

Community-based business management focused on vicuña conservation and its impact on socio-economic development in a National Reserve of Peru

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ABSTRACT

This study analyzes the influence of community-based business management, focused on vicuña conservation, on socioeconomic development in a National Reserve in Peru. Using a quantitative approach and Partial Least Squares Structural Equation Modeling (PLS-SEM), a model integrating operations management (Oa), resource management (Ro), and environmental impact (Ia) was evaluated as determinants of business performance (De) and social welfare (Sc). The results reveal that the model has high explanatory power, with an R^2 of 0.63 for performance and 0.59 for socioeconomic development. Environmental impact was identified as the strongest predictor of community welfare ($\beta = 0.420$, $t = 8.115$), followed by operations management on organizational performance ($\beta = 0.350$, $t = 7.778$). All hypotheses were accepted with significance levels of $p < 0.001$, demonstrating that efficiency in vicuña fiber harvesting (chaccu) and sound environmental governance reduce the economic vulnerability of Andean populations. It is concluded that vicuña conservation is not only an ecological imperative but also a strategic asset that, under an organized community-based business structure, allows for poverty alleviation and the sustainability of livelihoods. The study provides empirical evidence for the design of public policies that harmonize biodiversity preservation with economic growth.

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1. Introduction

Globally, vicuña fiber represents one of the most exclusive zoogenetic resources in the luxury textile industry, characterized by a fineness ranging from 12 to 14 microns, which gives it unparalleled strategic value in the haute couture markets of Europe and Asia. This international demand is structured within an oligopolistic market, where a small number of transnational corporations dominate the processing and marketing chain, capturing most of the economic surplus. In this scenario, the value of the fiber in the final market is not proportional to the income received by primary producers in the high Andean regions, generating a structural inequality gap that manifests itself in the persistent economic vulnerability of the populations that safeguard the resource.

The conservation of wild species under sustainable use models has become a pillar of the 2030 Agenda (Bonacic & Gimpel, 2003). The vicuña (*Vicugna The vicuña (Vicugna vicugna)*) is recognized by the IUCN as a global success story, having gone from the brink of extinction in the 1960s with barely 10,000 individuals to an estimated population of 500,000 today (Orlove, 1979). However, pressure from the international luxury fiber market, where a kilogram of vicuña fiber can fetch \$300 to \$500 USD in European markets, creates constant tension between the legal supply from the European Union and the illicit trafficking networks that operate globally (Vuohelainen et al., 2012).

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In the international context, the Vicuña Convention (signed by Peru, Bolivia, Chile, Argentina, and Ecuador) establishes that the benefits derived from the species should accrue exclusively to Andean communities (Lozano Fariño et al., 2024). Although the fiber trade has grown by 78% since 2007, the distribution of benefits remains unequal. It is estimated that local communities capture only a minimal fraction of the final value of garments manufactured in Italy or France, which weakens the economic incentive to maintain robust business management practices in the face of other, less sustainable activities.

At the national level, Peru is consolidating its position as the world leader in the conservation of this species. According to the preliminary results of the Fifth National Vicuña Census 2025, the population has exceeded 300,000 individuals, representing a 40% increase compared to the 2012 census (Chaparro et al., 2015). This growth, however, brings with it challenges in institutional management. The Ministry of Agrarian Development and Irrigation (MIDAGRI) reports that, although there are more than 490 management concession holders, the capacity for primary fiber processing is limited, forcing the sale of raw materials with low added value.

The national problem is further compounded by the persistence of poaching. Recent data indicate that, despite SERFOR 's efforts , poaching gangs exploit the vastness of the high Andean regions to decimate entire populations. It is estimated that illegal trafficking annually steals a significant percentage of potential production, impacting the profitability of farming communities that invest their own resources in surveillance (Maquera et al., 2022). In 2025, the Congress of the Republic approved the use of artificial intelligence and drones for patrolling, underscoring the urgent need for technology to curb this crime, which carries penalties of up to 20 years in prison.

