Sales Planning Based on Fuzzy Logic: An Alternative for Decision-Making in Cuban State-Owned Enterprises

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Abstract

Strategic planning remains a core component within any enterprise due to its influence on economic profitability. In recent years, the advancement of technology, artificial intelligence, and digital information systems has allowed decision-making in competitive organizations to incorporate statistical models that account for uncertainty. These models have enhanced both efficiency and effectiveness, thereby strengthening market positioning. In the specific context of Cuba, where state-owned enterprises play a crucial role in achieving economic and social objectives, no empirically validated and clearly structured approach currently addresses this need.

This study aims to develop a sales planning procedure grounded in fuzzy logic principles, while integrating traditional methods such as exponential smoothing. The company Cariflor, part of the PALCO business group, served as the case study.

The methodology was applied to Cariflor using historical sales data and expert judgment to estimate demand. Results revealed that the model produced forecasts with low error margins (1.5%–2.8%), indicating high accuracy and practical relevance for decision-making in business environments with limited information. This research offers an innovative contribution to Cuban business management by delivering a replicable, adaptable tool capable of minimizing subjectivity in critical planning processes.

Keywords: sales planning, fuzzy logic, exponential smoothing, Cuban state-owned enterprise.

Introduction

Historically, business dynamics have depended on multiple factors—economic, political, and social—where both domestic and international market behavior largely determines profitability. In recent years, the growing trend toward datafication has gained special relevance in decision-making across various business subsystems, particularly in marketing, market research, and strategic planning.

Companies, regardless of their type, must understand the specific characteristics of the market in which they operate to improve efficiency, optimize resources, and increase profitability. Sales planning serves as the foundation for this decision-making process.

The Cuban economy, currently facing a complex economic environment, reflects this broader global reality—especially within state-owned enterprises. The Constitution of the Republic identifies state-owned companies as the fundamental actors of the Cuban economic model. These enterprises traditionally function under centralized planning systems. However, since the 2021 introduction of non-state management models, they have begun navigating the challenge of market competition.

The country's economic model urges state-owned enterprises to achieve greater autonomy, which requires decentralizing resource management. Consequently, planning methods must shift away from allocation-based approaches and instead align with projected sales volumes. This shift demands access to reliable data and effective tools to support decision-making. Cuba, however, lacks publicly available databases with disaggregated sector-level or customer-specific information. Moreover, most organizations do not employ information management systems capable of systematically capturing and analyzing such data. As a result, sales planning processes remain fraught with uncertainty and subjectivity.

This research seeks to propose an empirical procedure that supports corporate decision-making, particularly in the area of sales planning, using the company Cariflor as a case study. The analysis incorporates statistical methods and techniques processed through the econometric software Stata. Specifically, it applies an exponential smoothing technique—non-seasonal and adapted to account for fuzziness—due to the lack of complete data necessary to ensure methodological consistency. Unlike previous studies, this work integrates expert judgment through fuzzy logic within a context of data scarcity.

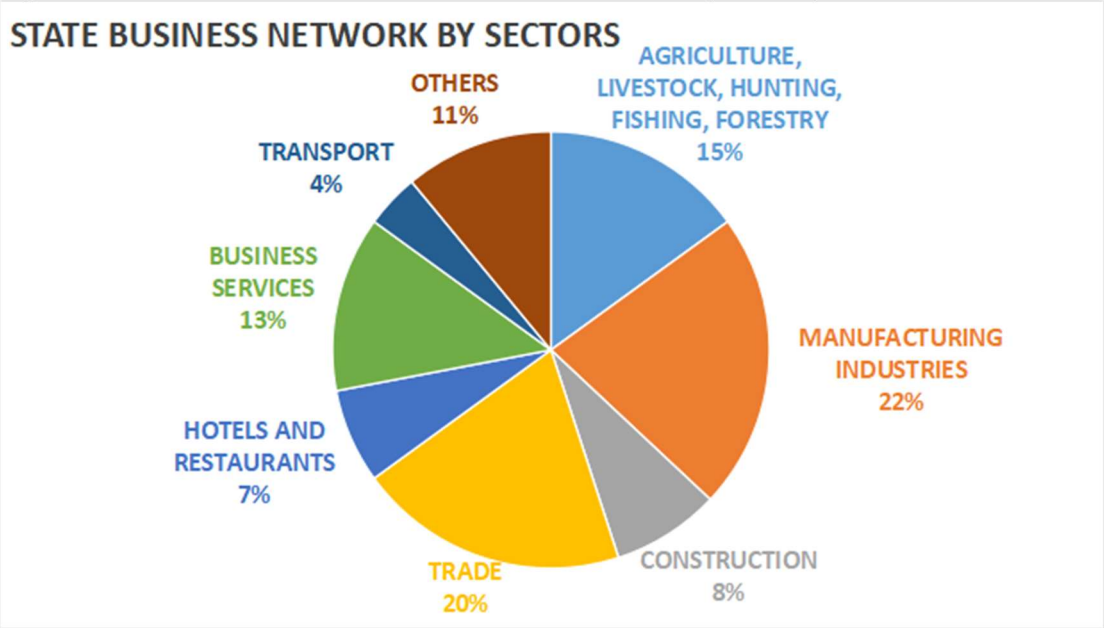
Theoretical Framework: An Approach to the Sales Planning Process in Cuban State-Owned Enterprises

