SCOR, Lean and Six Sigma integration for a complete industrial improvement

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Abstract: The challenging goal to achieve competitiveness in modern markets begins from business process integration.

The processes are actually driven by customer requirements rather than by the internal business gains. In order to meet the final customer requirements, companies are involved in supplier–customer chains and this is the beginning of a real need for global perception, going outside their boundaries. In this context the supply chain goals come first and drive process improvement actions.

This paper explains how some methodologies can be woven together in order to support this approach. In particular, the focus is to consider the combined use of SCOR, Lean and Six Sigma principles so as to enhance the management of the entire supply chain. As a consequence, the paper explains how to simplify the analysis of a complex and interconnected industrial environment, thanks to the development of a new problem-solving approach.

Keywords: Supply Chain Operation Reference; SCOR; Lean Six Sigma; process integration.

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1 Introduction

Modern business beliefs are based on a main concept: integration. This is a natural consequence of the market development over the last few years. Globalisation has caused an exponential increase in competition, and cooperation is the strategy for the survival of companies.

The market has changed into a customer-driven one. A lot of products and services are widespread and available all over the world. In this environment, a company can compete and gain only by internalising these assumptions, casting aside the old paradigms and promising to follow the customer requirements and needs. The processes should be driven by customer requirements rather than by the internal business gains. Thus a new, deeper concept of customer satisfaction is necessary (Ayers, 2000; Chopra and Meindl, 2001; George, 2005).

If these concepts are well understood, it seems natural that companies have to manage their processes, looking first at the effectiveness. Processes and activities must be considered as a sequence of transformation and movement of products or services in order to satisfy the customer's needs. The goal is not the local improvement of the processes, but rather a global management to maintain customer's loyalty. Therefore the challenging goal is to achieve competitiveness in modern markets by beginning from business process integration. It is possible to configure supplier–customer chains of processes that effectively enable products to reach the final customer (Ayers, 2000; Chopra and Meindl, 2001).

In this context the supply chain goals come first and drive process improvement actions in a hierarchical manner. The entire sequence of processes has to be managed together; the difficulty is to overpass the boundaries of the company and to define a common strategy that will reach customer satisfaction. The development of a spread way of thinking throughout a supply chain is a very difficult task; the complexity proportionally grows with the number of players who are involved in a supply chain.

The solution can differ from case to case, but a methodology can be traced in order to help companies reach such a challenging objective.

In this paper the authors discuss how business process integration can be supported and implemented at every level, by using the benefits of the combined effect of some powerful, modern methodologies. In particular, the paper explains three methodologies based on a common process improvement perspective, but with different principles and goals related to different areas or managerial levels. As the industry changes, expands and feels the need of integration, so are the managerial methods developed and updated in order to be more applicable to the industrial field.

2 Methodologies for integrated management

Every complex activity about organisation and management of an industrial network can be simplified if a rigorous method is adopted.

The process integration theories give the possibility of considering all the processes involved at the same time, in order to achieve customer needs in the most profitable way for the enterprise. Process integration emphasises the importance of a goal widely

understood in the company and shared at every step. Every entity involved in a supply chain network and every part of the company contributes to the improvement because the overall goal must come first (Chopra and Meindl, 2001). In this environment the importance of a basic method becomes more and more relevant.

The methodology for the improvement of a supply-chain-based integrated environment needs some features: it must include a problem-solving approach as a guideline for improvement; moreover, a useful method has to include the capability to manage processes at strategic, tactical and operative levels, to define a common language or, better, a shared metric.

In this paper authors consider three methodologies (SCOR, Lean and Six Sigma) from a managerial point of view, by analysing pitfalls and opportunities. Even if SCOR, Lean and Six Sigma are well known and overworked methodologies, it is, first of all, necessary to resume their principles individually and to introduce a critical overview.

2.1 SCOR model

SCOR is the acronym for Supply Chain Operation Reference. The methodology is based on a well-discussed model, whose focus is to rationalise and standardise flows, operations and metrics throughout a supply chain. The SCOR model attempts to generalise the actual needs of the companies involved in a supply chain (Supply-Chain Council Inc., 2004).

Some basics concur to raise the SCOR model to a method. First of all, its strategic purposes: the SCOR model has been introduced to solve some troubles strictly connected to modern markets and actual industrial environments. The key to competitiveness lies in supply chain organisations and in a new objective: a deeper customer satisfaction. The SCOR model aims at a generic framework in order to help companies reach their goals when they are involved in an integrated environment.

