Management control associated with stock costs (application to a case study)

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Abstract

The material costs in storage represent a large share of the companies' assets, whether by uncertainty in demand, advantage in buying a large quantity for discounts or even by poor forecasts. The optimization of the costs of detention and handling of stock in a company influence the ability of a company to compete on the market in which it operates. Given this fact and the competition between companies in today's markets increases, it is necessary to distance themselves from competitors by conducting business more efficiently, once material management directly affects the success of the sale of the articles.

Thus, the objective of this work is to make a study on the management control associated with stock costs and methods for reduce it, using Continuous Review Model, applied to company K, which operates in health and wellness sector. Intends to make a survey of the reality in which the company K is part and what are their needs as a company to apply the best method of cost optimization with their stocks.

Keywords: Stock Management, Costs Optimization with Stock, Stochastics Methods, Continuous Review Model.

I. INTRODUCTION

As referenced by Rouwenhorst et al. (2000), Ashayeri and Gelders (1985) and Cormier (1997) the topics of planning and control are repeatedly discussed in the scientific literature and in among thoses topics are the management/control of stock in storage costs.

This is perhaps the clearest and most obvious accumulation of assets for a company. Thus, according to Rushton et al. (2010), to ensure that the total logistics concept is put into practice and that the trade-offs are properly achieved, it is essential to adopt a positive planning approach, which aimed to ensure that the continuity and progress of the scope of the activity of a company are maintained, and for this we must agree that the existence of some stock is vital. However, the goal is to have the least possible time products in warehouse. (Richards, 2014)

However, these days there is a growing requirement for the companies thought to be customer-driven, and fast satisfaction. In this context the existence of stock becomes essential in order to reduce any lead time between the customer's needs and to their satisfaction. The stock is understood as being the accumulation of raw materials, semi-finished products and/or finished products, as well as spare parts needed for

maintenance of a production system (Gunasekaran, Patel, McGaughey, 2004).

This work intends to apply a cost optimization model to the Company K's stock. This company belongs to the health and wellness sector. Initially will be done an assessment on how the company right now, controls the stock costs to later propose the use of new methodologies that allow the reduction of these costs. Will still needed to understand which strategies best suited to the needs of the everyday life of the companies of this sector, in order to allow this optimization of the cost of stock and their movement.

II. CASE STUDY

Currently the company K faces a cumulative significant stock to the level of €500,000 of stock and equipment, representing more than 4% of their sales volume, many of whom are products with little or no validity and products that no longer are allowed to be commercialized in Portuguese market. All stocks of company K are stored in another company that was hired by be specializing in storage, handling and logistics in the pharmaceutical area.

This firm being a multinational company, with factories spread throughout the world, the average for the arrival of the products to Portugal is often over 6 months, which leads to the situation of having to order goods to factories with long in advance and they can't always predict market trends so that they has exactly what is needed.

On the other hand, a company belonging to the pharmaceutical world, there has to be a rigorous, demanding and beware of all products sold, and there is a very tight control on marketing laws, including minimum lifetimes, labels, packages, formats, environmental impact, etc.

Stock control in this case is essential, because in the context presented is very easy to lose money with excess stock that don't sell within a short period of time expire, or if they do not arrive in time to the Portuguese market lose money with the OOS, because in the world pharmaceutical consumers do not wait for the arrival of a medicine to treat, going to the competition, translating into sales sunk.

III. LITERATURE REVIEW

According to the study by Nemtajela et al. (2017) about the relationship between the stock management and the uncertainty of demand was visible a significantly positive correlation with each other. Concluded that there is a strong positive effect between these two variables, that is, the greater the uncertainty about demand, more difficult and challenging is to determine the stock to have in a company.

Lukinskiy et al. (2017) made an assessment of the reliability of stock management strategies in the search, the best strategy from the point of view of minimizing total costs is the strategy LTC (Long Term Care). On the other hand, also concluded that there is a relationship between the costs of safety stock and the index of confidence of supply, that is, the increased likelihood of confidence of supply requires increased costs with security stocks.

