

A Decision Model for Implementing the Theory of Constraints in Distribution Logistics

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Abstract

The understanding of the application of the concepts of the Theory of Constraints (TOC) in the management of logistics distribution is not yet consolidated in the academic field and especially practical. Thus, the main objective of this paper was to develop and test a proposed method to support decision making regarding the feasibility of implementing the proposals of OCD in managing distribution logistics. In other words, an artifact that serves as a transition between theory and practice. The research methodology used to conduct the investigation began with a literature review on the TOC and especially on the propositions of TOC in distribution management. Then, it was the presentation of the method and its steps. Finally, in an automotive industry, the proposed method was applied and mainly made up a critical analysis of the method and the potential implementation of the TOC concepts in the management of distribution and consequently in supply chain management. The main results of the research allowed to appoint a structured method in logical steps to be used in the practice of companies to improve their logistics performance. The research suggests that there is evidence that the use of the method contributed to the analysis and acceptance of TOC in distribution logistics industries.

1. Introduction

One of the main waste that occurs in manufacturing operations is generating stocks. Inventories are results from the lack of synchronization between processes, flaws in the raw materials, the absence of operators, manufacturing defects, among others, or in response to uncertainties that affect the manufacturing. Much has been studied about the impact of inventories, especially since the advent of the Toyota Production System (TPS). With the STP search mainly to elimination of waste, being one of the ways to reduce the inventory (BACCI, SUGAI, NOVASKI, 2005).

On the other hand, the Theory of Constraints (Theory of Constraints - TOC) argues for the need of inventories as part of the design of the production system, recognizing that there is a very high level of uncertainty and variability therefore very significant. Several scientific studies have been published on the application of TOC. However, only more recently has been applied to TOC Supply Chain problems, including those related to the management of product distribution, which is the focus of this work.

During the process of exploring literature on the subject, we identified a certain scarcity of scientific publications theoretical and practical knowledge about the use of TOC in distribution management, mainly in Brazil. It was also perceived that the published material, very little is developed about limitations regarding their implementation. Accordingly, this study aims to contribute to closing this gap by focusing on the practical aspects of

understanding, trying to describe situations in which there is a greater likelihood that the method does not work. In addition we propose a model to withstand the application of TOC. As the article discusses practical aspects, the actual situation of a manufacturer of spare parts will be presented through a case study.

2. Methodological Approach

Second Vergara (2000) for classification of research adopted is based on two aspects: the purpose or objectives, and the means or procedures. As for the purpose, the research is exploratory, it aims to encourage familiarity and understanding of the research problem, which involves carrying out a preliminary analysis in order to implement the principles of TOC in distribution management in a company producing automotive components aftermarket. As for the media, literature and research is a case study. Literature, because the theoretical foundation for a literature search was performed looking up basis for better understanding. Finally, research is characterized as a case study.

The case study is a research method that is characterized by in-depth analysis of a particular reality. Regarding case studies "represent the preferred strategy when issues arise such as" how "and" why "when the researcher has little control over events and when the focus is on contemporary phenomena embedded in the context of some real life." (YIN, 2004). According to Roesch (1999), its adoption as a research strategy is relevant to be able to study in depth the phenomena within their context, be appropriate to the study of processes and enabling explore phenomena from various angles. The approach taken was qualitative, since the sample used does not allow a broader assessment. The research methodology adopted in this work, the case study was used for two purposes: to assess the applicability of TOC in a real case and evaluate the proposed model.

3. The Proposed Model

Next, will present some initial findings about the needs in terms of practical application of concepts in a company, which will be discussed in the light of the development of a method. Then this model, as Figure 1, will be formalized in order to support decision making on the application of concepts in companies. In the following section, the application of the model is illustrated by the reality of a company. Considering the practical implementation of a new system of work, the first problem that must be addressed is the acceptance of the company where you want to apply it. The acceptance or otherwise of the company in evaluating the change management system of distribution depends on several factors, among which we can mention:

a) Degree of maturity of the company: depending on the challenges facing the company and its strategic as already matured, the application of the concepts of TOC may be more or less likely to have an initial acceptance. Using the classification proposed by Hayes and Pisano (1996) on the stage of the company in relation to competitive strategy, it can be said that firms in stage 1 are likely to be reactive to the application of the methods. In Stage 1, as stated by the author, little effort is made from shopping to product distribution. In undertaking which at this stage, the main goal is to keep costs down.

