

Knowledge management and business competitiveness in dairy producers in the province of Chimborazo

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ABSTRACT:

Knowledge management has become a key factor in improving competitiveness in productive sectors, especially in the dairy sector, where traditional systems and limited access to technical and strategic information predominate. In this context, the objective of this study was to analyze the impact of knowledge management on the competitiveness of dairy producers in the province of Chimborazo, with the aim of strengthening business sustainability. The research was conducted using a quantitative approach, with a descriptive design, correlational scope, and field methodology. A structured survey was administered to a sample of 354 producers, selected through stratified probability sampling. The results showed that knowledge management reached a high level, with a mean of 4.11, with knowledge transfer standing out as the most developed dimension. Competitiveness, on the other hand, presented a medium level with a mean of 3.47, where innovation showed the best performance, while sustainability revealed greater limitations. In conclusion, although producers have a solid foundation in knowledge management, it is still necessary to strengthen key dimensions of competitiveness to consolidate sustainable development and improve their market position.

Keywords: knowledge management, competitiveness, dairy sector, innovation, sustainability.

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Introduction

Knowledge management has established itself as a key element for the competitiveness of companies, especially in productive areas that require a large amount of practical knowledge and human capital, such as the dairy sector. The ability to produce, organize, transmit and use knowledge becomes a crucial competitive factor in an environment marked by a pressure towards sustainability, increasingly demanding markets and rapid technological advances. However, when it comes to dairy production systems, this management

tends to be fragmented, informal or solely based on empirical experience. (Medina, 2015) (Monagas-Cocasal, 2017)

On a global scale, the competitiveness of the dairy sector faces a growing challenge related to large disparities in knowledge management, particularly in developing countries. According to several international reports, more than 60% of small and medium-sized dairy producers do not have formal systems for transmitting technical and managerial knowledge, which reduces their ability to innovate

and adapt to market fluctuations. (Salguero & García, 2018)

It is also estimated that approximately 45% of production units have low productivity levels due to traditional methods and lack of access to information related to quality, market intelligence and technologies. This circumstance translates into increased costs, low competitiveness with respect to large industries and difficulties in meeting global standards, which has a negative impact on the sustainability of the sector. (Puerta et al., 2021)

This problem is expressed in a constant and structural way in the Ecuadorian environment. Despite the fact that the dairy sector contributes approximately 4% to agricultural GDP and creates direct and indirect jobs for thousands of rural families, more than 70% of producers operate under small-scale systems. About 65% of these producers do not have regular access to technical training or strategic information on production processes and the market, according to sectoral research. In addition, it is reported that about 58% have low levels of innovation and business management, which restricts their ability to differentiate themselves and be productive. Therefore, if there is no well-structured knowledge management, the competitiveness of the sector decreases and the differences with respect to other more technical actors are exacerbated. (Oladipo et al., 2022)

The situation in the province of Chimborazo becomes more critical due to the particular characteristics of its socioeconomic and production conditions. Despite the fact that the province contributes about 12% of the national milk production, more than 75% of the producers are small family systems with little organizational coordination. According to local data, about 68% of producers lack formal systems to store or exchange knowledge on management and production, while more than 60% show yields per cow below the national average. Added to this is a limited capacity to associate and restricted access to differentiated markets, elements that affect territorial competitiveness and put the economic sustainability of the dairy sector in the province at risk. (Arefin et al., 2020a)

In view of the above, the objective of the study is to analyze the impact of knowledge management on the competitiveness of dairy producers in the

province of Chimborazo, in order to strengthen business sustainability. To this end, it is intended to: a) diagnose the current situation of knowledge management in dairy producers in the province of Chimborazo, considering the processes of generation, storage, transfer and application of knowledge. b) evaluate the level of competitiveness of dairy producers, through indicators of productive efficiency, innovation, business management, market positioning and sustainability. c) propose strategies based on knowledge management that contribute to strengthening the competitiveness of the dairy sector in the province of Chimborazo.

