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Agribusiness Management Characterization and Performance of the Value Chain in the Production of the "Concha Prieta" (*anadara tuberculosa*)

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ABSTRACT

The Anadara tuberculosa in Ecuador called "Concha Prieta", is a bivalve mollusk that is obtained manually on the shores of the American Pacific Ocean, from northern Peru to southern Mexico. This artisanal business economically and socially benefits thousands of fishing families but also contributes significantly to the preservation of the mangrove swamp, one of the main ecosystems that produce blue carbon. The objective of this research was to characterize the management of agribusiness and the performance of the Anadara tuberculosa value chain. It was concluded that despite the low levels of agribusiness management, the performance of the value chain reaches an intermediate level, mainly due to the relevant characteristics of the Concha Prieta, the high demand in the Ecuadorian market and in neighboring countries.

Keywords: Mangrove; Bivalve mollusks; Management processes; Innovation processes; Environmental Processes; Ecuador
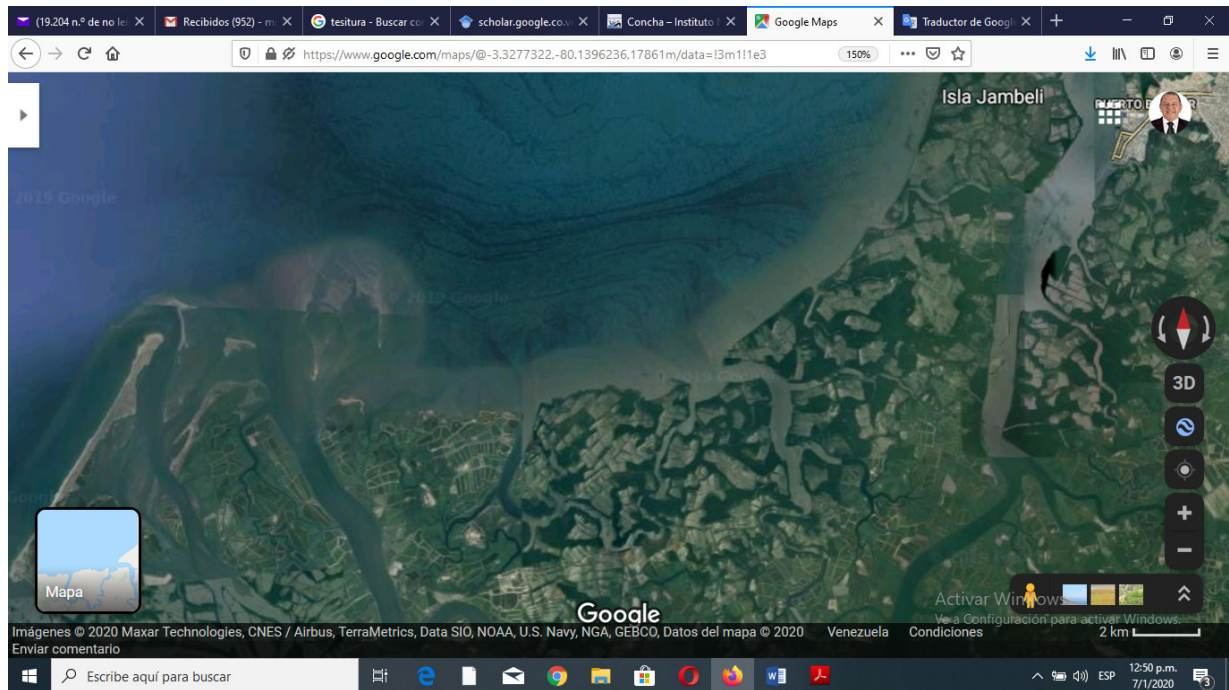
1. INTRODUCTION

Human societies face the immense challenge of having to provide food and livelihoods to a population that, by the middle of the 21st century, will far exceed 9 billion people, while addressing the disproportionate effects of climate change and environmental degradation (FAO, 2018).

Food and agriculture are key to achieving the full set of Sustainable Development Goals (SDGs), and many of them are directly relevant to fisheries and aquaculture, especially SDG 14, which emphasizes conserving and sustainably use the oceans, seas and marine resources for sustainable development (FAO, 2018) and food for the population.

Bivalve mollusks (oysters, mussels, clams, scallops and others, such as Ecuador's brown shell) constitute an important part of world fisheries production (FAO, 2006). Mollusks, mainly bivalves, constitute the third most important group of marine organisms, after shrimp and fish (FAO, 2007). Among the bivalve mollusks is the Anadara tuberculosa (Sowerby, 1833) (Arcidae) known in the Republic of Ecuador with the common name "Concha Prieta" (CP) or "Concha Hembra" which is associated and inhabits the mangrove ecosystem and is specifically associated to Red mangrove Rhizophora mangle Linnaeus, in the intertidal zone, where it lives buried in the mud around its roots. It is distributed only in the eastern Pacific from the Guaymas coasts, from Baja California to southern Mexico to the Bay of Tumbes, Peru (Keen, 1971), passing through Ecuador, Peru, Colombia, Panama, Costa Rica, Nicaragua, Honduras, El Salvador, and Guatemala, extending about 6,350 kilometers (Lazarich Gener, 2009).

This symbiosis between the mangrove ecosystem, the mangrove tree species, the Anadara tuberculosa and other species of economic, ecological and nutritional value, such as the red crab (Ucides occidentalis), the mica or male shell (Anadara similis) and the Pata de Mula shell (Anadara grandis), among others represents a relevant fact that amply justifies the present study since the sustainable and competitive production of Anadara tuberculosa constitutes a way of preserving this biodiverse ecosystem, producer of O2, captor of CO2 emissions, and one of the main depositories of the denominated blue carbon.

The first European explorers were surprised when they arrived in tropical America in the 16th century and saw "forests in the sea". From these trees, the natives harvested "oysters". Now in the 21st century, mangroves have a vital function: they are an important shield against climate change (Heredero, 2011). However, in spite of the important functions that the mangrove ecosystem has, in Ecuador in the last 40 years more than 70% of the mangrove surface has been lost (Figure 1) due to urban growth, the development of tourist infrastructure and the aquaculture (shrimp farms). However, it is estimated that there are still more than 156,000 hectares of mangrove swamps (Heifer Ecuador Foundation, 2018).

Figure 1. Shrimp pools and mangrove area in the Jambelí archipelago.