State-owned enterprises in Cuba, as the main drivers of the national economy, represent a foundational pillar for aligning economic and social objectives. Since the triumph of the Revolution in 1959, the State has assumed the leading economic role, replacing private ownership with public control and undertaking the responsibility of producing goods and services essential for the country's development.

Cuba's state-owned enterprise network includes 2,497 entities, of which 1,934 operate under the traditional model of state ownership. The remaining enterprises comprise commercial

corporations and new types of entities—such as subsidiaries and state-run MSMEs—that did not exist two years ago. (ONEI, 2023) Figure 1 illustrates the distribution of these enterprises by type of activity.

Figure 1: Structure of the State-Owned Business Sector by Activity



Source: Own elaboration based on the 2023 Statistical Yearbook of ONEI

State-owned enterprises account for 92% of net sales within the national business system, 75% of exports, and 87% of GDP, employing approximately 1,431,000 workers. However, 80% of total profits concentrate in just 56 entities (2.3%), while 80% of exports originate from only 12 firms (0.4%). Additionally, 278 enterprises operate at a loss, 389 receive budgetary subsidies from the State, and 309 report profit margins below 2 cents per peso of net sales. Only 626 enterprises currently hold the autonomy to determine employee wages independently (Odriozola Guitart, 2023).

Although Article 27 of the 2019 Constitution of the Republic of Cuba (Asamblea Nacional del Poder Popular, 2019) reaffirms the strategic role of state-owned enterprises as key economic actors, this mandate has not yet translated into the necessary outcomes in terms of sustainable growth, global integration, productivity, or prosperity aligned with the country's development vision for 2030.

Within Cuban state enterprises, planning follows directives and guidelines established by the Ministry of Economy and Planning (MEP) (Ministerio de Justicia, 2021). These directives reflect rigid structures, excessive bureaucracy, disconnection from market signals, and limited scope for innovation and self-management. Such conditions undermine firms' responsiveness and effectiveness in adapting to dynamic, volatile market environments—including demand fluctuations—thus weakening their competitiveness.

Based on the established framework, enterprises must draft their annual plans for submission and approval six months in advance by the Governing Board, specifically in July. While early

planning remains essential for strategic direction, failure to incorporate flexibility hinders the firm's ability to adapt and grow.

As previously noted, the State determines policies and legislation at both macro and micro levels. This centralized design implies that decision-making authority and organizational autonomy remain heavily constrained by upper structural levels.

According to the Ministry of Justice, companies must implement 18 internal systems. The state mandate (the portion of the plan guaranteed by the State) remains mandatory. The return on investment contribution—comparable to a dividend—requires a fixed 50% allocation of net profits (post-tax and mandatory reserves). Investment projects, voluntary reserves, and profit distributions all demand prior approval. Moreover, salary levels link directly to outcomes, which in turn depend on plan fulfillment—often unrelated to the enterprise's internal performance. Additional sector-specific restrictions limit the procurement of inputs and the sale of finished goods (Díaz Fernández, 2017).

Although national policy documents call for greater autonomy within the state-owned sector, the organizational structure follows a highly standardized model: OSDE–Enterprise–UEB. Decision-making remains centralized, and flexibility remains scarce (Ministerio de Justicia, 2021). OSDEs and Governing Boards jointly assume ownership functions, thereby shaping the owner–manager relationship.

The Cuban economy continues to face challenges imposed by the United States embargo and broader macroeconomic instability, including financing constraints and a regulatory environment that seldom encourages business growth.