Theoretical development

Knowledge management has been defined and considered one of the most valuable sources of processes, it is essential to manage it. Knowledge management facilitates the creation and dissemination of information and knowledge. In addition, it facilitates an appropriate, effective and efficient use of knowledge to generate strategic competitive advantages for organizations. Likewise, it is stated that knowledge is a key factor for the success of organizations, which allows them to obtain a sustainable competitive advantage. The development of competencies and knowledge within organizations is increasingly recognized as the key to achieving sustainable competitive advantages. (Arefin et al., 2020b) (Oliver et al., 2022)

Whereas, knowledge generation tends to spread among different human subjects, it must be constantly captured. This activity is also known as externalization. There are several traditional techniques for obtaining knowledge from individuals. This includes, for example, interviews, focus groups, surveys, or others. While this task is a major bottleneck in building internal organizational knowledge when most interactions are offline, it is easier to achieve in online communities, where interaction is naturally based on computer- or mobile-mediated platforms around which knowledge is exchanged. (Puerta et al., 2021)

Knowledge generation is an essential process by which organizations and individuals produce new knowledge from observation, experience, and systematic reflection on their context. In general, this process takes place when specific problems are

examined, ideas are shared, and lessons learned from both mistakes and successes are integrated. Access to reliable information, interaction in society, and the capacity for critical analysis are also factors that strengthen knowledge generation, because they allow individual perspectives to be contrasted with collective ones. (Ramírez et al., 2021)

Knowledge transfer is a crucial procedure for the knowledge produced at the individual or collective level to be transformed into a valuable tool for institutions and the community. Through this procedure, knowledge is no longer isolated from individuals and is distributed in a structured way through interaction, communication and cooperative learning. Effective transfer also enables experiences, good practices and lessons learned to be incorporated into decision-making and continuous improvement. (Oladipo et al., 2022)

The implementation of knowledge is a crucial stage in knowledge management, because it makes it easier for accumulated experiences and theoretical knowledge to be converted into specific actions that add value. In general terms, this procedure involves the effective use of knowledge, skills and information obtained to solve problems, improve practices and optimize the decision-making process in different organizational and productive areas. (Sundara et al., 2021)

Competition is a concept that encompasses notions from different environments, but it does not have a clear and reliable representation or a unanimously accepted definition. Competitiveness can be interpreted very loosely, depending on factors external to business activities, but also on factors related to the intrinsic nature of economic activity. Michael Porter defends the idea that globalization, production, and transactions must be regulated so that each small business can create its competitive advantage. (Navarrete, 2018)

Production efficiency is an essential component for the competitiveness of any economic activity, as it shows the potential of an organization to convert resources into goods or services with the least possible investment and with high quality standards. In general, this efficiency is subject to appropriate process planning, the rational use of inputs and the gradual integration of technologies that facilitate the optimization of time and the

reduction of waste. (Pilligua et al., 2024)

Innovation is an activity that is developed to obtain new (or significantly improved) products (goods) and launch them on the market. This activity involves the introduction into the industry of new and improved processes. Industrial innovation is defined as the transfer of new ideas or the adaptation of new concepts to the final phase of a product, process, or service. We know of four main types of innovation: product innovation; process innovation; organizational innovation and marketing innovation. (Shah & Ahmad, 2019)

The strategic management of a company is a complete process that focuses on making decisions consistent with the long-term goals of an entity, as it combines planning, organization of resources and constant analysis of the environment. Thus, it makes it possible to foresee risks, recognize opportunities and establish strategies that consolidate the competitiveness and sustainability of the institution. (Wang et al., 2021)

An essential aspect of competitiveness is positioning, because it shows the ability of an organization to establish itself in a defined and distinct place both in the minds of consumers and in its competitive environment. In general terms, this concept is associated with the perception of value that the market establishes based on characteristics such as reputation, quality, trust, and consistency in what is offered.

Materials and methods

Research Path

The research was developed under a quantitative approach, since it allowed to objectively measure the relationship between knowledge management and competitiveness in dairy producers in the province of Chimborazo. In this sense, a systematic process of data collection and analysis was established, aimed at obtaining verifiable and comparable results. In addition, this approach facilitated the operationalization of the variables in specific dimensions and indicators, which guaranteed precision in measurement and coherence with the objectives set. (Sánchez et al., 2019)

In coherence with the above, the study adopted a descriptive design, since it sought to characterize the state of knowledge management and the levels

of competitiveness within the dairy sector. Through this design, it was possible to identify the particularities of the productive context, as well as the predominant practices in the generation, transfer and application of knowledge. Likewise, the factors that affect competitiveness were described, which allowed understanding the behavior of both variables within the analyzed reality. (Díaz, 2020)