Accessible in: https://www.google.com/maps/@-3.3277322,-80.1396236,17861m/data=!3m1!1e3

However, according to FAO (2018), world fisheries production peaked at approximately 171 million tonnes in 2016, of which capture fishing production was 90.9 million tonnes in 2016. This figure represents only 53.15% of the world's total (Figure 2). In this sense, it should be noted that the production of capture fishing has reached a ceiling that has stabilized at this maximum figure since the late 1980s. However, between 1961 and 2016, the average annual increase in world consumption of edible fish was 3.2%, which exceeded population growth, which reached 1.6%. In per capita terms, consumption of edible fish increased from 9.0 kg in 1961 to 20.2 kg in 2015, at an average rate of approximately 1.5% per year.
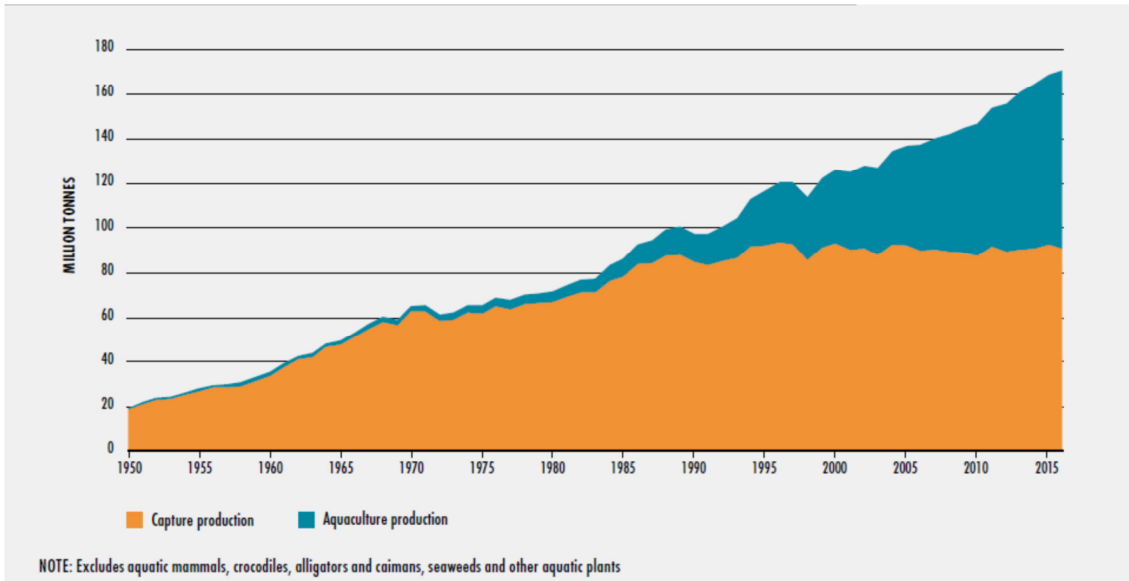
Figure 2. World production of capture fisheries and aquaculture

Source: FAO (2018)

In the particular case of the production of capture fisheries by groups of mollusks, it began to decrease since the early 1980s, such as oysters and clams at the end of that decade, as well as mussels in the early 1990s. Negative trends in catches of marine bivalve species could be a consequence of pollution and degradation of marine environments, as well as the circumstances that favor aquaculture production of some of these species (FAO, 2018).

The aforementioned figures show how world consumption of fish and shellfish has increased in recent years, up to an apparent per capita consumption of 20.3 kg for 2016 (FAO, 2018), but the catch figures remain stable at a ceiling with a tendency to decrease in some particular cases of species of bivalve mollusks, which generates a deficit that is growing, stimulating the overexploitation of fishery resources in different regions of the planet, causing environmental damage, reduced production and loss of competitiveness in the fishing activity, as well as deterioration in the quality of life and poverty of the fishermen.

In this same order of ideas, just as a maximum has been reported in the global fishing catch, particularly in bivalve mollusks, a maximum in the catch has also been reported in the case of the Anadara tuberculosa in the archipelago of Jambelí, province of El Oro, Ecuador, locality object of the present research (Figure 3).
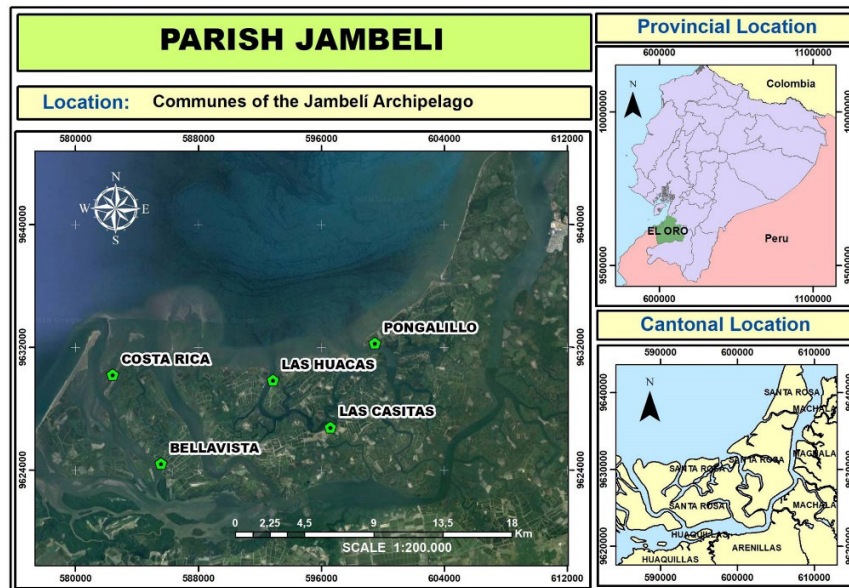
Figure 3. Study Area: Jambelí Archipelago, El Oro Province, Ecuador.
Source: Authors

In this sense, it is important to note that the Jambelí archipelago represents one of the most relevant shell capture areas in the Republic of Ecuador for its landing volumes (Zambrano et al., 2017). In 2011, a total catch was estimated, in the main landing ports of the Ecuadorian coast, of the order of 30 million individuals, of which approximately 40% were extracted in the Jambelí archipelago (Mora et al., 2012), which indicates that this area has some relevant characteristics for the study of the production chain of Anadara tuberculosa (PCAT).

On the other hand, according to the report of the National Institute of Fisheries of Ecuador (INP 2018) of the month of May of the year 2018, on the fishing monitoring of the shell resource, it was determined that 50% of the measured specimens were below 45 mm LT. This size is the minimum that allows each specimen to have reproduced before being captured, which tends to guarantee that new generations of individuals can reproduce and then be captured for food, social and economic purposes. However, the fact that more than 50% of the control sample is less than 45 mm LT in size accounts for the degree of over-exploitation of the resource at the present time.

The data that indicates that 50% of the specimens measured were below 45 mm, is a signal that alerts about the serious process of deterioration of the agribusiness model of the Concha Prieta in the archipelago of Jambelí, Ecuador.

By virtue of the situation raised in this section and in other research carried out on the subject (Prado-Carpio et al., 2018a), (Prado-Carpio et al., 2018b) and (Prado-Carpio et al., 2019), a theoretical model has been formulated to characterize the main aspects of the Anadara tuberculosa business with a prospective approach, on the best scenarios for this important hydrobiological resource of the tropical American Pacific. This theoretical model (Figure 4) integrates the agribusiness management constructs as an independent variable and the construct performance of the Anadara tuberculosa value chain as a dependent variable.
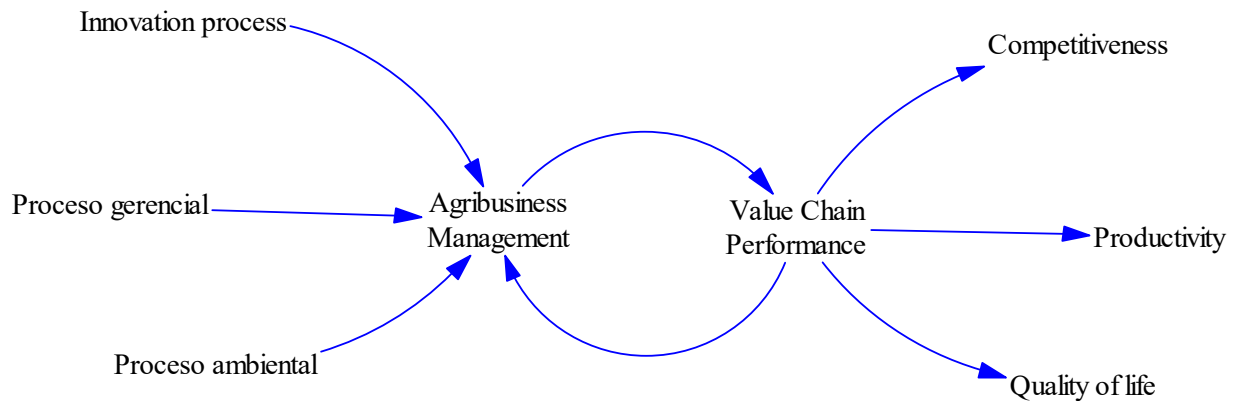
Figure 4. Theoretical Model of Relationships between Agribusiness Management and the Performance of the Concha Prieta Value Chain

Source: Authors

In turn, the agribusiness chain management construct is made up of the management process, the innovation process, and the environmental process dimensions. Two processes relevant to the present and future of the Concha Prieta business are added to the classic management process, such as the innovation processes and the environmental processes. The aim is to condense the best practices that the literature offers on these three dimensions and compare them with the way in which they are currently managed in the PCAT.

