



PROSPECTIVE STUDY OF PROBABILISTIC SCENARIOS FOR THE PALM SECTOR IN THE MUNICIPALITY OF VILLANUEVA (CASANARE)

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ABSTRACT

The article presents results of probabilistic scenarios through the strategic prospective for the palm sector of the municipality of Villanueva (Casanare), seeking to mitigate future risks and improve decision-making, establishing scenarios with a high relative probability of occurrence, through the use of strategic tools such as scenario design and the use of MIC-MAC and SMIC PROB EXPERT software to identify the key variables that are appropriate for the sector under study, the involvement of actors and the analysis of hypotheses, in relation to the strategic objectives and key variables. This shows the 15 probabilistic scenarios obtained, from which the scenario or scenarios with the highest relative probability of occurrence are established, which accepts to prioritize the strategic objectives of the sector, basing the events that make up the scenario.

KEY WORDS: structural analysis, foresight, palm sector, probable scenarios, strategy

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INTRODUCTION

For the specific case of the palm sector in the municipality of Villanueva (Casanare) there are no prospective studies that allow it to project future and probable scenarios for the sector.

The present research project aims to study the possible future scenarios of the palm sector of the municipality under study and to propose an idea of the future of this sector, for a better benefit of the use of internal resources, a potentiation of its strengths, and a progress of its weaknesses to successfully face the changes of the sector. It is important for the sector to cope with the advances of globalization, so it is necessary to study various markets, in order to determine the most likely future.

THEORETICAL FOUNDATION

This theoretical framework aims to state in a general way the main concepts of Strategic Foresight.

Strategic foresight provides the necessary resources to conceive a desired future, as well as the real means to achieve it. This breaks the traditional planning schemes proposed by Mintzberg and Porter. They propose rigid designs to develop strategic plans, where it is not enough to analyze the market environments and look for the desired guidelines in the competition. One of the fathers of foresight, Gastón Berger proposes that "looking to the future transforms the present", this leads to seeing beyond, to look at the whole scenario, to model what you want and day by day make the right decisions and react to the circumstances without losing the desired direction, knowing in advance what can happen. (Castillo, Shcherbakov, 2013, pp. 2-3)

FUTUROLOGY

Foresight is considered within the branch of the science of futurology, it was developed in the fifties by Gaston Berger. It is grouped within futurology since it was referred to as a study of possible futures or futures. Prospective analysis requires certain strict guidelines and a rigorous methodology, since it should not be considered as a tool to predict or forecast the future, much less try to guess it.

The father of Foresight, Gaston Berger, leaves as a legacy the five elements of foresight, which are: "to have a broad, deep and long view; to think about man and take risks" (Godet, 2009). These elements invite us to look at the world where we live in a different way, to put aside stereotypes, to look at the past and look for the elements to build the future day by day in the present. This encourages us to look back, then glimpse the point on the horizon and expand our present to build the desired future.

Michel Godet emphasizes the concept of foresight in the following statement (Godet, 2009), "... it is undoubtedly a forecast (preactive and

proactive) that allows us to clarify present actions in the light of possible and desirable futures" (p.18).

Michel Godet's concept calls for foresight, that the future can be built based on the actions and decisions that are made in the present, it aims to see the present based on the future that is desired to be achieved. This directly invites us to be proactive entities.

From a static point of view, the future, which is the timeline that is to come, is surrounded by a series of events, trends and invariants. With a prospective stance, the future is presented as a range of possible futures, which are known as futurables (futures – possible). (Castillo Shcherbakov, 2013, pp. 18-19).

Foresight defines then, a reflection for action, we cannot predict the future but mitigate uncertainty [...]

These tools can be used in various fields, as long as the necessary conditions and resources are available for their implementation. Among these are:

- The Method of the Actors' Game [...]
- The Method of Analysis [...]
- Simulation Models [...]
- The Abacus of Regnier [...]
- Cross Impact Matrix [...]

With respect to Godet's Foresight, a chain of techniques is presented in different studies that are carried out, these are described below:

- Mactor Technique [...]
- Scenario Technique [...]
- Delphi Technique [...]
- Structural analysis technique or the Micmac Method [...]
- Smic and Prob-Expert Technique (Alarcón López et al., 2016, pp. 23-27)

STRATEGY

According to (Mintzberg, 1997), "A strategy is the plan or pattern to integrate the main policies and goals of an organization, and at the same time, determine a sequence related to the actions to be carried out" (p. 7).

