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STRATEGIC PLANNING USING THE TOTAL COST OF OWNERSHIP MODEL

PLANEJAMENTO ESTRATÉGICO UTILIZANDO O MODELO TOTAL COST OF OWNERSHIP

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ABSTRACT

In a highly competitive global scenario, companies seek new ways to optimize production and implement continuous improvement mechanisms to reduce costs. An essential tool in this context is the Total Cost of Ownership model, applied to the acquisition processes of inputs to determine the costs involved and compare the economic viability between domestic and international suppliers. Given the unstable economic scenario and high exchange rate fluctuations, the possibility of nationalizing production is evaluated. The case study method is adopted, characterized as applied and exploratory research, with the objective of generating knowledge for practical application and solving specific problems. This method combines a literature review with exploratory field analysis. The studied company faces a loss of profitability due to rising import costs, reduced demand, and the loss of purchasing power of the national currency against international suppliers. The increase in costs resulting from exchange rate fluctuations necessitates the search for new supply options, primarily in the domestic market, where exchange rate influence is lower. Thus, the nationalization of inputs becomes crucial in business decisions to minimize costs and maintain competitiveness. The results indicate that the nationalization of production using the Total Cost of Ownership model is viable. This model considers all costs involved in the acquisition of inputs, unlike the traditional acquisition model, which focuses exclusively on the unit price.

Keywords: Total Cost of Ownership; Nationalization; Cost Reduction; Purchasing Decision; Strategic Planning.

RESUMO

Em um cenário global altamente competitivo, as empresas buscam novas formas de otimizar a produção e implementar mecanismos de melhoria contínua para reduzir custos. Uma ferramenta essencial nesse contexto é o modelo Total Cost of Ownership, aplicado aos processos de aquisição de insumos para determinar os custos envolvidos e comparar a viabilidade econômica entre fornecedores nacionais e internacionais. Diante do cenário econômico instável e da alta flutuação cambial, avalia-se a possibilidade de nacionalização da produção. Adota-se o método

de estudo de caso, caracterizado como uma pesquisa aplicada e exploratória, com o objetivo de gerar conhecimento para aplicação prática e solucionar problemas específicos. Esse método combina revisão bibliográfica com análise exploratória de campo. A empresa estudada enfrenta perda de rentabilidade devido ao aumento dos custos de importação, redução da demanda e perda do poder de compra da moeda nacional frente ao fornecedor internacional. O aumento dos custos, resultante da variação cambial, exige a busca por novas opções de fornecimento, principalmente no mercado doméstico, onde a influência cambial é menor. Assim, a nacionalização de insumos torna-se crucial nas decisões empresariais para minimizar custos e manter a competitividade. Os resultados indicam que a nacionalização da produção, utilizando o modelo Total Cost of Ownership, é viável. Este modelo considera todos os custos envolvidos na aquisição de insumos, ao contrário do modelo tradicional de aquisição, que foca exclusivamente no preço unitário.

Palavras-chave: Custo total de Propriedade; Nacionalização; Redução de Custos; Decisão de Compras; planejamento estratégico.

1. INTRODUCTION

In a market where efficiency and competitiveness are essential, this study aims to evaluate the cost management tool, Total Cost of Ownership (TCO), as a differential in the administration of the supply chain and strategic management to reduce the costs of acquiring goods and services.

According to Degraeve et al. (2005), the acquisition of products and services represents at least 50% of the total production costs for most companies. Therefore, procurement strategies can generate significant savings. The literature presents various qualitative and quantitative criteria used in purchasing decisions. Butter and Linse (2008) observe that the role of procurement in organizations has become strategic over the past 25 years, and Paulraj et al. (2006) emphasize the need to align procurement with supply chain management, focusing on supplier and sourcing management.

Decision-making tools such as TCO have been developed to strategically manage the purchasing sector. TCO allows for understanding the total costs involved in the acquisition of goods and services. Ellram (1993) describes TCO as a complex approach that seeks to determine and understand the true costs of dealing with a supplier, aiding in the buyer's decision-making process beyond the product price.

From this analysis, the study aims to verify the feasibility of the nationalization process in a scenario of exchange rate fluctuation through an in-depth analysis of TCO.

2 THEORETICAL FRAMEWORKS

2.1 Total Cost of Ownership (TCO)

In the supply chain, the purchase of goods and services is crucial for business operations, being a strategic area for cost reduction and increased competitiveness (Fleury, 2000). According to Bowersox and Closs (2001), the main role of procurement is to obtain inputs at low cost and in a timely manner. Butter and Linse (2008) highlight that, in the past 25 years, procurement has evolved from a simple acquisition process to strategic management (KRALJIC, 1983).