Similarly, the Anadara tuberculosa value chain performance evaluation construct has been made up of three dimensions. The first is the productivity dimension, which is a frequent way of evaluating the results of management processes. The other two are the competitiveness dimension that is geared more to business prospects and the quality of life dimension, aimed at understanding the benefits in living standards that the business generates for those who work and manage it daily.

For all of the above, the objective of this research is to characterize the management of agribusiness and the performance of the value chain in the production of the Anadara tuberculosa, which represents the first stage of a more extensive investigation into the agribusiness management and the performance of the Anadara tuberculosa value chain.

2. RESEARCH METHODOLOGY

The applied descriptive methodology was quantitative (Tamayo, 2014); its design was non-experimental, field, transversal and ex post facto (Sabino, 1992 and Hernández, 2004).

The population under study was 886 individuals, made up of the strata of shell workers, shell managers, merchants and restaurants of the CaPAT that are located in the Jambelí archipelago, in the province of El Oro, Ecuador, in the period of the month from January to October 2019. The type of sampling used was of the probabilistic, random and stratified type.

The sample size was estimated at 222 informants, using the formula proposed by Martínez (2005), which is as follows:

$$n = \frac{PQ}{\left(\frac{E}{Z}\right)^2 + \frac{PQ}{N}}$$

Where:
P: Probability of success (50%)
Q: Probability of failure (50%)
Z: Value of the standardized normal table associated with a 90% confidence level (1.65)
E: Maximum admissible error (4.8%)
N: Population size (886)

For the collection of information, four similar questionnaires were designed, validated (expert opinion) and applied to each link in the production chain: 138 shell gatherers, 12 executive managers, 27 merchants, and 45 restaurant-cevicherías, which served to measure the variables agribusiness management (independent) and performance of the value chain (dependent), their respective dimensions and indicators. The structured interview or survey method was applied to collect information.

The variable agribusiness management had three dimensions: management processes, innovative processes, and environmental processes. The performance construct of the Anadara tuberculosa value chain also had 3 dimensions: productivity, competitiveness, and quality of life. Each of these with its subdimensions and indicators.

The questionnaire was structured by a classification section and another of the variables under study themselves. The predominant measurement scale was the Likert scale with values from 1 to 5, representing the value of 1 "never", the value of 2 "almost never", the value of 3 "sometimes", the value of 4 "almost always" and the value of 5 "always", but also multiple scales and open questions for quantitative indicators.

The data recorded in the questionnaires were statistically processed with the SPSS software through univariate tests, according to the specific objective of this research.

3. RESULTS AND DISCUSSION

The results presented and analyzed below are ordered on the basis of the classification variables in the first place. Secondly, the descriptive results of the variable agribusiness management and its dimensions administrative processes, managerial processes and environmental processes are presented. Third, the construct performance of the value chain with its dimensions productivity, competitiveness, and quality of life of PCAT workers are presented and analyzed.

3.1. Classification Indicators

The classification indicators studied in this research were geographic location, business experience, gender, age, education level, and association with any organization related to the business of the Anadara tuberculosa.

Regarding the geographical location, 10 relevant sectors were found, which were: Costa Rica, Las Casitas, Las Huascas, Pongalillo, Bella Vista, Arenillas, Santa Rosa, Huaquillas, Machala and Pasaje; Machala reached the highest frequency with 16.7%. Likewise, it was determined that 42.5% of the sample had 13 to 23 years of experience in the Anadara tuberculosa business, the male sex being predominant with 81.7% of the interviewees, with an

average age of the interviewees in the range of 42.5 ± 12.8% years, a more frequent degree of complete primary education of 48.6%, and 63.2% belonging to associations as shown in Table 1.

Table 1. Classification indicators of the Anadara tuberculosa production chain

Indicator	Description	Unit	Value
Island, commune or district	Machala	%	16.7
Years of experience in the business	13 to 23	%	42.5
Gender	Male	%	81.7
Age	Average	years	42.5
Level of education	Complete primary education	%	48.6
Belonging to some association	Yes	%	63.2

Source: Authors

These results allow us to infer that the value chain of the Anadara tuberculosa has a wide geographical deployment in the Jambelí archipelago since it is located in at least 10 sectors, that those who participate in the business have significant experience, most of them with more than 10 years, who are in productive age and have a generation of relief when 22.52% have less than 35 years of age. Likewise, it was evidenced that 48.6% have a complete primary education and that only 17.3% did not complete their primary, which is indicative that more than 80% know how to read, write and perform basic mathematical operations. Finally, it was obtained as a result that the vast majority belong to socio-productive organizations, with this value being more pronounced in the link of shell gatherers with 86.9% and direct managers with 100%. This means that shell organizations are fundamental institutions for the development of any type of policy and actions for the development of the business of Anadara tuberculosa, in administrative, innovative, environmental, productive, competitive, and quality of life terms.

3.2. Agribusiness Management Construct

The agribusiness management construct was made up of the managerial process, innovation process, and environmental processes dimensions. The results of the perception of the members of the value chain of Anadara tuberculosa of the population under study, for each of the dimensions, subdimensions, and indicators, will be presented and analyzed sequentially below.