In order to increase the performances of a supply chain (defined as a series of processes strictly connected that involve different players linked together in a supplier–customer relationship, who transform or transfer goods and information from suppliers to customers and vice versa (Ayers, 2000; Chopra and Meindl, 2001; Lambert, 2001)), the SCOR model furnishes companies with a real methodological advantage to compete in modern markets. It effectively suggests what to do and how to do it step by step and how to drive the strategies in order to obtain the companies' goals.

The main focus of the SCOR model is to rationalise the steps a company should follow in order to define its strategy in an integrated environment. First of all, it would help the decisional activities with an opportune analysis of competitiveness and the achievement of the best practices through a benchmark analysis. Once a solid strategy is defined, the model works by improving the entire supply chain performances (Bolstrorff and Recker, 2003; Bolstorff and Rosenbaum, 2003; Harmon, 2003; Swartwood, 2003).

Some fundamental issues must be highlighted in order to resume the principles of the SCOR model. It presupposes that the environment and the internal organisation of each company approaching these new concepts have to be radically renewed; a well-defined partition of roles and a committed staff involvement are necessary (Bolstorff and Rosenbaum, 2003).

The strength of the SCOR methodology can be resumed in two words: metric and flow. Since the supply chain must be considered as a whole, if the final customer's needs are to come first, its goals are the engines for every company and process that

compose it. For this reason the SCOR model suggests a framework to decompose flows and metrics through a breakdown structure, to define managerial levels and to measure them in a hierarchical manner. The attempt is attractive: the decomposition of the flows into elementary processes (plan, make, source, deliver and return) and then their segmentation into hierarchical levels permit to align operations with strategy. At the same time these decompositions are held for the metrics that measure the performances. The performance indicators are included in a table so as to standardise their use, calculation and exploitation (Supply-Chain Council Inc., 2004; Bolstorff and Rosenbaum, 2003; Harmon, 2003).

The hierarchical structure of the SCOR model should guarantee the improvement and facilitate the discovery of lacks and opportunities.

The decomposition of the flows is very reliable and useful and the emphasised importance of a common metric is suggestive (Lambert, 2001; Bolstorff and Rosenbaum, 2003). Nevertheless, the SCOR model lacks in various aspects. It is based on a rigorous methodological framework and on a reliable hierarchical approach, but it is a model and cannot be generally adopted it depends on the system it represents. It strays from common project-oriented methodologies and from continuous improvement theories.

Moreover, the SCOR model is perfectly aligned with the needs of modern markets, thus it reasonably refers to strategies and attempts to translate them into operations. Philosophically this main goal is unambiguous, but in practice the SCOR analysis specifies where to operate but not how to do it. It would need more tools to support the methodological framework and a problem-solving approach that could lead to an effective improvement.

2.2 Six Sigma

Six Sigma is a well-known methodology based on continuous improvement and on a problem-solving approach. It mainly focuses on customer satisfaction (George, 2005; Pyzdek, 2001). Once the customer's expectations are clearly defined and collected, it is necessary to turn them into the processes of the company. In this way, effectiveness comes first and drives the efficiency.

Sigma is a Greek letter, commonly used in statistical models to signify the standard deviations from the mean. Thus Six Sigma immediately reveals its nature: it is a methodology based on statistical concepts, which aims to manage and to reduce the variability of the processes, in order to obtain a reduction of defects up to 3.4 parts per million (Basu and Wright, 2004; Brue, 2003). Every process at every level of detail can be measured and, as a consequence, it is possible to approach the management of the variability in the same way. For these reasons, Six Sigma is extremely flexible and can be generally considered as a project-oriented methodology. It is a great advantage.

Even if the methodology is based on statistics, it would be incorrect to consider Six Sigma as a statistical tool. Above all Six Sigma is a business strategy, where the staff is continuously involved and the objectives of the project completely shared. In this context, Six Sigma leans on a lot of tools and statistical analyses in order to implement the strategy and to reach its objectives (Pyzdek, 2001; Brue, 2003).

Six Sigma aims to improve the processes through the problem-solving method DMAIC (George, 2005; Pyzdek, 2001; Basu and Wright, 2004; Brue, 2003). Therefore a Six Sigma project can be divided into five sequential phases:

1 Define phase – clarifies the goals and values of the project.

2 Measure phase – gathers the data on the problem in order to measure the process, to define the capability and the performance.