The continuous pursuit of improvements and cost reductions has led organizations to adopt TCO, a technique developed in the late 1980s by the Gartner Group (2001), which evaluates the direct and indirect costs related to the acquisition of productive investments. TCO considers not only the price of the good but also other additional costs generated by suppliers, such as technical assistance, failures, administrative costs, maintenance, and lifecycle costs.

TCO helps understand the internalization costs of a good or service and identify trade-offs in purchasing decisions (Wouters, Anderson, and Wysntra, 2005). Degraeve et al. (2005) emphasizes that the expenditure on materials, equipment, and services is the largest portion of direct costs for most companies, resulting from obsolete procurement processes focused solely on price. Exploring the potential of the procurement area can generate competitive advantages and performance improvements.

For the procurement area, TCO shifts the exclusive focus from price and allows for a strategic exploration of costs, promoting opportunities for expense reduction and profitability increases (Ellram and Siferd, 1998). Ellram (2002) defines TCO as a technique to manage the true costs of a good negotiated with suppliers, applicable in strategic, operational, and tactical objectives, as illustrated in Figure 1.

Figure 1: Objectives and applications of TCO in the procurement process

Source: adapted from Ellram and Siferd (1998, p.67)

The model described in Figure 1, according to Ellram and Siferd (1998), categorizes objectives into three levels: Strategic, Tactical, and Operational. At the strategic level, it includes activities such as verification of fundamental processes, process redefinition, outsourcing decisions, and supply chain management. At the tactical level, it focuses on identifying high-cost factors both internally and externally. At the operational level, it encompasses feedback to suppliers, performance monitoring, supplier selection, allocation of purchase volumes, and cost allocation to products.

The TCO model is a decision support tool, ranging from routine operational tasks to strategic decisions for continuous improvement and process redefinition. Ellram and Siferd (1998) highlight the versatility of TCO in various applications for different types of organizations.

According to Garfamy (2006), TCO is a technique for measuring the costs associated with acquiring goods or services from the most efficient supplier. By evaluating suppliers' overall performance based on multiple criteria, TCO identifies benchmark values useful for decision-making.

TCO (Total Cost of Ownership) has become crucial for organizations seeking to better understand and manage their expenditures in selecting and maintaining supplier relationships (Bhutta and Huq, 2002). Garfamy (2006) emphasizes that TCO improves the buyer's understanding of supplier performance, providing a cost framework that facilitates more efficient negotiations.

According to Gasparetto (2004), the decision to acquire goods and services can manage costs before the transaction, defined as pre-transaction. Ellram (1996) describes TCO as a cost

modeling that, unlike other methods, focuses on the cost of doing business with a specific supplier rather than just the supplier's cost structure.