The study assumed a correlational scope, since the relationship between knowledge management and competitiveness was analyzed. To this end, statistical techniques were used to determine the intensity and direction of this relationship, in order to establish whether adequate knowledge management influences the competitive performance of producers. In this way, it was possible to provide empirical evidence that supports the importance of strengthening knowledge management as a key factor to improve competitiveness in the dairy sector. (Tunal, 2022)

On the other hand, the research was carried out in the field, because the information was collected directly from dairy producers in their natural environment. This approach made it possible to have direct contact with the actors in the sector, which strengthened the validity of the data obtained. Consequently, structured instruments were applied that allowed first-hand information to be collected, ensuring that the results faithfully reflect the real conditions of the participants (Ugalde & Balbastre, 2022).

Participants

For the development of the research, the population was made up of dairy producers in the province of Chimborazo, who constitute a strategic sector within the agricultural economy of the region. According to official information provided by the National Institute of Statistics and Census and the Ministry of Agriculture and Livestock (2022), an approximate population of 4,500 producers linked to dairy activity in the province was estimated, considering both associations and independent producers registered in agro-productive systems.

From this population base, a representative sample was determined that would allow reliable and generalizable results to be obtained. In this sense, the formula for finite populations was applied, with a confidence level of 95% and a margin of error of 5%, which resulted in a sample of 354 dairy producers. This amount allowed to guarantee an adequate representativeness of the study universe, while facilitating the operational feasibility of the fieldwork. Regarding the type of sampling, a stratified probabilistic sampling was used, due to the need to consider the existing heterogeneity among producers, especially based on criteria such as production size, geographical location and level of technification. In this way, the population was segmented into homogeneous strata, which allowed the selection of participants proportionally and ensured greater precision in the results obtained (See Table 1).

Table 1. Study sample

Parameters	Description
Study Sample	354
Population	4,500 dairy farmers
Environment	Chimborazo Province, Ecuador
Recruitment method	Survey
Sampling Type	Stratified probabilistic
Confidence level	95%
Margin of error	5%
Questionnaires applied	354
Source of information	INEC and Ministry of Agriculture and Livestock of Ecuador

Instrument Design, Validity, and Reliability

The instrument used in the research was designed based on two central variables: knowledge management and competitiveness in dairy

producers, which were operationalized in four dimensions each, with the purpose of comprehensively analyzing the productive and organizational performance of the sector. In the case of knowledge management, the dimensions of

knowledge generation, outsourcing, transfer, and application were considered; while, for competitiveness, productive efficiency, innovation, strategic business management, and positioning were included. Each dimension was composed of four items, which resulted in a total of 32 items in the instrument. In this sense, the measurement was carried out using a five-point Likert scale, in which 1 corresponded to strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree and 5 strongly agree

Scientific validity

The scientific validity of the instrument was based on the adaptation of theoretical models widely recognized in the academic literature on knowledge management. In this framework, the knowledge generation dimension was based on the contributions of Nonaka and Takeuchi (1995), who explain how organizations develop new ideas based on the interaction between tacit and explicit knowledge. In turn, the knowledge externalization dimension was based on the same model, specifically on the process by which tacit knowledge becomes explicit and can be shared in a structured way. In relation to the knowledge transfer dimension, the approaches of Davenport and Prusak (1998) were considered, who highlight the importance of the exchange of information and experiences as a key mechanism to strengthen organizational learning. Finally, the knowledge application dimension was based on Alavi and Leidner (2001), who point out that the value of knowledge lies in its effective use in decision-making and in the improvement of performance.

On the other hand, the competitiveness variable was structured based on consolidated theoretical

approaches in the field of business strategy. In this sense, the dimension of productive efficiency was based on Porter (1985), who argues that the optimization of resources is essential to achieve competitive advantages. Similarly, the innovation dimension was supported by the guidelines of the Oslo Manual (OECD, 2018), which recognizes the incorporation of improvements in processes and products as a determining factor in competitive development. Regarding the dimension of strategic business management, Barney (1991) was taken as a reference, who emphasizes the importance of adequate management of resources and capabilities to achieve organizational sustainability. Finally, the dimension of positioning was again based on Porter (1985), who considered that differentiation and perception in the market are key elements to consolidate competitiveness.