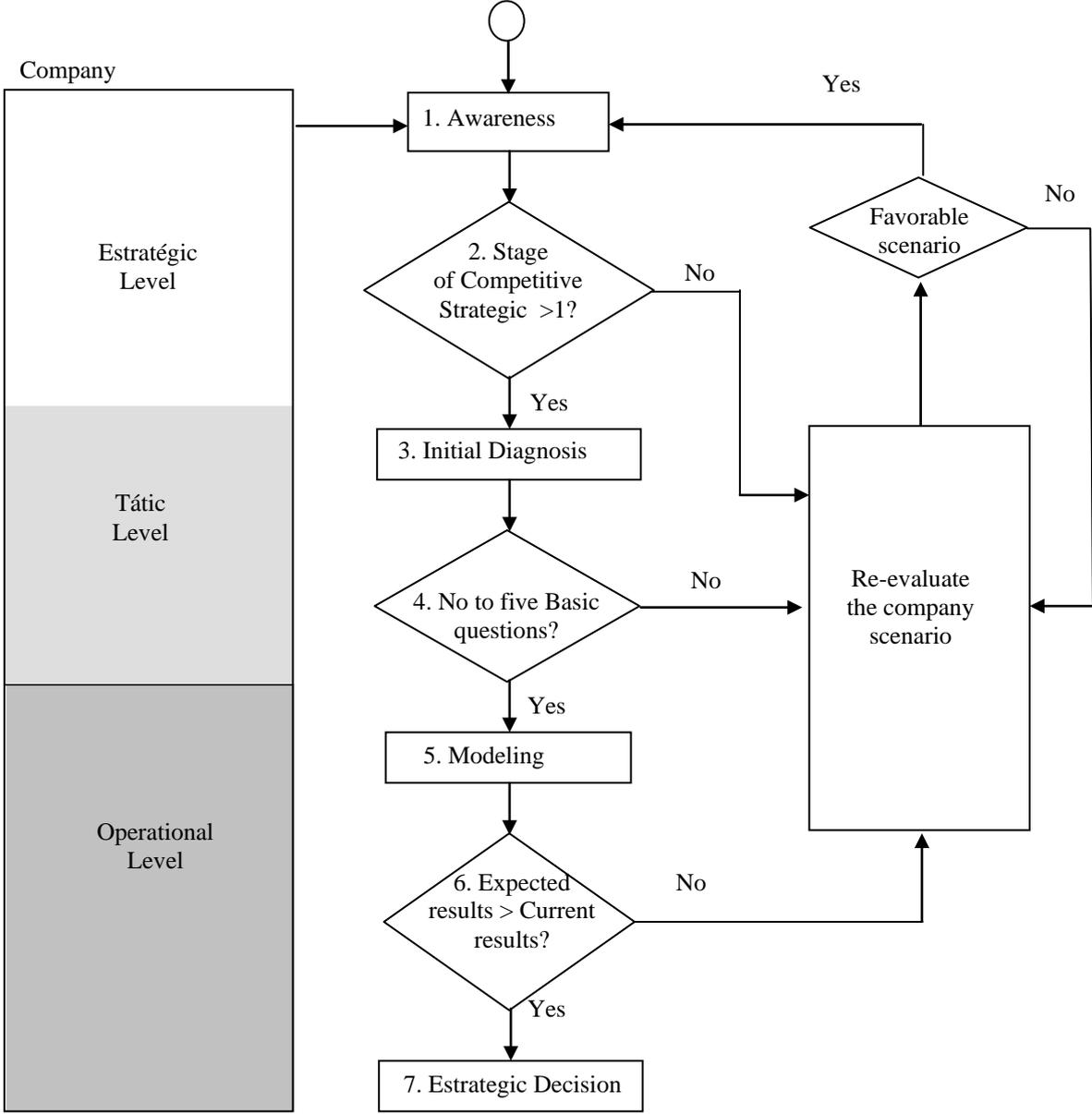
b) Opening of the company's direction for the application of new concepts: however the company is open to change, if you want to implement concepts that are not known to the direction of the company, so there is a pre-interest in the topic, initial acceptance depends on how well the idea is sold.

c) Prior knowledge of the subject: if the company's board already has familiarity with the concepts it intends to adopt, it can help the start of implementation.

In this first phase, as decision criterion suggests the following: if the company is diagnosed as

being in stage 1 in terms of competitive strategy, as mentioned earlier, it would not be appropriate to follow the implementation of the method. Other criteria may even help or hinder the tracking method, but should not be defined as criteria necessarily determinative. As tools to support the company's awareness about the potential benefits of applying the concepts of TOC on Distribution, one can make use of resources such as business games, training, etc.

Figure 1: Decision model for implementing the Theory of Constraints in Distribution Logistics



Once open the possibility of applying the method, you need to be aware that in certain operations, after a more detailed analysis shows that some characteristics make them infeasible to apply the concepts. That is, at this stage of the method, obtained awareness of the company, there will be a second check on the feasibility of implementing the concepts of TOC in distribution. A number of issues can be checked initially in a qualitative way. It is suggested answers to the following questions: Is there a significant amount of requests for

custom or specialty products, which makes impossible the formation of stocks? The company's products are lifecycle very small, which makes impossible the formation of stocks? Investments in a central stock are "unthinkable" (where the company working only on request)? Points of consumption are too far in the supply chain for the company, which makes it impossible to receive daily information consumption? (In distance refers to the number of intermediaries). There is one or more programs under implementation in the enterprise, resulting in less time available for business professionals to participate in "another project"? If the answer is "yes" to at least one of the questions, you should seriously consider not to pursue the application of the method, until the condition is eliminated.

