TOC, Lean, Six Sigma Are Complementary?

Bostan Rebeca Ioana
„Valahia" University of Târgovişte, Doctoral School
bostanrebeca@gmail.com

Abstract

Improving the performance of a company, whether it be services or production, depends on a detailed understanding of its structure to survive to world-wide competition. The six sigma, lean management, TOC plays an important role in resisting global competition. Constraints theory is a systematic approach that identifies the weakest links in a system and has focused on improving it by improving the overall efficiency of the company. This scientific approach is designed to provide an in-depth understanding of the interdependencies between these three approaches and to evaluate their contributions. This step-by-step approach aims to analyze very important features about TOC, Six Sigma, lean, when used to continuously improve processes in manufacturing systems. The results of this scientific approach have shown that tools such as TOC, lean, Six Sigma have complementary aspects that overlap with the exclusion points and that there is a wide open field for research on the subject.

Key words: TOC, lean, six sigma, constraint, improvement
J.E.L. classification: M41

1. Introduction

By completing this scientific paper, we propose to evaluate the complementarities between TOC, Six Sigma, Lean Management, the latter being two management methods dedicated to eliminating common variations as defined by E. Deming in 1997. The main objective of this paper is to investigate whether tools like Lean Six Sigma Constraint Theory (TOC) are complementary and are a perfect combination to continuously improve processes in production environments. This study is important because it is based on identifying the main features of these tools. These approaches focus on continuous improvement by the enterprise, but as a rule, such approaches have reached the performance limit, given the complexity and competitiveness of current markets. In addition, it is useful to find new tools of other approaches to make the current strategies more robust for a better continuous improvement over global competitiveness

Constraint Theory (TOC) assumes that a chain is not stronger than the weakest link, as a new management paradigm (Jaeck, 2008).

This means that processes, organizations, etc. are vulnerable because the poorest person or part can always damage or break them or at least negatively affect the outcome. In the United States Implementation of the TOC instruments has had some impact on the economic sector, in particular, on the results obtained with the Manufacturing Optimized Production Management (OPT) software. From the beginning of the 21st century, there have been numerous applications in a variety of areas: small, medium and large companies, such as, US mariners, health systems such as National Health Service in England, educational systems in Poland, Mexico and the Philippines, non-governmental organizations. According to the constraints theory (or TOC through its English acronyms), localized management is the main cause of many of the problems we face today in companies, such as lower overall performance results than expected, difficulties in securing and to maintain an advantage on the strategic market, financial difficulties, customer expectations with regard to the services offered are rarely satisfied, the manifestation of conflicts between employees from different departments (Burtan-Houle, 2001).

2. Theoretical background

Six Sigma and Lean management stem from statistical process control of Shewhart and Deming. These statistical processes were carried out at the beginning of the 20th century. The Americans rediscovered the work of these two researchers when the Japanese automotive industry, especially Toyota, began to invade the US market. Six Sigma approach and the Lean Management are now assembled in the fundamental specialized literature. Recently, more authors describe the complementary approaches of Six Sigma, TOC and Lean Management, in a new book that featured the book The Goal. This reflects the issue of distinguishing managerial practices that have been developed by Six Sigma and Lean Management over those of TOC, often confused in literature, so many companies, especially Anglo-Saxon, ask their staff to study The Goal as a reference for Lean Management. Constraint Theory (TOC) was invented by Dr. Eliyahu M. Goldratt in 1984 in his book The Goal. The Israeli physicist has developed a revolutionary method of programming production at the time, there were several accepted and available methods such as MRP (Lakshmi, 2014, 334). TOC or the theory of constraints evolved from the OPT (Optimized Production Timetables) system and was later known as the Optimized Production Technology (OPT). The central idea of the TOC philosophy was that any organization or system has a constraint or a limited number of constraints that dominate the entire system.