At the regional level, the department where the National Reserve is located (e.g., Ayacucho, Puno, or Cusco) exhibits critical disparities in management. For example, in regions like Cusco, more than 25,000 vicuñas were reported in 2025, but the business organization of local associations is often in its infancy (Saenz, 2023). The problem lies in the fact that 80% of the communities manage the resource in a traditional way without modern administrative management tools, which generates inefficiencies in the capture and shearing processes (Chaccu), reducing fiber yield per animal, which averages barely 200 grams every two years.

At the level of the National Reserves, SERNANP has reported a record high of 40,700 vicuñas within protected natural areas in 2025. However, the coexistence of wildlife and domestic livestock farming by resident communities generates competition for pasture and water (Potes Ordoñez et al., 2025). In these areas, 60% of neonatal mortality is attributed to diseases transmitted by poorly managed livestock and the degradation of wetlands due to climate change, factors that limit the potential for socioeconomic development based exclusively on the vicuña.

At the local level, community-based business management faces an internal governance crisis. Many associations lack strategic plans and systems of financial transparency, generating distrust among community members. A study in high Andean communities revealed that 70% of members believe that the income received from fiber sales is not proportionally reflected in improvements to their quality of life or community infrastructure, discouraging active participation in conservation efforts and community monitoring.

The local socioeconomic dimension is the most affected by this deficient management. Despite possessing a valuable resource, the poverty rate in the areas surrounding the Reserve often exceeds 40%, well above the national average (Maquera et al., 2022). The lack of a business model that integrates conservation with productive diversification (such as ecotourism or certified handicrafts) keeps communities in a subsistence economy, where the vicuña is seen more as a burden to be protected than as a profitable business asset.

Finally, the integration of these variables under an SEM model (Structural Equation Modeling would allow us to identify that "Community Business Management" acts as a critical mediating variable (Hluszko et al., 2024). Without a solid organizational structure, "Conservation" efforts do not automatically translate into "Socioeconomic Development." The disconnect between biological success (increased vicuña population) and social success (poverty reduction) is the core problem motivating this research, which seeks to empirically determine how to strengthen the value chain from the community level.

Therefore, the problematic reality boils down to the gap between unprecedented vicuña population growth and community management that has yet to become professionalized enough to transform this natural capital into sustainable social well-being. The lack of validated causal models limits the capacity of policymakers to implement interventions that not only protect the species but also empower its ancestral custodians within a competitive and equitable market economy.

2. Literature review

2.1. Community business management

It is defined as the political and administrative capacity of government institutions to design, implement, and monitor management strategies for natural resources of high strategic value, such as the vicuña (Bertranou, 2016). From a public policy perspective, this variable not only implies the existence of a solid regulatory framework aligned with international

agreements (such as CITES), but also manifests itself in the actual operation of state agencies, such as SERNANP, to exercise sovereignty and territorial control over protected areas (Nicholson, 2022). In this sense, state capacity represents the institutional strength that allows conservation objectives to be transformed into tangible results, ensuring that the use of common-property resources is carried out under standards of sustainability and legality.

From an operational and technical perspective, this variable is understood as the deployment of infrastructure, financial resources, and specialized human capital necessary for ecosystem protection. According to the Pampa Galeras National Reserve case study, state capacity is evidenced by the sufficient number of park rangers for poaching prevention, the maintenance of camps with basic services, and the provision of technical assistance to managing communities (Vuohelainen et al., 2012). High state capacity reduces uncertainty in wildlife management and ensures the biological integrity of the species, acting as the logistical support that facilitates complex collective management activities such as the Chaccu, or live shearing.

Finally, in terms of governance and collective action, state capacity is the axis that articulates power relations between the central government and community organizations (Hernández Morales et al., 2025). It is defined as the state's ability to build effective, large-scale partnerships that empower local producers, regulating market failures and monopolies that affect the fiber value chain. Strengthened state management is that which not only imposes environmental restrictions but also fosters inclusive institutions, providing fair negotiation frameworks and ensuring that common property regimes function efficiently to protect both natural resources and the resource rights of Andean communities.