In the final phase of application of the model, one must make a detailed diagnosis of the company, through qualitative data, unlike previous steps. At this stage what is proposed is basically to make a comparison between the actual results of the company with the theoretical results if the company were to adopt the concepts of TOC in distribution. The quality of information obtained in this final phase of the method thus will depend on the quality of the model made to represent the hypothetical situation that was assessed. In this sense, Moellmann (2008) says that if it's a strategic decision, studies should be made through modern simulation capabilities, through which the behavior in the environment of traditional supply chain can be compared with the same scenario, could adopting The methodology of TOC distribution. Some information needs to be collected, among which may be mentioned those reported by Moellmann (2008):

- a) Daily consumption of all retail outlets that serve end customers: obtained from historical records;
- b) Lead team of distributors transportation to points of sale: only useful for comparing the performance results of the distribution system;
- c) transportation lead time from the factories to the distributors: here too, useful for comparing performance results and also to scale inventories;
- d) Sizing of inventory per item: this is done by calculating method proposed in the TOC distribution.

Already Harmon (1994) to discuss aspects of qualitative viewpoint, indicates some other information: cost of implementing the software, storage costs and transportation costs. From the collection of all data required for the model, then the comparison is made between the results and the strategic decision making

4. Results of case study

The company is considered midsize, it manufactures and markets throughout Brazil spare parts for the automotive sector. It is a family business that has grown apace over the past 5 years. The following are the steps for implementing the proposed model, according to Figure 1. Were not necessary awareness activities as well as meetings on the subject, when they were exposed to the potential benefits to the company. The direction was seeking company growth through various improvements, which helped facilitate an opening to examine the possibility of applying the concepts of TOC in distribution. This scenario has been further facilitated by the fact the company has traditionally been developed, especially in recent years, through a focus on very large distribution channels. Your customers are retailers of spare parts for small, medium and large scattered across the country.

Assessing the status of the company in relation to the company's competitive strategy, through meetings with company management and observation of operations, it appears that the company is in a transition phase between stages 2 and 3. As Paiva et.al. (2004), this situation may occur some problems of character behavior in the company. Employees, in

stage 2, which only followed a series of procedures, in stage 3 are encouraged to take initiatives and make choices between different procedures. Therefore, when being in a higher stage than the first, the method can move forward.

For the period from initial diagnosis, as well as meetings with management and observation of operations, we needed a more detailed understanding of tactical issues of the distribution system of the company. He drew attention already at that stage the fact that the company operate with a systematic order fulfillment not unlike the proposal by TOC in distribution. The main strategy of the company as order fulfillment is: have products ready for delivery, which means deliver to customers anywhere in the country in less than 48 hours after receipt of order.

However it was found that there is no effective control of inventories. The definition of inventory levels is done in a completely empirical, by the production area, from experience with order volumes. Due to this the company had to invest in the areas of inventory increases, and is evident in the existence of stockpiles inadequate: there product inventory obsolete and eventually some requests are received and there is enough inventory to serve you. After an understanding of the strategic and tactical aspects most important company, was able to answer the five basic questions proposed by the method: The first response was said: "... There is a lot, but that can be treated differently. Represent about 10% of the products. " Regarding question two was identified that the life cycle was relatively large, because it was spare parts. The answer to the third question was also favorable, as already existed in the company stock for a large area. Regarding question four was found that there are no intermediaries; the products are sold directly to retailers. In some cases, clients are larger companies that distribute products to small shops, but this sets up a very great distance from the end customer. Finally in relation to question five, it was evident that he was in the final stages of implementing a program that requires the participation of the board for a few more weeks, but did not prevent the follow-up assessment, as in the implementation phase the board may have to focus on Project.

As we wanted to compare the current situation with the situation after the proposed use of the concepts of TOC in distribution, the starting point was to list the differences between the current working method and how would the proposed situation. As the company has a systematic order fulfillment is not very different from that proposed by the TOC, the comparison ends up being easier. Moreover, at first glance the gains with the use of the concepts of TOC distribution in the company do not seem so significant than companies that do not use centralized stock.

