez (2022), it was observed that the most widely adopted practices - based on national programs that promote such measures and the culture of the operators - allow for the use of technology to improve the quality of the finished product.

Furthermore, to achieve adequate sustainability within the organization, workers need resources, technical assistance, training, and incentives to use the equipment in various scenarios, which fosters a worker-machine connection that contributes to the organization's sustainability and thus ensures full safety (Sarandón, 2019).

Through discussions with the workers, the importance of the physical conditions of the work area and the condition of the machines and tools was confirmed. The workers recognize the benefits provided by the tannery, both in terms of its economic value and its relationship with the environment.

Identifying Problems Through SWOT Analysis

The internal and external characteristics of the organization during the diagnostic phase are shown in Table 4 and were developed based on the indicators proposed by Geilfus (2009). Their classification revealed the existence of four strengths, two threats, and four weaknesses. Despite the opportunities, these weaknesses could influence the proposal for the organization under study.

Table 3. Internal and external characteristics of the organization, according to the various indicators.

Indicator	Characteristics	Classification	Weighting
Social	High proportion of personnel directly engaged in production activities	Strength	3
	Lack of generational succession among aging producers	Strength	3
	Producers exhibit a moderate educational background	Strength	3
	Recognition and incorporation of emerging knowledge and expertise	Strength	2
	Predominance of male participation in the workforce	Weakness	1
	Limited interaction and cooperation with academic institutions	Threat	3
Technological	High proportion of machinery with associated operational risks	Weakness	1
	Need for innovation and technology transfer initiatives	Weakness	3
	Low adoption rate of emerging technologies	Weakness	3
Economic	Instability in financial revenue trends	Threat	2

Source: Prepared by the author based on the results of the assessment

The analysis conducted at the organization shows that systematic engagement with employees can facilitate progress toward sustainability, if efforts are made to address the identified weaknesses. When analyzing the tannery's environment for its sustainability development, efforts can be directed toward innovative research projects or initiatives, as reflected in the technological indicator. Implementing such projects facilitates the acquisition of funding and resources to develop necessary alternatives; furthermore, it aims to enhance the tannery's operations through the design of technological systems.

These findings align with those of Chirino et al. (2022) regarding the transition toward a sustainable model for leather production, which identified similar weaknesses related to dependence on the technical condition of equipment in the production process.

The main issues raised by the workers surveyed were related to the reports published by the organization's management over the past four years - proposals that have been discussed on various occasions with different stakeholders involved in the production and marketing of hides, including:

- They point out that academic aspects should be taken into consideration for future workshops.
- Limited adoption of new production technologies as a viable and necessary process for achieving greater economic, social, and environmental benefits.
- Limited use of eco-friendly products for process improvement.
- Implementing innovation and technology transfer projects.
- Unstable financial income trends affecting sustainability

Furthermore, the study revealed that the workers were able to identify that new knowledge is acquired through observation and consistent practice, leading to the development of their own expertise, which facilitates the adoption of technological practices and helps them set aside self-centered attitudes so they can fully and inclusively participate in their own development, in line with the findings of Moreno et al. (2018).

In general terms, it was observed that the issues raised by the workers fall into two categories that contribute to the sustainability of the José Ramón Martínez tannery:

- Technological management of the UEB
- Knowledge management

Studies by various authors, such as Nicholls and Altieri (2019), suggest that to protect workers' livelihoods, it is necessary to identify the factors that increase risk; however, it's even more important to increase the resilience of their production system. Given the interconnection between the environment and natural resources, it's necessary to reduce vulnerability by adopting strategies for the sustainable management of natural resources such as soil and water.

In this regard, with respect to knowledge management, various authors have noted that management in technological systems faces two common challenges: linking science to decision-making (horizontal) and linking science and decision-making to different levels of operation (vertical). In this regard, Díaz et al. (2021) studied decision-making and found that: if producers obtain complete, undistorted information, then reasoning processes come into play - in this case, accepting or modifying the innovation - which subsequently translates into action and is reflected in the work the producer performs in their field.

A successful technology management program for smallholder entities depends on the exchange of information and knowledge, as well as effective communication and interaction among the entity's stakeholders, and on an environment that allows researchers, professors, and involved staff to interact more closely with one another and, at the same time, with the workforce (Ochoa et al., 2007).

