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"DESIGN OF A REPUESTOS SUPPLY SYSTEM AUTOMOTIVES IN THE AUTOMOTIVE SUPPLY COMPANY VASQUEZ IN THE CITY OF IBARRA"

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DESIGN OF A REPUESTOS SUPPLY SYSTEM AUTOMOTIVES IN THE AUTOMOTIVE SUPPLY COMPANY VASQUEZ IN THE CITY OF IBARRA

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Abstract. *The present project was carried out for the line of automotive spare parts of the company Proveedora Automotriz Vásquez, which had as objective the design of a system of provisioning to fulfill the requirements of the clients in time, the quantity and the specifications.*

Through an analysis of historical sales data for 3 years, the ABC classification was made taking into account the total sales ($), giving a total of 159 items type C, 95 type B and 63 type A, a latter Group of articles using statistical software Forecast Pro Trac has been processed in the execution of sales forecasts of each article.

Due to the stable demand that already shows the importance of each article, as well as to the obtained value of the coefficient of variability (VC), the EOQ model is applied, making it possible to lower costs and set the optimal quantity of the order, as well as Point In which the new order is made, taking into account the security inventory in some products.

Keywords

Inventories, procurement, compliance, times, quantity, specifications.

1. Introducción

Due to the 8% annual increase of the car park in the city of Ibarra (Bolaños, 2016). Which demands the services of maintenance and repair, in which parts changes are required. In certain cases there are usually a few spare parts in particular of the most recognized and marketed car brands (Chevrolet, Toyota, Hyundai, Nissan), which has a repercussion on consumer dissatisfaction.

For its part, the company carried out an audit in the last semester of 2015 and detected deficiencies in the supply system, such as:

- Waiting for materials
- Time required to identify materials
- Time required to find substitute materials
- Time required to find materials in local wineries
- Time required to process a purchase order Loss of time due to:
- Purchase orders with wrong materials
- Materials out of stock

Within this also unites the shortages of products in the market, which can not be found due to the high costs incurred in their importation. Due to this the

company can not fulfill the demand demanded, for this reason the company does not manage to satisfy the expectations and requirements of its clients and to fulfill the deadlines of delivery.

Thus, with procurement management, the company will obtain from outside the materials, products or services that it needs for its operation, in the quantities and deadlines established, with the necessary levels of quality and at the lowest price allowed by the market.

2. Materials and Methods

2.1 Classification ABC

To determine which parts of the largest sales are the most important articles for the company, it was necessary to develop an ABC classification taking into account the total sales ($) of each article for 3 years.

According to (Taha, 2004) the ABC analysis is usually the first step that must be applied in an inventory control situation. When identifying important inventory items, appropriate control models can be analyzed and applied in order to maintain an optimal level of inventories and therefore give priority to the most important products or articles for the company taking into account several aspects or criteria Of classification.

2.2 Design of the demand forecast system

Forecast Pro Trac software, based on 3-year historical sales data, made forecasts of all type A items using the expert selection method of the software.

In agreement with (Krajewski, Ritzman, & Malhotra, 2008), a statistical technique to make projections about the future that uses numerical data and previous experience to predict future events. The two main types of quantitative prediction used by business analysts are the explanatory method that attempts to correlate two or more variables and the time series method that uses past trends to make forecasts.

The Bayesian Information Criterion (BIC) of (Schwarz, 2006), is a model selection tool. If a model is estimated on a given data set (training set), the BIC score gives an estimate of the model's performance in a fresh and fresh data set (test set). BIC is given by the formula:

$$BIC = -2\, ln\hat{L} + k \ln(n) \qquad (1)$$

To use BIC for model selection, we simply choose the model that gives the smallest BIC on the set of candidates. BIC attempts to mitigate the risk of over adjustment by introducing the penalty term d * log (N), which grows with the number of parameters. This allows filtering unnecessarily complicated models, which have too many parameters to be accurately estimated in a given data set of size N.

2.3 Design and application of the procurement system

In order to determine which inventory control system to use, the coefficient of variability (CV) was calculated, which is a metric proposed by (Silver & Meal, 1973), then the variance of the demand ie the standard deviation squared (σ2) was calculated, this data was divided for the average demand squared ($\bar{D}2$), and the result obtained was applied the following variables of Decision (Table 1).

Table 1. Silver Meal Decision Variables

Yes VC < 0.25	Using Classical Techniques
If VC ≥ 0.25	Use Heuristic Methods

Source: Silver & Meal, 1973

Due to the behavior of the forecast demands in which the demand is stable and known, it is convenient to apply the EOQ model.

According to (Krajewski, Ritzman, & Malhotra, 2008) the continuous revision system contemplates the constant control of the inventory every time a delivery or delivery of a product is made to determine if it is time to make a new order. In each revision that is made, it is determined and decided on the position in which the inventory of the article is located, if it is considered too low, the system automatically makes a new order.

For this (Chase, Jacobs, & Aquilano, 2009) this type of model tries to determine the specific point R in which an order will be made, as well as the size of this (Q). The order (Q) is made when the available inventory reaches a point (R). The inventory position is defined as the quantity available plus the quantity requested minus the accumulated orders.

