

ABC Curve Application in Materials Stock Optimization in a Restaurant in Manaus - Amazonas

Brunno Vasconcelos Costa

brunnovasconcelos7@gmail.com

Centro Universitário FAMETRO – Brasil

Fabiana Rocha Pinto

fabiana.floresta@gmail.com

Coordenação de Engenharia Centro Universitário FAMETRO – Brasil

David Barbosa de Alencar (Corresponding author)

david002870@hotmail.com

Coordenação de Engenharia Centro Universitário FAMETRO – Brasil

Alexandra Priscilla Tregue Costa

ptreguep@yahoo.com.br

Coordenação de Engenharia Centro Universitário FAMETRO – Brasil

Francisco Carlos Tavares Amorim

amorim.mao17@gmail.com

Coordenação de Engenharia da Universidade Nilton Lins – Brasil

Abstract

In a highly competitive global scenario, companies are looking for ways to optimize their processes, reducing costs and improving the quality of their products. In this context, several tools were developed to improve the companies' inventory management, one of them being the ABC Curve as a method to hierarchize the inventory according to the intrinsic value of each material, allowing the analysis of how the supply should work. from each supplier. The present work aims to perform the application of the ABC curve method in the zagaia restaurant, located in the city of Manaus / AM that will allow the stock hierarchy and will be through the classification of the raw material according to its annual demand and its Unit price. As a premise, a bibliographic research on content planning and inventory management was adopted, as well as an on-site study to catalog the items and check with the restaurant management, their values, their quantities and how the chain works. of supplies. The results presented confirm that Class A items need greater attention due to their high value, while Class C items do not impact financially as much, but need attention to be properly allocated within inventory as they represent the largest volume.

Keywords: Inventory Management, ABC Curve; Supply chain;

1. Introduction

Faced with a highly competitive market and which in many different fields, their customers will increasingly value credibility and reliability, companies seek to stand out for the quality of their products while high competition forces entrepreneurs to keep their prices low. This complexity results in a high mortality rate among enterprises: 35% of bars and restaurants close in two years, according to Abrasel. Thus, the biggest obstacle for companies is to reduce their costs and improve their reliability simultaneously. For this, organizations seek techniques for cost management and process optimization. Inventory management is a key strategy for meeting these challenges.

By the traditional equation: $\text{Price} = (\text{Cost} + \text{Profit})$, we have the price, usually dictated by the market and the profit, prefixed by the shareholders. There remains only the “cost” as a variable component of direct business action. To act on costs is to turn expenses into revenues by continually improving process efficiency by identifying and eliminating waste.

One of the main assets and with the best optimization and cost reduction opportunities is inventory. Second [1] means by stock any quantities of physical goods that are unproductively conserved for some time; Inventories are both finished goods awaiting sale or dispatch, as well as raw materials and components awaiting use in production.

According to [2] from a financial point of view, stocks are seen as investment and represent trapped money, which cannot be used for other purposes. Therefore, keeping them to a minimum is a guarantee that resources are not being over-invested and that the company's cash is not being compromised.

In the case of bars and restaurants the stock is operationalized in the short term, as all raw material purchased is soon converted into a finished product, the downside is that if there is a larger than necessary purchase, this MP will lose its shelf life. consequently the restaurant will need to throw the material away. According to [3] it is necessary to use all principles, concepts and techniques to know which items to order, how much to order, when they are needed, how and where to store them. A good understanding of inventory management drives the optimization of inventory investments and capital involved, customer service, and production, purchasing, and distribution operations.

One of the main and most widespread tools in the corporate world is the ABC curve. The ABC curve consists of the separation of inventory items into three groups according to annual demand value for finished products or annual consumption value for work in process or raw materials and inputs. According to [4] these values are determined by multiplying the price or unit cost of each product by its consumption or its annual demand. The ABC curve is important because it allows the stock to be hierarchized and the manager has a view of which materials need the most. attention and control.