The study done in the context of the reduction of inventory and storage costs, directed by Krittanathip et al. (2013), had as its main purpose to meet the greatest source of high levels of stock and storage costs and reduce them. The sample consisted of 10 Thai companies. They concluded that there were few stock control systems which led to large financial losses. It was thus implemented a stock model and model-based forecasts storage, warehouse layout and marketing strategy in order to reduce the final costs with these processes. Was only used the

system Excel for any necessary analysis, based on the model of EOQ order, the Pareto rule 80:20 and the marketing strategy of the 4 P's. The data collection was done via information provided by owners of enterprises, observations and interviews.

The study done by Van Foreest et al. (2017), focused on articles simple inventory systems with backordering with continuous review, lead-times and controlled by a simple modification of the normal stock policy. This modification is based on the introduction of a reserve stock.

The model that was used was based on the idea of disruption orders of FCFS (First-come-First-Served), i.e. is stipulated a safety stock when it's reached a level less than this stock, any replenishment will cover the stock and serve to place orders, satisfying any order delay exists. It is assumed that backordering costs but is prevented a higher cost of delays on all subsequent orders. The authors proved the efficiency of the method in study with a reduction of total costs something between 10% to 30%.

Van der Heide et al. (2018) analyzed the optimization of stock levels for a car with expeditions through a low-cost support and partial backordering.

It was then concluded with this study that for this type of companies will be ideal to have a warehouse of central support and various local warehouses to reduce transportation costs and optimize the inventory submissions for the various markets. To these conclusions was used the theory of Markov chain as well as the partial recovery of orders not served because it demonstrated that it would be a significant recovery of custom values. This recovery has led to the company's cost reduction also by the failure of deliveries (costs in contract when the supplier paid to customer by not providing the stock for the order within the time limit set).

The study done by Korponai et al. (2017) aims to understand the effect of safety stock in the likelihood of lack of stock (OOS). For the implementation of this analysis used the EOQ model (economic order quantity) by which it is guaranteed the most favorable stock cost.

The study led by Dai et al. (2016) about the consequence of the bullwhip effect and supply chain costs with little or a lot of information quality in stock reduction revealed that the bullwhip effect is increased along the supply chain when supply quality information on the reduction of stocks, mostly in real time, but that does not translate into general costs increases. They have also shown that information with higher quality increases the benefits of information sharing.

However, this study has two limitations. First, only considers problems in that stock levels are low due to lack of stock but in fact we may be looking at other problems such as errors of stock transfer. Second, assumed that the error of the stocks was additive, without considering that the reduction of stock depends on the level of the stock, and the findings would be other if the error were multiplicative.

IV. PROBLEM ANALYSIS

The best interests of the company focuses on products considered slow movers, obsolete (discontinued) or locked in storage because they are those that reflect the greatest fixed asset value of the company and what’s have interest in minimize. However, these categories just come to exist because the stocks of continuous selling products are not optimized. See the following diagram (Figure 6.1) that shows how does the flow of stock within the company:

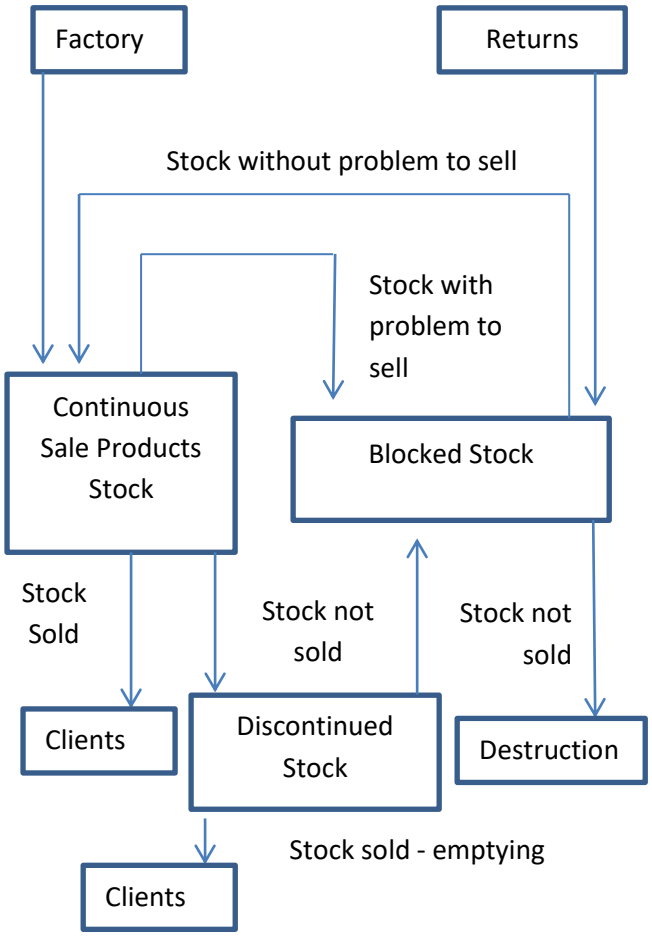


Figure 1 – Phases of stocks' chain of K's Company

If you optimize the Continuous Sale Products stock, stock that passes for discontinued and/or blocked are reduced, which in turn will reduce the stock that ends in destruction, thus avoiding waste of money for the company K.

In detail, the company considers slow movers all products that remain as stock in storage more than 24 weeks (6 months) according to sales forecasting, i.e. they are considered to be low rotation; consider obsolete discontinued products, which have no place in the strategy of the company; considers blocked all products that no longer meet the physical conditions and/or legal conditions for sale. The company considered continuous selling products, all products that have sales forecast for at least 18 months.

Was denoted that every category of product has to be treated differently and requires a different and differentiated method if the intend is optimize stock costs, i.e. there is no single method for all products of this company, since each cluster has its characteristics and peculiarities. Since only the Continuous Sale Products category is actively controlled by the company and the remaining categories are a result of not selling the products to customers, it can be said that if you control this first stage, will reduce waste in the following phases.

1. Limitations Found

By analyzing the flow of stock of this company and all stages of life of a product in this stream, were identified limitations and characteristics inherent in the fact that a pharmaceutical company and also because of the stock-sharing with another country.

Then, the main limitations/features are listed below relevant to the analysis of the case study:

- Mandatory acceptance of returns of medicines by ending shelf life;
- Contracts with mandatory acceptance of returns of all products in end of shelf life (contracts to customers with greater relevance in business);
- The fact that there is no programme to assist sales team forecasting, which leads to many errors;
- Difficulty in allocating stock between Portuguese and Spanish stores requiring sometimes the return of products to Spain, having more operating costs;
- Non-existent safety stock levels.

2. Assumptions

The Continuous Review Model will be applied to the problem presented, however, because of the spaciousness of the problem were made some assumptions for the application of the model.

The first assumption is related to the different types of stock that exist in Company K. In order to reduce the extent of the problem, this will be reviewed only for the first typology of products the flowchart shown in Figure 1, since will be the beginning of the stock cycle, because if you expect a gradual reduction in the types of stock resulting in accordance with the flowchart (Figure 1).

In order to simplify the application of the model, will also consider that during the year of 2018, the company K just don't receive returns of product, since the product about which we will apply the model is a new product and thus is not expected returns at least one year. Also considered that there will be no cost per unit out of stock in order to test the model and subsequently enable the company to provide its own parameters to insert in the template.

During the presentation of the problem, the company revealed that despite trying to have some safety stock, this does not exist in fixed value stipulated. In this way, will then assume a fixed safety stock value during the entire implementation of the model chosen, which was agreed with the company as being an acceptable value.

