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The Search for a Methodology of Software Development for the Assessment of the Decision Making Process on Product Mix: Preliminary considerations

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Abstract: *The present text is based on the premise that each company always operates with some kind of restriction, which ends up giving them an insight into the optimized production technology that is the basis of the theory of constraints. It is understood that companies to treat constraints that limit their best performance need to make efforts to manage their constraints and not just their traditional administrative processes. Thus, we highlight in the article now presented a methodology for the development of software for evaluation and decision making on product mix, since the conditions of competition in Brazil establish great restrictions for some national companies, what they are facing such challenges by the strategy of mix in its product lines. The text refers to the first considerations of the authors on the methodology for the future development of software.*
Keywords: *Theory of Constraints, Decision Making, Product Mix*

I. Introduction

In general, the scientific research aims at seeking answers to proposed questions. It is known that the scientific research is the result of a query or detailed examining which have the objective of solving a problem through the means of methodological procedures. It also consists of a set of proposed actions that intend to find the solution to a problem and that are based on rational and systematic procedures. The scientific research is, thus, performed when one has a problem and no information to solve it. This proposition also applies to business problems.

If we depart from the premise that a problem is a practical or technical difficulty and bear in mind that in the business area it means searching for the knowledge of something of actual importance that requires a solution, we can accept that in order to define a business problem which normally encompasses costs and risks it is necessary to specify it in accurate details. Therefore, when posing a problem meaning to attain business results, one must be clear, concise and most importantly, objective.

In order for that to be achieved, the use of methods that identify and solve problems in business activities has four main concerns:

- Measurement: concept, hypothesis, measures and variables;
- Causality: dependent and independent variables, relation of cause and effect;
- Generalisation: there must be a permanent (or long-lasting) applicability, beside its primary objective of usage;
- Replication: to permit that the conclusions be verified and replicated in other moments under similar conditions.

For the purpose of this article, it is known that companies establish the product mix as a strategy and for that matter factors that are internal and external to the company are taken into account. If, on one hand, internal factors are linked to the installed capacity, the discretionary costs or the stocking and training of labour force *etc*., on the other hand, the external factors are related to prices, the existence of substitutes, distribution channels, suppliers' bargaining power, taxes, financial costs, the competitors' ability to penetrate the market, among others.

Any internal or external factor, conceptually or methodologically speaking, may equal to a restriction which will limit the achievement of a business goal and that makes controlling and reducing potential bottlenecks or hurdles - be they internal or external - that restrict or stop from achieving goals of absolute paramount importance.

In these terms, this article aims at presenting a method which is capable of taking measurements, considering that the company's goals correspond to parameters that aid the measuring of how efficient the company is (set by the achievement of the goal). It is known that every company employs gauges to assess their situation, such as the net profit, which serves as an "absolute" measurement of the amount of money generated

by the business, or the return on investment, which acts as a "relative" measurement of the necessary effort for a certain level of profit to be reached.

Thus, what is here proposed by us is based on actions of causal nature, since the main hypothesis guiding our search for a methodology lies in the finding that, compared to foreign companies, Brazilian ones face fierce competitive conditions.

In fact, according to data released by the FIESP - Federação das Indústrias de São Paulo (São Paulo Federation of Industries), nowadays in the internal market, one out of four companies (26%) competes with Chinese goods, whereas 58% of Brazilian exporters compete with Chinese goods in the international markets.

Such change and increase of competitive conditions have generated major restrictions to some Brazilian companies which tend to face them by establishing an alteration of mix in their line of products. This can be proved by observing the expo promoted in April 2016 by the ABRINQ - Associação Brasileira de Brinquedos (Brazilian Association of Toys), when over 1,200 new products were launched or, to be more precise, beside the totally new products, some were re-designed, adjusted or adapted. This fact shows the sector's concern in facing the intensified competition by means of the product mix, which is focused on either the strategy of cost adjustment or the motivation to be differentiated.