Thus, the objective of this paper is to analyze how the application of the ABC Curve method influences waste reduction and improves inventory management in a restaurant located in Manaus / AM. This will happen by separating the materials into 3 segments; Which are the items of greatest importance and cost, corresponding to 80% of the stock value and 20% of the items. B which are the intermediate items and correspond to 15% of the stock value and 30% of the items. C which are the minor items, but in high quantity, correspond to 5% of the stock value and 50% of the items. After collecting and sorting the data one can build the ABC curve graph.

2. Literature Review

2.1 Stock Concept

According to [5], inventory is the amount of physical goods that are held in reserve awaiting sale or use in production. Inventory goods can be understood as raw materials, semi-finished goods, finished goods and goods for sale. Inventories are items that are not being used constantly, but are stocked for future needs.

According to [6], inventories represent a means of investing resources that, if not properly controlled, can reach a large portion of a company's total assets. Because of this, companies need the inventory to be managed with maximum efficiency, keeping only the balance needed to supply the productive system for a certain period.

According to [7], managing inventories is to reconcile and resolve existing conflicts between each area, without affecting the operability of each sector, always aiming at optimizing the company's overall performance.

Inventory management is a vital task for a company's financial health as well as setting the pace of production. It is the manager's job to be able to balance the daily supply of production processes and at the same time not exceed the agreed value. An extremely complex task, since if there is a lot of material, there will be a lack of physical space to store and the company will have an illiquid asset that may eventually lose its value. If the problem is a very low stock, the production process will be constantly hampered by the lack of material, generating idleness in various sectors.

2.2 Stock Types

According to [8], the stock can be classified in five different ways. They are: in transit; of speculation; regular or cyclic in nature; security and the obsolete.

In the segment of bars and restaurants, the most addressed stocks are those of a regular and obsolete nature. This is due to the fact that the short term between the acquisition of raw materials (food) and their period of validity, thus there is no space or time for large stocks.

2.3 Inventory Costs

One of the main objectives of companies when carrying out inventory control is related to costs. All material purchased and that will be stored within the company generates a stocking cost. Therefore, it is important for managers to be aware of the costs incurred by the mere existence of stocks within a company.

According to [3] the storage cost "corresponds to the costs of the physical space required to store the material, which can be rented or owned. According to [1], furthermore, the "storage cost includes the cost of the space occupied by the goods, insurance, fees, losses, material obsolescence or its deterioration. "

Inventory costs range from raw material procurement to receipt and storage of material within the company. There is also the cost of inventories that will become obsolete, as well as all the inherent cost of inventory, they will also add the cost of being thrown away.

According to [9] the main activities to reduce such costs are; reduce production and supply lead time; synchronize the delivery of materials and components in the production process; increase the speed of

receipt of orders by electronic means; reduce production planning time; develop the continuous flow of material movements.

2.4 Inventory Management

Companies have been adopting production models that focus more on reducing costs and increasing the quality of their products. Thus, improving inventory management to reduce waste and reduce costs becomes an excellent opportunity for companies to achieve their goals.

Second [10] it is important to know that when we have high inventories, to fully meet the demand, it entails the need for high working capital and leading to high costs. However, low inventories can lead to inadequate management, resulting in costs that are difficult to account for due to delivery delays, redesign of the production process, customer dissatisfaction, and especially customer loss.

According to [11], the function of inventory management is to maximize the effect of return on sales and the adjustment of production planning and scheduling. It should minimize the capital invested in inventories, as it is high cost and increases with the financial cost.

In this scenario, where companies are increasingly looking for efficient inventory management, several tools have been developed in recent decades to improve this management, such as; JIT, Kanban, PEPS, UEPS and others.

2.5 ABC Curve

According to [10] the ABC Curve, also known as the Pareto Principle or 80/20 Principle, emerged in Italy around 1897. It was elaborated by Vilfredo Pareto after studies on the distribution of income and wealth of the local population. In this study, Pareto noted that total income was largely concentrated in the hands of a small part of the population, at a rate of approximately 80% and 20% respectively, ie 20% of people controlled 80% of wealth.