Thirty years after the publication of The Goal (1984), Constraint Theory has been the subject of numerous experiments and publications in the Anglo-Saxon world, particulary in the United States, North Europe, and over the past ten years , in India and Japan. In addition to Goldratt's publications, many academic books have been published about TOC. Ronen et al. in 2006, for example, describe TOC applications in the health industry. Mabin and Balderstone in 2000, implies an interesting review of international literature on TOC. Kim et al. in 2008 it focuses in particular on the thinking process based on articles in revised journals and conference papers published between 1994 and 2006. Watson et al. in 2007 discusses the evolution of TOC over time. Recently, Cox and Schleier in 2010 have compiled the Handbook of Constraints. However, despite the very wide adoption, several factories failed at the time of implementation. In analyzing these failures, Goldratt concludes that the main problem comes from understanding how the commands are produced. This led him to publish the book The Goal. This book was made in 1984. It presents in a narrative format the fundamental techniques of the theory of constraints. The book sold well for over 5 million copies, translated into 21 languages, making it a necessity for many people in many training programs around the world.

3. Methodology

The object of the scientific research is to identify the complementarity between the lean approach, the six sigma approach and TOC. The issue of the scientific approach is the following: approaches such as lean, six sigma and constrain theory are complementary? The resultats of this research will generate us knowledge in operations management. The most academic research requires understanding of the current state of research problem. A systematic review has shown that identification between TOC, lean and six-Sigma is a recent topic in literature and thus an opportunity for further research. The scientific approach was based on the study of the specialized literature. Throughout the work we have provided the interaction between different studies of scientific literature to discover new information on the subject. This scientific approach has been achieved through a theoretical documentary research, aiming at acquiring the necessary, new, advanced knowledge for starting the empirical research process. The information sources used for this research include: specialized books, national or international; specialized articles published in reputable magazines, recognized at national or international level.

4. Findings

Although many projects have proven to be successful, poor programs are struggling to be on the right track, according to a recent study by the ARC Advisory Group: Many Lean programs are struggling. In a recent Lean Enterprise study, 36 % of Lean practitioners believe that their businesses are returning to their previously used work habits.

The same phenomenon was also observed in companies that implemented Six Sigma. Even those with very good initial results have difficulty preserving the impetus of their programs, and in some cases the programs have been stagnant. And yet why? One of the problems is that many organizations implement too many Lean, Six Sigma or a combination of the two. Managers complain that they have reached a saturation point and that they do not know what the important projects are. This issue is highlighted on the basis of the essential assumptions that formed the basis of this scientific approach: Lean's key assumption is that waste disposal will automatically and obviously result in a fundamental improvement in performance, but it is not valid under all circumstances, nor the circumstance that using the Six Sigma will reduce variations, which will automatically lead to a general improvement of the system.

It is very difficult to bring arguments against the philosophy of continuous improvement, but the economic reality is that companies want an efficient and maximum improvement that requires a minimum investment. An attempt to bring about continuous improvements throughout the entire process involves employing many employees within the economic entity. However, in fact, determining the processes and eliminating all waste from the entire economic entity does not result in an unnecessary cost reduction, and does not result in an increase in revenue automatically. Under these conditions, how do managers manage to determine which are the core projects and what are they not? If the priorities are everywhere, then there is no priority! It also happens that the organizers of these projects perceive them only in terms of local optimization, without taking into account the entire organization. In a prominent case, a procurement department has launched a cost-cutting initiative: the company has made huge savings by purchasing components in China, but these economies havecost very high because the delivery time was very long and very uncertain - 6 weeks on average and sometimes 8 weeks - during the time when the cycle was a key competitive factor on the market. The backup solution was large deposits, filled with stocks of intermediate components. The company was very close to the abyss and winding up.

This is a classic situation that involves many local improvements that result in compromising the system as quickly as possible. The economic entities that have made global efforts with Six Sigma or Lean - with a multitude of projects in the same period - have predispositions to this difficult situation. But how can managers be able to understand the effects of local initiatives on the economic entity? The combination of constraint management, Lean, Six Sigma, may have the key to this difficult question.

Economical entities that have obviously and effectively used Six Sigma and Lean have been able to eliminate many of the variations and waste of their processes many times and have been able to make profits in an easier way. But what is the way managers will decide what appropriate Six Sigma, Lean improvement initiatives will be launched?