Finally, the assumption is related to costs associated with stock. The cost of the stock that will be considered for the model, are fictitious, not corresponding to the actual costs incurred by the company, having taken this decision for reasons of confidentiality. However, are directly related to the actual values, thus ensuring your ratio.

3. Data

In order to obtain a comparative method of efficiency of the solution to the problem, will be used as an example a product marketed by this company and with the actual sales data used for establishing the levels of stock, shall apply the method of Continuous Review. From now on, the product will be designated as the Product A.

The Product A has as sales forecast, prepared by elements of the company according to their prospects, what is represented in Table 1.

Product A	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Forecast	15000	8000	6500	3000	6000	3250	3240	3240	3240	3240	3240	3240

Table 1 –Sales Forecast for Product A in 2018 (units)

Will be presented, in Table 2, the data provided by the company with regard to the costs of this product, allowing apply the model.

Produto A	c (€/uni)	S (€/enc)	i (%)	ss (uni)	Q (uni)	D (uni/ano)	H (€/uni)
Dados	1,9	6 000	10	1 000	20 000	61 190	0,19

Table 2 – Product A data in 2018

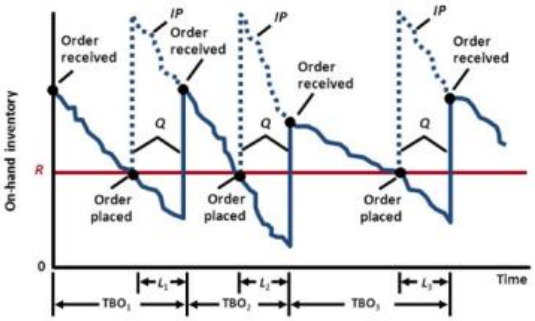
It should be noted that this product fits in a category quite specific, the NPD (New Product Development), which means that there are no previous sales data associated with, because this is a new product.

V. IMPLEMENTATION AND RESULTS DISCUSSION

In order to get the results to the problem presented in the course of this work, it was necessary to implement this proposal for a solution through the use of Excel.

It will be implemented the Continuous Review Model. In this model, the order amount is fixed (Q), as shown in the Graphic 1, but the period between orders is variable (depends on the pace of demand in the period between orders). As demand and lead-time is variable, there is a possibility of OOS. If you split the order cycle in two parts (when the quantity in stock is greater than the order point and

when the quantity in stock is less than the order point), the possibility of OOS exists only in the second part of the cycle, which corresponds to the period of delivery of the supplier. There will be OOS if the demand during the period of delivery of the supplier exceeds the point of order.



Graphic 1 – Continuous Review Model (retirado de Vaz et al, 2017)

The model can be formulated through an equation, equation 1, that represents the Supplying Total Cost that includes annual acquisition cost, the cost of annual order, the cost of annual stock ownership and the cost of OOS.

$$CTA = \overline{D} \times c + \frac{\overline{D}}{Q} \times S + \left(\frac{Q}{2} + ss\right) \times H + K \times \bar{\beta}(R) \times \frac{\overline{D}}{Q} \quad (1)$$

$\overline{D} = Average\ rate\ of\ demand\ (units/year)$

$Q = Minimum\ Order\ Quantity$

$S = Order\ unit\ cost\ (€/order)$

$ss = safety\ stock$

$i = Stock\ holding\ rate\ (\%/year)$

$c = Unit\ acquisition\ cost\ (€/unit)$

$H = Cost\ of\ holding\ unit\ stock\ (H = i \times c)(€/unit/year)$

$K = Cost\ of\ out\ of\ stock\ per\ unit\ missing\ (€/missed\ unit)$

$\bar{\beta}(R) = Average\ amount\ missing\ per\ cycle\ as\ a\ function\ of\ point\ of\ order$

$CTA = Supplying\ Total\ Cost\ (€/year)$

So, it was used the equation 1 to apply the model MRC to the reality of the company K as regards the cost of the Product, and the only part that doesn't apply to the case in concrete, is the last one, referring to the costs for OOS considered not to exist, since the product is new and will supply to avoid this scenario.