Instrument reliability

The reliability of the instrument was evaluated using Cronbach's alpha coefficient, which allowed determining the degree of internal consistency of the items that make up each dimension and variable of the study. In this sense, it was considered that the alpha values range between 0 and 1, where coefficients equal to or greater than 0.70 indicate acceptable consistency, values above 0.80 reflect high reliability and those above 0.90 show excellent internal consistency. Based on this criterion, the analysis allowed to verify that the items maintain coherence among themselves and stably measure the constructs of knowledge management and competitiveness, which guaranteed the accuracy and reliability of the data obtained for subsequent statistical analysis.

Table 2. Cronbach's alpha

Dimension	Cronbach's alpha	N of elements
Knowledge generation	0,734	4
Knowledge Outsourcing	0,698	4
Knowledge transfer	0,715	4
Application of knowledge	0,680	4
Production efficiency	0,678	4
Innovation	0,765	4
Strategic Business Management	0,725	4
Positioning	0,688	4
Global Alpha	0,949	32

The analysis of the reliability of the instrument, measured through Cronbach's alpha coefficient, shows a solid behavior in the internal consistency of the dimensions evaluated. In general terms, the results show that most of the dimensions reach values equal to or greater than 0.70, which indicates adequate stability in the answers and acceptable coherence between the items that make up each construct. In this sense, the innovation dimension stands out with a value of 0.765, followed by knowledge generation (0.734) and strategic business management (0.725).

On the other hand, dimensions such as knowledge transfer (0.715) also show adequate reliability, while knowledge externalization (0.698), positioning (0.688), knowledge application (0.680) and productive efficiency (0.678) show values slightly

below the conventional threshold of 0.70. However, these coefficients are considered acceptable in exploratory studies and in complex social contexts, where perceptions may vary among participants. This allows us to affirm that, although there are opportunities for improvement in the accuracy of some items, the instrument maintains a reliable structure for statistical analysis.

Results

This section presents the results obtained from the processing and analysis of the information collected in the field, with the purpose of responding to the objectives set out in the research. Subsequently, the current situation of knowledge management and competitiveness in the sector was examined, based on the assessment of each of its dimensions.

Table 3. Sociodemographic profile

		Frequency	Percentage
Sex	Male	145	41%
	Female	209	59%
Age	Under 28 years old	74	21%
	From 29 – 33 years old	100	28%
	From 34 – 39 years old	100	28%
	Over 40 years old	80	23%
Level of Education	Basic education	99	28%
	Baccalaureate	106	30%
	Technical or technological	54	15%
	University	76	21%
	Postgraduate	19	5%
Marital status	Single	125	35%
	Married	129	36%
	Free union	63	18%
	Divorced	37	10%
Years of experience in dairy production	Less than 5 years	72	20%
	5 – 10 years	107	30%
	11 – 20 years old	103	29%
	More than 20 years	72	20%
Average daily milk production	Less than 50 liters	89	25%
	50 – 100 liters	109	31%
	101 – 200 liters	96	27%
	More than 200 liters	60	17%
Production Type	Traditional	132	37%
	Semi-technified	132	37%
	Technified	90	25%
Main destination of production	Direct sales	100	28%
	Intermediaries	117	33%
	Dairy industry	99	28%

	Own consumption	38	11%
Canton where the production unit is located	Riobamba	70	20%
	Cultured	66	19%
	Guamote	51	14%
	Alausí	30	8%
	Chambo	28	8%
	Guano	41	12%
	Penipe	39	11%
	Volleyball	29	8%
	Total	354	100%

The analysis of the sociodemographic profile allows us to clearly understand the predominant characteristics of the surveyed dairy producers, where a greater participation of the female sex with 59% compared to the male sex with 41% is observed, which shows an active role of women in this productive activity. In terms of age, there is a balanced distribution, although the groups of 29 to 33 years old and 34 to 39 years old predominate with 28% each, which reflects a population in a consolidated productive stage. With respect to the educational level, the baccalaureate stands out with 30% and basic education with 28%, while the higher levels have less presence, which shows limitations in specialized academic training. In terms of marital status, married people prevail with 36% and single people with 35%, which allows us to infer a stable family structure in a large part of the participants.

