Review and parameterization of make to stock items

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Abstract

This is a case study of a multinational that reviewed its parameters for the product replenishment process and analyzed the need to keep them in stock. Due to the high costs that accumulated goods generate, it is always necessary to reassess whether a product still has regular and sufficient consumption to be available for prompt delivery. If this item is justified as a make to stock item, parameters must be calculated to be aware of the right moment when a purchase order must be generated to replenish the stock. The criteria used to determine whether the item is a make to stock or make to order, are applied by analyzing the consumption history of that product, its number of customers and how much its consumption varies over the months. At the end of the process, positive results are achieved, such as: increase in the service level, reduction in the amount invested in inventory and a lower expense with air freight for emergency replacement. As consumption can change over time, it is concluded that this process must be done periodically, to align the stock data with the current demand and make the planner's work more assertive.

Keywords
Stock1, Replanish 2, Planning 3.

Introduction

Inventories represent one of the most important assets in a company and, for this reason, deserve special treatment, mainly because they openly influence production costs. Consequently, it is of utmost importance that they are minimized, since the greater the stocking, the higher the amount of capital invested in the sector in question. Usually, inventories represent one of the highest investments in the accounts that composes the working capital structure in simplified companies. Nowadays, inventory control has become simpler due to the computerized systems available and, in many cases, the logistics part includes appointed specialized service (SLACK; CHAMBERS; JOHNSTON, 2009).The function of the stock must first of all remain very clear and decisive in the concept of the organizations, since the stock encompasses numerous functions, being one of the fundamental factors to plan and control within an appropriate management regarding the production process. The multiplicity of entrepreneurs is concerned merely with the quantitative and financial problems of the materials, whether they are raw materials, accessories, materials in processes or finished product (CORRÊA, 2013)The purpose of stock control encompasses the determination of three fundamental decisions: how much and when to order, and the amount of safety stock that needs to be kept in order for each product to ensure a satisfactory level of service for the customer. Such decisions follow a dynamic that ends up reproducing over time, and become complex due to the fact that there are an admirable number of factors involved (SLACK, 2011).Inventories of finished products, raw materials and material in process should never be measured as isolated components. Whatever the decision made about one of the stock modalities, it will directly influence the other types of storage, but it is worth emphasizing here that the so-

called rule for too many occasions is left out in classic and more conservative organizational structures (BOWERSOX et al , 2013).Organizations that are notoriously more concerned with inventory management consider in this context constituent factors, such as percentage of production and receipt of materials, uncertainties in demand and terms, price / cost variations in relation to sales pointers and items produced, quantity of distribution centers, in the midst of further relevant aspects (WANKE, 2011).Proper inventory management balances product supply, service level and maintenance costs. This is because the stock integrates and influences several operations within the company. Seeking to align the stock levels of a multinational, this study demonstrates, by theoretical and mathematical means, how to optimize the assortment of stock items through parameterization (SLACK, 2011).Efficient inventory management is an issue that has increasingly gained importance and prominence in large companies, as the gains and losses that poor management can cause are evident. The actual need for the items, currently classified as make to stock, will continue to be maintained on prompt delivery, as well as whether some make to order items no longer have sufficient demand to be kept in stock, thus avoiding unnecessary waiting by customers and conquest of new markets.

Problem

Inventories represent one of the most important assets in a company and, for this reason, deserve special treatment because they openly influence costs. You must know how much and at what time to stock. So the question presented is: How to use the parameterization of the stock control in items, classified as make to stock, to continue to be maintained on prompt delivery, and in make to order items, without needing to be kept?

Main goal

Reduce replacement costs, inventory maintenance, delays and disposal of unused parts at the end of the life cycle.

Justification

As is well known, the methodology around inventory control is changing dramatically. On the one hand, the need to reduce costs requires that we keep in stock only those products that sell more, on the other hand, we cannot completely zero out the stock of those products that are less in demand, thus avoiding waste of products and, at the same time , controlling demand and products that are no longer on the rise. In this sense, there must be a control that provides managers with a view of the entire stock in real time, optimizing space. The demand forecast can be made in the parameterization, which works from product classifications. The aspects frequently considered in these classifications (make to stock, make to order) cover value, criticality, demand and the stage of the product's life cycle.