For the model exists a fixed Q (quantity) that represents an optimized quantity to order, but in this case, this Q is already known, the MOQ (Minimum Order Quantity), defined by the factory and can't be changed. In chapter IV this amount is already set Q = 20.000units.

Gets the equation 2 which reflects the reality of Company K regarding the release of the Product A.

$$CTA = \overline{D} \times c + \frac{\overline{D}}{Q} \times S + \left(\frac{Q}{2} + ss\right) \times H \quad (2)$$

After applying the equation 2, using the data collected in the previous chapter, in order to calculate the cost of the total supply of stock required for the first year of life of the product, the results were as follows:

$$CTA = 61\,190 \times 1{,}9 + \frac{61\,190}{20\,000} \times 3000 + \left(\frac{20\,000}{2} + 1\,000\right) \times 0{,}19 \quad (3)$$

$$CTA = 127\,530€$$

In other words, for a year, the first year of life of the product, the total cost with the

stock and what's inherent, such as storage, transport and possible destruction of product, would be 127 530 €.

Let us see the table 3 that demonstrates how the phasing in terms of distribution of stock should have occurred:

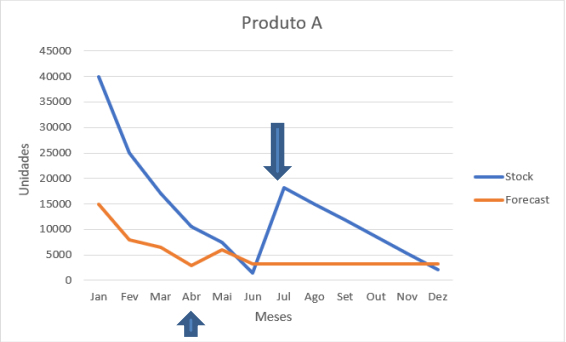
Product A	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Forecast	15000	8000	6500	3000	6000	3250	3240	3240	3240	3240	3240	3240
Stock	40000	25000	17000	10500	7500	1500	18250	15010	11770	8530	5290	2050

Table 3 – Product sales forecast and their level of stock per month according MRC

At the beginning of the year, was done the forecast of stock to start selling the product in the Portuguese market. Being the minimum amount to be requested to factory 20,000 units, it appears according the table 3 that only a MOQ wouldn't get to satisfy 2 months. So, the first delivery was of 40,000 units (Jan).

The question to be answered after the start of sales, it would be when it's necessary come back to order more stock, knowing that matters to minimize the amount of time that the stock is stuck in storage, instead of asking the entire amount on the first order. Thus, there was done an analysis with no second order analysis to understand the point of OOS, according to sales forecast.

Making a graphic representation, Graphic 2, you can see clearly that the level of stock would be too low in June for what would no longer be possible to meet the demand expected from the month of July. So, it would have to be received in July so that it does not go into OOS. However the lead time of arrival of the product is 3 months, this request would have to be ordered in April, causing the stock never reaches zero.



Graphic 2 – Product sales forecast and their level of stock per month according MRC

However, this product was on the market for a year, since it was discontinued in December 2018 and later released a product equal but with a more economical packaging.

So, and this product's category being the most relevant in this company, the medicines, all remaining stock was sent for destruction, such as regulatory rules dictate, in respects to this category.

In this exercise was used a product that ceased to exist in December, when there was still stock in the warehouse. So, if your life cycle were greater than a year, would not have the cost of the destruction of product. This reveals that, at the level of stock in warehouse, must be studied the impact of each product that discontinues, or what is the best timing to do so, in order to minimize the negative impacts of the company's costs.