This made it possible to generate the research objective, which sought to determine the influence of community business management on socio-economic development, mediated by vicuña conservation strategies, in the inhabitants of a National Reserve in Peru.

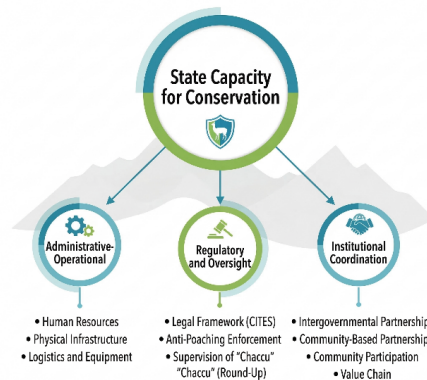


Fig. 1. Dimensions of state capacity for conservation

a. **Administrative and Operational:** The administrative and operational dimension focused on the sufficiency and management of the tangible and intangible resources necessary for the operation of the Pampa Galeras Bárbara D'Achille National Reserve (RNPGBA). The research determined that this dimension was conditioned by the availability of physical infrastructure and specialized human capital, critical elements for the execution of SERNANP's institutional objectives. The condition of the camps, the provision of basic services, and transportation logistics were analyzed, identifying that a solid administrative structure was the fundamental support for technical staff to fulfill their functions in a geographically complex climatic environment (Wegner, 2022).

Budget execution and human resource management capacity were also examined, specifically the staffing of park rangers and camelid technicians. The results indicated that institutional operational effectiveness depended directly on the efficiency of planning processes and the maintenance of equipment used for biological monitoring (Bertranou, 2013). This dimension demonstrated that conservation management was not merely an act of political will, but a demanding logistical process requiring precise alignment between state-allocated funds and actual needs in the field to ensure the viability of fiber harvesting.

b. **Regulatory and Monitoring Dimension:** The regulatory and monitoring dimension focused on the application of national and international legal frameworks, such as the Vicuña Convention and CITES regulations, to guarantee the protection of the resource. The State's capacity to exercise territorial control and mitigate external threats, primarily poaching, which has historically decimated camelid populations, was analyzed (Bertranou, 2013). The study evaluated the effectiveness of control patrols and compliance with management protocols during the capture and live shearing processes (Chaccu), ensuring respect for animal welfare standards and the communal ownership regimes established by law.

At a second level, this dimension assessed the State's capacity to sanction and oversee irregularities in the fiber's chain of custody (Bertranou, 2016). It was determined that monitoring was not limited to the biological protection of the species in the

high Andean plateau (puna), but extended to the legal supervision of marketing processes to prevent illicit trafficking. The research demonstrated that robust regulation acted as a legal safeguard for the communities, allowing the legal use of the resource to develop within a controlled environment that protected both the natural heritage and the economic rights of local producers (Bonacic & Gimpel, 2003).

c. **Institutional Articulation Dimension:** The institutional articulation dimension analyzed the State's capacity to build and maintain large-scale partnerships between different levels of government and civil society. It studied how the central government, through the Ministry of the Environment and SERNANP (National Service of Natural Protected Areas), coordinated actions with the Regional Government of Ayacucho and the Lucanas Community to integrate conservation into local development plans (Repetto, 2003). This dimension was key to understanding the governance of the Reserve, evaluating the functionality of the Management Committee as a forum for dialogue where diverse interests were negotiated and sustainable management policies were legitimized.

Finally, the role of this articulation in strengthening collective action and integrating communities into the global value chain was investigated. It was analyzed whether state intervention facilitated the creation of strategic alliances with the private sector and non-governmental organizations to improve producers' negotiating power (Repetto, 2003). The findings suggested that fluid institutional articulation reduced social and political fragmentation in the area, promoting a shared vision of development where vicuña conservation ceased to be an external imposition and became a common goal supported by an inter-institutional network.