According [12], the ABC curve is a very useful tool, as it is able to identify those items that deserve greater attention in the decision making process in inventory management. The curve is obtained starting from the ordering of the items according to their relative importance; and according to the authors and following Pareto's law, which is the basic principle of the ABC curve, there is a small portion of the items (about 20%) accounting for about 80% of the total stock value and a large about 80% of the items representing only 20% of the stocked values.

Second [13] states that to classify is to use a system to stratify the population into classes based on relevant criteria for the prioritization of management treatments. The most common classification in terms of inventory is the ABC that segments inventories according to the values consumed and is used when the number of distinct items stocked is large enough to the point where companies are short of human resources or timely. enough to track all stocks in detail

According to [7], companies generally keep a large number of items in stock, but few are considered the most important and require special attention. Control of the stocks by the ABC curve provides greater depth of analysis with a small margin of error.

Following the Pareto principle, items are classified into three categories A, B, and C. Table 1 shows this classification;

Table 1: ABC Curve Classes

Class	Description	% of items Qty	% of value
A	They are the most relevant items and need to receive more attention. 80% of the value and 20% of the items.	20%	80%
B	They are the intermediate items and second in importance. They correspond to about 15% of the value and 30% of the items.	30%	15%
C	These are the least financially important items. Only 5% of the value despite being in large quantities, being 50% of the items.	50%	5%

Source: Adapted from [10].

According to [10] after calculating the annual investment of each item, one must sort them in decreasing value and allocate them according to their class. Following the Pareto Rule, class A, on average, corresponds to 20% of items and 80% of stock value, class B equals 30% of items and 15% of value, and class C represents 50% of items and 5% of the value. Pozo (2007) adds that the delimitation of class percentages is not a fixed rule. The cutoff point can be defined by summing the percentage values until its result is close to 80% of the value and 20% of the total of the analyzed items. The goal, however, is to separate the important from the insignificant.

According to [14] for the elaboration of the ABC curve, first one must define the variable to be analyzed or the problem to be solved. It is common to calculate the ABC curve to know the cost value of the annual demand for inventory items. This technique can also be used for checking against average stocks, sales made, which are the largest customers, suppliers, etc.

According to [9] the ABC classification process can be divided into three steps. What are they:

- Data collection: This is a time-consuming step as it involves a large amount of information. The data collected corresponds to the item identification, the quantity consumed or projected for the period and unit value.
- Annual cost calculation: It is the multiplication of the quantity of items consumed in a period of one year by its unit value.
- Sorting items in descending order: Once items are calculated, items are sorted in decreasing value. Following the methodology applied to classification, items in categories A, B or C are appropriated, which is commonly assigned 20% of items to class A, 30% to class B and 50% to class C.

After collecting and sorting the data one can build the ABC curve graph. Figure 1 shows this graphical representation.

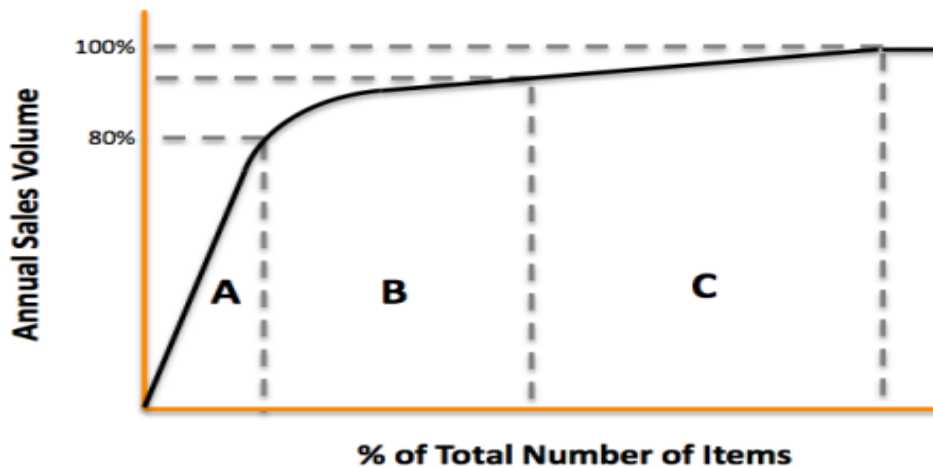


Figure 1 - Graphic Representation of ABC Curve

Source: [15]

The ABC rating can be very useful for managers as an indicator of the importance of each product in terms of value, but it has some limitations, for example: it does not reveal what happens when any of these items is missing from inventory, it only takes into account value of products not explaining production factors, replacement time, possibility of errors in demand forecasting and others.