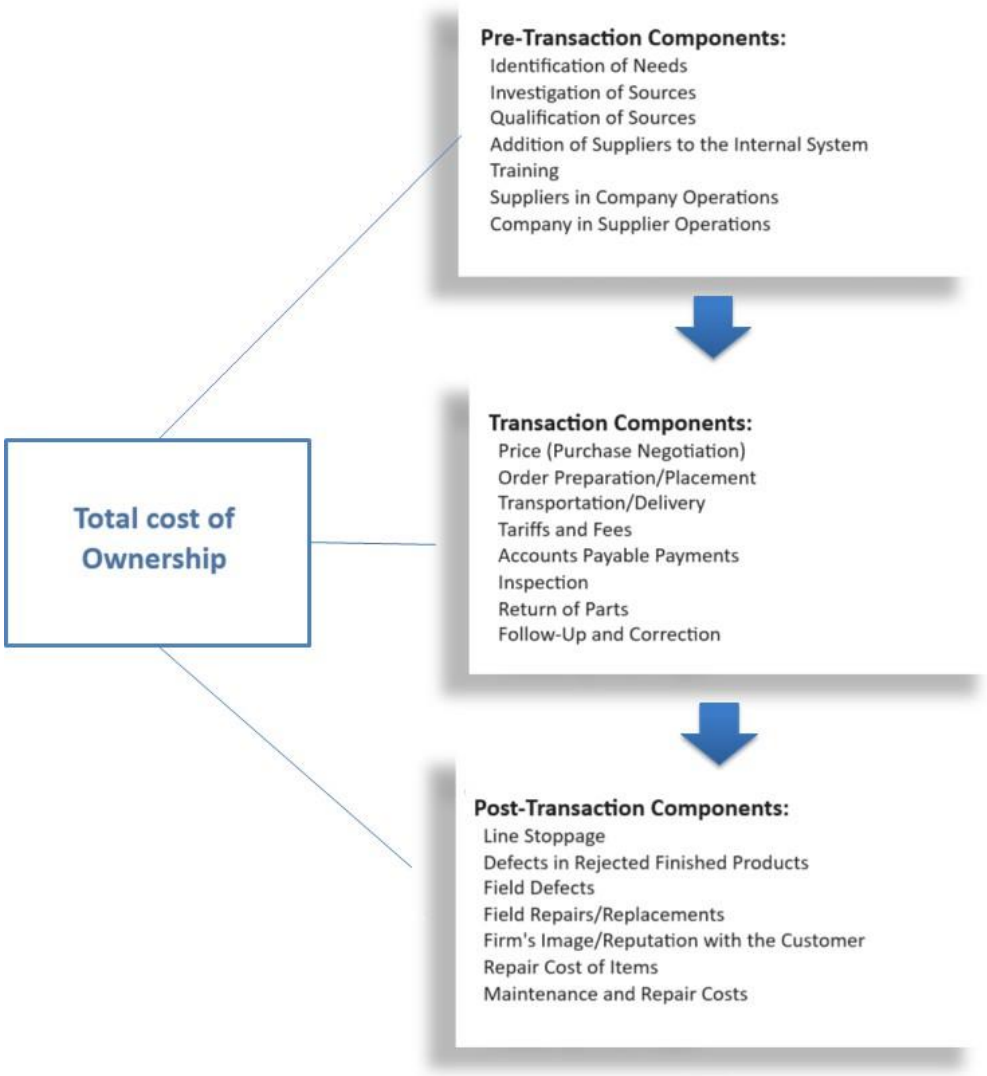
TCO is a strategic cost management technique related to continuous improvement tools. Ellram (1996) states that TCO helps identify supply alternatives that reduce total costs and directly benefit the company, as well as providing valuable information about purchasing transactions, performance evaluation, and value-adding factors in the production chain.

Carr and Ittner (1992) emphasize that the goal of TCO is to understand the underlying costs of acquiring and using inputs, products, or services from a specific supplier. The structured approach of TCO involves determining the costs associated with obtaining and maintaining an item.

Ellram (1996) emphasizes that TCO operates at the supplier-buyer interface, identifying related activities and allowing the company to see the total cost of activities, contributing to prudent decisions in the acquisition of goods and services.

Figure 2, adapted from Ellram (1993), allows visualization of all costs that make up the Total Cost of Ownership, determined as Pre-Transaction, Transaction, and Post-Transaction, as detailed below:

Figure 2 - Composition of Total Cost of Ownership (TCO)



Source: adapted from Ellram (1993, p.7)

According to Ellram (1993), pre-transaction costs occur before the order is placed and the goods are received, including all costs from the identification of the need by the employee to the investigation of potential sources. Transaction costs are associated with the purchasing process and the transfer from the supplier to the buyer. Post-transaction costs refer to expenses related to potential defects and the maintenance of the asset.

Therefore, the Total Cost of Ownership of a material must consider all these costs, from the identification of the need to the resolution of problems. This comprehensive view allows for identifying purchasing alternatives that may lead to total cost reductions.

2. MATERIALS AND METHODS

The method used for the development of this work is characterized by applied research of exploratory nature, focused on generating knowledge for practical application and solving specific problems. The deepening of the topic is carried out through a bibliographical review combined with an exploratory field analysis. According to Mattar (1999), exploratory research is indicated when the knowledge about the topic is insufficient, providing greater familiarity with the problem and allowing the formulation of hypotheses. This type of research is mainly based on bibliographical survey, which may include interviews with people who have practical experience about the problem or analysis of illustrative examples (Gil, 1991).

The research will be divided into two stages. The first stage consists of a literature review, through the collection of bibliographical data and documents, followed by a qualitative analysis of the content. In this phase, data will be collected on the Total Cost of Ownership (TCO) model proposed by Lisa M. Ellram (1993) and on logistical costs based on the work "Logistics Cost Management" by Ana Cristina de Faria (2013). The main advantage of bibliographical research lies in its ability to cover a wide range of phenomena (Gil, 1999).