By observing these approaches, a position is established where the strategy is determined as the set of actions and plans developed to achieve an objective. (Shcherbakov Castle, 2013, p. 22)

STRATEGIC FORESIGHT

The strategic foresight establishes a work scheme that includes three stages:

- a) Pre-prospective stage (posture): it constitutes a preparation prior to the analysis, where the individual must break certain paradigms that allow him to adopt a prospective posture.
- b) Prospective stage (analysis): includes prospective analysis, where its study is based on the elaboration of scenarios.
- c) Post-prospective stage (strategies): from the results obtained in the elaboration of scenarios, the desired one is chosen and the action plan to be followed is established.

For application in organizations we can describe five phases:

- a) Defining the problem and choosing the desired future
- b) Identification of key variables
- c) Hypothesis development (relationship between variables)
- d) Building Possible Futures
- e) Selection of strategy and action plans. (Shcherbakov Castle, 2013, pp. 24-25)

SCENARIOS

Michel Godet (2011) defines a scenario as: *"a hypothetical series of events constructed with a view to bringing to light causal sequences and decision knots"*. A scenario is a set advanced by the image of a future environment and by the series of events that allow us to move from the original situation to the future situation. However, in order for a scenario to be constituted, these hypotheses must meet five conditions simultaneously: relevance, coherence, plausibility, importance and transparency. Two main types of scenarios must be distinguished: exploratory scenarios, which are based on present and previous trends that lead to credible futures; and predictive ones, built from disjunctive images of the future and designed in a 'retroprojective' way. (Alarcón López et al., 2016, p. 29)

METHODOLOGY

This research proposes a descriptive and exploratory nature and a quantitative approach, allowing the research team to execute it through the use of techniques of information collection, analysis, tabulation and presentation of quantitative results in the research and thus allow us to respond to the problem.

Casanare is one of the 32 Departments of Colombia, located in the R. Study Area. In this research, the population will be made up of one of the 19 municipalities in the Department and the third municipality with the largest number of hectares of oil palm cultivation, Villanueva. Population or unit of analysis. For the research work, the population to be analyzed will be made up of all the actors that are part of the production chain of the palm sector, taking into account that; under its structure can be found: Suppliers of inputs, palm growers and palm oil extractors of the municipality under study. We find then for the agribusiness - agricultural (growers), 7 Associations with 58 members and those registered with the Chamber of Commerce of the Department 72 palm growers, in addition to the two extraction plants for the transformation of the oil fruit.

Based on the theoretical system developed by Godet et al. (2000) in *The Strategic Foresight Toolbox*, the purpose of this study is to determine the key variables that affect the development of the sector under study of the research and through a tool of foresight *Scenario Design* it will make it possible to visualize desirable scenarios for the subsequent design of action strategies that promote alliances and minimize conflicts between the different actors that are part of the sector. On the other hand, the elaboration of scenarios starts by analyzing the driving factors, trends and strategies of actors. The combination of the relationship of forces between variables and actors will allow the construction of probable and desirable scenarios, however, as the evolution of the identified trends is not always fulfilled, hypotheses may also be required. With the results obtained from the AE, these hypotheses will be proposed, taking into consideration the probability of occurrence of certain events associated with the variables of the strategic axis; then the questionnaire (SMIC) will be applied to the experts consulted about the probability of occurrence of these hypotheses. The answers obtained will constitute the basis on which the future scenarios for the sector under study will be developed. The SMIC (Cross-Impact Matrix System) method will allow to achieve, from the assignment of probabilities to the set of hypotheses, a range of possible final scenarios related to the future of the sector under study in a 20-year horizon. It will also make it possible to visualize the image corresponding to the most likely scenario. This method will be supported by consultation with experts. The development of strategies is the final stage of the analysis of strategic foresight (it is suggested to make a map where, in the form of a tree of pertinences, the different levels are established: macro or general objectives and the particular or section objectives, resources involved and action plans).

RESULTS

Of the key variables identified directly and indirectly in the Structural Analysis (AE), the following can be found:

1. Production processes: In production processes it is important to have excellent efficiency and effectiveness on the part of the operators and the machines and the correct management of the processes, to achieve the expected production and meet the demand.
2. Skilled labor: "There is a great general lack of knowledge about new technological advances and it was evident that although some have heard of, at least the name, some technologies, their knowledge is scarce" (Torres Borrero, 2019, p. 6). Therefore, training and implementation of new technologies are needed in the palm oil sector.

