A Strategic – Operative Lean Integrated Model for Small Companies

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Abstract— The paper is focused on the development of lean methodology in small companies with no previous lean knowledge. The lean integrated model proposed has the aim to link the pillars of lean thinking to an operative view. The framework identified was implemented in Global Equipment Spares, a small company in Northern Ireland that produces abrasive wear plates for use in a number of high wear applications, such as hopper liners, impact chambers, punch plates, check plates. Possible further development of the work here presented would be on the possibility to implement the framework in bigger companies in order to answer to a bigger range of issues. Moreover, by extending the lean approach to six sigma methodology or agile manufacturing, it is also possible to widen the model approach.

I. INTRODUCTION

The need to answer faster than competitors to the customer needs and maintain, at the same time, low costs have moved many companies to pay attention to their operations, in a lean view. Having a lean approach in a manufacturing company means, mainly, do the right operations at the right time (takt time), reducing wastes and pursuing perfection.

The following study and the related practical case is born from the need to assist and improve business development in Northern Ireland, through the program “Invest in Northern Ireland”.

One of the aims of the program “Invest in Northern Ireland” is to support business development, help to increase productivity and export levels, attract high quality inward investment, and stimulate a culture of entrepreneurship and innovation. Indeed, the program is mostly addressed to small companies, with a growing economy.

The importance of small manufacturer (SME) to take part in lean implementation is align with large manufacturer which implementing new management system i.e. lean manufacturing, as to improve their performance. Therefore, it will affect the small and medium enterprises (SMEs) that are the suppliers to the large. [9]

Many SMEs have problems with unreliable inventory control system, with no stock tracking and poor cost control. This leads to excess obsolete stock and eroding customer service levels. Another key important issue for productivity improvement program is the management of people [1]. Job satisfaction is an important antecedent to having productive workers, so any improvement in a working environment, should be taken into account [2].

Due to limited resources, SMEs are impossible to implement all elements or practices at one time (Achanga 2006). As been published by past researchers and practitioners, lean manufacturing has been implemented successfully in many large organizations but there is still less documented evidence of its implementation in smaller organizations (Achanga et al. 2006). The increasing demand for high quality products and highly capable business processes by large organization has left no choice on the SMEs to consider Lean Manufacturing [9].

The aim of this paper is to give a detailed model that works as a handbook for the managements, for lean implementation in small companies, with no previous lean knowledge. The model presented is detailed with the explosion of each phase in which the tools and instruments are presented.

The strength of the model is that the tools used are easy to implement and do not required an advanced knowledge of lean that is often missed by the managements of SME. Moreover, the tools used, even in the diagnostic phase, are simple and based on the work- study approach directly on the shop – floor. The usage of these simple tools allow overcoming the common problems that many SMEs have: unreliable inventory control system, with no stock tracing and poor cost control [1].

According to the needs of the company object of study, after a diagnostic phase, we chose to implement 5S’s methodology to overcome the problems related to work organization and standardization. 5S’s is one of the methodologies that constitute the fundamentals of the lean basics and it is a technique that results in a well-organized workplace complete with visual controls and order. It is an environment that has “a place for everything and everything in its place, when you need it”.

II. LITERATURE REVIEW

In the past decades, several models have been presented as approaches to improve customer satisfaction, production and operations performance.

Among these models, there are Total Quality Management (TQM) and, more recently, Six Sigma programs, Lean Production, Agile Manufacturing and World Class Manufacturing (WCM). All those methods
are based on the concepts and techniques of improvement and change. In general, the literature on improvement and change management emphasizes the importance of developing organizational values, capabilities and methodologies for a systematic development and review of progress, based on strategic orientation of improvement and change actions [4]. Often, the methods and tools of lean manufacturing have been related to other methodologies, creating an integrated approach to manage enterprise resources.

This is the case of Lean Sigma [5] in which the lean and six sigma approaches are compared and contrast, finding the great benefits that can be obtained by blending the best of each. This study underlines that the lean approach offers a set of solution to waste in an high variety production environment, and, therefore, it could show limited improvements across the organization, while the Six Sigma approach is more complete, but mainly focused on a improved level of Sigma capability through rigorous application of statistical tools and techniques. In essence, an integrated approach utilizing the best of Six Sigma and lean strategies will maximize shareholder value by accomplishing dramatic improvements in customer satisfaction, cost, quality, speed and invested capital.