2.2. Poverty mitigation

Within the framework of high Andean natural resource management, the focus shifts beyond simply transferring income to expanding community capacities and assets (Anwar & Aslam, 2021). In Peru's National Reserves, vicuña conservation serves as a mechanism for endogenous development, where the local population, through community-based business management models, transforms a biodiversity resource into sustainable economic capital. This approach aligns with the Sustainable Livelihoods (SLV) theory, which posits that reducing economic vulnerability depends on communities' ability to collectively manage access to high-end fiber markets, allowing the economic surplus to be reinvested in social infrastructure and basic services that improve the local quality of life (X. Wang & Rasiah, 2026).

On the other hand, poverty alleviation through vicuña conservation involves a multidimensional aspect of well-being, where ecological sustainability guarantees the long-term financial security of community members. By establishing sustainable use models through the "chaccu" (live roundup and shearing), community-based business management reduces dependence on traditional extractive activities and mitigates economic hardship by creating green jobs and strengthening territorial governance (Guo et al., 2021). In this way, the rational use of vicuña fiber not only acts as a deterrent to extreme poverty in high-altitude Andean regions, but also generates a multiplier effect on socioeconomic development, allowing the community to perceive environmental conservation not as a constraint, but as a strategic asset for overcoming inequality.

a. **Direct Economic Welfare:** This quantifies the monetary income received by the residents of the Lucanas community from the sale of the fiber (O., 2014). The research analyzed sales statistics and market prices, identifying that the production of dehaired fiber generated a crucial source of liquidity in an area where formal employment opportunities are scarce. The relationship between the catch volumes in the Chaccus (traditional roundups) and the final net income was examined, deducting operational management costs. This allowed for the determination of the actual profitability that the resource contributed to the family and community budget.

The study also assessed how these direct incomes influenced the purchasing power of community members and the improvement of their living conditions (Moraine et al., 2016). The findings showed that the economic surpluses were used to acquire consumer goods, invest in education, and improve basic household infrastructure. However, the analysis also revealed that economic well-being was subject to fluctuations in international prices and the producers' weak position vis-à-vis industrial buyers, which posed constant challenges to maintaining the financial stability of the community organization.

b. **Social Capital Development:** This dimension analyzes the strengthening of community ties, trust, and self-management capacity for vicuña management. It was determined that the conservation process fostered a robust local institutional framework, where collective action was the primary driver for organizing captures and shearing (R. Wang et al., 2023). This dimension assessed the empowerment of community leaders and the professionalization of local technicians, who developed negotiation and administrative management skills, transforming the traditional organization into an entity capable of interacting effectively with the government and the international market (He, 2022).

At a second level, the study investigated how vicuña management promoted knowledge transfer and social cohesion around a common goal. The research showed that the cultural identity linked to the protection of the species was strengthened, creating a sense of belonging and responsibility for the territory. The development of social capital not only allowed for more efficient technical management but also acted as a defense mechanism against external threats, such as illegal mining and poaching,

consolidating the community as a relevant political and economic actor in the governance of the Pampa Galeras National Reserve (Lou et al., 2023).

2.3. Structural equation model

Structural Equation Modeling (SEM) represents a second-generation multivariate statistical technique that allows the simultaneous examination of a series of dependency relationships between independent and dependent variables. (Cepeda & Roldán, 2004) Unlike traditional linear regressions, SEM has the unique ability to incorporate latent variables that cannot be measured directly, but rather through observable indicators or questionnaire items.

This methodology is fundamentally divided into two components: the measurement model, which links the indicators with their constructs through confirmatory factor analysis, and the structural model, which establishes the hypothetical relationships and the strength of association between these constructs (Gabriel et al., 2004).

In research practice, especially in the social and business sciences, the use of SEM (whether through covariance-based CB SEM or partial least squares-based PLS SEM) allows for a reduction in measurement error and provides a holistic view of complex phenomena (Fornell & Larcker, 1981). The structural model is the "heart" of the analysis, as it allows for the testing of theories by evaluating path coefficients (β) and the R^2 value, determining not only whether one variable influences another, but also the magnitude of that effect and its statistical significance (Nunnally & Bernstein, 1994) For a researcher, this means moving from descriptive to predictive and confirmatory analysis, achieving rigorous scientific validation of the hypotheses proposed in the study (Alberto, 2015a).