Currently, the state business sector in Cuba undergoes a restructuring process aimed at enhancing autonomy and efficiency. Reforms include the separation of state and business functions and the introduction of new organizational forms, such as local enterprises and fully Cuban-owned corporations. The emergence of joint ventures and international economic partnership contracts also reflects an effort to diversify the business fabric and attract foreign investment (Odriozola Guitart, 2023).

Historically, the state enterprise system operated under centralized planning, with centrally allocated resources and access to captive markets. Since 2021, as part of the broader update of the Cuban Economic Model, authorities have called for greater autonomy in the sector. Within this context, analyzing how firms currently approach planning becomes essential to identify existing shortcomings.

Unfortunately, Cuba's public information systems lack sufficient sectoral and competitiveness data. Moreover, many state enterprises—accustomed to segmented, secure markets—have not integrated market research or customer satisfaction assessments into their operations. This disconnect between production and consumer needs has triggered overproduction, which reduces profitability due to shrinking margins, rising inventories, and diminished efficiency. On the other hand, shortages leave customers unsatisfied and, more critically, production often fails to match expectations, leading to lost market share and resource waste.

Rigid frameworks discourage innovation and creativity. Excessive bureaucratic oversight further prevents firms from pursuing new market opportunities or developing innovative products.

The following figure summarizes the key features of the current state planning process:

Figure 2: Characteristics of State Planning

Source: Own elaboration

The sustained and robust prosperity of a country stems only from its economic and social development. To achieve this, enterprises must generate wealth with both efficiency and effectiveness (Díaz Fernández, 2017). Empirical evidence suggests that only organizations operating efficiently will survive in competitive markets, highlighting the need to address and mitigate intrinsic inefficiencies.

Currently, the Cuban state-owned enterprise system faces a renewed call to reclaim its leading role in the national economy. Given the challenging macro- and microeconomic conditions in which these firms operate, it becomes essential to implement procedures that reduce distortions and enable more accurate decision-making. The following section outlines a proposed sales planning procedure—an essential entry point into corporate planning. This process, previously limited by centralized economic models, begins to regain relevance within state-owned firms that now must operate in closer alignment with market dynamics, especially in the context of newly authorized non-state management models.

Based on a review of the regulatory framework and informal exchanges with experts active in this domain, the authors identified several factors that hinder planning effectiveness:

Rigid planning processes: The inflexibility of plans prevents rapid adaptation to changing economic environments.

Formal participation: Most participatory mechanisms reflect scheduled activities controlled by the State, resulting in a disconnect between formal procedures and real effectiveness.

Lack of information: The absence of reliable and updated data undermines the quality of decisions.

Limited use of analytical tools: Decision-making rarely benefits from structured models, methods, or tools.

Cuba's economic model, built upon centralization and state planning, prioritizes resource allocation according to national strategic goals. Consequently, economic decisions—including those related to production and distribution—fall under strict state control. State-owned enterprises, in particular, lack sufficient autonomy, having to operate within rigid guidelines and limited capacity to adjust plans in response to changing supply, demand, or cost conditions. These firms remain accustomed to receiving centrally allocated resources and planning production accordingly, rather than projecting needs based on actual market demand.

While this model aims to ensure equity and sustainability, excessive centralization introduces systemic inefficiencies by disconnecting enterprises from market signals. Although centralized planning helps mitigate macroeconomic imbalances, it often overlooks indicators of business efficiency, such as profitability or quality. As a result, enterprises struggle to respond to supply chain disruptions, price fluctuations, or shifts in consumer preferences.

Sales planning within an organization functions as a strategic process through which firms define sales targets, outline corresponding actions, and make forward-looking decisions aligned with overall business goals. This process aligns subsystems across the organization to manage available resources more efficiently and maximize outcomes.

In complex macroeconomic environments such as Cuba's, sales planning acquires even greater importance. It enables companies to mitigate the impact of external shocks through scenario-based forecasting, optimize the use of scarce resources by avoiding costly overstocking (especially under inflationary conditions), and prevent stockouts that result in lost customers. In doing so, companies not only preserve profit margins but also fulfill their social commitments.

To develop effective sales plans, enterprises often rely on econometric models and quantitative analysis tools that enhance decision-making accuracy. In this regard, several studies have examined the use of time series models—such as ARIMA (Autoregressive Integrated Moving Average) and multiple regression models—for demand forecasting and sales strategy optimization in uncertain environments (Box et al., 2015; Gujarati & Porter, 2020). However, the effectiveness of these models depends heavily on the availability and quality of historical data—resources often limited in centrally planned economies like Cuba, where information remains incomplete or inconsistent.