In this regard, Hassan et al. (2019), Ramli et al. (2019), and Wan et al. (2020) argued that the agricultural sector must evolve toward modern technology and information and communication technologies (ICTs), which can help facilitate the knowledge management process to achieve sustainable development goals.

Prioritizing Problems Using the Vester Matrix

The low adoption rate of new technologies turned out to be the tannery's central problem, as shown in Table 4.

Table 4. Assessment of Problems Using the Vester Matrix

Code	Identified Problem	Active (X)	Passive (Y)
P1	Limited collaboration with academic institutions	8	2
P2	High proportion of machinery operating under risk conditions	9	3
P3	Low adoption of emerging technologies	9	11
P4	Insufficient innovation and technology transfer projects	4	9
P5	Unstable financial revenue trends affecting long-term sustainability	5	9

Source: Prepared by the authors based on the problem prioritization analysis.

In this regard, Table 5 shows that the central problem is the low adoption of new technologies (P3), as it is in Quadrant I (Critical). In Quadrant II (Passive), we observe the lack of ties with academia (P1) and the need to carry out innovation and technology transfer projects (P2), both of which are causes of the central problem. Similarly, they cause the weaknesses to be exacerbated, indicating that actions must be devised to mitigate these issues.

Table 5. Representation of the prioritized problems.

Code	Critical	Passive	Indifferent	Active
P1	–	X	–	–
P2	–	X	–	–
P3	X	–	–	–
P4	–	–	–	X
P5	–	–	–	X

In Quadrant IV (Assets), the following were identified: innovation and technology transfer projects (P4) and an unstable trend in financial income affecting sustainability (P5). These aspects represented the main effects or consequences of the low adoption of new technologies, which was considered the tannery's critical issue.

Therefore, the proposed action plan should outline short-term activities to minimize these problems and thereby help eliminate the main issue. In Quadrant III, where problems rated as "indifferent" are located, no causal or consequential effects were identified in relation to the other problems. These results are consistent with those of Vargas et al. (2022), who demonstrate the impact of adopting appropriate technologies on favorable environmental conditions. The prioritization of problems using the Vester matrix helped define the central problem, its underlying causes, and its potential effects.

Development of the Problem Tree

In the focus group workshops, the main causes identified were the lack of ties to academia and the high percentage of machines at risk. The workers identified the low adoption of new technologies as a central critical problem and, as effects: carrying out innovation and technology transfer projects and the unstable trend in financial income for their sustainability (Figure 3).

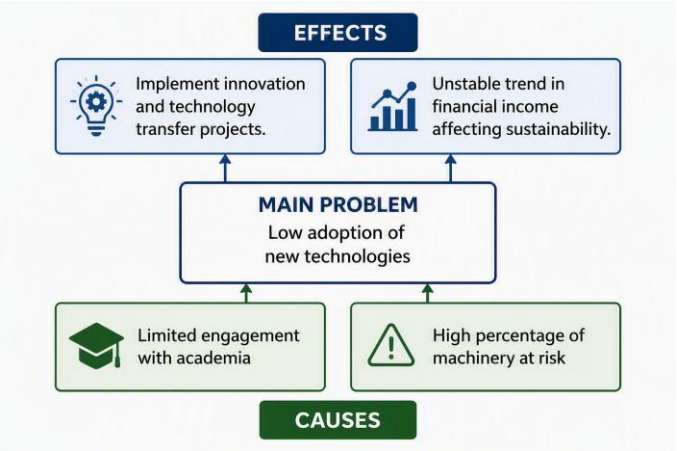

Figure 3. Problem tree based on the assessment conducted at the José Ramón Martínez Tannery.

The analysis of the matrix demonstrated that the lack of engagement with academia contributes to the low adoption of new technologies. In this regard, research conducted by the PIAL project shows that collaboration between academia and workers fosters the adoption of technologies, as well as an environment of innovation through multi-stakeholder management platforms (Larrea 2021).

Proposed Actions for the Management of the José Ramón Martínez Tannery

During the feedback workshops with the stakeholders, an action plan was developed by category, as shown in Table 7. The primary objective of the action plan is to design a technological management strategy for the "José Ramón Martínez" Tannery, with a view to achieving economic, social, and environmental benefits.