Based on these key variables, probabilistic scenarios will be established for the sector under study.

SCENARIOS

The scenarios are predominantly of the future in which the palm sector of the municipality of Villanueva (Casanare) could be found in the year 2030; through the

delineation of scenarios, the question is answered: What options for the future does the palm sector have?

Through the technique of "Morphological Analysis", the possible alternatives for the future are determined for each key variable of this study, likewise, hypotheses are proposed, assuming other challenges defined for each of them.

The hypotheses that are established must have characteristics such as being possible, probable and alternate; that is, situations that do not yet exist must be taken into account, and that may be additional potential to be carried out.

The following table 1 presents three possibilities of future hypotheses described for each strategic variable:

Table 1. *Strategic variable hypotheses*

Strategic Variables	Current Status	Hypothesis 1	Hypothesis 2	Hypothesis 3
Production Processes	Currently less than 20% of production processes are efficient	30% of the sector's production processes are efficient	50% of the sector's production processes are efficient	70% of the sector's production processes are efficient
Skilled Labor	There is little availability of labor from the municipality of Villanueva (Casanare), since the labor it currently employs must "import" it from other regions of the country, especially from Santander and the Atlantic coast. The municipality's workforce has a low level of qualification and has no interest in this work.	30% of human capital training in production areas and the palm industry	50% of human capital training in production areas and the palm industry	70% of human capital training in production areas and the palm industry

Source: Own elaboration

The possible combinations of these hypotheses of the strategic variables presented in Table 1 are presumably future portraits that will give rise to possible, probable or desirable scenarios.

Below are the three scenarios chosen to be analyzed:

1.1. SCENARIO 1:

The first scenario shown in Table 2, called "Competitiveness" is posed by the hypotheses that were chosen by experts, which are shown in light green:

Table 2. *Scenario 1 "Competitiveness"*

COMPETITIVENESS		
Production Processes		
H1	H2	H3
30% of the sector's production processes are efficient	50% of the sector's production processes are efficient	70% of the sector's production processes are efficient

Skilled Labor		
H1	H2	H3
30% of human capital training in production areas and the palm industry	50% of human capital training in production areas and the palm industry	70% of human capital training in production areas and the palm industry

Source: Own elaboration

1.2. SCENARIO 2:

The second scenario shown in Table 3, called "Optimal Productivity" is posed by the hypotheses that were chosen by experts, which are shown in light green:

Table 3. Scenario 2 "Optimal productivity"

OPTIMAL PRODUCTIVITY		
Production Processes		
H1	H2	H3
30% of the sector's production processes are efficient	50% of the sector's production processes are efficient	70% of the sector's production processes are efficient
Skilled Labor		
H1	H2	H3
30% of human capital training in production areas and the palm industry	50% of human capital training in production areas and the palm industry	70% of human capital training in production areas and the palm industry

Source: Own elaboration

1.3. SCENARIO 3:

The third scenario shown in Table 4, called "Sustainability" is posed by the hypotheses that were chosen by experts, which are shown in light green:

Table 4. Scenario 3 "Sustainability"

SUSTAINABILITY		
Production Processes		
H1	H2	H3
30% of the sector's production processes are efficient	50% of the sector's production processes are efficient	70% of the sector's production processes are efficient
Skilled Labor		
H1	H2	H3
30% of human capital training in production areas and the palm industry	50% of human capital training in production areas and the palm industry	70% of human capital training in production areas and the palm industry

Source: Own elaboration

Experts specify the "Sustainability" scenario as the betting scenario, given that it is the most difficult and is the one that presents the most important ruptures to build the future, of the palm sector in the municipality of Villanueva (Casanare).

1.4. CROSS-IMPACT MATRIX SYSTEM – SOFTWARE (SMIC)

As noted by the SMIC software

The realization, at a given horizon, of a hypothesis constitutes an event, and the set of hypotheses constitutes a referent in which there are as many possible states, that is, as many final images as there are combinations of sets

of hypotheses. The SMIC method allows, based on information provided by experts, to choose, among the 2 to n possible images, those that deserve to be further studied, taking into account their probabilities of realization.