3.2.1. Management Process Dimension

The managerial process is configured by the subdimensions of planning, direction, execution, and evaluation, with its different indicators as shown in Figure 5.
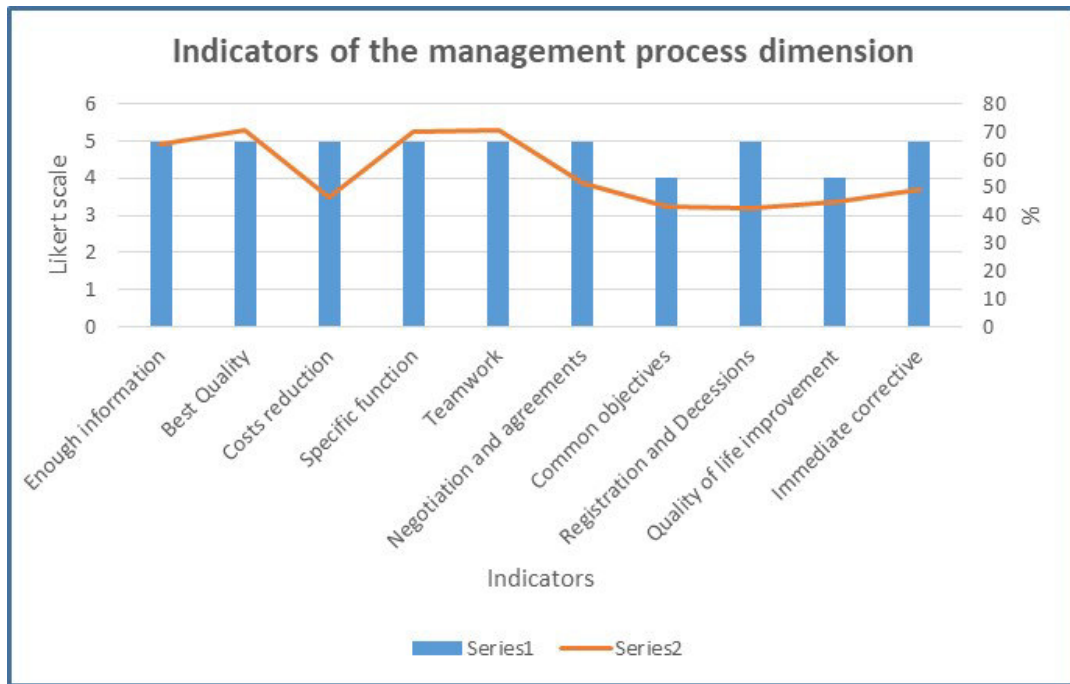
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Figure 5. Indicators of the management process dimension in the *Anadara tuberculosa* agribusiness

Source: Authors

In the planning sub-dimension, information management and strategy indicators were investigated, reaching the maximum values of 5 (Series 1), according to the Likert scale used in this research, which means that in the production chain, there is sufficient information to achieve what is proposed in the Anadara tuberculosa business, in this case in a proportion of 65.6% (Series 2), for example in aspects related to costs, prices, environment, tides, markets, logistics, work to be done, time spent and others.

Regarding the strategy indicator in which aspects related to quality and costs were probed, a value of 5 was obtained, which means that in the PCAT, the best levels of quality in the collection activity are aimed at, for example dealing with fresh, classified, uniform, clean and sanitary apt products. The control and reduction of cost is always relevant, keeping records of income and expenses, avoiding doing double work and double-spending, using the time and fair resources necessary for the process, among other related aspects. However, it should be noted that there is a considerable difference in favor of the higher quality levels that reached a value of 70.6%, higher than the 64.8% achieved by the cost reduction strategy. This allows us to infer that there is greater interest in the quality issue in relation to the cost issue in the PCAT.

In the management sub-dimension, the indicators of functions and coordination were investigated. Both reached the value of 5 on the Likert scale (Series 1), which means that the participants in the PCAT always fulfill a specific function, in the activities related to the production chain, which they know perfectly, such as collection, transportation, sorting, trading, cleaning, and others. Likewise, the work is always coordinated from start to finish, with an acceptance percentage in both cases of 70.1% and 70.6% (Series 2) respectively.

In the execution sub-dimension, the negotiation and harmonization indicators were explored, obtaining in the case of the negotiation indicator a value of 5, which means that the execution of tasks in the CP activity is always carried out in agreement between the parties involved, among which gatherers, merchants, associations, clients, suppliers, and others stand out, in a proportion of 51.6% (Series 2). For the harmonization indicator, a value of 4 was obtained according to the Likert scale (Series 1), which means that almost always the objectives and interests of the respondents are adequately related to those of the rest of the participants in the activity of the CP. Such is the case

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of buyers, sellers, suppliers, associations, clients, the State and others, in a proportion of 43.2%. These results allow us to infer that when negotiations are carried out in PCAT, there is a moderate tendency for the actors to always agree. Likewise, that the interests between the different links and actors of PCAT can almost always be harmonized with a moderate to low trend. Therefore, it can be pointed out that although there are important levels of negotiation in harmony of the actors, these levels of negotiation in harmony are not always reached.

For the evaluation sub-dimension, the registration, results, and correction indicators were inquired, for these three indicators the values of 5, 4 and 5 respectively were obtained, according to the Likert scale (Series 1), which means for the In the case of the registry indicator, the data it records is always used to know the business situation and make decisions in a proportion of 42.7% (Series 2), and in the case of the correction indicator, whenever something does not go as planned, corrections are made immediately, in a proportion of 49.1%, which indicates that there is a moderate tendency to use the registers and make corrections by the actors in the PCAT. Regarding the results indicator, it was obtained that the participants in the PCAT perceive that they have almost always improved their quality of life as a final result of their activity in the Concha Prieta business, in a proportion of 44.7%. These results allow us to infer that the actors in the PCAT always use them to correct the aspects that correspond in a moderate proportion. Likewise, they perceive that their standard of living has almost always improved as a result of the activity of the Concha Prieta in a moderate proportion, that is, that there is a significant proportion of actors that are not achieving the expected results.

Regarding the target-goal indicator of shells handled daily in the different links or groups that make up the Anadara tuberculosa production chain, it was obtained as a result that the group of shell managers is the one that manages the largest number of shells daily with an average of 6,404 shells (Figure 6), which is indicative of the predominance at least in terms of shells planned and managed daily in the said production chain, which is equivalent to 21.6 times more than collectors; 15.9 times more than restaurants and 4.9 times more than merchants.
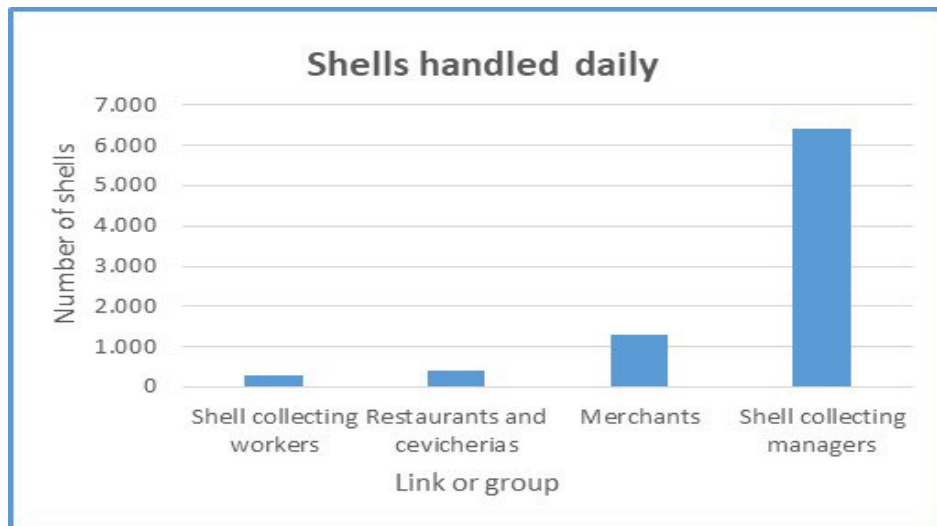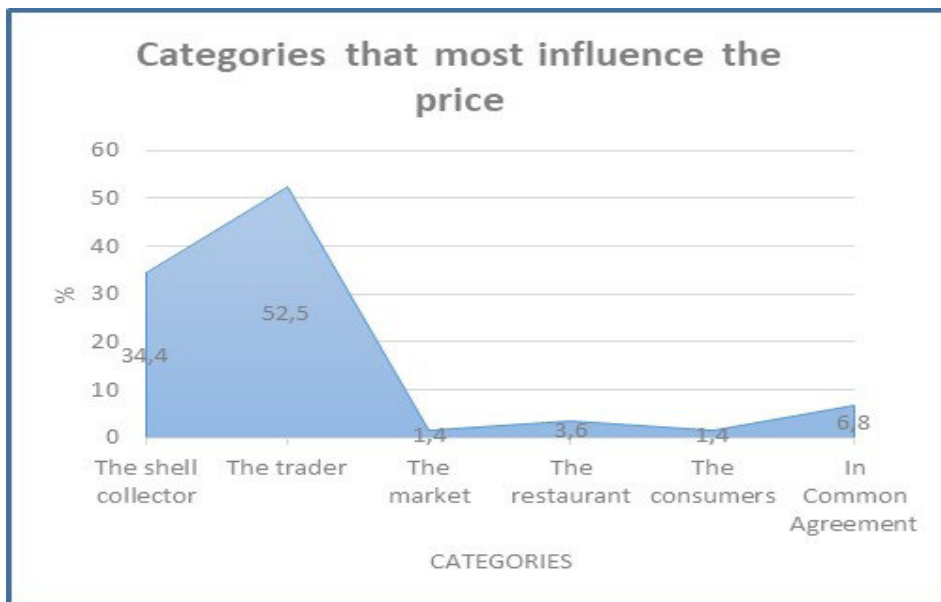