3. Tool and methods

3.1 Methodology

The study took place in 2019 in a restaurant in the city of Manaus / AM. The survey was conducted based on all items in stock. All 220 items in stock were cataloged and classified according to the ABC curve. However, for demonstrative purposes the chart was drawn using data from the 20 most relevant items for the process.

In order to obtain the data, site visits were made at the company, so that, together with the restaurant management, it was analyzed item by item, separating them according to their unit price and weekly demand. Due to the fact that there is a constant inventory turnover in a restaurant, the weekly period for demand analysis was adopted. Subsequently to calculate the annual demand, the weekly demand value was multiplied by 52 (Number of weeks in the year).

In addition, for a better understanding of the subject, we also adopted a literature search on the concepts of inventory management and the ABC curve.

3.2 Characterization of the place of study

The Zagaia restaurant where the study took place is a famous fishmonger located in the city of Manaus in Campos Elísios, Planalto. With more than 10 years since its opening, the restaurant is a reference among fishmongers in the region. Already with a consolidated clientele, owners are looking for ways to optimize their processes and improve the management of their assets, because of this there was the opportunity to implement the concept of the ABC curve.

4. Application of the study

4.1 Classification of materials

To apply the study, 7 steps were developed to construct the ABC table, according to the flowchart presented in figure 2.



Figure 2: Steps of the ABC Table Build Process

Source: The Author.

The first step for building the ABC curve is the cataloging of inventory items. As mentioned earlier, the present study took into consideration the 20 most relevant items for the production process, namely; Tambaqui, Pirarucu, Matrinchã, Jaraqui, Rooster Olive Oil, Champignon, Titty, Beef Rump, Mayonnaise, Soybean Oil, Vinegar Virrossas, Beach Beans, Elect Milk, Mozzarella Cheese, Shoyo Sauce, Lettuce, Biju White Rice, Trigolar Flour, Extract of tomato and refined salt.

The second step is to point the unit price of each item, to perform this step was analyzed the purchase history based on the purchase invoices of these products.

The third step is to calculate the monthly or weekly demand for each of the items. In the case of restaurants and bars it is recommended that the demand be evaluated weekly as the stock turnover is constant due to the validity period of the materials.

The fourth and final step of the data collection phase is to calculate the annual demand for each item, which is given by the weekly demand multiplied by 52 (Number of weeks in the year), according to EQ1:

$$DA = DS * 52 \text{ (EQ1)}$$

Where DA is the annual demand. DS is the weekly demand. And 52 is the number of weeks in the year.

The fifth step is the calculation of the annual investment, which is the crucial step for assembling the ABC curve. This is when the manager can see how much is spent per year on each item. This calculation is performed by multiplying the annual demand and the unit price of each item, according to EQ2:

$$IA = DA * PU \text{ (EQ2)}$$

Where IA is the annual investment. DA is the annual demand. PU is the unit price

The sixth step is to break down the annual investment according to the percentage of each item. First we calculate the total investment by summing the annual investment of each item. After that the annual investment of the item in question is divided by the total. You can see this calculation in EQ3:

$$\% \text{ of X} = IA / IAt \text{ (EQ3)}$$

Where % X is the percentage of each item. IA is the annual investment. IAt is the total investment of all items.

The seventh and last step is the construction of table ABC, with the information obtained so far it is possible to classify the items according to their percentage value. By sorting the table downwards, from highest to lowest investment, you can view and sort items in categories A B and C following the 80/20 rule.

4.2 Implementation of ABC Table

Through table ABC, it was possible to make the distribution of priorities of inventory items, and provide the consolidation of the analysis.