More recent is the diffusion of the World Class Manufacturing (WCM): a set of concepts, principles and techniques for managing the operational processes of a company. The term captures well the breadth and the depth of the fundamental changes taking place in industrial companies that embrace WCM[6].

Recent studies [7], pointed out that the main problem of WCM implementation is the sequence of the pillars to open, and, therefore, the need to have a guideline. The WCML (World Class Manufacturing Light) Tree model proposes the Cost Deployment as first pillar to open, because that is a guide for the reduction and elimination of losses for business. Thus, after having identified the losses and the macro categories which they belong to (Man, Machine, Materials, Method) it starts the step of costing, and the allocation of the priority for the losses identified.

Two index as LPI (N° of lean techniques implemented) and LUI (N° of techniques used/ LPI) can reveal if it would be easy implement the WCM. Indeed, if the LUI is greater than 50% should be easy to implement the proposed WCML Tree Model.

This last observation about the WCM model constituted a starting point for further research for the enterprises that cannot achieve that score, but that have a huge need to implement some lean techniques and improve their operational performance.

In [9] the strengths and weaknesses of SME to adopt lean manufacturing are listed and it is pointed out that limited resources, lack of exposure by the management on lean practices are the main difficulties that SME’s have to face. Rathie et al. (2001) found that lack of top management commitment, lack of team autonomy, lack of organizational communication and interest in lean are the reasons why a lean implementation fails in SMEs. Therefore, to success in lean, the organization has to plan properly with total employee involvement and clearly highlight on vision and mission.

Then, in [8] the effects of three contextual factors are examined: plant size, plant age and unionization, on the likelihood of implementing 22 manufacturing practices that are key facets of lean production systems. In our dissertation, the last factor will not be taken into consideration, while the first two are of high interest. The findings suggest that older plants are less likely to implement only five practices relative to newer plants. Therefore, even if the age of plants is an inhibitor to implementing lean practices, the plant size seems to be a more critical factor. Indeed, the findings support the idea that large plants are more likely to possess the resources to implement lean practices than smaller plants. Overall, the evidence presented suggests that the organizational context significantly affects the likelihood of implementing lean practices.

The literature reviewed suggests that, despite there are not many studies that deal with productivity problems in SME, the issue of how improve productivity with limited resources is still open.

III. THE STRATEGIC/OPERATIVE LEAN INTEGRATED MODEL

In this section we have developed a framework to guide small companies through a rapid and effective lean implementation. The model promoted is based on the literature survey and the case study experiences presented as followed.

Based on a review of the literature it can be pointed out that various models for improving productivity have been developed through years. Especially, the WCM seems to be the one that have combined the Japanese way to work to the West mindset. The developing of pillars, technical and managerial, enhances the intention of the WCM approach to be integrated, by encompassing a set of tools and techniques modulated not only from the lean approach. Moreover, the WCM is preferably addressed to companies that already have in place some lean techniques. The study here conducted starts from the need to find an easier and more practical methodology that small enterprises can apply. The methodology do not want to be a mere applications of lean tools., but a handbook that gives instruction about how to implement a lean technique, in this case 5S’s. In this sense, the model intends to give a framework to plan how to implement a lean technique in a SME. Indeed, in many cases, a model as WCM driven by the Cost Deployment pillar can be ineffective due to the impossibility to have already a cost control on the resources involved. The model here discussed want to try to overcome limit, presenting a framework adapted to the needs and limits of small enterprises.

The contextualization of the following framework assumes, therefore, a vital importance to understand the benefits and the limits of the model. There are five key words for a lean approach:

- Value (from the customer’s perception)
- Continuous flow
- Waste
- Pull
- Perfection (Continuous improvement)

The first objective of the model is to link these strategic pillars to the operative level, characterized by four phases.
The first phase of Diagnostic and Design includes the study of the as–is situation and the scope definition. This phase is linked to the concept of process simplicity. Simplicity reflects designing processes from the ground up to be as simple as possible. Therefore, while we are looking to the process in scope, the idea to keep in mind is: “How can I make this process simpler in order to facilitate a continuous flow (of information, materials, etc.)?”

The statement “Attack the wastes” is generally referred to the core idea of the lean approach: understand what is valuable from a customer perception and try to reduce or eliminate what is not valuable for the customer. Therefore, the general value of the sentence Attack the wastes has to do with a careful analysis of what is value added and what is not.