Figure 6. Average number of shells handled daily by each actor in each link of the Anadara Tuberculosa production chain

Source: Authors

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In this sense, it should be noted that the shell workers' associations for the most part do not participate in the shell trade, since they are mainly dedicated to managing the mangrove area concessions that have been granted by the government, for the preservation of the mangrove and the sustainable use of mangrove natural resources, such as Anadara tuberculosa.

All these results obtained in the managerial process dimension allow us to deduce that the links and actors of the PCAT present satisfactory levels in the managerial processes, which have been empirically developed on the basis of routines that have been learned by imitation of generation in generation since the shell business is an ancestral activity. Two aspects to highlight are, on the one hand, that the negotiations are not always harmonious between the actors and, on the other hand, that their quality of life levels have not always improved as a result of the shell gathering activity. Likewise, that the goals for the amount of management of the Concha Prieta have been established, with the group with the highest management goal being that of the associations of shellfish gatherers or shell managers, although many of them do not participate directly in the purchase-sale transactions of the shell.

In this sense, it should be noted that the shell workers' associations, for the most part, do not participate in the shell trade, since they are mainly dedicated to managing the mangrove area concessions that have been granted by the government, for the preservation of the mangrove and the sustainable use of mangrove natural resources, such as Andara tuberculosa.


Figure 7. Categories that most influence the setting of the shell price

Source: Authors

Finally, in this dimension on management processes in the negotiation indicator, the perception of which category of actors had the greatest influence in setting the price of the PC was explored, showing that the merchant link is the one that has the greatest influence with a 52.5% of the observed trend, followed by the category of shellfish with 34.4%. From this, it can be inferred with more than 86% that the price of the shell is established in a relationship of power between shellfish collectors and merchants based on the supply and demand of the market in the Jambelí area and its national and international environment. The categories of restaurants, consumers, market and common agreement are relegated to a very low level.

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3.2.2. Innovation Process Dimension

The innovation process dimension in agribusiness management is made up of the product innovation, process innovation, internal factors, and external factors subdimensions, with their different indicators (Figure 8).
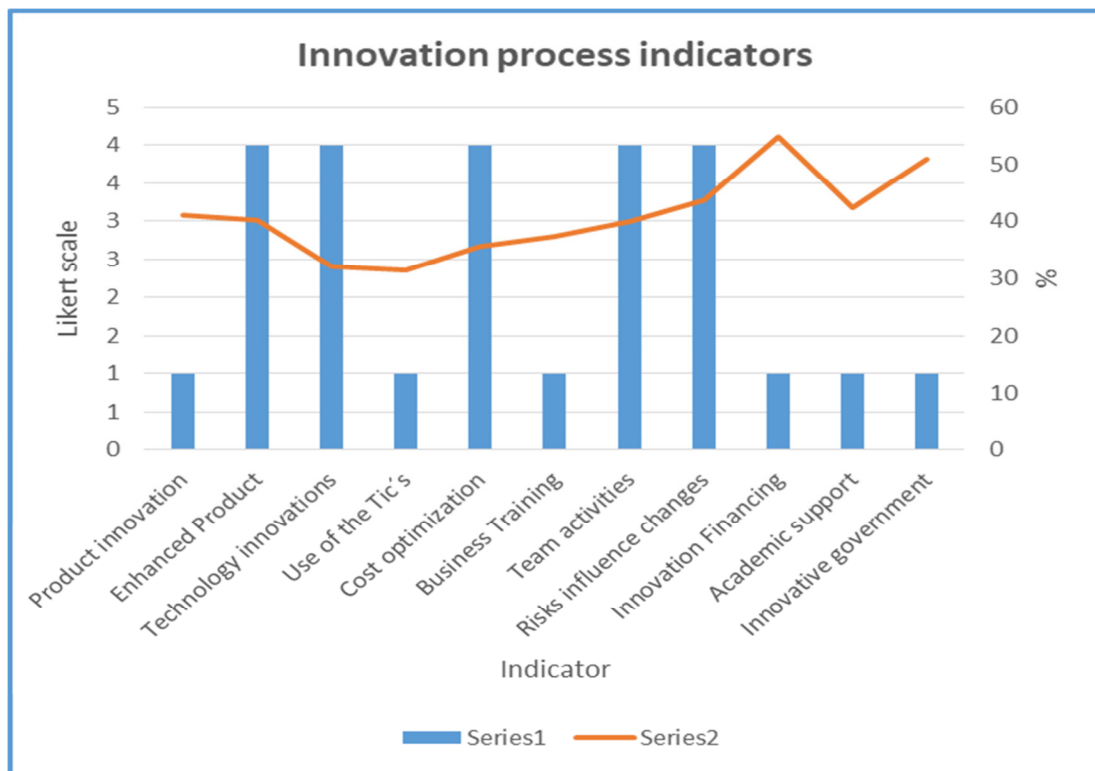
Figure 8. Indicators of the innovation process dimension in the agribusiness management of the Anadara tuberculosa

Source: Authors

In the product innovation sub-dimension, the new product and improved product indicators were evaluated, the new product indicator reaching a value of 1 in the Likert scale (Series 1), with a moderate trend of 41.1%, which means that there has never been made some innovation in the Concha Prieta product. In relation to the improved product indicator, it reached a value of 4, which is interpreted to mean that the Concha Prieta has almost always been offered to customers with some added value higher than that offered by its competitors in a moderate trend of 40.2%, which as a whole represents 82.6% of PCAT actors who have never, almost, sometimes, and almost always added value or made improvements to the Concha Prieta product. These facts are indicative of the low levels of innovation in this ancestral sector.

In the process innovation sub-dimension, work methods, computer systems, and cost optimization indicators were investigated, reaching a value of 4, 1, and 4 on the Likert scale (Series 1) with a trend of 32.0%, 31.4%, and 35.5%.

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This can be interpreted in the sense that almost always technical innovations have been made in the way of working the Concha Prieta, such as in aquaculture techniques, selection, mangrove preservation, job security and others. Likewise, that almost never have computers, mobile phones, the Internet and social networks been used to innovate in the activities of the CP and finally, that almost always improvements have been made in their work that allow them to reduce costs in the activities of the production chain. All this is indicative that the innovations in the PCAT are carried out mainly in the technical aspects of capture, commercialization, and preparation, as well as in reducing costs, but not in the incorporation of information and communication technologies (ICTs).