Table 2: ABC table with data obtained in the restaurant.

Item	Unit Price (R \$)	Annual Consumption (Units)	Annual Investment (R \$)	Total Investment in%	Descending Sort	ABC classification
Tambaqui	R\$ 55,00	1560	R\$ 85.800,00	27,73%	20	A
Pirarucu	R\$ 50,90	1456	R\$ 74.110,40	23,95%	19	A
Matrinchã	R\$ 41,90	1612	R\$ 67.542,80	21,83%	18	A
Jaraqui	R\$ 6,00	2600	R\$ 15.600,00	5,04%	17	A
Rooster Olive Oil	R\$ 19,99	520	R\$ 10.394,80	3,36%	16	B
Champignon	R\$ 12,90	624 (kg)	R\$ 8.049,60	2,60%	15	B
Titty	R\$ 15,00	520 (kg)	R\$ 7.800,00	2,52%	14	B
Beef rump	R\$ 24,99	312 (kg)	R\$ 7.796,88	2,52%	13	B
Mayonnaise	R\$ 4,46	1560	R\$ 6.957,60	2,25%	12	B
Soy oil	R\$ 3,15	2080	R\$ 6.552,00	2,12%	11	B
Ferrous Vinegar	R\$ 2,56	1248	R\$ 3.194,88	1,03%	10	C
Beach Bean	R\$ 2,79	1040	R\$ 2.901,60	0,94%	9	C
Elect Milk	R\$ 1,69	1404	R\$ 2.372,76	0,77%	8	C
Mozzarella Cheese	R\$ 5,00	416	R\$ 2.080,00	0,67%	7	C
Shoyo sauce	R\$ 7,00	260	R\$ 1.820,00	0,59%	6	C
Lettuce	R\$ 7,00	260	R\$ 1.820,00	0,59%	5	C
Biju white rice	R\$ 2,99	520	R\$ 1.554,80	0,50%	4	C
Trigolar Flour	R\$ 1,51	832	R\$ 1.256,32	0,41%	3	C
Tomato extract	R\$ 9,50	104	R\$ 988,00	0,32%	2	C

Refined Salt	R\$ 0,53	1560	R\$ 826,80	0,27%	1	C
TOTAL INVESTMENT			R\$ 309.419,24	100,00%		

Source: The Author.

4.2.1 Table ABC Consolidation

Consolidating the information from table 2, we have the following representation:

Table 3: Consolidated between values and items in percentage.

Class	Values in%	Items in%	Relevance
A	78,55	20	Great
B	15,37	30	Intermediate
C	6,08	50	Little

Source: The Author.

For classification, the items were selected until they reached the cutoff point established by the ABC curve. For class A, the cutoff is 80%, class B 15% and class 5% of the annual investment value. It is noticed that the results were not exact according to the 80-20 rule, however, the delimitation of the percentages of the classes is not a fixed rule. The goal is to separate the important from the insignificant.

5. Results and discussions

For the construction of the graph in figure 3, the items cataloged as X axis were taken into account, while the accumulated percentage of all items was the Y axis. As a legend is the ABC curve, segregating the items according to their financial value for the stock.