3 Analyse phase – examines and identifies the causes of variability.

4 Improve – uses some tools in order to reduce the variability and defects.

5 Control – determines the ability to control the critical variables in order to maintain the results.

Defining, measuring, analysing, improving and controlling the activities of the organisations can increase the efficiency that is gained by improving equipment usage, improving management methods and implementing strategic plans and goals (Adams *et al.*, 2003).

Six Sigma is a real modern methodology, characterised by innovation and flexibility. It holds a lot of opportunities owing to the generalisation of standardised problem-solving approaches and to the data collection and measurement activities. On the other hand, the Six Sigma methodology deals with a vision oriented to the internal flows, leaving out the supply chain theories. Moreover, Six Sigma focuses on reducing the variability in order to improve the processes, but it does not consider an early possibility to renew them. Six Sigma reduces defects and increases effectiveness and quality, but the efficiency of the system, because of the Work-in-Process (WIP) reduction and the increasing of the process speed, is forgotten.

2.3 Lean

Lean is a modern strategy for production management and a philosophy based on three purposes: to eliminate wasted time, effort and material; to provide customers with made-to-order products; to reduce costs while improving quality. This methodology is an evolution of waste elimination and process streamlining techniques founded in the Just-in-Time, Toyota production system, 5S and visual workplace concepts and applications. The goals of Lean are to optimise process leanness, to increase the speed of flows and to configure a reactive and flexible system (George, 2005; Bicheno, 2000; Womack and Jones, 2005; Womack and Jones, 1996).

Lean once again considers customer satisfaction as the main objective a company has to achieve. Once the customer's requirements are identified, it is possible to detect the value stream. It would be suitable to extend the value stream identification, looking at the whole supply chain. The value stream should be mapped and should be the reference for specifying the value flow. The final objective is the reduction of all the obstacles to the leanness of a process, such as queues, pointless transportations and waiting times. In order to obtain these ambitious goals, the Lean methodology emphasises the concepts of staff involvement and internal integration between functions (Bicheno, 2000; Womack and Jones, 1996).

Even if the application of the Lean methodology can enhance the flexibility and the productivity of the processes, Lean does not consider other fundamental aspects. In an integrated approach, the customer's requirements come first and the effectiveness drives the efficiency. Lean theories do not comprehend tools and analytical frameworks in order to capture the voice of the customer. It mainly focuses on increasing the speed of

processes, omitting to manage the variability. Thus no methods or tools are incorporated in order to analyse the variability, to control the processes and to reduce defects, as no metric is defined to uniformly measure the processes.

Actually the principles and the benefits of Lean and Six Sigma are gathered together and their integration has found a powerful new methodology called Lean Six Sigma (George, 2005; Bolstrorff and Recker, 2003). In this paper the authors would like to go beyond this synergy, considering the modern methodologies as sources and drawing on them in order to completely support the management of a modern integrated environment.

3 Natural integration of SCOR, Lean and Six Sigma

As the markets and the management theories evolve, the methodologies that support the decision-making processes must go forward and be updated at the same time. SCOR, Lean and Six Sigma are three of the commonly discussed methodologies developed to manage an integrated environment. The opportunities they individually hold have been shown, but it is more interesting and useful to consider and to integrate their common and/or complementary characteristics in order to align them and to adopt them in a unique framework.

An integrated environment refers to a complex network of players. In order to achieve customer satisfaction, companies need integration, both in internal functions and between different players in the supply chain. As a consequence, the organisation of the company must be considered in an integrated way through staff involvement and the sharing of objectives. SCOR, Lean and Six Sigma focus on these basics. Thus the field is ideal for discovering a new convergent approach. Other activities, such as benchmarking and the definition of metrics, are commonly used in all the three methodologies.