In contrast to data-rich settings with stable demand patterns, where traditional econometric models perform effectively, hybrid models have emerged. These models combine econometric techniques with fuzzy logic, a methodology that has proven effective for business planning under uncertainty (Zadeh, 1996; Khashei & Bijari, 2010).

Fuzzy logic has found application in numerous international studies on estimation and business planning, particularly in settings where decision-making depends on qualitative and subjective variables. For instance, Kahraman et al. (2007) applied fuzzy models to strategic management in volatile markets, demonstrating how such approaches reduce uncertainty and improve planning precision. Similarly, Rodríguez et al. (2019) combined fuzzy logic with regression models to forecast demand in the manufacturing sector, achieving more adaptive responses to unexpected market changes. Recent research confirms that hybrid models—integrating fuzzy logic with traditional forecasting techniques such as neural networks or exponential smoothing—yield more accurate and robust predictions (Torra & Narukawa, 2022; Wang et al., 2020).

This study presents a practical example that integrates exponential smoothing with fuzzy triangular numbers, offering a more flexible and adaptive sales planning method suited to Cuba's state-owned sector—marked by volatility, uncertainty, and data limitations. This approach addresses the shortcomings of traditional models by incorporating uncertainty and subjectivity into the analysis, making it a valuable tool for contexts with restricted data availability and highly variable demand conditions.

Development of a Fuzzy Logic-Based Sales Planning Procedure in the Cariflor Company, Part of the Palco Business Group

In general, state-owned enterprises in Cuba operate under a model designed to fulfill both social and economic objectives within a State-regulated framework, as previously outlined. Nevertheless, they currently face several limitations—technological obsolescence, insufficient funding, inadequate employee training, and rigid, bureaucratic systems—that constrain their potential and hinder development within the broader business ecosystem.

The Palco Business Group stands out as an exception within the Cuban state-owned enterprise structure. Its uniqueness emerges from its organizational model, operational dynamics, and the economic and financial environment in which it performs. Formally established as a Superior Business Management Organization (OSDE) in 2011, the group traces its origins to 1979 with the creation of the Palacio de Convenciones, and it specializes in providing integrated services (Cubadebate, 2023). Unlike most Cuban state-owned companies, Palco benefits from a considerable degree of autonomy, enabling it to adapt swiftly to market demands and client expectations.

The companies that comprise the group operate as an integrated system, supporting one another to achieve maximum efficiency. The group includes ten independent yet interrelated enterprises, as shown in the figure below (Palco, 2023)

Cariflor joined the Palco Group in 2013. The company specializes in the production and marketing of flowers and ornamental plants and ranks as the country's main importer in this category. It also offers floral arrangements, event design, and decoration services, positioning itself as a key player within the group's service portfolio.

Figure 3: Companies within the Palco Business Group

PALCO	REAL ESTATE
	EMPLOYER
	IMPORTER
	INVERCO CONSTRUCTION COMPANY
	FORWARDING AND CUSTOMS AGENCY
	TRANSPORTATION
	CARIFLOR
	ORGANIZER OF CONFERENCES, FAIRS AND EXHIBITIONS
	TECHNICAL SERVICES
	SPECIALIZED SERVICES

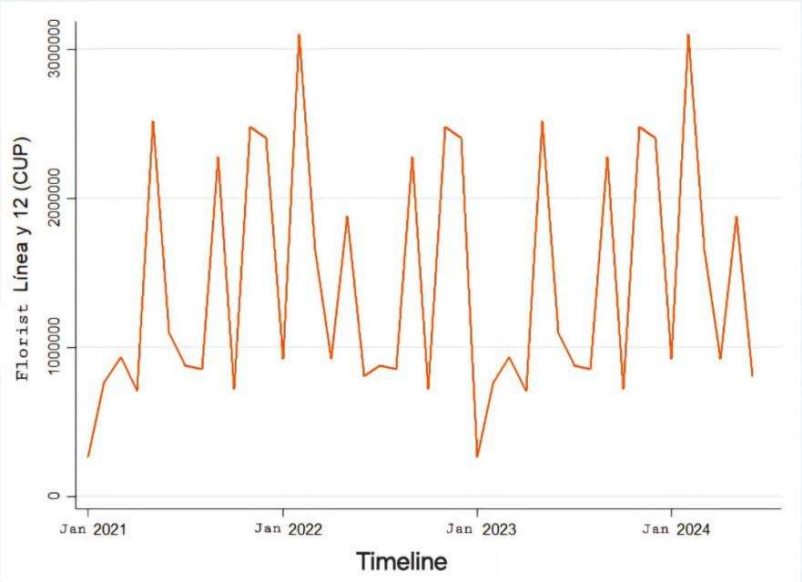
Source: Own elaboration based on the Palco Group Organizational Chart