First, however, it should take into account the objective of an improvement initiative: in the situation of the economic entities, the increase of the shareholder value by increasing the net profit and by increasing the profitability of the investment. Managing with the TOC instrument creates a framework to highlight and measure the impact of a particular local initiative globally. For example, when output increases - without affecting investment and running costs in line with the TOC definitions - then net profit and return on investment are simultaneously increased. When it comes to deciding to implement local improvement with Lean or Six Sigma, managers should consider the impact on the three indicators - capacity, investment and spending.

The position of TOC management is that the focus should be first on increasing capacity, then lowering investment, and ultimately lowering spending. Respecting the management framework, using TOC for Six Sigma and Lean projects, companies avoid problems when the priority is to reduce costs. Let's take a look at the cases of many companies that have been excessively committed to waste disposal, in order to reduce costs without making such great efforts in new sales. Excessive, sometimes personal, abilities are perceived as wasting, and that perception results

in certain problems over a long period of time. First, reducing capacity to meet demand creates a little room to increase demand: if capacity has been diminished, it will not be easy to raise it back because it requires a certain amount of time and an amount of money to find and recruit a number of employees with professional skills.

A second situation is the effect of these decisions on future performance and morality: how can the actors of the economic entity achieve cooperation on Six Sigma, Lean, if they know they cut off the arm they stand on? From this point of view, all initiatives for continuous improvement are condemned.

In order to determine what should be improved, it is very important to remember that a system can be governed by a small number of constraints. Rule 80/20 consists in the fact that 20% of the initiatives will lead to 80% of the results. But what is the moment when we understand that constraints condition the improvement of the system? It is interesting to consider that only some of the elements will have a very significant effect. Specifically, Rule 80/20 will be Rule 99/1.We need a process to ensure that this constraint lies at the heart of our efforts. We study below the five steps of constrained management improvement (Jaeck, 2014, p.309):

- ✓ Identify system constraints. Where does the factor that leads to the limitation of performance of the economic entities position? An analysis of the symptoms of economic entities may have the effect of constraining diagnosis. An example may be that for a production unit that can not achieve enough to satisfy all demand, constraint may be the machine whose capacity is also a constraint;
- ✓ Decide how constraint should be exploited. When the constraint was established, managers should do something to maximize performance. An example, is when a machine is a constraint, all sources of waste during use of this machine must be removed;
- ✓ Understand economic constraint. It is very important and necessary to determine how other resources should work to cope with stress;
- ✓ Removing constraint. Managers need to work to eliminate constraint. This can take the form of additional equipment or additional labor.
- ✓ Go back to Step 1, but be careful of inertia. At one point, constraint may change. It is necessary and important to establish the new constraint and redirect our efforts and not to continue to focus our efforts on the previously identified constraints. An example is that production capacity can be improved, and the market and the market will be the constraint of the system. In this case, efforts will have to relate to sales forces.

Following these 5 steps is facilitating the stage in which the process of continuous improvement develops, as an economic entity always has at least one constraint. Lean, Six Sigma approaches should therefore be prioritized and evaluated and reprioritized and reassessed over time, in the context of their impact on the successive constraints of the economic entity. So, as the production capacity of an organization is constrained, the six sigma and Lean tools should be used to eliminate and destroy waste, and to streamline flows through the use of customer-based programming.

If the constraint is externally identified by the economic entity, then the Six Sigma tools should be dedicated to certain areas that will result in the economic entity's offerings being more attractive and advantageous to prospects. This includes the length of time that customer feedback is received and reliable delivery time. There is no doubt that these three improvement initiatives are not mutually exclusive, but are therefore complementary.

Management using TOC is a systemic thinking system to determine where it is most important to focus efforts. TOC can be used to make the economic entities' efforts on the right solution and to assure the real problem at the right time, but also in the right place. Lean and Six Sigma Techniques and Tools can then be used in circumstances where they will result in many benefits.

Supply chain managers need not invest their resources on projects that drive the strongest links identified in the chain. Conversely, alastia should use constraining theory to better focus Lean, Six Sigma efforts on weak links. For economic entities that initiate their efforts with Six Sigma, Lean, and by using the theory of constraints, the results will accelerate because it will focus first on the most promising areas, with opportunities for improvement.