In the internal factors sub-dimension, the indicators human factor, organizational factor, and business-market relationship were investigated, obtaining as a result that the participants in the PCAT have never been trained to undertake in a particular way or associated their own business, related to the CP, in a moderate to low proportion of 37.3%, but representing more than 70.0% the options of never, almost never and sometimes for this indicator. Likewise, it was obtained as a result of the organizational factor indicator that almost always the new activities of the PC are carried out as a team among the interested parties in a moderate proportion of 40%. Also, that almost always the risks in the business of the Concha Prieta influence a proportion of 43.6% (Series 2) on its changes, such as tides, insecurity, market fluctuations, price, seasonality, and others. From this, it is inferred that it is the collective innovations on the one hand and the circumstances of risks to the business on the other that most influence the internal innovation processes in the PCAT.

Finally, the external processes sub-dimension inquired about the indicators of financing and fiscal incentives, academic cooperation and also related to public innovation policies, obtaining as a result for the three indicators the value of 1 on the Likert scale (Series 1), which means that they have never received any type of financing or benefit for developing innovations in their CP activity in a moderate to high proportion of 54.8%; that they have never received scientific or technical advice or aid from universities and research centers in a moderate to low proportion of 42.3% and that the government has never encouraged innovations in production techniques, the way of doing business and working in relation to CP, in a moderate proportion of 50.9%; from which it can be inferred that the PCAT maintains its traditional operations and develops few innovations despite being a sector that suffers from the lack of support from financial, scientific and public policy institutions in general, by virtue of which the maintenance of this socio-productive activity achieves a higher value even in conditions of indifference by key organizations in the production process.

All of which allows us to infer that the few innovations are concentrated on work techniques on the one hand and cost reduction on the other, in order to achieve an improved and competitive product.

3.2.3. Environmental Process Dimension

The environmental process dimension is made up of the indicators leadership, support, operation, performance evaluation and improvement (Figure 9).
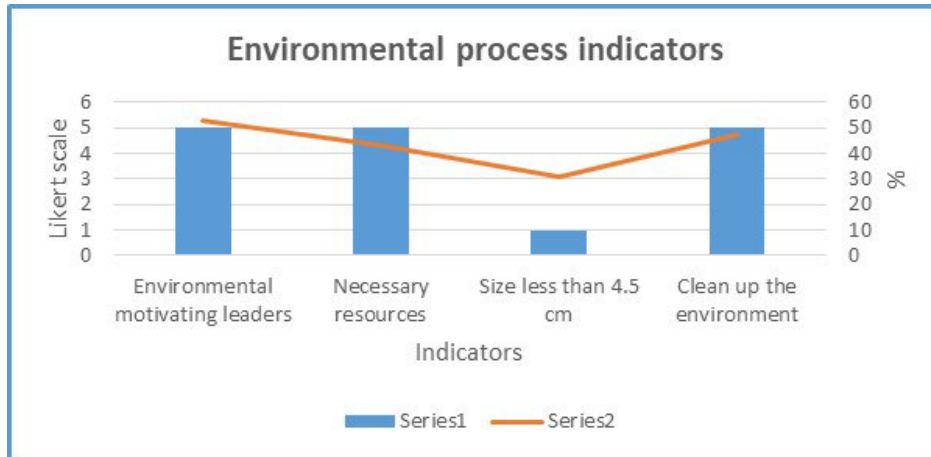
Figure 94. Indicators of the environmental process dimension in the agribusiness management of the Anadara tuberculosa

Source: Authors

The results obtained in the leadership, support and improvement indicators reached 5 on the Likert scale (Series 1), which means in the leadership indicator that leaders always motivate the community about environmental care in the shellfish activity with a moderate tendency 52.7% (Series 2). In the support indicator, it means that in the shellfish activity there are always the necessary resources to carry out environmental care in a moderate to low proportion of 43.3% and in the improvement indicator it means that activities are carried out to clean up the environment, such as reforestation, seeding of shells, control of physical, chemical and biological contaminants, not negotiating shells of less than the allowed size, purifying, disinfecting shells and other practices, in a proportion of 47.5%. These results allow us to infer that among the actors of the PCAT and in the links that comprise it, there is an important level of sensitivity to environmental processes in the management of agribusiness in the Concha Prieta.
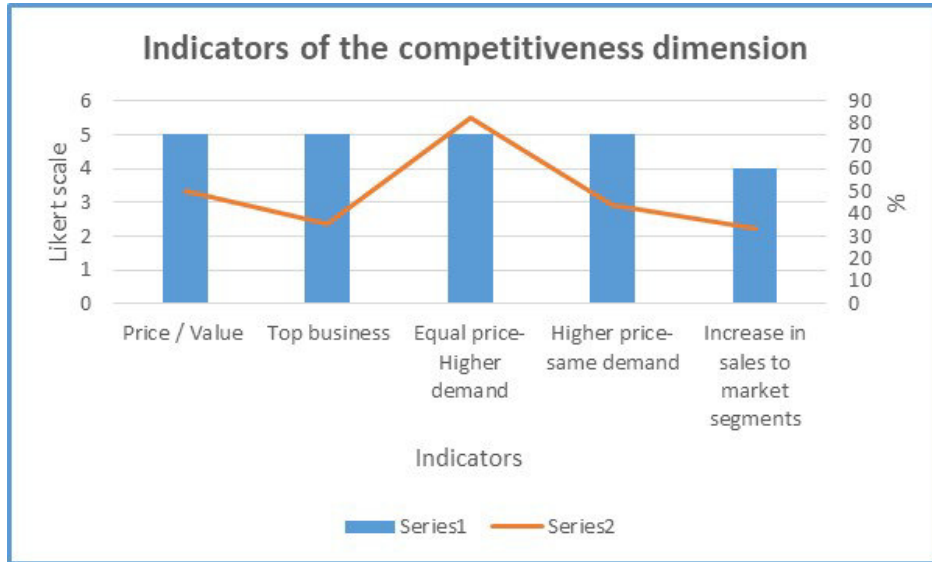
However, in the performance evaluation indicator, a value of 1 was obtained on the Likert scale (Series 1), which means that the proportion of shellfish that is managed with a size less than 4.5 cm has never decreased in a low proportion of 31.0%, inferring, therefore, that it is stagnant or that the number and proportion of shells that are handled with a size less than 4.5 cm not allowed in Ecuadorian legislation is increasing. This trend is negative in the shellfish business, evidencing a contradiction between the levels of awareness and management in environmental processes and the results that are actually being obtained, which make them vulnerable. This corresponds to the results obtained in the operations indicator in which it was inquired about the percentage of shellfish that the interviewees handled with a size less than 4.5 cm, in which 47.9% answered that 0%, which implies that more than 50% of the participants in the P business work with specimens of sizes prohibited in the legislation and also scientifically verified as an indicator of overexploitation of the resource.

3.3. Value Chain Performance Construct of the Anadara Tuberculosa

The dimensions, subdimensions, and indicators of the performance construct of the Anadara tuberculosa value chain, whose dimensions are competitiveness, productivity, and quality of life, are presented and analyzed sequentially below.

3.3.1. Competitiveness dimension

The competitiveness dimension is made up of the leadership dimensions in costs, differentiated product, and market segment, through its different indicators (Figure 10).