Building on previously established ties with the Palco Group, both parties jointly agreed to select Cariflor as the case study for this research. The group's executives perceive high potential in this enterprise and express interest in gathering as much information as possible to inform future strategic decisions. Furthermore, conducting the study in a company focused on product commercialization—unlike the majority of service-oriented businesses in the group—provides an added advantage. The relatively homogeneous behavior of product-based operations offers a more stable basis for validating the proposed procedure.

Cariflor operates six locations, although only two—Floristería Línea y 12 and Floristería 32 y 5ta—remained fully operational throughout the entire exploratory period. For the purpose of this research, the dataset used comes from Floristería Línea y 12, given its greater data consistency. Compared to the alternative (Floristería 32 y 5ta), this branch exhibits more homogeneous observations, allowing for a more reliable analysis of its sales behavior.

Accordingly, the database for implementing the proposed procedure consists of 42 sales records from this branch, covering the period from January 2021 to June 2024. The sales trend reflects irregular patterns (Figure 8), with peak values observed in February, May, and September 2023, while the lowest figures occur during the initial months of the year. The average sales for the period reached CUP 1,401,190. The observed peaks correspond to celebrations such as Valentine's Day (February) and Mother's Day (May), which traditionally trigger exponential increases in sales levels.

Figure 4: Sales Levels in CUP at Floristería Línea y 12



Source: Own elaboration

To reduce subjectivity in sales estimation and enhance certainty and reliability in the process, the procedure outlined in the previous section has been applied. This procedure unfolds in three stages: from the selection of the Expert Committee and collection of their judgments to the projection of sales behavior for the Línea y 12 branch during the period July–December 2024, using the exponential smoothing technique.

● Stage 1: Selection of the Expert Committee
Selecting the experts for this research constitutes a critical step. As García Rondón (2010) notes, the number of experts proves secondary to the quality of their qualifications. The selection process adhered to two criteria:

Demonstrated experience in the commercial field

Achievement of a Competence Coefficient above 0.6

The initial panel consisted of the General Director, the Commercial Director, and three specialists from the commercial department. One of these specialists manages the department at the study site. In total, the committee included five experts.

To evaluate the competence levels of the expert group, each member completed a self-assessment survey. This instrument enabled the calculation of their Competence Coefficient (K). The resulting data appear in detail in the following table:

Table 2: Experts' Competence Coefficients

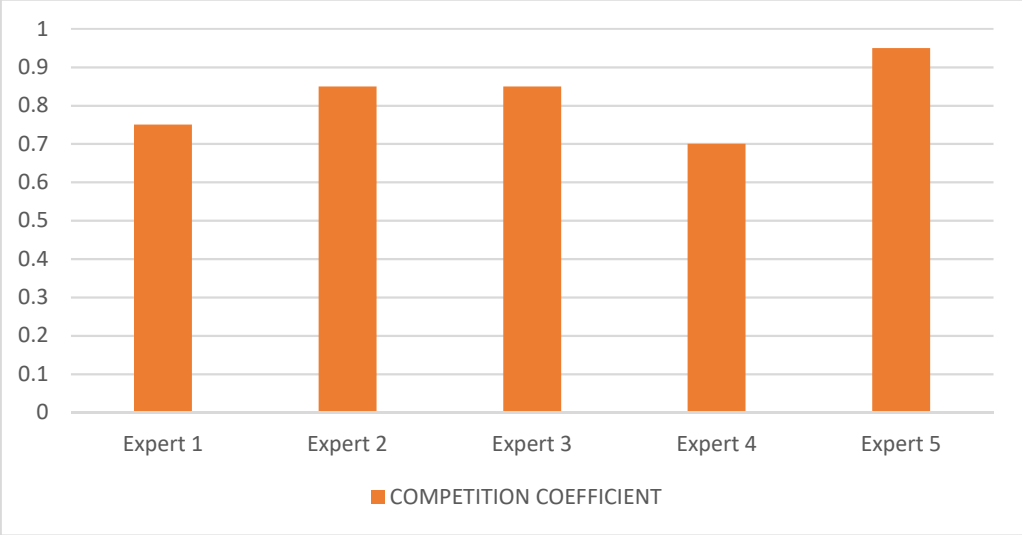
Coeficients	**Experts**				
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5
Kc	0.7	0.9	0.8	0.6	0.9
Ka	0.8	0.8	0.9	0.8	1
K	0.75	0.85	0.85	0.7	0.95

Source: Own elaboration based on survey data

As shown in Table 2, all selected experts meet the required threshold to form part of the group, each achieving a Competence Coefficient above 0.6. This requirement proves essential; otherwise, their assessments could distort the process.