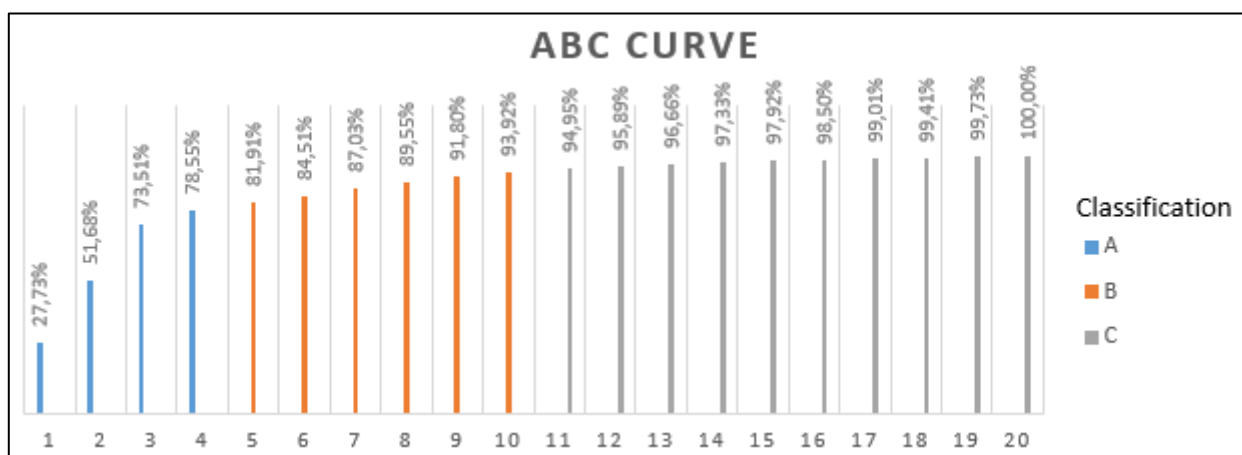


Figure 3: Bar graph, indicating the accumulated percentage of each item.

Source: The Author.

In the graph in figure 4 we can see an area representation of the ABC curve, where class A items constitute the largest advance in the accumulated percentage.

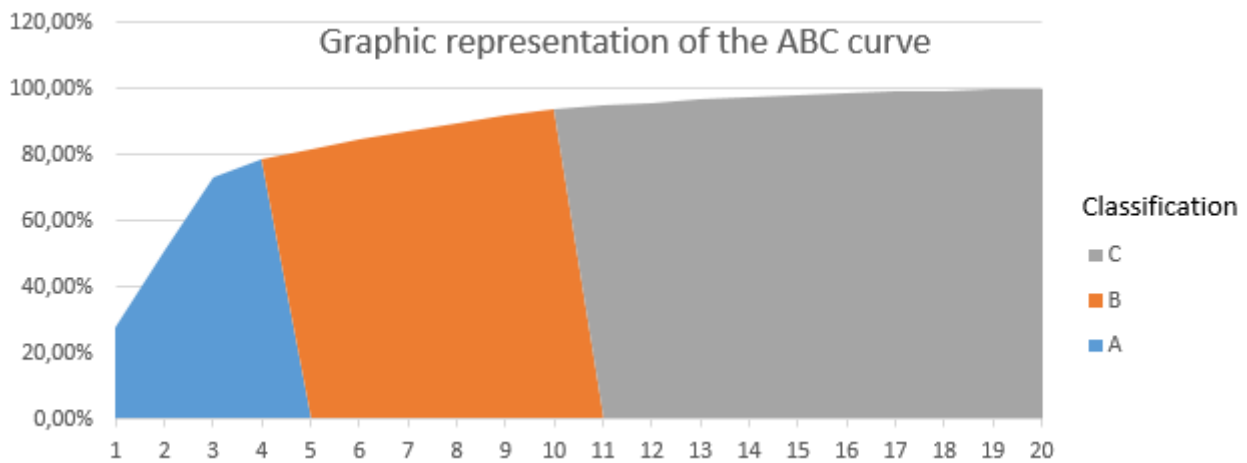


Figure 4: Graphical representation of the ABC curve.

Source: The Author.

The results of the present study revealed numbers very close to those expected by the ABC curve concept, allowing restaurant managers to be clearer where their largest investments in stock are.

Class A items are concentrated in proteins, namely Tambaqui, Pirarucu, Matrinchã and Jaraqui, which consist of 78.55% of the total stock value. However, it is only 20% of the cataloged items. We can notice that these values are due to the unit price of these assets being very high, except for Jaraqui which has the annual demand well above average.

Class B items are divided into less demanding proteins and preparation material, such as rooster olive oil, champignon, titty, beef rump, mayonnaise and soybean oil. These items constitute 15.37% of the total inventory value and 30% of the cataloged items.