Figure 10. Indicators of the competitiveness dimension in the performance of the Anadara tuberculosa value chain

Source: Authors

The cost leadership subdimension was evaluated through the minimum cost indicators and the standard quality-cost ratio. In the standard quality-cost indicator, a value of 5 was obtained on the Likert scale (Series 1), in a moderate proportion of 49.8%, which means that customers of the Concha Prieta business prefer this food, its favorable relationship between quality and low cost, which is indicative of a favorable price-value ratio. On the other hand, the trend in costs of the different links and actors of the PCAT was investigated, evidencing a trend to increase costs with 50.5%, slightly higher than the 46.4%, indicating that costs have remained the same in recent times, but only 3.2% indicate that costs have decreased. However, when possible sources for cost reduction were investigated, it was found that 67.7% of those who interact in the PCAT expect to reduce unit costs through increased production in the shellfish business (Figure 11), leaving in a secondary position other options such as the use of new technologies and production processes, preferential access to Concha Prieta (raw material), highly organized and routine business activities (optimization of organizational systems) and better geographic location.
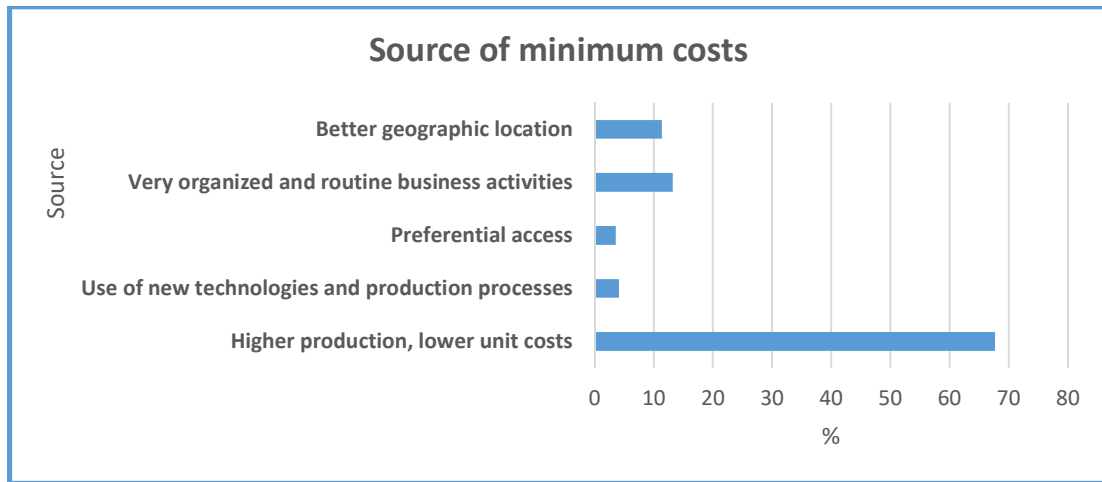
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Source of minimum costs

Figure 51. Source of minimum costs

Source: Authors

In the differentiated product sub-dimension in the competitiveness dimension (Figure 10), the indicators of competition, demand-price, and price-distinction were explored. In these three indicators, a value of 5 was obtained on the Likert scale, which is interpreted for the competition indicator as the perception that the business of the Concha Prieta is always superior to that of other species of the sea with the exception of shrimp in a moderate to low proportion of 35.6%. In the demand-price indicator, it means that at the same price, this shellfish will always be more demanded than other shell species such as the mule-leg shell, the male shell, and others, in a very high proportion of 82.3%. And in relation to the distinction-price indicator, the result indicates that the different characteristics of the Concha Prieta in relation to the competition, allows its sale at a higher price, in a moderate to low ratio of 43.6%. The results obtained in the differentiated product sub-dimension allow us to infer that the Concha Prieta has very specific characteristics and qualities that place it as a unique and demanded food product.

Finally, in the market segment sub-dimension, a value of 4 on the Likert scale was obtained as a result for the potential market indicator, which means that sales to specific market segments have almost always increased, for example by tourist market, in a moderate to low proportion of 33.6%, data to which it can be added that the value of 1 in this market segmentation indicator reached a proportion of 27.7%, the second largest. This allows us to infer that although the Concha Prieta has very specific and attractive commercial and food attributes that allow it to achieve a better price in the market, this is not being properly managed from the point of view of market segmentation.

3.3.2. Productivity Dimension

The productivity dimension is made up of the indicators of physical productivity and economic productivity.

The physical productivity indicators investigated whether production is sufficient to satisfy customer demands, reaching a value of 4 on the Likert scale, which means that it is almost always satisfied in a moderate to low proportion of 41.8%, which is indicative of the need to increase production to fully satisfy existing demand.

Likewise, we examined what is related to the average number of shells that each of the main groups or links that intervene in the PCAT handles daily (Table 2). In this sense, it was verified that the group of shellfish associations and their managers are the ones that handle the largest number of shells daily, with 5,283 shells, but at the same time, they are the group whose compliance with productivity goals is lower with 82.5 % of shells actually collected,

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in relation to the number of shells that were planned to be collected. In this regard, we can highlight the group of merchants, who reached the proposed goal and exceeded it with an achievement value of 143.8%.

Table 2. Number of shells handled daily by links or groups in the production line of Anadara tuberculosa

Link / Group	Unit	Planned quantity	Quantity achieved	Achievement %
Shellfish collectors	Shells/day	296	295	99.6
Restaurants	Shells/day	402	383	95.2
Traders	Shells/day	1294	1,861	143.8
Managers of shell collectors	Shells/day	6404	5,283	82.5

Source: Authors

Likewise, in order to estimate the number of shells each group handles per year, it was investigated how many days per week it works, reaching the result of 5.55 days per week, which multiplied by 52.14 weeks per year would give an annual average total for the group of shell workers of 85,271 shells/year, for the restaurant group 110,703 shells/year, for the group of merchants 538,563 shells/year and for the group of shellfish associations and their managers 1,528,875 shells/year.

In this research, economic productivity indicators were also inquired, being the first item consulted if the income from the sale of Concha Prieta has been increasing in recent times, obtaining the result of 5 on the Likert scale, which means that the members of the production chain have always experienced improvements in their income in a moderate to low proportion of 35.4%, which is noteworthy as an aspect in favor of the shellfish business, even though a proportion of 23.1% experience that their income has almost never increased (value 2 on the Likert Scale).

Regarding the size of shell sold, it was obtained as a result that 50.7% of its participants and actors sell it in mixed sizes and 34.1% sell it in large sizes (Table 3), being the result of selling small shells very low. However, in the market, a large number of shells with sizes below the allowed size are observed, which are most likely covered in the category of mixed shells.

Table 3. Size and price of the Anadara tuberculosa shells for sale

Size of shells sold	%	Price of 100 shells (US$)	Price per unit (US$)
Only large	34.1	13.60	0.14
Only medium	2.9	11.81	0.12
Only small	0.7	7.33	0.07
Mixed sizes	50.7	12.12	0.12
Only large and medium	11.6	NA	NA
Total	**100**	**NA**	**NA**

Source: Authors   NA: Does not apply

In this same sense, it was obtained as a result that the average price of the Concha Prieta within the PCAT is 0.14 USD/shell if they are large, 0.12 USD/shell if they are medium, and 0.07 USD/shell if their size is small and $ 0.12/shell if the shell size is mixed.

Likewise, in the economic indicator, it was explored, on what percentage of its income does the activity of Anadara tuberculosa represent for the different actors and participants that intervene in its production chain, reaching an average of 65.12%, which shows that those who participate in the PCAT obtain their main income from the Concha Prieta, mainly the shell workers, who reach the average value of 78.5%, much higher than the 30.4% reached by the restaurants. In total, 24% of those who work at PCAT obtain 100% of their income from the Concha Prieta business.