Figure 4 presents a more visual representation, illustrating with greater clarity the competence levels of the selected expert team.

Figure 4: Competence Coefficient Performance



Source: Own elaboration based on survey data

The values obtained from the competence coefficients indicate that the selected experts from Cariflor possess high competitiveness, with a 1:1 acceptance ratio among those evaluated. Of the five experts, three exhibit a high level of competence (60% of the total), while the remaining two fall within the medium range (40%). All demonstrate strong qualifications, enabling them to make accurate sales forecasts.

Their judgments will be consolidated using an Expertón model, as described in the following section.

● Stage 2: Collection of Expert Opinions
Once the expert team had been selected, each member provided forecasts—grounded in their experience—on expected sales levels (in CUP) for the Línea y 12 branch during the months of July through December 2024.

Historical sales data from January 2021 to June 2024 served as the basis for eliciting expert opinions, as these represented the available dataset for the present research.

Using the company's actual data, researchers calculated the optimal number of future periods to forecast. The result identified six periods (i.e., the months of July to December 2024) as optimal, as this range reflected the highest convergence of expert judgment (see Table 5).

Table 2: Calculation of Optimal Number of Periods to Forecast

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
6	-511.183	24.105*	9	0.004	1.0e+11*	33.8239*	34.2794*	35.198

Source: Own elaboration based on Stata processing

Based on these criteria, each expert provided their opinion using confidence intervals with minimum and maximum values. They operated under the assumption that sales levels could fluctuate between 10% and 30%, as this represented the expected growth range compared to the equivalent period in 2023. This approach enabled the collection of opinions in a manner that reflects real human reasoning, incorporating uncertainty and imprecision without forcing experts to select a single fixed value. However, if an expert expressed certainty about a specific value, that value could be recorded as an absolute range. It is also important to note that, in cases of anticipated demand contraction, experts had to record the value within parentheses.

Once the information had been collected, mathematical processing began to calculate the Expertón.

Since percentage values were used, the expected value (Esperanza Matemática) reflects the percentage by which monthly sales levels should increase during the second half of 2024, using historical data from 2021 as a reference point. Notably, although experts could have forecasted a decline in activity, no such predictions occurred in this case. Table 3 presents the resulting estimations for the months of July to December 2024:

Table 3: Expertón of Future Sales at the Línea y 12 Florist Shop

	Min	Máx
jul-24	792058,5	1144085
aug-24	768942	1110694
sep-24	2050191	2961387
oct-24	652086	941902
nov-24	2234210	3227192
dec-24	2166306	3129109

Source: Own elaboration

- **Stage 3: Projection of Estimated Sales Using Triangular Fuzzy Numbers (TFNs)**

Following the logic previously described, the theoretical procedure applies the exponential smoothing statistical technique. However, due to the conditions outlined earlier, this study employs Triangular Fuzzy Numbers (TFNs), which help minimize the subjectivity often present in sales planning. Such subjectivity may stem from factors like inflation, national context, or external shocks that affect business operations. A TFN consists of three characteristic values:

- **Lower bound (minimum)**: Based on expert assessments recorded in the "Minimum" column, this figure represents the least expected sales value. Although unlikely, it remains possible. This pessimistic scenario accounts for negative contingencies in the estimation process.
- **Upper bound (maximum)**: Drawn from expert estimates in the "Maximum" column, this value denotes the most optimistic projection—where sales may exceed expectations due to factors such as increased demand, marketing campaigns, or new product introductions. This scenario implies exceptional performance.
- **Most likely value (mode)**: Defined by the expected value (*Esperanza Matemática*) of the distribution, assuming a continuous uniform distribution. In this case, it coincides with the average of the expert estimates. This central figure reflects the most realistic scenario, grounded in historical data and past trends, and lies between the lower and upper bounds.