In relation to experience, the ranges of 5 to 10 years with 30% and 11 to 20 years with 29% show that most have a significant track record in the activity. In daily production, the range of 50 to 100 liters concentrates 31%, followed by 101 to 200 liters with 27%, which reflects intermediate production levels. In terms of the type of production,

traditional and semi-technified systems predominate with 37% each, while technified systems reach 25%, which shows a gradual process of modernization. In the destination of production, intermediaries represent 33%, followed by direct sales and the dairy industry with 28% each, which shows dependence on traditional marketing channels. Finally, the territorial distribution indicates a greater concentration in Riobamba with 20% and Colta with 19%, although there is also a relevant presence in cantons such as Guamote with 14% and Guano with 12%, which confirms the geographical diversity of the sector within the province.

Current situation of knowledge management in dairy producers in the province of Chimborazo, considering processes of generation, storage, transfer and application of knowledge

To respond to this objective, a questionnaire was applied, which allowed the calculation of the means and standard deviations of each dimension, in order to identify the level reached in each process. Subsequently, the analysis was complemented by the evaluation of discriminant validity, which allowed to verify the differentiation between the dimensions and the consistency of the construct.

Table 4. Discriminant validity of knowledge management

Dimensions	Generation	Storage	Transfer	Application
Knowledge generation	0,861			
Knowledge storage	0,699	0,847		
Knowledge transfer	0,61	0,714	0,858	
Application of knowledge	0,555	0,673	0,752	0,869

The evaluation of discriminant validity allowed to verify that the dimensions of knowledge

management present an adequate differentiation from each other, which guarantees the consistency

of the measurement model. In this sense, the values of the main diagonal, corresponding to the square root of the AVE, are higher than the correlations between the dimensions, which confirms compliance with the Fornell-Larcker criterion. This behavior shows that each dimension, generation, storage, transfer and application of knowledge captures a specific aspect of the construct without presenting significant overlaps. (Landázuri, 2023)

Likewise, the correlations between the dimensions show moderate levels, which reflects a logical

relationship between the knowledge processes within the dairy sector. This result allows us to understand that, although the dimensions are interrelated, they maintain conceptual independence, which strengthens the validity of the instrument and supports the accuracy of the subsequent analysis. Consequently, it is confirmed that the model is adequate to assess the current situation of knowledge management in dairy producers, allowing a reliable and structured diagnosis. (Erazo et al., 2024)

Table 5. Mean response

Dimension	Media	Standard deviation	Level
Knowledge generation	4,11	0,87	High
Knowledge storage	4,12	0,82	High
Knowledge transfer	4,14	0,82	High
Application of knowledge	4,09	0,87	High
Knowledge management	4,11	0,84	High

The analysis of the current situation of knowledge management in dairy producers shows a high level, with a global average of 4.11, which reflects that the processes related to knowledge management are developed in a consolidated manner within the sector. This behavior allows us to recognize that producers not only generate knowledge from their experience, but also manage to organize, share and use it in their productive activity, which strengthens their performance and ability to adapt. (Brasse, 2022)

When examining the dimensions, knowledge transfer reaches the highest value with 4.14, which allows identifying an active exchange of information and experiences among producers. On the other hand, knowledge storage with 4.12 shows that there is an adequate conservation of relevant information, while knowledge generation with 4.11 shows that practical experience continues to be a key source of learning. Finally, the application of knowledge registers an average of 4.09, which reflects that the knowledge acquired is used in decision-making and in the improvement of production processes. Overall, these results allow

us to understand that knowledge management in the dairy sector is at a strengthened level, with a dynamic articulated between its dimensions, which contributes to improving productive and organizational performance. (C. Andrade et al., 2023)

Level of competitiveness of dairy producers, through indicators of production efficiency, innovation, business management, market positioning and sustainability

To evaluate the level of competitiveness of dairy producers, an analysis was carried out based on the indicators of productive efficiency, innovation, business management, market positioning and sustainability, which were measured through a questionnaire. Based on the answers obtained, the means and standard deviations of each dimension were calculated, which allowed the levels to be classified as low, medium and high. In this way, it was possible to build a comprehensive vision of competitiveness, considering both the productive and strategic aspects that influence the ability of producers to maintain and position themselves in the market.