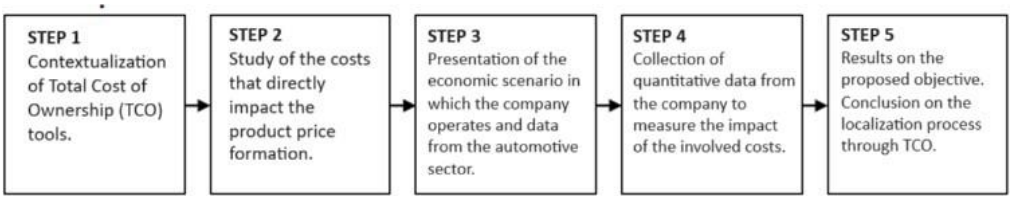
The second stage involves descriptive qualitative research. This approach allows for a better understanding of a specific phenomenon from the perspective of the involved parties, considering all relevant viewpoints. Various types of data will be collected and analyzed to understand the dynamics of the studied model. Qualitative research is exploratory, encouraging respondents to think and express themselves freely on the subject. The data will be presented in reports that consider relevant aspects, such as opinions and comments from the interviewees.

In this phase, a case study will be conducted, collecting practical data from a company in the automotive sector to obtain a deep and detailed understanding (Gil, 2002). Semi-structured interviews will also be conducted with purchasing managers, where the impact of this study is most significant. The objective is to provide a decision-making solution based on the TCO model. A spreadsheet will be developed to determine the feasibility of the nationalization of production, considering economic and logistical factors that affect input costs.

A case study was chosen for this research as it is a type of research whose object is a unit that can be analyzed in depth. According to Yin (2003, p. 32):

> It is a form of empirical research that investigates contemporary phenomena within their real-life context, in situations where the boundaries between the phenomenon and the context are not clearly defined.

The data collection and all research stages of the project followed an order to be considered, as can be observed below:



Source: Adapted from Yin (2003).

A pilot project will be suggested based on the company's internal data, focusing on a critical item for the organization. The study will compare two distinct suppliers, one national and the other international. The analysis will be based on a limited number of suppliers due to the technical characteristics and Sourcing approval standards adopted by the company. The price analysis will consider all processes with a direct impact, from acquisition at the source to availability on the production line. This approach is justified because traditional procurement methods are based exclusively on the offered price, without considering other important factors such as international logistics costs and exchange rate variations.

3. RESULTS AND DISCUSSION

Alpha company, named this way to maintain the confidentiality of the information, operates with a traditional procurement decision model, based exclusively on the final product price without considering other involved costs. The decision-making process for acquiring inputs from new suppliers occurs through quotation and subsequent investigation. To analyze suppliers from different locations, a single reference currency, the dollar, is used, with an annual forecast of the exchange rate variation to estimate the currency's behavior during the year. This way, it is possible to assess the impact of both suppliers in a single currency.

During this analysis, other aspects are considered, especially transportation costs and taxes, called Uplift, which are based on the previous year's database costs. The mechanism adopted by Alpha company hinders the understanding of the actual product cost and superficially influences the decision-making process, especially due to significant changes in economic and commercial standards from one year to the next.

In the model adopted by Alpha company, the international supplier located in India presents a competitive final price due to the analysis based exclusively on price. As illustrated

in Table 1, for the national product, the company adopts a standard Uplift of 1.54% on the unit price, as domestic transportation costs are allocated per product. On the other hand, for the international supplier, costs vary according to quantity, volume, type of transportation mode, and location, resulting in an Uplift of 27%.

Table 1: Price comparison of national and international suppliers

	Supplier X		Supplier Y	
	Domestic		Imported	
Initial price in local currency	R$	0,3750	R$	0,0500
Initial part price	$	0,09	$	0,05
UpLift		1,54%		27%
Price per unit with tax	$	0,0952	$	0,0635

Source: developed by the author

This result demonstrates that Alpha company's current decision model, which does not incorporate Total Cost of Ownership (TCO), limits the complete view of the total costs involved in acquisition. Including all related costs, such as transportation and exchange rate variation, in the decision-making process can provide a more accurate analysis and potentially favor the nationalization of inputs.

The decision-making process based on the Total Cost of Ownership (TCO) model aims to determine all costs involved in acquiring inputs and analyze how these costs impact the final product price, in order to assess the feasibility of nationalizing production. Through data collection and a pilot project at Alpha company, the intention is to create a mechanism that assists buyers and employees in input acquisition decisions. The cost determination covers from the purchase order issuance to the final delivery, with these data stored in a database.