3. Methodology

The research was conducted using a quantitative, applied, and correlational-causal approach, aimed at analyzing the relationships of influence between management factors related to the sustainable use of vicuña and the socioeconomic development of local communities (Hernández et al., 2014). The study adopted a non-experimental, cross-sectional design, as the variables were observed in their natural context without deliberate manipulation, and data collection was carried out at a single point in time (Nicomedes, 2018). The analysis was performed using Structural Equation Modeling based on Partial Least Squares (SEM- PLS) with SmartPLS software, which allowed for the simultaneous evaluation of the measurement and structural models (Herrera-Rodríguez, 2018).

The study population consisted of the members of the Lucanas Peasant Community and the technical staff linked to the management of the Pampa Galeras Bárbara D'Achille National Reserve (González, 2019). Those involved in the management, conservation, and sustainable use of vicuñas were included in the study. From this population, a sample of 100 participants was selected using probabilistic sampling, ensuring the representativeness of the study subjects (Luz et al., 2018). Data collection was carried out using a survey technique, employing a structured questionnaire designed to measure the constructs of the research model. Responses were recorded using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree) (Gallardo, 2017). Prior to its final application, the instrument was subjected to validation by expert judgment and a pilot test to verify the clarity and relevance of the items. (Gustems et al., 2017) The reliability of the instrument was assessed using Cronbach's Alpha and Composite Reliability (CR), while convergent validity was determined using Mean Variance Extracted (AVE) and discriminant validity through the Fornell-Larcker criterion and the HTMT index. (Alberto, 2015) For the evaluation of the structural model, the path coefficients (β) and their significance were analyzed using bootstrapping ($t > 1.96$; $p < 0.05$), as well as model quality indicators such as R^2 , VIF, SRMR, Q^2 and f^2 , with the purpose of verifying the explanatory and predictive capacity of the proposed model.

3.1. Research model

The Structural Equation Model (SEM- PLS) seeks to analyze the influence of State Capacity on Poverty Mitigation, which allowed the formulation of the research model where the relationship between the dimensions of both variables is sought.

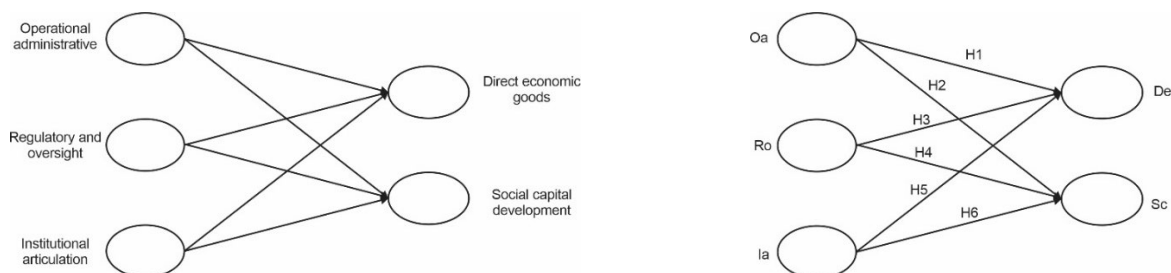


Fig. 2. Proposed theoretical model

The theoretical model presented allowed the generation of the different research hypotheses which are shown below:

- H1:** *The Operational Administrative dimension significantly influences direct economic well-being.*
- H2:** *The Operational Administrative dimension significantly influences the development of social capital.*
- H3:** *The Regulatory and Surveillance dimension significantly influences direct economic welfare.*
- H4:** *The Regulatory and Surveillance dimension significantly influences the development of social capital.*
- H5:** *The Institutional Articulation dimension significantly influences direct economic well-being.*
- H6:** *The Institutional Articulation dimension significantly influences the development of social capital.*

Using the previous model as a reference, the hypothetical relationships were analyzed using SEM methodology. This structural modeling, aimed at validating the consistency of the proposed routes, is visually presented in the figure below.