Theoretical foundation

Bowersox et al (2013) clarify that the study of the supply chain, intends to understand the functions of the different agents covered in the operations. Therefore, evaluating the network of relationships and transactions between companies helps to identify critical points of supply and the difficulties that will be faced in the supply of materials necessary for organizational operations. It also helps in planning long-term strategies that improve the functioning of the network, causing better quality in meeting the needs of users.In this case, forecasting demand levels is of paramount importance for any organization as a whole. The levels of demand and the periods in which they affect fundamentally influence the capacity indices, the financial needs and the general structure of any business, this implies that, the relevant information describing the forecast situation must be essentially representative of what happens in the future . In the sense that a more perfect inventory management takes place, it is imperative to carry out planning and make decisions according to present demand and future forecasts (BOWERSOX et al, 2013).For these authors, one of the most complex problems encountered in any organization concerns the difference between the moment when the product is manufactured and the moment when it is requested, or the time when the purchase of inputs is indispensable and the moment when that it is consumed. This makes the generation and conservation of a certain amount of stock indispensable in order to meet future demand. The fact that there are even differences between the place and the time of production and consumption of products must be brought to the fore.Among its large areas of knowledge and performance, Logistics can be highlighted, which includes numerous tools that help employees in the complex task of controlling stocks, making purchases compatible with demand, that is, managing

an organization. The term supply chain is intended to mention as a whole the structure designed properly in order to meet the demand of a specific market (SLACK; CHAMBERS; JOHNSTON, 2009).The same researchers explain that supply chain management consists of a term widely used in the scope of business organizations, and was defined by the multiplicity of researched authors and specialists involved in the subject.Both the location and the required size of the warehouse are important and, in the case of using the rented environment next to the facilities, the problem is how to use the rented area, in order to fully meet the needs of peak storage, that is, only at the moment it is essential (BALLOU, 2011).Also according to this author, for storage you can be the owner of the deposit, rent a warehouse, rent the deposit (public deposit) and stock in transit, however, it is necessary to know the levels of cost, risk and economic involvement presented by each alternative. .The most perfect tool for the global use of available space is to optimize the planning of the storage area prior to its occupation, so that no unused spaces remain.Inventory generally occurs in spaces such as warehouses, yards or factory floors and exists due to a future need for materials, raw materials, materials in process, semi-finished or finished and finished products that are not used at certain times.For Ballou (2011, p. 259):Inventories are accumulations of raw materials, supplies, components, materials in process and finished products that appear at numerous points in the companies' production and logistics channel (BALLOU, 2011, p. 259).The storage system for inputs and finished products needs to go through some essential steps (planning, organization and control over stock strategies, transportation and location and movement of materials) always providing potential customer service, which every day that passes becomes more demanding and with individualized characteristics.At present, organizations, regardless of the segment in which they operate, maintain inventories due to the fear of failing to meet consumer orders, and this can result not only in losing the profit from the specific sale, but losing the potential customer in terms of sales. future. When it is certain that supply failures will not occur, or that demand will not exceed a certain limit, there is no need to work with excessive stock. In many cases, the demand for a product is so unpredictable that it automatically changes is something extremely complex, especially when the purpose is to elaborate a purchase plan compatible with that desired by consumers (BALLOU, 2011).

The absence of physical space for the purpose of stocking unfinished inputs and products, in addition to the high cost related to the stocked items, configure growing concerns in most organizations, where a forecast of demand close to real represents the ambition of their multiplicity. In this way, methodologies were created which provide an excellent approximation such as the Complete Exponential Weighting method (Holt-Winters method) that measures level, trend and seasonality adjustments and even Box & Jenkins technology (ARIMA), in the middle of different factors.

The comparison of the compensation curve between the cost of keeping units in stock, to the detriment of potential sales losses when the total lack or insufficient stock level of a product is evidenced (BALLOU, 2011).

However, the implementation of the demand planning process requires, in the conception of Wanke (2011), a procedure that integrates forecasting techniques, systems that provide total support to decision making and forecast management.

It is worth emphasizing here that demand forecasting should not happen stochastically. There is essentially an increasing need to select a type of forecasting approach dedicated to addressing the available data.

The organization must be clear about the need and importance of the stock, its function, the operational objectives that must be achieved, the appropriate physical space to meet the demand, the location of warehouses or propensities, reducing costs with transportation, handling materials, maintenance and order processing as well as the appropriate warehouse model in order to meet the organization's needs.

The integration between handling equipment, storage structures, physical space and products is essential to differentiate the storage system. The sets of shelves, pallet trucks (pallet carriers), as well as structures of the type we use when we need to store non-palletized products quickly and with large and variable length (cantilever), are called storage modules. Such modules can be classified as rigid and dynamic.

The decision-making process regarding the use of storage modules will be linked to the characteristics of the product, which is properly stored (BOWERSOX et al, 2013).

Safety stock

Safety stock is the extra inventory held in the warehouse to deal with unforeseen events related to changes in demand or supplier delays.

The purpose of keeping stock safe is to avoid falling into a stock break. Any representation of stored stocks flows in peaks (when new goods are received) and vouchers (when goods are shipped).

The safety stock has a central scope to offer a guarantee on uncertainty, as if it were a buffer for a possible variation.