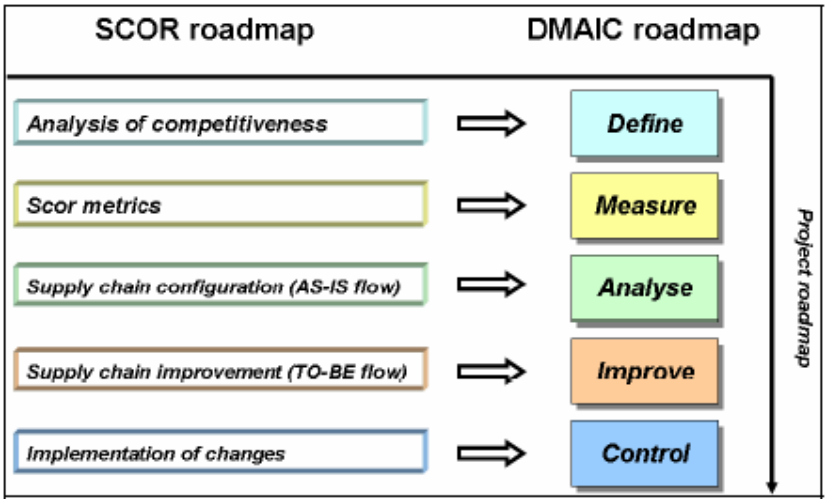
The advantages of each methodology have been separately described in the previous sections. Their characteristics are complementary and no trade-offs can be generated from their joint application. The effectiveness of this convergence can be achieved by using the strengths of each discipline to balance the limitations of the others. By combining the best aspects of each methodology, the companies can achieve better organisation, process optimisation, speed in the value chain and continuous improvement.

It is a very difficult skill to specify where and when a methodology ends and another begins. But it is surely opportune to attempt to generalise the approach.

The weaknesses of the SCOR model have been previously discussed and it must be complemented by Lean and Six Sigma. Therefore it would be an error to ignore the opportunities provided by the SCOR model. It is possible to consider the SCOR model as the green field where to build something innovative. It crosses the boundaries of the companies and really manages the activities of an entire supply chain. SCOR projects focus on strategy and are conducted in a structured manner. The phases of a SCOR project could be better clarified and managed if they are considered under a DMAIC framework. Through sequential phases, the SCOR approach defines the goals and the organisation to support them, uniformly measures the processes, analyses them by mapping the flows and measuring them in a hierarchical manner. Therefore the SCOR model attempts to improve the as-is flows towards a to-be configuration. Finally a control phase must be considered in order to verify if the results are time-persistent. A different

language, more direct, easier to understand and to develop, is used with the DMAIC approach. DMAIC and SCOR roadmaps are similar, but the DMAIC method provides more specific tools and frameworks that facilitate project planning and evolution in order to collect results (Figure 1).

Figure 1 SCOR and DMAIC roadmaps



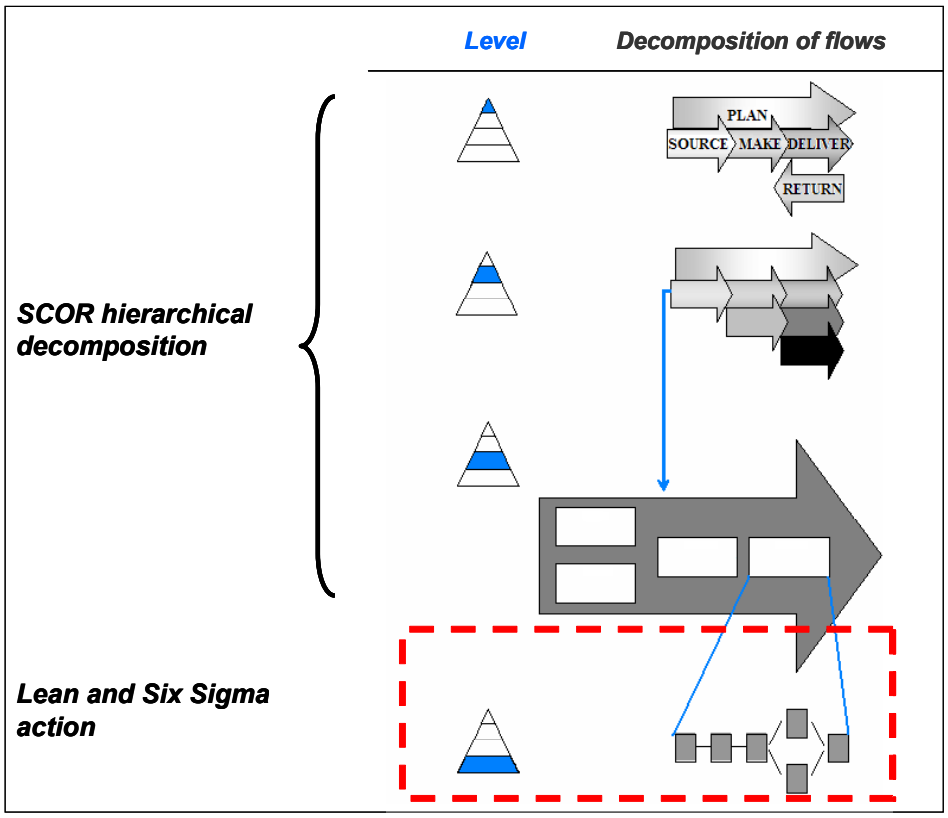
On the other hand, the SCOR offers a template to standardise metrics and to base the analyses on a more structured basis. This enhances the Measure phase of DMAIC, even if it forsakes the ability to build a metric fully representative of a particular reality.