This database, combined with a cost spreadsheet, results in a universal tool applicable to all cost analyses. Some data are fixed, but others vary according to product specifications and negotiations. The pilot project focused on a specific item, named "Nut." To obtain appropriate responses, a quotation was conducted with two suppliers located in different geographic regions, aiming to study the possibility of nationalization in an unstable economic scenario with exchange rate fluctuations, highlighting the importance of strategic purchasing to increase company competitiveness.

A single currency standard, the dollar, was used to present the impact in a format already adopted by the organization.

Due to the supply standards required by Alpha company, the limited number of suppliers that participated in the quotations is justified. Supplier X, a national supplier, meets all technical

specifications and performance and quality parameters but initially presents a higher price than the imported product from supplier Y, even considering the dollar quotation.

If the study were based solely on price, international supplier Y would be indicated. However, the TCO model serves as a basis for more informed decisions. Data from the automotive sector shows how the slowdown impacted volumes and, consequently, final prices, reducing economies of scale and increasing production costs, affecting competitiveness.

Alpha company annually acquired 81,631,110 units for 564 active components from different product lines. The regional distribution is detailed in Table 2 below:

Table 2: Global distribution of Alpha company's suppliers

Region	Active component quantity	Volume
South America	252	18.301.973
Asia	189	45.068.783
Europe	37	8.341.719
North America	86	9.918.635
Total	**564**	**81.631.110**

Source: developed by the author

To generate the results regarding the TCO tool, several measures were adopted to understand the behavior of costs in the final price composition. The costs involved were separated for detailed analysis.

3.1 Taxes

The study enabled the quantification of the impact of each tax on the pricing of national and international products. Taxes contributed to a 37% increase in the unit price of the national item and a 79% increase in the price of the imported product. This significant increase in the cost of the imported product is mainly due to the import tax, which acts as a barrier to the entry of international products, aiming to protect the Brazilian industry.

3.2 Transportation

Transportation cost is one of the most significant factors in the product cost composition. In the case of Alpha company, national logistics have evolved over the years, despite the predominance of road transport due to its flexibility in deliveries. Road transport

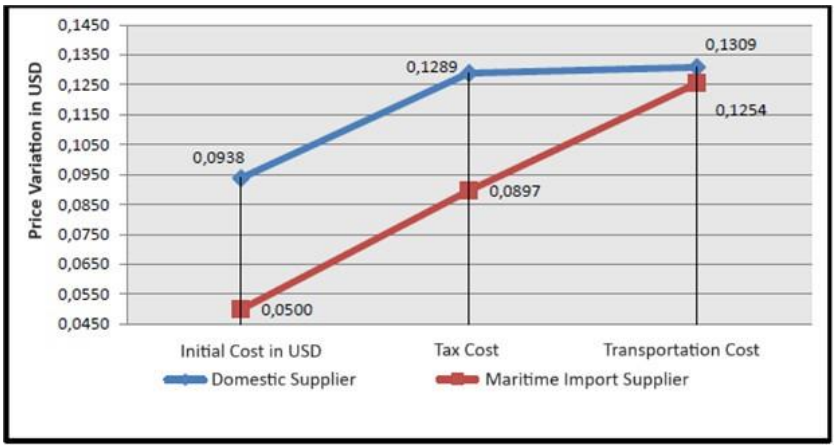
represents one of the least impactful national logistical costs and is maintained through contracts with carriers at fixed prices. There are two transportation options: the first where the supplier delivers the material to the carrier's warehouse, and the second where the carrier collects the material from the supplying company. Although these services have different costs, due to the large volume of daily deliveries, comprehensive contracts that cover all aspects and prices are chosen.

The logistics department of Alpha company, aiming to maintain low inventory levels, operates with a high flow of material replenishment. Therefore, shipments are made daily, and the service is provided exclusively by two carriers. Transportation costs are fixed and allocated among all products, being reassessed annually. Costs represented 1% of the product price last year, and this percentage has now increased to 1.54% due to the increased volume of national transportation and operational transportation costs.

In international transport, Alpha company uses two delivery modes, with maritime transport being the most frequent due to its lower costs. However, this type of transport has a significant disadvantage related to lead time, which is approximately 45 days. Any failure in logistical scheduling or technical problems at the port can disrupt the production line. Additionally, maritime transport requires a high volume to be viable, as the customs agent needs to consolidate other loads before starting the transport.

The cost of maritime transport represents a 71% increase in the product cost, making it one of the most significant factors in the unit price composition, as shown in Chart 1.