3.3.3. Quality of life dimension

The quality of life dimension is made up of the sub-dimensions of housing quality, overcrowding, drinking water supply, excreta disposal system, children's schooling and finally, in relation to the interviewee, their possible income level (Table 4).

Table 4. Indicators of the quality of life dimension in the performance of the Anadara tuberculosa value chain

Subdimension	Indicator	Category	Unit	Value
Housing quality	Roof	Zinc	%	73.4
Overcrowding	Average	Spaces	Ambients	4.75
Overcrowding	Average	Residents	Persons	4.42
Overcrowding	Average	Residents/Spaces	Persons/Spaces	0.93
Potable water	Supply System	Water by pipe	%	94.5
Excreta	Sanitary Services	Sewers	%	41.7
Excreta	Sanitary Services	Cesspool	%	37.2
Schooling	Children aged 7-12 at home	Yes	%	50.2
Schooling	These children attend school	Yes	%	87.4
Income	Average	Age	Years	42.75
Income	Educational level	Complete primary education	%	48.6

Source: Authors

In the housing quality subdimension, a survey was made on the type of roof that the PCAT participant's home has. Among the options consulted are earthenware, eternit, zinc, concrete roof, and mixed-materials roof, being the obtained result that 73.4% of those consulted have a zinc roof in their house, which is indicative of an intermediate quality of life within the urban context of the area where the study was carried out.

Likewise, in the overcrowding subdimension, it was obtained as a result that in the homes of those who participate in the PCAT there is an average of 4.5 spaces, which includes a kitchen, laundry room, living room, bathrooms, and bedrooms. This result is related to the number of 4.42 inhabitants in the dwelling, for an overcrowding index of 0.93, which means that there are 0.93 inhabitants per room, an adequate and favorable result, considering the area under study.

For the drinking water supply subdimension, the options for piped or potable water, cisterns, large bottles or basins, and desalination plant were consulted, reaching the highest level the category of piped water with 94.5%, which it is indicative of excellent coverage of the drinking water service to the homes of PCAT participants.

In the excreta disposal system subdimension, values of 41.7% for sewage services and of 37.2% for blind or septic well sanitary services were obtained, which are indicative of the intermediate level coverage reached by health services in the area under study, where the PCAT is located.

In the case of the subdimension of children's education, two indicators were investigated, the first related to the presence of children from 7 to 12 years old in the home of the PCAT participant, the result of which was that 50.2% of the households have school-age children, of which 87.4% attend school. Both indicators reached intermediate levels when only about half of the households of the participants in the Concha Prieta production chain and of these households less than 90% go to school, with the optimal value being greater than 95%.

Finally, in the income subdimension, an extrapolation is made, based on the educational level and age of the PCAT participants, reaching these indicators the values of 42.75 years and complete primary schooling in a proportion of 48.6%. These results are indicative of youth, maturity and basic educational levels for the generation of the income necessary for family support.

If an integration of the results obtained in the quality of life dimension is made (Figure 12), it is obtained that 49.5% of the participants in the PCAT have their basic needs quite satisfied and 39.2% have their basic needs moderately satisfied, which is indicative that those who participate in PCAT experience moderate to high levels of quality of life as a result of the performance of the value chain of the Concha Prieta business, which represents a desirable result, which may be improved, through advancements in the agribusiness management model under study.
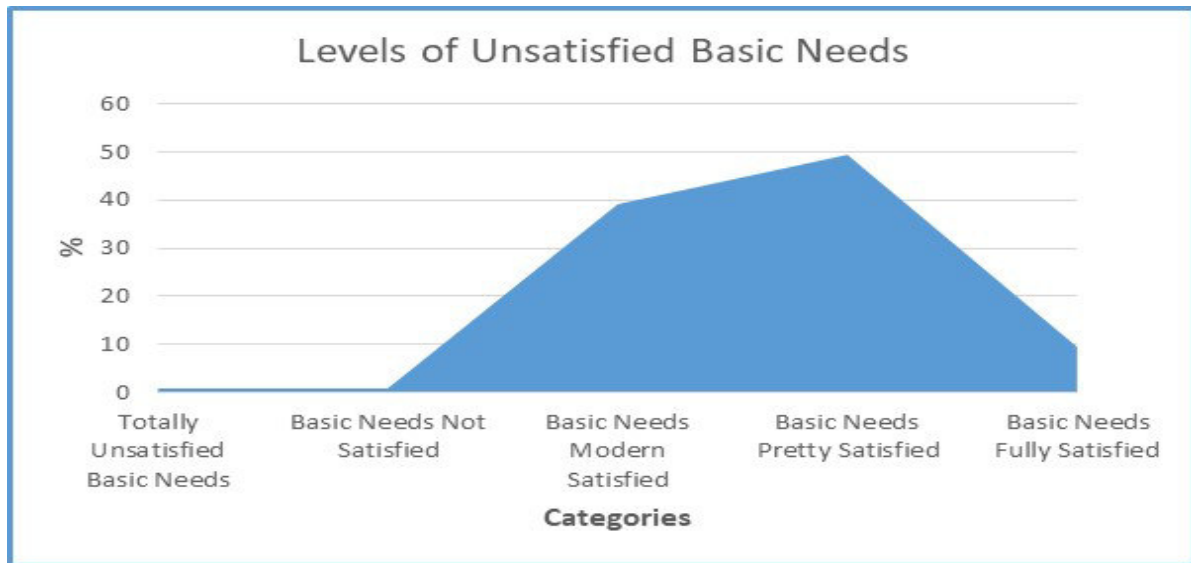

Figure 12. Surface graph of the Levels of Unsatisfied Basic Needs in the Performance of the Anadara tuberculosa Value Chain

Source: Authors

4. CONCLUSIONS AND RECOMMENDATIONS

In correspondence with the objective set forth in this research, which is to characterize the management of agribusiness and the performance of the value chain in the production of the black shell (Anadara tuberculosa) and as a consequence of the revision of the state of the art, the application of the proposed methodology and the analysis of the results achieved, the following conclusions have been reached:

1. Agribusiness management is characterized by being an unprofessional activity of shell collectors, entrepreneurs and owners of small restaurants, based on experience and routine, in which management processes achieve moderate to high levels of performance that keep the business operating, but with moderate to low levels of innovation, which make the business vulnerable to changes in the environment, as well as moderate to high levels of sensitivity in relation to the environmental dimension, but with poor results in the main environmental indicators.

2. The performance of the Anadara tuberculosa value chain is characterized by moderate to low levels of productivity, mainly because it is based on the sustainability capacity of the mangrove ecosystem whose surface has decreased and its degree of contamination has increased, as well as in mangrove management practices and the production of the shellfish, which have not been improved and adapted to changes in the environment. Likewise, the competitiveness dimension is characterized by moderate to high levels, mainly due to the qualities and characteristics of the mollusk, which make it a unique, practically irreplaceable product, with national and international demand greater than supply and is still increasing if it meets the minimum standards. The prices have been increasing, making it less competitive and displaced by the complementary offer of other similar items such as other types of shells or seafood. Finally, in the quality of life dimension, it is concluded that agribusiness management and the performance of the Anadara tuberculosa value chain allow those who participate in the business to live with moderate to high levels of satisfaction of their basic needs.

3. It is recommended to extend the analysis to determine how these characterized variables are related.

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