Table 6. Management Plan for the José Ramón Martínez Tannery

Dimension	Actions	Participants	Implementation Period (Years)
Social	Promote partnerships with universities and research centers	Entity's Board of Directors	2024–2027
Social	Coordinate collaborative work among different associations	Entity's Board of Directors	2024–2027
Social	Encourage the entity's participation in national and international projects	Entity's Board of Directors	2024–2027
Social	Apply methodological tools currently available in Cuba	Entity's Board of Directors	2024–2027
Economic	Achieve economic self-sufficiency	Entity's Board of Directors	2024–2027
Economic	Diversify commercialization and market channels	Entity's Board of Directors	2024–2027
Technological	Maintain and upgrade machinery identified as being at risk	Entity's Board of Directors	2024–2025
Technological	Train workers to develop innovation and technology transfer projects	Entity's Board of Directors	2024–2027

The proposed actions for managing the tannery were based on knowledge appropriation; that is, a comprehensive analysis was conducted regarding the problems and situations that arise within the production system. Based on this reasoning, profound changes were implemented in the redesign and management of the entity, where structural, spatial, and temporal management activities (diversification) were planned to promote functional interactions among production activities and improve income generation.

At the same time, the facility was treated rather than in isolation during the design process, and was analyzed comprehensively by (processes), given that it is complex, interacts with the environment, and is composed of elements that interact with one another. Furthermore, the design proposal considered the economic, technological, and social dimensions, which in practice are integrated and interdependent, and this interaction is essential for the holistic success of the tannery.

In this regard, Funes-Monzote (2018) confirmed that the social dimension is of vital importance as a real guarantee of the entity's development and the continuity of a culture that can be acquired, maintained, and enriched within it. It was also noted that the design approach was not carried out in isolation but rather through a comprehensive approach based on the application of technological principles, which were conceptualized as systems—consisting of a set of structural arrangements of processes that took on different technological forms, according to (Altieri et al., 2012)

In other words, it encompasses all the elements of the system under study, as well as their interactions and interdependencies; therefore, according to Leyva (2023), comprehensive research based on technological processes must be conducted in the future, and science, technology, and responsible governance must be integrated to create a favorable environment that helps workers transform their work environments in accordance with established concepts and practices.

Knowledge management focuses on the social and economic dimensions. Four and two actions are proposed, respectively, which promote the organization's ties with academia, the creation of projects, the adoption of innovations, and financial management within the organization. Regarding ties with academia, the tannery should promote interactions with universities and research centers that facilitate scientific, technical, and technological exchange on various topics aligned with the organization's interests. This interaction can foster participation in both national and international projects, as calls for proposals are generally publicized within academic circles. Furthermore, participation in projects organized by various associations is possible; this requires coordination between the tannery and these nongovernmental organizations.

In this regard, the use of various tools - such as diagnostic studies of agricultural enterprises, participatory rural appraisals, and technology workshops, among others (Marchín et al., 2010) - contributes to the adoption of innovations in production settings.

Regarding the economic dimension, initiatives related to economic self-sufficiency and market diversification stand out, involving a management process that coordinates stakeholders to ensure that the product reaches the market with the characteristics required for consumption (Minag, 2014).

The Guidelines on Science, Technology, and Innovation Policy, approved at the 7th Congress of the Communist Party of Cuba, state that the organizational, legal, and institutional conditions must be created to achieve a form of economic organization and a system for the widespread application of results that combines scientific research, the development of new products, efficient production, and export management; they also emphasize the need for technological development (Sáez et al., 2014).

Likewise, the interaction among the talented individuals who make up these networks must take place through a "dialogue of knowledge," which dialectically links explicit/scientific and technical knowledge with tacit or empirical/local knowledge, while the approach to intervention should be geared toward aligning local needs with the priorities and strategies of the province, the nation, and higher-level business entities (Sáez et al., 2014).

Conclusions

- The assessment of the José Ramón Martínez Tannery revealed limited ties to academia, technological obsolescence, and a high percentage of machines posing a safety risk.

- It was found that the main problems limiting production at the "José Ramón Martínez" Tannery are the limited adoption of new production technologies as a viable and necessary process for achieving greater economic, social, and technological benefits.

- It was demonstrated that it is possible to collaboratively design an action plan for the technology used that meets workers' demands within the context of the study.
- The theoretical foundations employed support management alternatives for the organization that take a holistic approach and improve socioeconomic and technological conditions while contributing to knowledge.

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