It is necessary to evaluate the integration of SCOR, Lean and Six Sigma from another point of view, following the hierarchical procedure explained in the core of the SCOR theory. From strategy to operations, SCOR proposes a cascade-structured procedure in order to add details to the modelled processes. From a strategic level, the as-is flow and the relative metric have been decomposed down to the operational levels. The approach based on Plan, Make, Source, Deliver and Return decomposition is used, but ends at strategic and tactical levels. This guarantees a correct alignment to the market requirements, since the supply chain strategy determines the operational needs. However, there is a great weakness: the SCOR model does not explain rationally what to do and how to practically achieve the desired results. In this manner SCOR seems to be a guideline for the process improvement, rather than a methodology. Once again it needs something more, whose strength is to really produce results. Lean and Six Sigma methodologies must be applied to make a SCOR project effective. By their nature, they look thoroughly at finite processes to improve. Hence, once the supply chain goals are achieved, they provide solutions at every level of detail by eliminating the non-value-added activities and reducing the process variability (Figure 2).

Lean and Six Sigma or better, Lean Six Sigma, provides SCOR the framework, the practices and the tools to make a SCOR-based supply chain strategy a reality. On the other hand, Lean Six Sigma completes a SCOR approach, by aligning the strategic opportunities with the capability to execute them.

SCOR guidelines elevate Lean Six Sigma gains to a shared, integrated objective; this is the final and winning solution in order to successfully manage a supply chain.

Figure 2 Lean and Six Sigma as a completion of SCOR



4 Opportunities for the small-medium companies

The opportunities resulting from the integration of SCOR, Lean and Six Sigma are enormous; a new method and a generalised approach for the effective improvement of a supply chain are proposed. However, there is a fundamental constraint: the supply chain must be clearly defined and an effective improvement requires the visibility of the entire supply chain. Thus only the company leader can successfully promote a SCOR project as a whole and align the other players to common objectives. So, what are the opportunities for small-medium companies involved in supply chains or in other networks? In particular, can the advantages previously explained be applied where the network is above all a horizontal integration of small-medium companies that work together, as in the industrial districts?

If a buy-power company develops a SCOR project, a small-medium company involved in the same supply chain aligns its strategy and operations in order to catch opportunities and advantages. If this strong player does not exist, the effort in cooperation and strategy alignment between different companies is greater. As a consequence, the integrated method is too far from reality. Lean and Six Sigma by their nature are two methodologies that focus on the sharing of the objective inside the company. Instead, the SCOR approach deals with the supply chains.

From a small-medium company perspective, Lean and Six Sigma can be successfully implemented even if a supply chain strategy is not really defined. The SCOR could be considered as their modern completion. The most attractive principles and characteristics of the SCOR model, such as the customer-driven objectives, the standardisation of metrics and the hierarchical decomposition of the flows, have to be maintained even if the system does not completely reflect the supply chain structure, on condition that cooperation and coordination are strategically pursued.

5 Conclusion

In this paper the authors analyse how the convergence of three consolidated methodologies can align the management of an entire supply chain to modern market requirements. A company involved in a supply chain can achieve competitiveness through business process integration, thanks to a method that can support it.

Once the managerial philosophy and organisation have been renewed, there is the need to align the strategy of a company to that of the supply chain and to align operations and activities to the strategy previously defined.

SCOR, Lean and Six Sigma are three successful methodologies with a common objective: to achieve customer satisfaction driving the processes in the most profitable way. Each methodology focuses on a different business level and uses different bases, but their goals are not in conflict. Thus it is possible to take out the strengths from every methodology and put them all together; a modern and complete methodology is outlined as a consequence.

The integration of SCOR, Lean and Six Sigma is based on the SCOR supply chain strategic approach, simplified by the tools of the DMAIC problem-solving method. The hierarchical levels and the relative metrics of a SCOR model decompose the flows to get down from strategy to operations. If the SCOR model supports an integrated vision and offers guidelines for the system improvement, Lean and Six Sigma provide the actions and the tools to put it in practice.

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