Table 6. Level of competitiveness of dairy producers

Dimension	Media	Standard deviation	Level
Production efficiency	3,54	0,71	Medium

Innovation	3,68	0,74	High
Business management	3,47	0,69	Medium
Market positioning	3,39	0,76	Medium
Sustainability	3,28	0,73	Medium
Global competitiveness	3,47	0,61	Medium

In order to evaluate the level of competitiveness of dairy producers in the province of Chimborazo, the averages of each dimension and the global construct were calculated. The results show that competitiveness reached a general average of 3.47, a value that places the sector at a medium level. This behavior allows us to recognize that producers maintain acceptable conditions to develop their economic activity; however, there are still aspects that require strengthening to consolidate a more solid and sustainable position within the market. (G. Andrade et al., 2023)

When reviewing each dimension specifically,

innovation obtained the highest average with 3.68, which placed it at a high level. This result shows that a significant part of the producers have incorporated improvements in their processes, work techniques and forms of productive organization. In contrast, sustainability registered the lowest average with 3.28, although it remained within the medium level, which reflects that there are still weaknesses in practices aimed at the permanence of the activity in the long term. In addition, productive efficiency reached 3.54, business management 3.47 and market positioning 3.39, values that show an intermediate performance (See table 6). (Zambrano et al., 2022)

Table 7. Distribution by level of competitiveness

Level of competitiveness	Frequency	Percentage
Low	48	13,60%
Medium	228	64,40%
High	78	22,00%
Total	354	100%

The distribution of competitiveness levels confirms that most producers are at a medium level with 64.4%, while 22.0% reach a high level and 13.6% remain at a low level. This behavior shows that, although the sector has a productive base that allows it to remain active, it has not yet managed to consolidate a high competitive performance in a generalized way. In this context, it is necessary to strengthen key aspects such as business management, market positioning and sustainability, in order to improve the ability to adapt and remain in an increasingly demanding environment (See

Table 7). (Zambrano et al., 2023)

To analyze the relationship between knowledge management and competitiveness, a structural equation model was used, which allowed the simultaneous evaluation of the relationships between the variables and their dimensions. This approach made it easier to estimate the influence of knowledge management on competitiveness, as well as to validate the consistency of the proposed model based on the trajectory coefficients. (De Los et al., 2023)

Table 8. Trajectory coefficients

Structural relationship	Coefficient (β)	Interpretation
Knowledge Management $\rightarrow$ Competitiveness	0,71	High positive influence
Knowledge generation $\rightarrow$ Knowledge management	0,82	Strong relationship
Knowledge Outsourcing $\rightarrow$ Knowledge Management	0,85	Strong relationship
Knowledge Transfer $\rightarrow$ Knowledge	0,83	Strong

Management		relationship
Knowledge Application → Knowledge Management	0,81	Strong relationship
Production Efficiency → Competitiveness	0,82	Strong relationship
Innovation → Competitiveness	0,8	Strong relationship
Strategic Business Management → Competitiveness	0,8	Strong relationship

The analysis of structural relationships shows that knowledge management maintains a high positive influence on competitiveness with a coefficient of 0.71, which confirms its role as a key factor in the performance of the sector. Internally, the dimensions of knowledge management show strong relationships with their construct, highlighting outsourcing with 0.85, followed by transfer with 0.83, generation with 0.82 and

application with 0.81, which reflects a solid integration of these processes in productive practice. Similarly, the competitiveness dimensions also show consistent relationships, where productive efficiency reaches 0.82, while innovation and strategic business management register values of 0.80, which shows a balanced behavior between factors that drive the positioning of the sector (See Table 8). (Zambrano & López, 2022)