Class C items are concentrated on side dishes and preparation materials that are less in demand, namely: Vinegar Virrossas, beach beans, Elegê milk, mozzarella cheese, shoyo sauce, lettuce, Biju white rice, Trigolar flour, tomato extract and salt. refined. These items make up only 6.08% of the total stock value, however they are 50% of the items and need attention when storing them properly so that the physical space is optimized.

Through the results found, several decisions can be made by management, for example, to seek loyalty with suppliers of class A products, to ensure that these products will not be lacking, given the added monetary importance to them. Since the stock has a high turnover, there is no concern about capital stock. The stock is ranked in the following order; Proteins, preparation materials and side dishes. With this information the restaurant zagaia can prepare a supply plan focused on proteins, because although they are few items, constitute the largest value of the stock.

6. Final Considerations

Inventories are assets held by companies to be sold or consumed. These assets need to be managed properly, so that there is no shortage of materials and, on the other hand, the company's finances are not damaged. Therefore, the importance of inventory management, which aims to maintain adequate levels of materials, ensuring the balance between inventory and consumption, and the reduction of costs incurred, is highlighted.

For a restaurant there is no finished product stock, as all production is done under the demand of a customer. However, it is of the utmost importance that all the material needed to prepare a meal is in stock, because in case of lack of any item, it will generate unavailability of some dishes, frustrating customers.

By applying the proposed methodology it was possible to classify the raw materials in stock according to their monetary value, taking into account their annual demand and the unit price of each item. With this information was constructed the chart with the ABC curve, hierarchizing the stock.

ABC Curve is an important management tool. Through it, it is possible to identify the items in inventory that require more rigorous control, which represent about 80% of the resources invested and which have the largest share of costs incurred. Applying this management tool, the restaurant managers under study will be able to control the most consumed items by focusing their efforts on these materials to save money.

7. Bibliographical References

- [1] MOREIRA, D. A. Administração da produção e operações. 2. ed. São Paulo: Thomson, 2002.
- [2] ARNOLD, J.R Tony. Administração de materiais: uma introdução. São Paulo: Atlas, 1999.
- [3] BERTAGLIA, Paulo Roberto. Logística e gerenciamento da cadeia de abastecimento. São Paulo: Saraiva, 2003.
- [4] DIAS, M. A. P. Administração de Materiais: resumo da teoria, questões de revisão, exercícios, estudos de casos. 4ª ed., São Paulo: Atlas, 1995.
- [5] TÓFOLI, I. Administração financeira empresarial. São José do Rio Preto: Raízes, 2012.
- [6] CHIAVENATO, Idalberto. Iniciação à administração dos materiais. São Paulo: Makron, 2000.
- [7] FRANCISCHINI, Paulino, GURGEL Floriano do Amaral. Administração de materiais e do patrimônio. São Paulo: Pioneira Thomson Learning, 2002.
- [8] BALLOU, R. H. Gerenciamento da Cadeia de Suprimentos. 5ª ed., Porto Alegre: Bookman, 2006
- [9] BERTAGLIA, Paulo Roberto. Logística e gerenciamento da cadeia de abastecimento. Editora Saraiva, 2017.
- [10] POZO, Hamilton. Administração de recursos materiais e patrimoniais: uma abordagem logística. 3. ed. São Paulo: Atlas, 2007
- [11] DIAS, Marcos Aurélio. Administração de materiais: princípios, conceitos e gestão. São Paulo: Atlas, 2009.
- [12] BRAGA, L.M.; PIMENTA, C.M.; VIEIRA, J.G.V., Gestão de armazenagem em um supermercado de pequeno porte. Revista P&D em Engenharia de Produção, Viçosa, n. 08, p. 57-77, 2008.
- [13] GASNIER, D.G., A dinâmica dos estoques: guia prático para planejamento, gestão de materiais e logística. São Paulo- IMAM, 2002.

[14] FERNANDES, José Carlos de F. Administração de material um enfoque sistêmico. 2 ed. Rio de Janeiro: Livros Técnicos e Científicos, 1984.

[15] FRITSCH, Daniel. Georg Simmel im Kino: die Soziologie des frühen Films und das Abenteuer der Moderne. transcript Verlag, 2015.