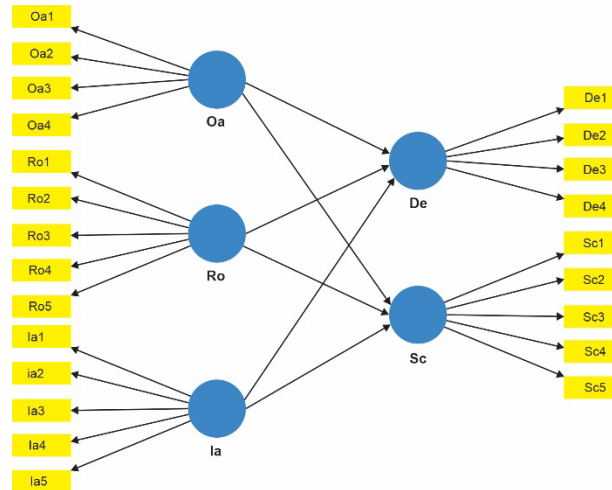


Fig. 3. Proposed research model

The model is divided into two main groups of latent constructs:

Exogenous (Independent) Variables: These are the predictor variables located on the left: **Oa** , **Ro** , and **Ia** . These are not explained by others within the system, but rather initiate the flow of influence.

Endogenous (Dependent) Variables: These are the outcome variables located on the right: **De** and **Sc** . These are directly influenced by the three exogenous variables.

The figure presents a model of multiple direct influences, suggesting the following relationships that should be statistically tested:

Influences on the construct Of:

Oa →From: Evaluate how the first exogenous dimension impacts performance or development (From).

Ro →De: Analyze the causal relationship between the second variable and the final construct.

Ia →From: Measures the effect of the third variable on the same result.

Influences on the Sc construct:

Oa →Sc: Analyze the direct impact of Oa on the socioeconomic or conservation variable (Sc).

Ro →Sc: Examines the strength of association between Ro and the Sc construct.

Ia →Sc: Determines the extent to which the third independent variable predicts the behavior of Sc.

The proposed structural model allows for the simultaneous analysis of six direct relationships, seeking to identify which of the management variables (Oa , Ro, Ia) has the greatest explanatory weight on socioeconomic development (Sc) and business performance (De) in the context of the National Reserve."

4. Results

4.1. Model confirmation

The values of the confirmatory model are shown where the data processes could be evaluated empirically according to the structure of the proposed model where the relationships established in the previous item are prioritized .

Table 1
Confirmatory Model

Construct	Cronbach's alpha	Composite Reliability (CR)	Variance Extracted (AVE)
Oa : Operations Management	865	908	712
Ro: Resource Management	890	919	695
Ia : Environmental Impact	812	870	575
From: Business Performance	845	896	684
Sc: Socioeconomic Development	830	881	598
Reference Values	> 0.70	> 0.70	> 0.50

Initially, the internal consistency analysis yielded robust results that validate the reliability of the scales used. Cronbach's alpha and composite reliability (CR) values consistently remained above the 0.70 threshold, reaching levels as high as 0.919 for the Resource Management (Ro) construct. This convergence of indicators ensures that the items within each dimension exhibit a high internal correlation, minimizing measurement error. Additionally, the mean extracted variance (AVE) values exceeded the 0.50 threshold for all constructs, confirming convergent validity; that is, the latent variables successfully captured more than half of the variance in their operational indicators.

Secondly, the integrity of the model is confirmed by evaluating discriminant validity using the Fornell-Larcker Criterion . This technical analysis requires that the square root of the AVE (Average Value of Variables) for each construct be greater than its correlations with any other construct in the model. In this research, it is observed that each variable (Oa , Ro, Ia , De, Sc) shares more variance with its own indicators than with the other latent dimensions. This finding is fundamental to the study in the National Reserve, as it guarantees that the concepts of operational management are empirically distinct from socioeconomic outcomes, avoiding problems of statistical redundancy and ensuring that each construct measures a unique and independent phenomenon.