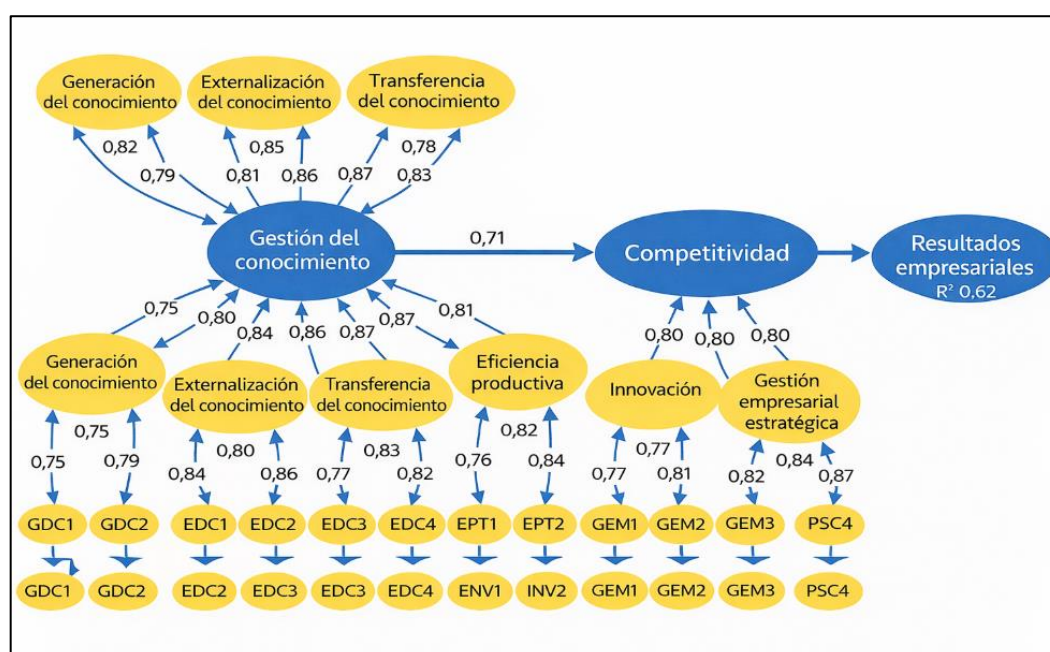


Figure 1. SEM Model

The structural equation model shows a clear and consistent relationship between knowledge management and competitiveness in dairy producers, where the former exerts a positive and significant influence on the latter with a coefficient of 0.71. This result allows us to understand that knowledge, when generated, shared and used appropriately, becomes a key resource to improve productive and organizational performance. In addition, the dimensions that make up knowledge management have high factor loads, especially

outsourcing, generation and transfer, which reflects that producers not only acquire knowledge from their experience, but also communicate and take advantage of it within their activity, thus strengthening their capacity to respond to the challenges of the environment. On the other hand, competitiveness shows a balanced and well-defined structure, where its dimensions, productive efficiency, innovation and strategic business management, present coefficients close to 0.80, which shows a homogeneous performance in these

aspects. In addition, competitiveness accounts for 62% of business results, confirming its role as a determining factor in the success of the sector (See Figure 1). (Pedro et al., 2020)

Strategies based on knowledge management that contribute to strengthening the competitiveness of the dairy sector in the province of Chimborazo

Based on the results obtained, strategies based on knowledge management are proposed aimed at strengthening the competitiveness of dairy producers. These proposals seek to articulate the processes of generation, storage, transfer and application of knowledge with concrete actions that improve the productive performance, innovation and sustainability of the sector.

Table 9. Strategies based on knowledge management

Knowledge management dimension	Strategy	Specific actions	Monitoring indicators	Impact on competitiveness
Knowledge generation	Innovative capacity building	Development of technical training programs in dairy production. Practical workshops on process improvement; training in production problem solving Implementation of participatory learning days Promotion of innovative ideas in productive activity	Number of trainings carried out Level of participation Percentage of adoption of new practices	Improved innovation and increased production efficiency
Knowledge storage	Systematization of productive information	Implementation of physical and digital production records Preparation of procedure manuals Organizing data on performance, costs, and quality Use of technological tools for information storage Regular updating of production records	Existence and updating of records Frequency of use of information Data Organization Level	Strengthening business management and optimizing resources
Knowledge transfer	Collaborative Learning Networking	Formation of associations or groups of producers. Organization of regular meetings for the exchange of experiences Development of collective learning	Number of meetings held Level of participation Amount of knowledge shared	Increased innovation and improved market positioning

		spaces Participation in trade fairs and technical events Dissemination of good practices through workshops and consultancies		
Application of knowledge	Implementation of good production practices	Adoption of improved livestock handling and feeding techniques Application of sanitary controls Implementation of production improvements based on previous experiences Use of information for decision-making Monitoring and evaluation of productive results	Level of Practice Adoption Improvement in production indicators Cost reduction	Increased production efficiency and sustainability of the system

The strategic proposal shows that strengthening the competitiveness of the dairy sector depends directly on the way in which knowledge is managed in each of its dimensions. In this sense, the actions proposed in the generation of knowledge allow innovation to be promoted through continuous learning and technical training, which favors the improvement of production processes. Similarly, the systematization of information through the storage of knowledge contributes to a better organization of data, facilitating decision-making and optimizing the use of available resources. This approach allows knowledge not to be lost, but to become a key input for productive development. (Landázuri, 2023) (Erazo et al., 2024)