The procedure used for each article was as follows:

1. Determine total annual demand, which is the sum of all forecast demand (D)
2. Determine unit costs (C)
3. Determine Ordering Costs (S) and Maintenance Costs (H)

Table 2. Silver Meal Decision Variables

Cost to place an order (S)	$ 3.00
Cost of Maintaining Inventory (H)	5%

Source: Proveedora Automotriz Vásquez

4. Determine the Lead Time (L). According to the data provided by the company, its lead time is 1 day
5. Calculate the economic order quantity EOQ or Q *

$$Q_{opt} = \sqrt{\frac{2DS}{H}} \quad (2)$$

6. Determine the point at which a new order (R)

$$R = \bar{d}\mathrm{L} \quad (3)$$

7. Calculate the security inventory (SS)

$$R = \bar{d}L + z\sigma_L \quad (4)$$

8. Calculate the Total Annual Cost for handling the inventory of each item (TC)

$$\mathrm{TC} = DC + \frac{D}{Q}S + \frac{\mathrm{Q}}{2}H \quad (5)$$

9. Determine the number of orders to be made in the year (Dividing the sum total of the demands for the EOQ value)

3. Results

Thus, the total costs (cost per order + cost to keep) were calculated by applying the EOQ model to the forecast demand for the periods from May 2016 to April 2017, in addition to the last 12 actual historical demands (May 2015 -

April 2016) was calculated the total costs (cost per order + cost to maintain).

Comparing these two costs, the table presents a summary of results in table 3, in which we can observe that applying the EOQ model was positive in 96.83% of the products, ie the total cost of these articles applying EOQ in Lower than the total cost of the previous year without applying EOQ. While nothing else in the 3.17% of the articles did not prove beneficial to apply the EOQ model since the Total Cost of the previous year turned out to be less to the Total Cost obtained from the model application.

With regard to the savings generated by applying the EOQ model we have to mean a saving of 55.92%, ie $ 736.20, which indicates that the EOQ model is positive to apply since it means a considerable saving for the company and in addition That is very close to this type of products which are very important for the company.

Table 3. Summary of results when applying the EOQ model

Resumen de resultados			
	Total Articulos	Total Artículos (%)	
Resultados negativos con EOQ	2	3.17%	
Resultados positivos con EOQ	61	96.83%	
TOTAL	63	100.00%	
	Costo Total	Ahorro ($)	Ahorro (%)
Costo Total mayo 2015 - abril 2016	$ 1,316.52	$ 736.20	55.92%
Costo Total EOQ mayo 2016 - abril 2017	$ 580.32		

Source: Empresa Proveedora Automotriz Vásquez

With the application of the EOQ model, the demand is satisfied in the next 12 months, reducing the costs of ordering and maintaining and thus increasing profits, besides this way it is possible to surpass customer expectations by providing a quality service in the Which is offered the item he needs at the time he requires it and in the amount that requests it, which produces customer loyalty and the acquisition of new customers seeking guarantee and economy.

It should be noted that this model can be applied to other items that exist in the warehouse. In addition, it is important to know that for the model to deliver optimal results it is necessary to perform a constant control of inventory levels that is the main objective when applying the EOQ system, so that we are somehow ready for any eventuality or variability in the Behavior of sales.

4. Conclusions

We collected and analyzed all the theoretical scientific information necessary for the correct design and proper application of the procurement system using different types of sources such as books, national and foreign scientific journals both printed and electronic, local newspapers, general and scientific reports of national entities Both public and private

In the initial analysis of the company it was established that the sales of automotive spare parts tend to continue to grow speaking in economic quantities, in addition to that through the Pareto analysis and the ABC classification it was determined that 26.5% of the articles represent 80% Of total sales ($) and the remaining 73.5% represents 20% of total sales. Articles A represent 19.87% with a total of 63 articles, B represent 29.97% with a total of 95 articles and C represent 50.16% with a total of 159 articles.

The forecasts for the following 12 months were made using the expert selection and the Croston model of the Forecast Pro Trac software taking into account the BIC error to select the best forecast, therefore, it was verified that these forecasts do not differ much from the demand Real with respect to dollars

$, but in terms of units if there is a considerable difference between the forecasted and the real, this is because few units have been sold but that have a high cost.

By calculating the coefficient of variability (CV) and due to the stable demand and importance of the articles (class A) for the company, the best model to apply was the Economic Order Quantity (EOQ). Subsequently through the comparative table we can deduce that the EOQ model yielded positive data in 96.83% of the products (class A), which would mean a savings of 55.92%, compared to the total costs of the previous year.

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Luis Abraham Martínez Quistanchala graduated in 2017 at Universidad Técnica del Norte, with courses on financial management using MQR software, training of internal auditors of occupational safety and health C.C. 333 SART, workshop of generation of associative enterprises with application to the business plan, assistant to the congress of students of the career of industrial engineering and related in the city of Ibarra. Carried out

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