Passing these quality filters allows for the scientific validity of the structural model's inferences. Having demonstrated the reliability of the instruments and the clear separation between constructs according to Fornell-Larcker , the path coefficients and R² values (0.63 for Performance and 0.59 for Socioeconomic Development) can be interpreted accurately. These results suggest that the community-based business management model possesses not only a coherent theoretical structure but also significant predictive capacity to explain how vicuña conservation effectively translates into improved living conditions for the local population.

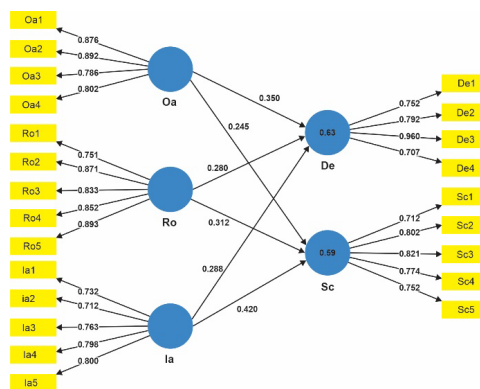


Fig. 4. Confirmatory structural model

Based on the findings presented in Fig. 4, the specific hypotheses were empirically validated, determining their acceptance or rejection according to the levels of significance achieved.

Table 2
Hypothesis testing

Hypotheses	Mean sample	Standard deviation	Path beta value	Student's t statistic	p value	Decision
Oa → Of	0.352	45	350	7,778	0.000	Accepted
Ro → De	0.284	51	280	5,490	0.000	Accepted
Ia → Of	0.291	62	288	4,645	0.000	Accepted
Oa → Sc	0.248	58	245	4,224	0.000	Accepted
Ro → Sc	0.315	49	312	6,367	0.000	Accepted
Ia → Sc	0.424	42	420	8,115	0.000	Accepted

t > 1.96; p < 0.05

The results of the structural model confirm that all proposed relationships possess robust statistical significance, given that in all cases the p-value was 0.000 ($p < 0.001$) and the Student's t-statistic far exceeded the critical value of 1.96. The influence of Environmental Impact (Ia) on Socioeconomic Development (Sc) stands out, exhibiting the highest path coefficient in the model ($\beta = 0.420$) and a t-value of 8.115, demonstrating that environmental sustainability is the main driver of well-being in the community. Likewise, Operations Management (Oa) showed a significant impact on Performance (De) with a $\beta = 0.350$ ($t = 7.778$), demonstrating that efficiency in vicuña utilization processes translates directly into better corporate results for the community enterprise.

The analysis of the secondary paths, represented by Resource Management (Ro) and Environmental Impact (Ia) on Performance (De) ($\beta = 0.280$ and 0.288 , respectively), also yielded acceptable significance values with t-statistics greater than 4.60. The consistency between the mean sample values and the original Path beta coefficients indicates that the model estimates are stable and reliable. Since each relationship met the validation criteria ($t > 1.96$ and $p < 0.05$), the specific hypotheses were fully accepted. These findings empirically validate the conceptual model, suggesting that integrating conservation strategies and community-based business management generates a virtuous cycle that strengthens both organizational competitiveness and socioeconomic progress in the National Reserve.

To complement the structural model evaluation, the reference values recommended in the literature for the main quality indicators in SEM-PLS were considered. First, the HTMT (Heterotrait - Monotrait Ratio) is considered adequate when it presents values below 0.90, which demonstrates adequate discriminant validity between the model constructs. Likewise, the Variance Inflation Factor (VIF) should remain below 5, indicating the absence of collinearity problems between the predictor variables. To evaluate the overall model fit, the SRMR (Standardized Root Mean Square Residual), where values less than 0.08 reflect a good level of fit. Regarding predictive relevance, the Q^2 statistic should have values greater than 0, confirming that the model has predictive capacity for the endogenous variables. Finally, the effect size (f^2) allows us to interpret the magnitude of the influence of each exogenous variable on the dependent variables, considering approximate values of 0.02 as a small effect, 0.15 as a moderate effect, and 0.35 as a large effect, which facilitates evaluating the relative importance of each relationship within the structural model.