Whichever the case, it is wise to highlight that by monitoring sectors, such as the toys one (here given as example), it is possible to create a method to examine the efficacy of the decision making process in mix of Brazilian companies and thus generalise and replicate the conclusions observed in the method to other sectors by creating a reference matrix about the national competitiveness

II. Theoretical Background

This article is based on the premise of the theory of constraints that states that companies operate with some type of constraint and, once such constraints are identified, they should be explored to the maximum of their capacities, given that the performance of the resources with a capacity constraint (bottlenecks) will determine the performance of the whole organisational system.

Obviously, the constraints were there from the moment the first companies appeared. Nevertheless, a theory analysing how companies should learn how to live with these constraints by making better use of factors that limit their productive capacity in order for the goals to be achieved only appeared a few decades ago.

According to Guerreiro (1996), it was in the 1970s that Eliyahu Goldratt, who was involved with production logistics problems, developed a mathematical formula for the planning of a plant. It was from this formulation that the OPT (Optimized Production Technology) software was created, which is oriented to the production programming.

The practical experience enabled by the system implementation has brought about many contributions. Every time that a problem and its solution were discovered, Goldratt noticed that they were based on specific principles which, despite being logical and almost elementary, were ignored by the traditional methods of production. Consequently, Goldratt went on to formalising a series of principles that ended up building the idea of the optimised production technology, which is the foundation of the TOC (Theory of Constraints). Therefore, the understanding that the theory of constraints is an expansion of the optimized production technology because of its usage in a substantial part of its theory, is worth mentioning.

It is understood that every company who aims at achieving its goal will always have one or more constraints; otherwise its profits would tend to be infinite. Therefore, Guerreiro (1996) defines as a constraint any factor limiting a better performance of a system, like a chain's weaker link or even something that is insufficient in the company. To the actor, the constraints can be classified in two types:

a) Constraints of resources, which encompass market, supplier, machinery, materials, orders, project and people; and
b) Political constraints consisting of norms, procedures and usual practices from the past.

Starting from the simple assumption that the company's goal is to make more money and that it will always have one or more constraint in the process of obtaining its goal, the efforts of its executives should be focused on the management of these constraints and not only on traditional processes of management such as cost reduction, for example.

III. Theory Of Constraints And Linear Programming

The theory of constraints basically works by executing a procedure of maximisation or minimisation of its performance measurements, according to the identification of the constraints that limit the system's efficacy. Indeed, its objective is to maximise the gain by minimising operational expenses, even though the constraints govern this process and become, more often than not, actual obstacles for the company.

It is known that the linear programming is a method of conditioned optimisation and that it refers to the determining of a mathematical problem that obtains viable solutions, in compliance to the system's limitations. Its goal is, therefore, to optimise the performance of this system without violating any of its constraints.

In order to have a good modelling of a linear programming problem, it is necessary that the model's variables, the system's constraints and the objectives to be reached be initially defined, as well as to verify its viability. Thus, we observed that the functional objective of the Theory of Constraints is similar to the one of the linear programming in that both methods present intentions to maximise and/or minimise some performance measurement, given some constraints.

Within this context, it is understood that the usage of linear programming can be the base of the quantitative analysis that will be applied to develop softwares used in companies because it is, as a mathematical model, capable of identifying constraints, analyse and decide how to minimise factors that will limit the achievement of its goals: the gain.

IV. Thinking About Methodology

In order to develop software with such features, the following steps would be necessary:

Preliminarily, an exhaustive review of the actions taken by the company in the past has to be carried out, aiming at understanding the economic-financial metrics that were involved in the decision making process of its products mix.

Following that, one should follow-up and monitor the data and information originated by the business structure with the intention of identifying the sources of uncertainties that impact the competitive conditions and, consequently, the product mix decision.

Once the sector's constraints are listed, we will use the knowledge inherent to the Theory of Constraints associated with the Linear Programming through the means of developing a software that solves problems of products distribution in the production flow of industries, production, programming, management, among others, but mainly one that manages to combine the qualitative and quantitative analysis and generates specific reports.

In short, the software will use the mathematical method proposed by the Theory of Constraints by applying it to the company, so that it can support the decision making process, either of productive problems in complex systems with multiple constraints mainly because of its degree of exposure to international competition, or of the products mix, so that it can contribute to a decrease of positioning constraints.

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