Chart 1: Road vs. Maritime Transport Comparison



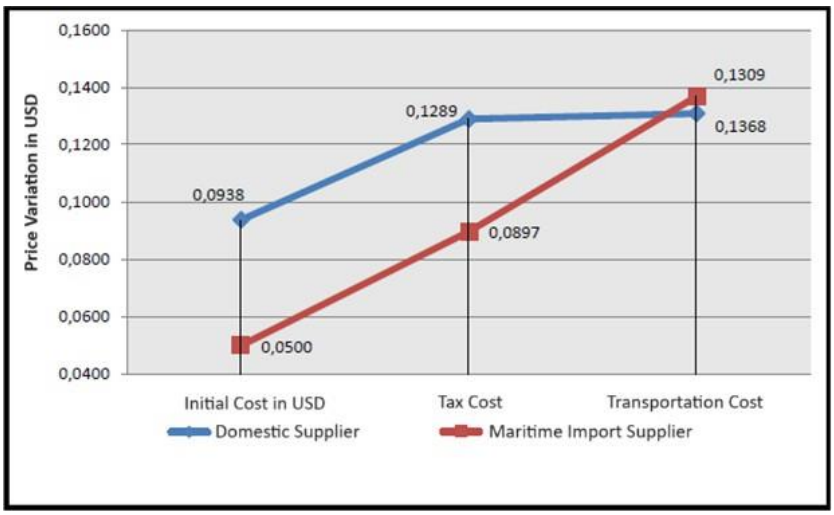
Source: developed by the author

Through Chart 1, it is possible to observe that the cost of the imported supplier is similar to that of the national supplier due to the significant impact of maritime transport. In this

analysis, it is verified that the international product presents economic viability compared to the national one, despite requiring a considerably larger volume, which directly impacts inventory and batch costs.

For international transport, it is also possible to use air transport, which has high costs due to its agility and speed of delivery. This type of transport is recommended for samples, products with a short shelf life, and high-value items, resulting in a 94% increase in unit price, as shown in Chart 2.

Chart 2: International Air Transport Comparison



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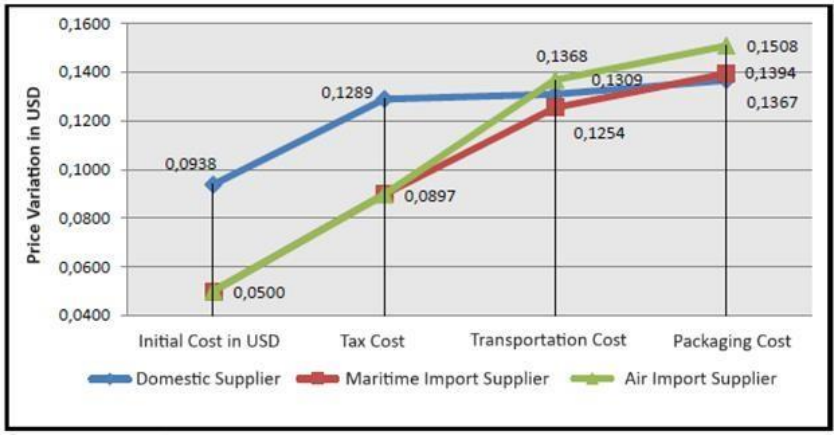
3.3 Packaging

The packaging used for product protection and storage varies according to the type of transport and the supplier's location. For products purchased from domestic suppliers, a lower degree of complexity is required in the packaging models and types. The domestic supplier allows the use of returnable packaging, which requires an initial investment amortized in the unit price. In the case studied, the types of packaging required for domestic transport were considered, with the value based on the box dimensions (28x40x60) and the item, determining the ideal quantity of pieces per box. The calculation considers the monthly demand for the item, the volume allocated in each returnable box, and the investment in returnable packaging.

On the other hand, the international supplier uses disposable packaging and must carry out fumigation procedures for wooden pallets to prevent environmental imbalances caused by the proliferation of forest pests present in grain and wood packaging.