Based on expert input, historical trends, and the time series pattern, Table 4 summarizes the results obtained across all three scenarios. The projected sales figures in CUP for the July–December 2024 period are as follows:

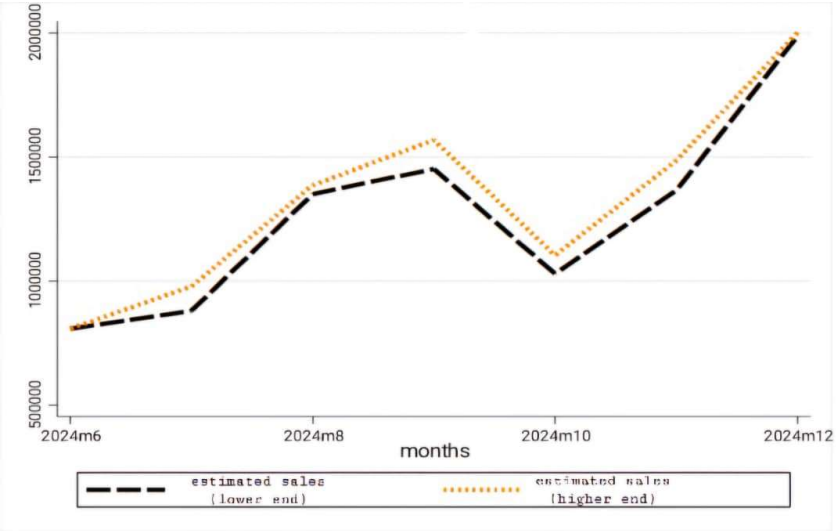
Table 4: Sales Forecasts by Holt-Winters Model Expressed as Triangular Fuzzy Numbers

	Estimated sales (lower end)	Estimated sales (higher end)	Maximum presumption
jul-24	880023	978541	929282
aug-24	1350625	1386257	1368441
sep-24	1452145	1568893	1510519
oct-24	1029541	1103548	1066545
nov-24	1365241	1485625	1425433
dec-24	1987541	2001035	1994288

Source: Own elaboration

To enhance the visualization of the forecasted data, Figure 5 displays the projected sales levels for both minimum and maximum values across the six estimated months. The results reveal consistency between both bounds and align with the figures presented in the previous table 4.

Figure 5 displays the projected sales



Additionally, the narrow gap between the lower and upper values in a triangular fuzzy number reveals reduced variability or uncertainty in the estimation. This observation carries several implications:

- Estimation accuracy: Closely clustered estimated values imply stronger confidence in the projection and greater precision in the forecast. When sales remain within a narrow range, planning and decision-making processes become significantly more manageable.
- Lower risk: Fewer external factors exert substantial influence over the results.
- Simplified decision-making: Reduced fuzziness enhances decision-makers' confidence in developing plans and strategies, as the expected outcomes exhibit greater predictability.
- Data interpretation: The limited dispersion of values enables a clearer evaluation of potential trends and patterns within the dataset.

Margin of Error and Potential Estimation Errors

Forecasts generated through the fuzzy logic model exhibit a narrow error margin, ranging from 1.5% to 2.8%. This level of accuracy strengthens the reliability of future demand estimations. The low degree of variability allows companies to base strategic decisions on these results without facing significant deviations.

Table 6: Error margin for the estimated period.

Month	Error Margin (%)
Jul-24	1.8
Aug-24	1.5
Sep-24	2.3
Oct-24	2.0
Nov-24	2.5
Dec-24	2.8