In this particular product the company K released the destruction cost per unit, which will be 0,05€/uni. With this, we have to add this cost to our total annual cost calculated previously. This new installment of the calculation represents the value that is lost through the destruction of excess material (2 050 units).

Is it possible, with the total cost of supply of the product to be in the year 2018, represented by the equation 4, the total of 131 527€ /ano.

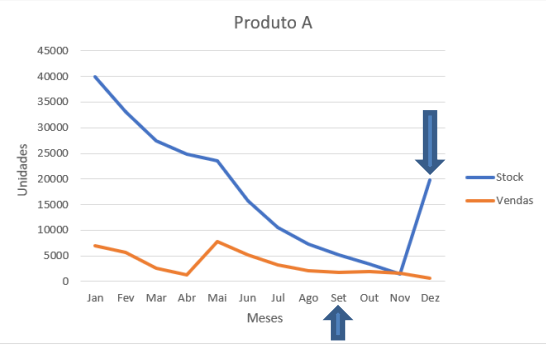
$$\text{CTA} = 127\,530 + 1{,}95 \times 2\,050 \quad (4)$$

$$\text{CTA} = 131\,527€$$

Analyzing now the sales that occurred in that year and in this product, represented below by Table 4 and Graphic 3 by, during the year should have been made an analysis of the evolution of stock levels and once sales were underwhelming, it appears clearly that the stock provider should have been done only in September, since only in December this product would OOS, if this supply didn't exist.

Product A	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sales	6900	5622	2642	1328	7716	5208	3276	2118	1848	1915	1563	689
Stock	40000	33100	27478	24836	23508	15792	10584	7308	5190	3342	1427	19864

Table 4 – Sales of product A and their level of stock per month according MRC



Grapic 3 – Sales of product A and their level of stock per month according MRC

In this scenario, if the MRC had been applied to the total value of the Total cost of supply would be 166 264€/ano, since the value of the remaining stock at the end of the year would be 19 864 units, as shown in equation 5.

$$CTA = 127\,530 + 1{,}95 \times 19\,86 \quad (5)$$

$$CTA = 166\,264€$$

Once the value of stock destroyed, by obligation of receiving fixed value amount of stock, it has been demonstrated so great in this case, it might have been less expensive to the company K, suffer the costs of OOS the last month. Is left this note so that in the future the company may analyze this case, in the context of OOS stock value.

VI. CONCLUSIONS

Throughout the chapters we saw that for an efficient cost control with stock order it is not enough to have in storage, it is also necessary to make a detailed analysis of the business in question, see how this varies in terms of its sales and only after building a map of need for materials to be satisfied, thus avoiding excesses of materials ordered, stock failures and product obsolescence.

It also concluded that, as demonstrated earlier, the existence of a system of analysis and management of stock computer level is also essential to efficient management and cost reduction, which advised the company that acquires a most advanced computer system, such as SAP, which helps in this management, since the current system does not allow analysis necessary for the proper control of the stock. Because this is the only way to have global awareness of the whole movement of stock in the company, detecting failure, requirements and difficulties of the management model implemented in such a way as to this being improved and optimized in terms of cost reduction with all stock and the real sense of the final value of optimization.

For this study, we applied the model of Continuous Review by using the sales forecast plan (forecast) that the company expected to have over the months, then compared with actual sales that existed in 2018 and it was compared with the real real scenario (sales) of what happened in 2018, concluding that in fact this company needs overloaded stock levels in order to mitigate risks with OOS.

For future work suggests to apply this solution to all products, whether continuous selling or new products to ensure stock levels acceptable by avoiding excess or lack of product in warehouse, thereby also increasing your optimization and profit through savings.

Regarding to returns, in continuous selling products, should be included in the model, the months in which they exist, having a global notion of costs with the stock of products.

The level of safety stock, the company K does not have a value set for all products, which it is advised as a next step to implement, in order to mitigate risks of OOS for several months and give time to the Manager to act depending on the reaction of the market.

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