Chart 3: Comparison of Packaging Cost in Product Price



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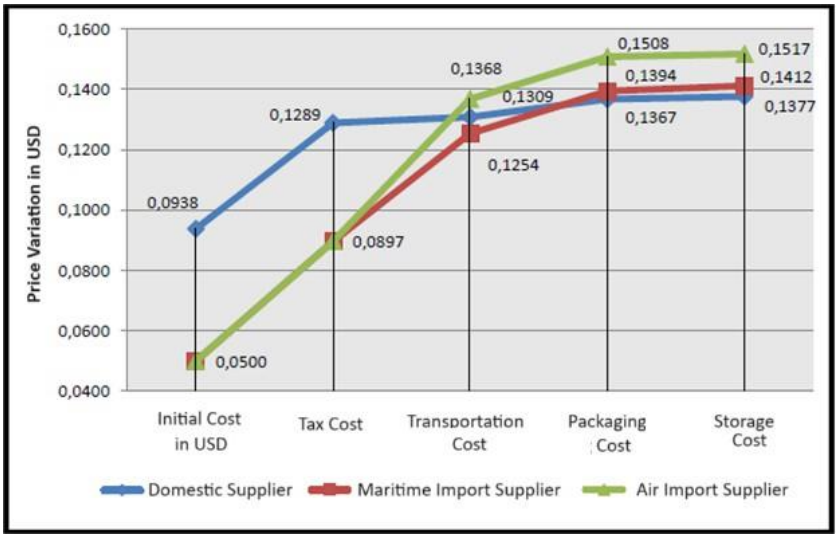
3.4 Storage Cost

The measurement of storage cost considers the expenses associated with weight and volume. The cost of primary storage is allocated based on the product's weight and volume. Thus, the larger the minimum delivery lot, the higher the storage cost. According to data from Company Alpha, the storage cost for the studied product is $0.0113 per unit, allocated by the volume of the delivery and the minimum lot for each mode of transport. Since maritime transport requires a larger volume to be economically viable, the impact of storage cost is also more significant.

Chart 4: Comparison of Price with Storage Cost



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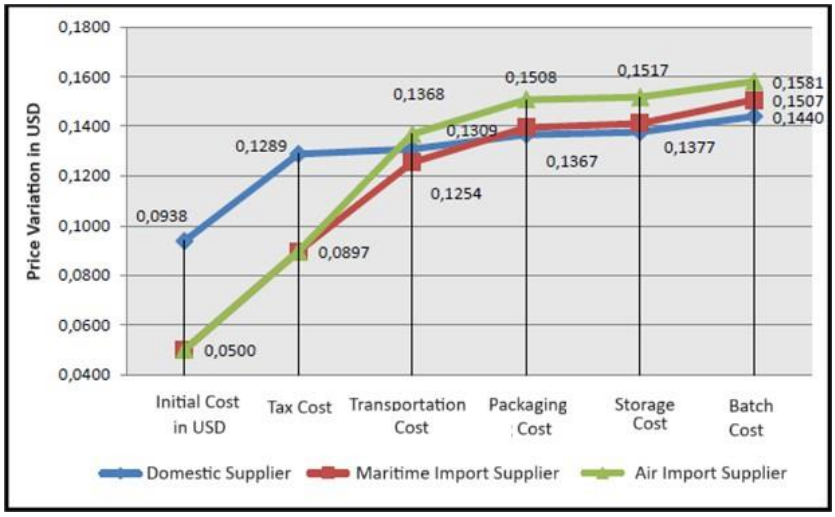
3.5 Lot Cost

The definition of the minimum lot size to be adopted involves two different perspectives. From the supplier's point of view, larger lots are preferable as they help minimize fixed costs, reduce production waste, and decrease costs associated with machine setup. On the other hand, Company Alpha considers it ideal to work with smaller lots to reduce inventory costs. However, producing on a smaller scale result in a higher unit cost.

Chart 5: Price Evolution Due to Involved Costs



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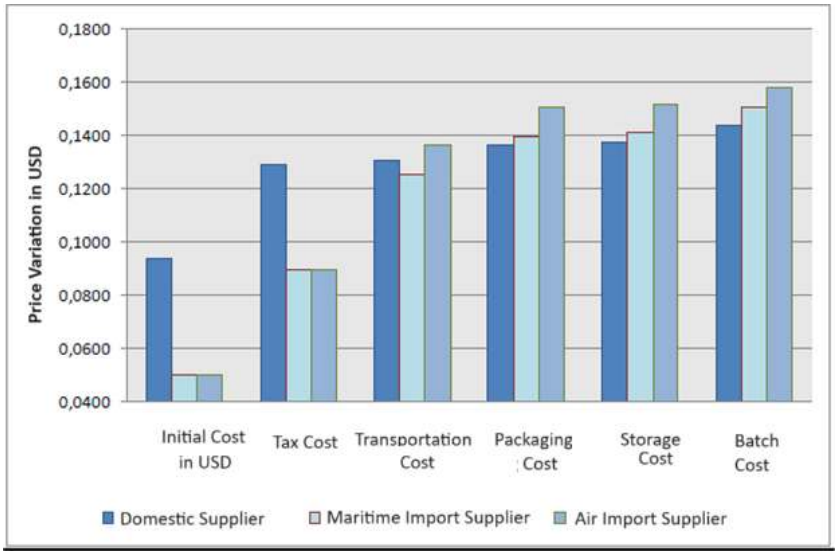
According to Chart 6, it is possible to identify the point at which nationalizing production becomes viable. From the packaging costs, the price from the domestic supplier begins to be more competitive than that of the international supplier.