To carry out the exercise, the experts are asked for the following information;

- to. The list of hypotheses they consider are fundamental to the objective of the study: $H = (H_1, H_2 \dots H_n)$;
- b. The simple probabilities of realization at a given horizon: $P(i)$ probability of the hypothesis H_i .
- c. The conditional probabilities of the hypotheses:
 - $P(i/j)$ probability of i if j is realized
 - $P(i/\bar{j})$ probability of i if j is not realized. (Jerez Jerez & Aguirre Sanabria, 2017, pp. 107-108)

1.4.1. Description of the variables and hypotheses

Supported by morphological analysis, the definition of the hypotheses to be used in the ICMS for each strategic variable is established, according to Table 5.

Table 5. Hypothesis for using SMIC software

VARIABLE	EVENT	FUTURE HYPOTHESIS	CURRENT SITUATION
Production Processes	E1	30% of the sector's production processes are efficient	Currently less than 20% of production processes are efficient
	E2	50% of the sector's production processes are efficient	
Skilled Labor	E2	50% of human capital training in production areas and the palm industry	There is little availability of labor from the municipality of Villanueva (Casanare), since the labor it currently employs must "import" it from other regions of the country, especially from Santander and the Atlantic coast. The municipality's workforce has a low level of qualification and has no interest in this work.
	E3	70% of human capital training in production areas and the palm industry	

Source: Own elaboration

1.4.2. Simple Odds (Expert Set)

Table 6 shows the simple probabilities of occurrence given to the hypotheses of each strategic variable per expert.

Table 6. Simple Probabilities of Occurrence – Strategic Variables

Strategic Variable	Odds
Production Processes 1	0,28
Production Processes 2	0,29
Skilled Labor 1	0,30

Skilled Labor 2	0,26
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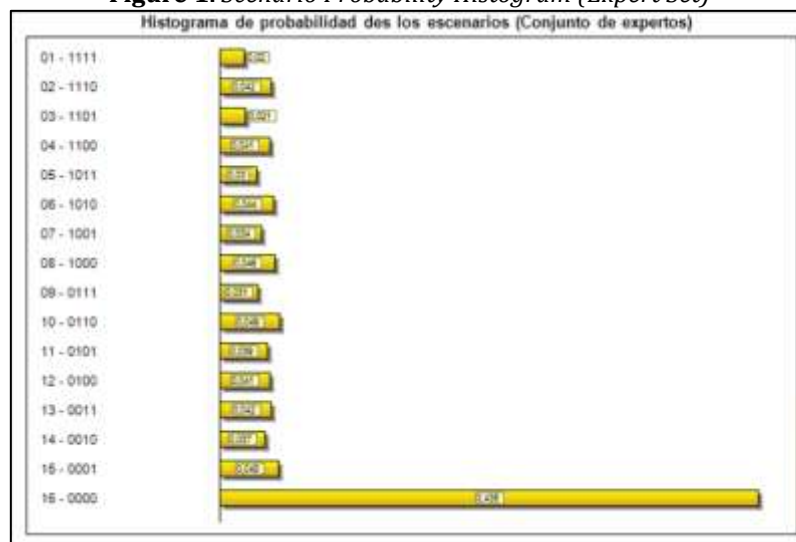
Note. Table prepared from the Smic-Prob-Expert software.

The probabilities of occurrence of the hypotheses by 2030 are at an average of 0.28, with skilled labor (50% of human capital formation in production areas and the palm industry) being the hypothesis with the highest probability determined in this study. But it must be borne in mind that this probability is simple, therefore, each hypothesis is studied separately, the influence or dependence it has on the other hypotheses is not taken into account.

1.4.3. Likely Scenario

The positive and negative conditional probabilities are grouped in graph 1 where we will find the possible scenarios distributed from lowest to highest probability of occurrence, as well as the probable scenario, alternate scenarios and betting scenarios.

Figure 1. Scenario Probability Histogram (Expert Set)



Note. Graph made from Smic-Prob-Expert software. In original language Spanish

The scenario with the highest probability of occurrence of 44% is 0000, being in this scenario where none of the hypotheses raised are fulfilled; The scenario where all hypotheses are fulfilled is scenario 1110 with a percentage of 4%.