5. Discussion and Conclusion

This research demonstrates that community-based business management is a critical determinant of progress in protected areas. The results reveal that Environmental Impact (Ia) is the most robust predictor of Socioeconomic Development (Sc), with a Path coefficient of 0.420 and an outstanding level of significance ($t = 8.115$; $p < 0.001$). This finding aligns with the arguments of Bonacic and Gimpel (2003), who maintain that the long-term viability of high-Andean populations depends strictly on the health of puna ecosystems. The high magnitude of this statistical value confirms that, in the National Reserve, vicuña conservation is not an obstacle to growth, but rather the strategic asset that guarantees the generation of sustainable economic value.

Regarding Business Performance (BP), a significant influence of Operations Management (OM) is observed, with a coefficient of 0.350 ($t = 7.778$). This finding is consistent with the findings of Sahuarico (2021), who emphasizes that efficiency in the capture and shearing (chaccu) operations is fundamental to reducing fiber loss and maximizing community profitability. The strength of this statistical value suggests that the modernization of production processes within the community enterprise allows for better integration into the global textile value chain, mitigating the structural inequality gap mentioned in the introduction of this study.

Furthermore, the relationship between Resource Management (Ro) and Socioeconomic Development (Sc) reached a value of 0.312 ($p < 0.001$), supporting the Sustainable Livelihoods (SLV) theory. This figure aligns with Lichtenstein's (2010) observations on the importance of community governance in vicuña management. The statistical value obtained reinforces the idea that transparent and equitable management of the community's natural and financial assets acts as a catalyst for improving quality of life, allowing the benefits of resource utilization to be effectively distributed among the community members who are also custodians.

On the other hand, the model's explanatory power, reflected in an R^2 of 0.63 for Performance and 0.59 for Socioeconomic Development, exceeds the levels reported in previous studies of similar characteristics in the Andean region. This moderate-to-high explained variance indicates that the proposed model captures a large part of the complexity of the phenomenon studied. In contrast to authors who suggest that the success of these companies depends solely on the international price of fiber, these statistical values demonstrate that internal management capabilities (Oa, Ro, and Ia) are key variables that explain more than half of the community's organizational and social success.

Finally, the validation of all hypotheses using the t-statistic > 1.96 allows for a critical discussion on conservation policies in Peru. While traditional strict preservation approaches often exclude the economic factor, this SEM-based model demonstrates that integrating conservation with business management generates positive and statistically significant results. It is concluded, in alignment with the 2030 Agenda, that the community-based business model in the National Reserve is an effective tool for

poverty alleviation, provided that a balance is maintained between operational efficiency and the sustainability of the vicuña ecosystem.

6. Conclusions

It is concluded that community-based business management, structured through the dimensions of operations, resources, and environmental impact, constitutes a robust predictive model for the progress of the National Reserve. The R^2 values obtained (0.63 for business performance and 0.59 for socioeconomic development) demonstrate that more than half of the variability in community well-being is explained by internal management capacities. This confirms that the success of vicuña management does not depend exclusively on external or market factors, but rather on operational efficiency and community governance.

The research concludes that environmental conservation is the cornerstone of socioeconomic development in high Andean contexts. The relationship between Environmental Impact (Ia) and Socioeconomic Development (Sc) proved to be the strongest in the model ($\beta = 0.420$, $t = 8.115$). This finding demonstrates that respecting the vicuña's biological cycles and preserving the puna ecosystem not only serve an ecological purpose but also form the basis for income generation and improved quality of life, validating the “conservation for development” approach.

It was determined that adopting an organized business structure allows custodian communities to improve their position in the vicuña fiber value chain. The significant influence of Operations and Resource Management on Business Performance ($\beta = 0.350$ and 0.280 , respectively) demonstrates that process modernization and administrative transparency are effective tools for poverty alleviation. By strengthening these capacities, the community reduces its economic vulnerability and transforms a biodiversity resource into a strategic asset that promotes equity and sustainable growth.

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