Chart 6: Price Evolution of the Item Considering All Costs



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3.6 Exchange Rate Variation

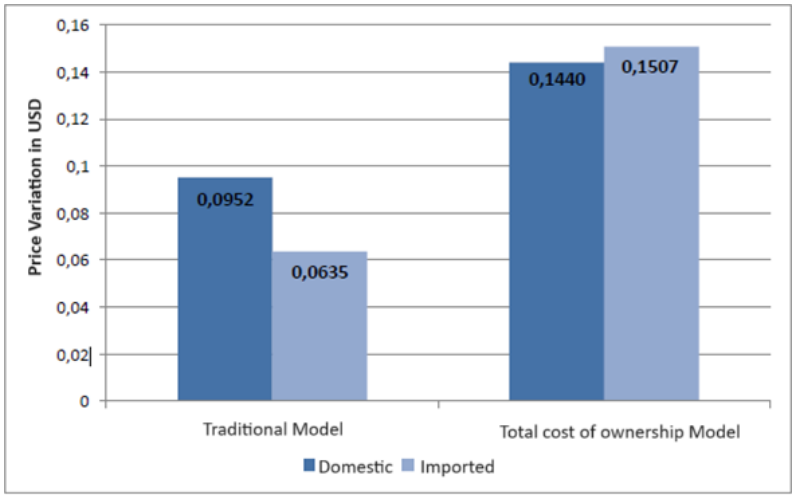
One of the factors increasing the need for nationalization is the constant exchange rate variation, which diminishes the purchasing power of the national currency. With economic slowdown, imported products become excessively expensive for the organization.

Over the past three years, the exchange rate between the Real and the Dollar has shown significant variation. In 2021, the average rate was around R$5.41 per USD, with peaks above R$5.60 in February and March. In 2022, the rate fluctuated between R$5.00 and R$5.70, reflecting global economic instability. In 2023, the Real showed some recovery, but the rate still varied from R$4.70 to R$5.30 per USD. These fluctuations directly impact the cost of imported products, making them more expensive for the organization.

3.7 Comparison Between Traditional Model and Total Cost of Ownership Model

When comparing the traditional acquisition model used by company Alpha with the Total Cost of Ownership (TCO) model developed in this study, the need for companies to adapt to new managerial and organizational practices is highlighted. As illustrated in Chart 7, the traditional sourcing decision model indicates that the imported product has a lower initial price. However, when considering all the costs involved in the acquisition, especially transportation and taxes, the international supplier loses competitiveness, resulting in a final price higher than that of the domestic product.

Chart 7: Comparison Between Traditional Model and Total Cost of Ownership Model



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FINAL CONSIDERATIONS

The Total Cost of Ownership (TCO) tool has proven essential for accurately calculating total costs, unlike the traditional purchasing model that ignores various costs, negatively influencing acquisition decisions. By using TCO, Alpha company was able to reduce the annual impact by $5,009 for the studied item, enhancing its competitiveness. Expanding TCO to other items could result in savings of up to $1,500,000, providing significant advantages for the company.

However, the implementation of TCO faces several barriers, including the complexity of the process, lack of accessible information, the need for adequate training, and cultural resistance within the organization. The absence of readily available and easily accessible data in companies hinders the effective adoption of TCO, requiring the purchasing team to be trained to identify and collect all relevant costs.

The complexity of implementation also involves a significant investment of time and human resources, making it challenging to understand and uniformly apply the model across all divisions of the company. Employee resistance to traditional models and a lack of confidence in the new method are also significant challenges. To overcome these barriers, it is crucial to gain support from senior management and educate the organization about the benefits of TCO.

Additionally, the extra costs of training and developing the model may be seen as an obstacle if management is not convinced of the long-term benefits. However, these costs are justified by the gains in competitiveness and cost reduction that TCO can provide. The adoption

of TCO enables more informed purchasing decisions based on a realistic scenario, resulting in more competitive quotes and new business opportunities.

In summary, the TCO tool offers a more precise and comprehensive approach to purchasing decision-making, despite the implementation challenges. Overcoming these barriers can lead to significant cost reductions and increased competitiveness, making it an important strategic differentiator for the company.

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