On the other hand, the transfer and application of knowledge reflect the passage from information to action, which is essential to achieve concrete results in the sector. The creation of collaborative learning networks fosters the exchange of experiences and strengthens collective knowledge, which has an impact on innovation and market positioning. In turn, the implementation of good production practices makes it possible to transform knowledge into real improvements, impacting the efficiency

and sustainability of the system. Together, these strategies show that competitiveness does not depend solely on productive factors, but on the ability of producers to manage, share, and apply knowledge effectively.

Discussion

The results obtained with respect to knowledge management show a high level in dairy producers in the province of Chimborazo, which reflects an active dynamic in the generation, storage, transfer and application of knowledge. This behavior is consistent with what has been stated by , who argue that knowledge management in productive contexts allows optimizing the use of information and strengthening decision-making. In Ecuador, research such as that of the Andean region highlights that the agroproductive systems of the Andean region are characterized by learning based on experience, where knowledge is built from daily practice and interaction between producers. In this sense, the results confirm that, despite the structural limitations of the sector, producers have managed to develop effective mechanisms to share and apply knowledge, which strengthens their ability to adapt to the demands of the productive

environment. Landázuri (2023) Erazo et al. (2024)

Regarding the level of competitiveness, the results show a medium behavior, which indicates that, although there are advances in dimensions such as innovation, there are still weaknesses in aspects such as sustainability and market positioning. This finding coincides with what has been pointed out by , who affirm that productive efficiency in the Ecuadorian agricultural sector depends to a large extent on the adequate management of resources and access to technology. Similarly, studies such as those of show that strategic business management and planning are key elements to improve competitiveness, especially in small productive units. In the context of Chimborazo, these limitations are related to dependence on intermediaries and poor differentiation in the market, which restricts the competitive development of the sector. Brasse (2022) Andrade et al. (2023)

Finally, the analysis of the structural model confirms that knowledge management significantly influences competitiveness, with a coefficient of 0.71, which demonstrates that knowledge acts as a determining factor in productive performance. This result is aligned with what has been stated by , who argue that the development of organizational skills and knowledge constitutes a fundamental basis for achieving sustainable competitive advantages. Likewise, Sundara et al. (2021) highlight that the effective application of knowledge allows information to be transformed into concrete results, which is reflected in improvements in productivity and in the ability to respond to market changes. In this sense, the findings of the study confirm that, in the dairy sector of Chimborazo, the strengthening of knowledge management not only improves internal processes, but also directly boosts competitiveness, consolidating itself as a strategic axis for the sustainable development of the sector. Andrade et al. (2023)

Conclusions

The current situation of knowledge management in

dairy producers in Chimborazo is characterized by a high level, evidenced in the adequate development of the processes of generation, storage, transfer and application of knowledge. This concluded that producers not only build knowledge from their productive experience, but also manage to conserve, share and use it effectively in their daily activities. Overall, this dynamic reflects a consolidated knowledge management, where there is a functional articulation between its dimensions, which favors decision-making, improvement of production processes and the ability of the sector to adapt to the demands of the environment.

In conclusion, the level of competitiveness of dairy producers in Chimborazo is at a medium level, which shows that the sector has functional capacities in terms of productive efficiency, innovation, business management, market positioning and sustainability, but has not yet reached a consolidated competitive development. Although innovation presents a relatively more favorable performance, other dimensions such as sustainability and positioning show limitations that restrict the integral strengthening of the sector. This behavior reflects the need to improve the articulation between productive, strategic and market factors, in order to move towards a more solid model that allows producers to adapt to more demanding environments and ensure their permanence over time.

Finally, the strategies based on knowledge management proposed allow strengthening the competitiveness of the dairy sector in the province of Chimborazo by effectively articulating the processes of generation, storage, transfer and application of knowledge with concrete actions aimed at improving productive and organizational performance. In this sense, the strengthening of innovative capacities drives continuous improvement, systematization of information, which facilitates more efficient decision-making, collaborative learning networks enhance the exchange of experiences, and the implementation of good practices allows knowledge to be transformed into tangible results.

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