1.4.4. Description of scenarios

Scenarios 1. Competitiveness in the palm oil sector

Description:

Precision agriculture is a modern crop management system through which, in a sustainable way, technologies are used for the collection, analysis and manipulation of information related to climatic, soil and agronomic factors that at a given time affect the crop, in order to make decisions that allow the

increase of yields. the reduction of production costs and the reduction of environmental impacts. (Srinivansan, 2006, as cited by Romero et al., 2008, p. 13)

"Today, African palm growers in Colombia are open to significant changes in precision technologies that aim at yield, productivity, and resignation of labor risks in workers" (Pabón Trujillo, 2021, p. 17). In technology, a mobile GIS is implemented:

through which work can be monitored, records and statistics of the different tasks assigned can be kept, the application of fertilizers can be better monitored, in addition to being useful for the movement of personnel in the field. (Sanz et al., 2007 as cited by Romero et al., 2008, p. 16)

With the purpose of continuing to accompany palm growers throughout the agro-industrial process of oil palm cultivation, providing more and more tools that optimize their work, Cenipalma launched "Colombia palm tree online", a permanent virtual platform available to all producers in the country. (Cooman, as cited in Fedepalma, 2020, para. 1)

"Colombia palm tree online", designed to be a permanent institutional platform, through which we will put Cenipalma's expertise and knowledge at the service of producers, in an easy way and in which all their concerns will be shared. (Giraldo, as cited in Fedepalma, 2020, para. 3)

On the platform, Cenipalma seeks to promote interactive conversations to address topics of interest to the sector: technical assistance, profitability, nutrition, among others.

- Lack of knowledge in the use of digital platforms
- Lack of implementation of state-of-the-art machinery and technology
- Lack of training on advances and manipulation of technological tools -Skilled labor
- Deficiency of the Implementation of new Technology and machinery
- Deficiency in road infrastructure

Scenarios 2. Optimal productivity in the palm oil sector

Description:

Productivity and its commercialization, its demand and market projections indicate that the oleochemical industry is an opportunity for the national development of the commercialization of products derived from palm and palm kernel oils. In Colombia, the expectations involved in the transformation of palm and palm kernel oils are great, even more so if one takes into account that the country is in a process of renewal and expansion of the planted area, with which it is expected that in a few years there will be an excess of palm and palm kernel oil that could well be used in the production of oleochemical products.

- Efficiency and effectiveness in the production process

- Lack of technological resources for the transformation of derived products
- High technology costs

Scenarios 3. Sustainability Palm Growing Sector

Description:

"More efficient, sustainable productive palm growing that generates profitability for producers and improves the quality of life of palm communities" (García Azuero, 2019, p. 25).

Strategy:

Sustainable palm kernels: principles and conditions of sustainable palm oil, closing gaps in economic, social and environmental best practices.

Resilient palm regions: biodiverse palm landscape, integrated watershed management, palm communities: CSR (corporate social responsibility), human rights and business.

Sustainable market:

Positioning and commercial differentiation: brand positioning – sustainable palm oil from Colombia, **PPPs marketing campaign.CO** ("is the Digital Entrepreneurship Program of the Ministry of ICT in Colombia, created with the aim of promoting and enhancing the generation, creation and consolidation of technology-based enterprises such as mobile applications, software, hardware, e-commerce and content" (Apps.co, n.d., para. 1).

Innovation and new markets: circular economy (zero waste approach), bioeconomy (innovation and value addition for bioproducts).

Institutionality: alliances and cooperation for sustainability, governance and participation mechanism.

- Negative effects on biodiversity associated with the cultivation of oil palm
- Optimising palm profitability
- Lack of knowledge of e-commerce – Marketing
- Method of delivery of the product to consumers

CONCLUSIONS

As a result of this study, an ideal or more probable scenario is not obtained, it is there where the palm sector of the municipality under study, must align the strategic objectives against the success factors production processes and qualified labor, to reach better scenarios that allow it to potentiate the strengths, mitigate the weaknesses, to deal with changes in the sector in a timely manner and to improve the proper use of resources. It is important to note that the sector must adapt to the changes generated by globalization, making it necessary to investigate various markets and assimilate the most likely future.

In the SMIC Method, it can be concluded that the probability of occurrence of the three scenarios is 4%, the probability of the first and second scenarios occurring and the third is not 15%; For strategy two to occur and strategy one not to happen is 4%, but the most important thing is that there is a 44% non-occurrence of the three scenarios. Therefore, according to the opinion of experts, in the short and medium term it is not possible to repair the problems posed by means of these solutions.

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