The Six Sigma approach involves identifying projects that result in the reduction of defects for a successful deployment of processes and a wide range of operational improvements. However, it does not have a systemic view to understand how these projects affect the overall performance of

the system and do not fully involve operators. This can lead to the company's financial impact, prioritizing projects and eliminating the positive impact on other processes. Alternatively, several authors have suggested that the five focusing phases of TOC can result in overcoming this gap. However, the author points out that the TOC debugging and analyzing process uses language that requires a different approach for management and operators and complex intellectual leadership by experts with appropriate professional skills. The customer and the company represent the focus of Six Sigma, lean and TOC. Although these philosophies have been used by various industries to improve processes, because while Six Sigma requires in-depth solutions, TOC sometimes presents bottlenecks and can overcome them. The common form of integration between Six Sigma and TOC is to identify the company's constraints and use. These approaches have the effect of reducing or resolving this problem. The main advantages of combining the three approaches are: First, the restrictions are analyzed, controlled and measured using a set of statistical tools to understand the problem and make the most appropriate decisions. Second, blocking is the first point to analyze, generating greater financial profit for the enterprise. Finally, the Six Sigma project is not chosen by a single business area, but rather relies on the general view that TOC will generate project outcomes across the whole system. There are some disadvantages. First of all, variations can not always be diminished, which will increase the capacity of the restrictions. Second, when any decrease in variation increases the production rate, downstream processes can lead to higher rejection rates. Finally, there is also a slight uncertainty when using the principles of TOC, Lean and Six Sigma. There is also a model that integrates TOC and Six Sigma that implies a limited budget environment to improve Six Sigma to ensure application quality and efficiency. This model has been used in an economical engine manufacturing entity, using its satisfactory results. There are similarities between the improvements achieved through the implementation of the approaches Lean, Six Sigma, TOC. The authors suggested the inclusion of the TOC thinking process to understand the cause / effect of interactions in the system, as well as the addition of other approaches aimed at continuous improvement. Studies have shown that there are differences between these three important approaches, but have concluded that these approaches are complementary.

5. Conclusions

Constraint management focuses on the efforts made by using Six Sigma and Lean, on resources, processes, principles and procedures that constrain the organization to its purpose. In this context, the continuous improvement process produces remarkable results very quickly and easily. The priorities are clearly identified, the projects are being carried out, and the quick results produce a certain training effect for all the actors in the organization. This step-by-step approach has analyzed very important factors about TOC, Six Sigma, lean when used to continuously improve processes in manufacturing systems. This paper also contributed to a better understanding of the essential principles of some such methodologies by making a comparative analysis of the aspects that are considered to be critical. Following this scientific approach, it has been found that examining the points of convergence and the exclusion of the three approaches results in a better understanding of its essential principles. Thus, it has generally been deduced that there are more points than overlap between these approaches. In the general context, the results of this study have shown that OCD, lean, as well as Six Sigma have some complementary features that overlap with the exclusion points and therefore there is a very wide open field to explore this topic.

6. References

- Cox, J., Schleier J., 2010. *The Theory of Constraints Handbook*, New York: McGraw –Hill.
- Goldratt, E.M., Cox, J., 1992. *The Goal*, Great Barrington: North River Press.
- Houle, B., 2001. *The Theory of Constraints and its Thinking Processes,* Tracey: The Goldratt Institute.
- Jacob, D., Bergland, S., Cox, J., 2010. *Velocity: Combining Lean, Six Sigma and the Theory of Constraints to Achieve Breakthrough Performance - A Business Novel* . New York: Free Press.

- Jaeck P., 2014, *Pratiques managériales et theory of constraints: le cas d'une entreprise de taille intermédiaire (ETI) française dans le secteur des services*, Strasbourg.
- Jaeck, P., 2008. *Une nouvelle vision de la comptabilite de gestion.Pour manager synchronise!,* La Plaine Saint- Denis: AFNOR.
- Lakshmi, C. H., Ramakrishna, R., 2012. *Review on Theory of constraints,* Tirupati: IJAET, 3 (1), 333-334.
- Mabin, V.J, and Balderstone, S.J., 2000, A Review of Goldratt's Theory of Constraints (TOC) – lessons from the international literature.
- Watson, K.J., Patti, A., 2008. *A comparison of JIT and TOC buffering philosophies on system performance with unplanned M/C downtime*, International Journal of Production Research, 46(7), 1869- 1885.