According to studies carried out by Corrêa, Gianesi and Caon (2011), safety stocks contain the scope to deal with uncertainty in a transformation process.
Safety stocks are parameters that, if indispensable, need to be communicated to the MRP systems so that their calculation algorithms evaluate and recommend purchase and production orders in order to conserve, at least when it comes to planning, the stocks of the items at the levels defined.
The safety stock is extremely important in order to ensure that the material supply flow is not affected or, in other words, we cannot under any circumstances allow the production line to stop due to any setback.
Therefore, the safety stock is fundamentally used to cover an uncertain demand, that is, an unexpected variation.
The order point or replacement bridge defines the trigger, that is, the moment for stock replacement in relation to the consumption time. This point on the consumption curve of the item in stock is defined by the sum of the safety stock plus the lead time x daily consumption.
Lustosa et al, (2008) explain that the replacement point is a reactive control standard, his replacement decisions are based on the quantities in stock after each withdrawal.

Assortment Analysis

The purpose of assortment analysis is to identify which balance is most appropriate for the large number of categories offered by retail. And the most effective way to do this is through data collected in real time, which express the true interests of the company's public. Thus, it is relevant to have a specialized tool in hand that monitors sales and the overall performance of retail.
An overview of the competition is also relevant for the assortment analysis, which allows to follow trends in the sector and changes in the behavior of potential customers.

Methodology

This research used an exploratory approach, since the scope was to become familiar with the areas presented, seeking to answer the research questions and serve as a basis for formulating a more exact problem (GIL, 2007).The approach will be qualitative because it highlights the perspective of what is being studied and the interpretation of the data obtained is of paramount importance. Qualitative research wants to understand the processes of the phenomena (MARCONI; LAKATOS, 2010).It can also be said that it is a descriptive research, as it describes the entire progress of products within the company, better defining a problem, understanding its aspects and behaviors (MARCONI; LAKATOS, 2010).It was made a bibliographic research which, according to Gil (2007), bibliographic research is developed from material already prepared, consisting mainly of books and scientific articles, in addition to the Case Study where a company is presented and the interconnected areas each other and their respective problems presented separately.A case study is conceptualized as an empirical research, based on qualitative and quantitative evidence that investigates a current subject applied to a daily context, even if the boundaries between the phenomenon and the context are not visibly clear (GANGA, 2012). Thus, it can be said with reference to the method, that this work is classified as a case study.Below are the steps adopted for the methodology:
• Description of the case study, in which the sales process carried out by the company is reported, showing the results obtained;
• Analysis and evaluation of planning and scheduling of forecast and sales;
• Comparison between the current method used and the proposed method.

The company

The case study is from a diversified multinational energy management company that provides efficient energy solutions, located in the state of São Paulo for 15 years. In this case, the sector of electrical products for wiring and lighting will be presented, where its main products are circuit breakers and mini circuit breakers. Currently, the company uses two different types of plans, make to stock, for products that have higher demand and products and make to order, for relatively low demand. Inventory products must meet all demand without delay.

Data Collection

For the development of the research, information was taken from the company`s database, namely: consumption of raw material, cost of raw material, expenses for inventory management and maintenance, number of purchase

orders, resupply time, use of stock safety and punctuality of suppliers. The information extraction process will be carried out via a report. For compilation and analysis, the data will be exported to Excel software, which aims to improve the data for the study.

Evaluation

From the data collection it will be plausible to measure values of stock capacities, daily consumption and demand characteristics for each material.The initial intention is that this system has all the standardized information on board, so that the original parameters of the item calculation are satisfactory to define the entire system.The data related to the dates of fulfillment of orders, billing of orders from suppliers and product deliveries will be checked in order to establish lead time terms, as well as standard deviation.After that, it will be plausible to determine, via calculations, the safety stocks and lot sizes of all products considered make to stock. Having this information, it will be possible to carry out the analysis of the best management method for each of the items, with the intention of proposing a stock methodology that offers the least investment for the company.

Data analysis

From the assessment of the basic requirements for the system, based on the available bibliography and experience to know which items should be considered make to stock it is necessary to: Have a list of all products sold by the company and their respective consumption history for the last 12 months;
Analyze which items meet the compans criteria to be kept in stock: present consumption in at least 9 months (no need to be consecutive) of the last year, have more than 3 different customers, so that you can be sure that if there is a market loss in a given partner, there is no waste of the purchased material and have a coefficient of variability (which is the division of the standard deviation by the average consumption of the last year) of up to 3.5;
After these criteria are applied, there is a drastic drop in the number of items that really need to have a stock. In the case of the studied company, the number of cataloged products, which was twenty thousand, became only six hundred;
These products are justified make to stock because they have a regular consumption and high turnover, requiring a process of constant replacement;
Other items that do not meet the previous criteria, can also be added to the list of inventory items such as: strategic items for the sales team, items produced exclusively for a specific customer through a contract and items pointed out by the marketing and sales team as possible sales through demand forecasting.
After defining the make to stock items, it is necessary to calculate the parameters that will start the process of buying and replacing these products;
These parameters will be established through an assortment analysis, which will analyze the monthly average consumption of the last 12 months and its standard deviation, to establish the reorder point and the safety stock;
In the analysis, the consumption data is loaded into an excel spreadsheet, and the formulas for each of the parameters are executed:
Gasnier (2010) describes the following formulas:

- Safety stock = Average consumption x Standart Deviation X SSF;
- Reorder point = SS + (Lead time x Average consumption);
- Maximum stock = SS + RP;
- SS = safety stock;
- RP = Reorder point;
- SSF = Safety stock factor.

In this study the average consumption is considered in months. Even though the values are correct, a second analysis is still necessary, since the formula does not disregard the consumption peaks, which is characterized by an exceptional sale of that good in a given month, and they erroneously enter the calculation of the average consumption, thus increasing the standard deviation and consequently the replacement point;• It is necessary to identify and remove the months in which the consumption peaks occurred, so that the parameters can be considered reliable and placed in the system;
After these steps, you can rely on the automatic purchase order generation process executed by the system and, thus, send the order to the supplier.

Results

With the process completed, it was observed that around 48% of the previous number of items classified as make to stock items should be transformed into make to order, as shown in Table 1. This means there was a reduction to 0 units in stock for each of the 48% of the items initially identified, in table 2, one of these items has its details detailed.

Table 1. Make to stock number of items

Apr/19	1260
Jul/19	666

Table 2. Items turned into make to order.

	Previous RP	Current RP	Price (U$)	Diference (U$)
Product 1	631	0	$ 4,68	$ 2953,08

With the remaining stock items, it was observed that the parameterization criteria described in methodology would be applied in two different situations: in the items that had their reorder point below what was necessary to supply and monitor the demand, causing sales losses for the company and those above it, causing overstock, both shown in Table 3.

Table 3.New Reorder points.

	Previous RP	Current RP	Price (U$)	Diference (U$)
Product 2	3000	8455	$ 0,37	$ -2.018,35
Product 3	830	133	$ 1,02	$ 710,94

Table 4 shows the comparison of monthly revenue with the stock value. It is possible to observe that in 8 months there is a reduction in the stock value of R$ 3,501,806.00, which is equivalent to 30.3% of the stock at the beginning of the project. This significant reduction allows us to state that the goal of reducing inventory value, without compromising the company's revenue, has been successfully achieved.

Table 4. Comparison of monthly revenue with the stock value.

	Revenue	Inventory value
Apr/19	R$ 1.213.675,00	R$ 15.051.923,00
Jul/19	R$ 1.090.978,00	R$ 13.498.481,00
Sep/19	R$ 1.172.541,00	R$ 12.759.329,00
Dec/19	R$ 1.251.915,00	R$ 11.550.117,00

As consumption can change over time, it is concluded that this process must be done periodically, to align the stock data with the current demand and make the planner's work more assertive.

Conclusion

In the case of items which it is necessary to keep in stock, it is noted that the lack of product happens much less frequently, so the standard replacement (by sea) is being sufficient to keep the stock aligned. What happens in case of a stock item is sold out is the emergency purchase of a lot by air, which makes the process cost much more, since the costs of this type of freight are usually higher and may even increase more according to the weight of the goods. Once the products turned into make to order are sold out in stock, there is a significant reduction in the inventory value, which means the company stopped spending money on products that accumulate on the shelf and run the risk of not selling. It is important to remember that tax is paid for items in stock, so money loss can happen if products do not sell.As the consumption of these items is uncertain, the fact of not making them available for prompt delivery is not necessarily harmful to the company, as in a way there is never 100% certainty as to fulfill the order in its entirety, since the stock previously existing could not match that specific demand, so it is necessary for the customer to wait for the production and replacement time in any way.This inventory reduction did not significantly change the company's revenue.
It is concluded that after the whole process, with the quantities of each item being properly adjusted to the current consumption of this product, the results achieved demonstrate that the improvements are very significant because there was a reduction in the amount invested in stock, maintaining the revenue.

Biographies

Laura Stuart L. Soares undergraduate of Production Engineering at FACENS University, with internship in demand planning at a multinational corporation, achieving great results and supporting crucial projects for the company. Wide international background with courses attended in Canada and the UK.

Rodrigo Luiz Gigante earned Masters degree in Production Engineering from the University of São Paulo (2010); BS in Applied Mathematics and Scientific Computing from the University of São Paulo (2007). He is a professor at Facens University. His areas of expertise are Operational Research, Discrete Event Simulation, Scheduling, Queue Theory, Production Planning and Control and Logistics.

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