One of the points that was intended to decide on is whether or not the addition of regional warehouses. The addition of regional warehouses would not add costs to the existing distribution system, so the question is to understand if the benefits outweigh these additional costs. In this study it was not possible to estimate the charge in order to involve a study of the location of such warehouse according to the historical consumption, transportation costs, etc., which has not yet been made by the company. Yet were assessed discuss possible impacts related to the addition of regional warehouses from existing data. By adding regional warehouses, the total inventory of each item would be diluted from the stock plant, which would keep the majority, and the regional warehouses, according to the consumption in each region. The delivery time to customers, before 48 hours, could be reduced to less than 24 h. Since the stock at these sites would be given by the maximum consumption within 48 h (transport time), already pondering the reliability of spare time. Already in the central warehouse, the inventory would be given by the maximum consumption within the reset time, which in this case is given by production time (less than 24 h, from the assembling step). In the current situation, without the addition of regional warehouses, the stock would be given

that the real "A" option would require 78 shipments between the factory and the customer, with the condition "B" would be the total of 16 shipments from the factory (warehouse center) and regional warehouses more remittances between regional warehouses and customers. This example shows that if the company in question intends to evaluate the option "B", it is necessary to elaborate a model far more detailed than previously described. In this model due include parameters such as: amount of transport between the factory and the central warehouses, each piece costs of transport, etc.

The only difficulty envisaged, which would represent a significant change in fact, would get daily data from the point of consumption. The difficulty is not in the technology to do this, but in the interest of customers. Through interesting offers, such as the payment of fines in case of delays, it is believed that there may be a greater interest on their part. Analyzing differences in inventory turnover between different company's products, it is suggested to evaluate the possibility of maintaining inventory of finished products only items with high turnover and greater demand on the delivery time. For items with an average turnover of just keep stock components. Since some components are used for more than one type of product, it would also help to further reduce the variability of consumption. It is also worth mentioning that the data obtained, as well as additional data that could be obtained through a more significant amount of products, even showing the average size of stocks that are expected to get, you can not compare it with the current amounts of stock . This is because the company does not have effective control of inventory, in other words the actual amounts are not known. Before the implementation of the concepts of TOC distribution in this business, it is essential that the physical stocks are known and that there is accuracy in relation to stocks listed in the computer system.

From what can be seen in the case study in question, we conclude the following:

The implementation of the concepts of TOC in distribution would be a step not too hard and with great earning potential, considering that she already has a central warehouse and produces to replenish that store;

- a) First the company needs to have effective control of its inventory, including an adequate level of inventory accuracy;
- b) Using a computational tool, you can have an effective control of inventory levels desired, substantially improving the current control is done in a visual way and from quantities obtained empirically;
- c) If your company has an interest in evaluating the implementation of regional warehouses will need to create a more complete model, and can be in a spreadsheet, to simulate the costs and benefits of this option;
- d) It is suggested that for items with a smaller inventory turnover, is maintained just one component stock in order that replenishment time from the assembly is low;
- e) There is no data available in order to inform the firm of which the planned reduction of inventory levels, but there is an evident difference in strength between the current way of defining the replenishment of stocks and how would the implementation of a computerized tool that uses the concepts of the delivery TOC.

5. Final Remarks

This article outlined a current problem of industries where they are located and presented a literature review of the Theory of Constraint applied to distribution management, as well as other related topics. The initial discovery that has stimulated the development of

this work (limited amount of scientific work in this area), it was confirmed from a more extensive literature search. We conclude that there is still plenty of room for development in this area of work, including case studies evaluating the practical results obtained. In this sense, one of the gaps that help fill sought was to develop a method of assessing the viability pair implementation concepts. In other words, an artifact that serves as a transition between theory and practice.

Besides the literature review that was presented and the proposition of a model application, we aimed, through the reality of a company, discuss the practical difficulties in the use of concepts. When comparing the methods used by the company, which were created intuitively, with the concepts of TOC in distribution had become a pleasant surprise to see that the differences are not very significant. Perhaps just as simply by the current method was being developed at the company. The adjustments to current practices for the concepts of TOC in distribution seems to be a natural for the company evaluated.

The simple and intuitive nature of OCD in distribution indicates that a major expansion of its use in the business should be a matter of time. At the same time, you can say that without information technology there is no way to take advantage of the techniques presented. On the other hand, being relatively simple techniques, the greatest challenge is to properly configure the parameters of the distribution system. Moreover, it is necessary to develop strong partnership relations in distribution channels and customers, so that the information that will feed into the system can be trusted.

As mentioned previously, there is a very large space to develop further work in this area. Some suggestions for future work: a study to determine what level of penetration of the buffer that should trigger the increased size of the tracks; development of a more complete model than the one presented in this work, to assess quantitatively the costs of transportation, distribution, etc; case studies in companies varied sizes and segments; assessment focusing on potential gains market share and the company's results, discussion of indicators of "gain-money day", which was not part of the scope of this paper; relations between the concepts of TOC and the concepts of cooperation networks.

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