Source: Own elaboration

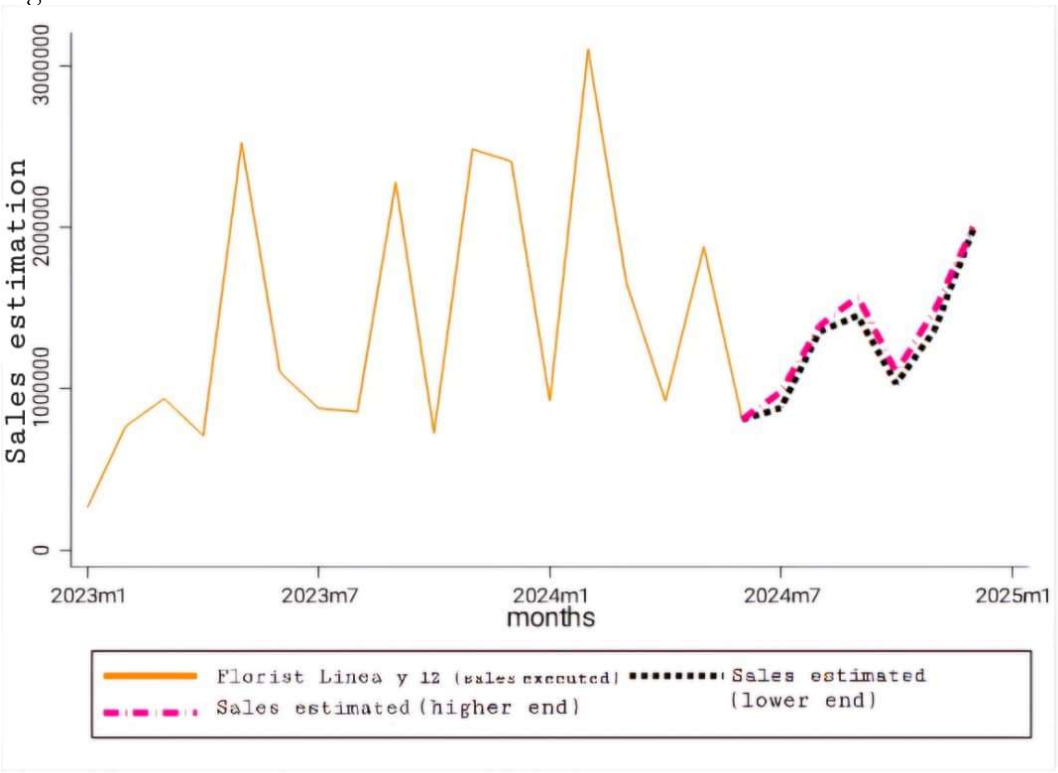
As shown in Table 6, the error margins remain low and within an acceptable range for strategic decision-making. The highest variability appears in December, reaching 2.8%, while August displays the lowest, with 1.5%. These figures highlight the high reliability of the projections, enabling the company to plan its sales strategies with a substantial degree of confidence.

The impact of these errors on decision-making remains minimal, given that the discrepancies between actual and estimated values prove sufficiently small to avoid compromising strategic planning. This reinforces the model's applicability in sectors facing uncertain environments, where prediction reliability plays a critical role in optimizing resource allocation and inventory management.

Nevertheless, abrupt market shifts, demand fluctuations due to unforeseen events, data collection errors, or inconsistencies in model parameterization may increase these error margins. Continuous model evaluation and the integration of updated data become essential to preserve accuracy and ensure the model's adaptability across diverse scenarios.

Additionally, Figure No. 6 illustrates the corresponding forecast as an extension of the function that encapsulates actual sales values up to the preceding moment. When the upper and lower bounds of a triangular fuzzy number projection extend directly from the real data function, the estimation suggests a precise alignment with reality. This behavior captures the inherent variability and dynamics of the variable in question—in this case, sales—with notable fidelity.

Figure 6: Historical Sales Function and Forecast 2021–2024



Source: Own elaboration

The uncertainty in the estimation is minimal; the criteria used to establish the bounds are consistent with the observed reality, and the alignment between the actual and estimated functions is clearly shown. This is especially useful for organizations operating in contexts where decision-making requires justification based on concrete data.

Therefore, the results obtained are not only relevant to the analyzed context but can also be extrapolated to other companies in the sector with similar characteristics. The applicability of the model will depend on the availability and quality of data in each organization, as well as the correct parameterization of the techniques used and the experts included in the initial procedure. However, it is worth highlighting that its flexibility and ability to adapt to high-uncertainty environments make it a valuable methodology for improving accuracy in sales planning and strategic decision-making across diverse organizations.

Conclusions

In Cuba, enterprises have traditionally operated in a context marked by centralization and captive markets. Today, the state-owned enterprise is being called upon to reclaim its role as a key actor in the national economy, and thus must improve its planning processes—especially in the area of sales.

To reduce the uncertainty and subjectivity inherent in decision-making, a sales planning process based on fuzzy logic is proposed. This process also integrates more traditional econometric methods such as exponential smoothing. It is divided into three main stages. The first aims to correctly select the experts who, in their role as evaluators, will estimate sales trend behavior based on their experience and the available information, however imperfect it may be. In the second stage, these judgments are aggregated into an Expertón using a triangular number. The process concludes with smoothing of this triangular series to obtain a forecast as accurate as possible to support decision-making.

The proposal was applied in the Cariflor company of the PALCO Business Group, demonstrating that it is possible to make sales forecasts based on historical data using techniques associated with fuzzy logic.

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