The third phase, Make it standard, answer to the need to make fixed and standard the changes made in the previous phase. Indeed, the standardization of methods and practices is a way to institutionalize the changes adopted and the new approach. This does not mean that what is standardized cannot be subject to further changes.

This is exactly the sense of the 4th phase: Revise and Check. Thanks to the checking actions about the changes made, it is possible to enhance the concept to pursue perfection and continuous improvement. Some of the lean tools are represented as a wheel. This representation wants to communicate the need to choose the lean tool which better suits to the company as – is situation.

Indeed, as is shown in the following scheme, the Diagnostic and Design phase gives the information to choose a lean tool from the wheel, based on the needs required:

Then, every lean tool is linked to the second phase, of attacking wastes, and the flow restarts. In this framework it is highlighted the fact that after the 4th phase there is an arrow that returns to the lean wheel. This is because, the revise and check phase can give an opportunity to think about the next lean tool to implement, in a continuous improvement view.

The entire model presented is guided from the first phase until the last by a waste driven approach. Find the wastes, reduce or eliminate them is the core message of the entire model approach.

In [14] a similar approach is given for an integrated framework for productivity improvement into a lean application, but the model here discussed has the characteristic to work as a guide. By detailing the tools used in the model explosion, especially in the diagnostic phase, the framework offers a set that can be easily adapted to any context into a SME.

IV. THE MODEL APPLICATION: CASE STUDY AT A SMALL MANUFACTURING COMPANY IN NORTHERN IRELAND

The company object of study is a leading supplier in spare parts to the mining and recycling industries, situated in Northern Ireland. The company was established in mid 2010 to supply spares to a large customer base built up through years of experience in the aggregate, mining and recycling industries. It is a new company and it has known a rapid grown.

The core skill of the company is the manufacture of abrasive wear plates for use in a number of high wear applications, such as:
- Hopper Liners
- Impact chambers
- Punch plates
- Cheek plates

The model application assumes its explosion by characterizing the tools applied for each phase. The first phase is broken down into two levels:
- A tactical level that includes a major involvement of the management, through brainstorming sessions and process study.
- An operational level: in this case, there is a work study conducted on site with the aim to individuate wastes, value added and non-value added activities.

The tools used for the tactical level are the process flow chart, and the fish bones diagram (or cause effect diagram). On the operative level, it is conducted a value added versus non-value added analysis by observing and timing the process steps for each worker involved in the manufacturing process. The waste element sheet is used just to list and categorize the wastes observed during a process (like painting or dispatch) that it is difficult to describe through process steps. The spaghetti chart is used to detail the actual physical flow and distances involved in a work process. The second phase, attack the waste, involves a direct attack to the wastes observed in the first phase by implementing various actions with the common aim to reduce or eliminate waste. In the case study the following actions have been done:

- Reducing the unloading time for the parts on plasma bed: the solution adopted was to start the unloading operations while the machine was still working, in order to minimize the time required later more than 50%.
- Standardizing the height of the pallets involved in the lifting up and down operations by the usage of the jib crane: this action took a save in movements and time of the 48%.
- The WIP traceability issue was solved by adopting a color code for pallets associated to the machine color.

Moreover, the second phase is characterized by the choose of one of the lean tool presented in the wheel. The main problem enhanced by the first phase was the lack of an organized workplace.

The implementation of the first 3S’s, and some visual management practice cannot be independent from a right application of Change Management considerations. More than in big companies, the resistance to change is very high in the smaller. This is because the working environment is smaller and everyone, even in a small part, is involved in the change.

The third phase is characterized by the application of the 4th S, or standardise, and the creation of a supervisor figure in order to control that the changes adopted are followed and check them for further improvements. This phase is a critical phase to consolidate the first 3S’s by establishing standard procedures. The aim of the 4th S is avoiding that there will be a return to the situation prior to the 3S’s implementation.

Finally, the results observation and the possible opportunities have to be taken into consideration for further improvements.

V. CONCLUSIONS AND FURTHER DEVELOPMENTS

We think it is important to enhance the limits and the possible further development about the model presented.

The application of the framework presented could be enlarged in further research for companies that have a LUI not equal to zero, but with a value inferior to the 50%. These kind of company should have some knowledge about lean manufacturing and the intent to implement them, or having some lean techniques implemented or almost implemented.

Then, even if various tools are used in the practical case presented (spaghetti charts, work study sheets, etc.), there is not a combination with other useful tools borrowed
from other methodologies (six sigma, WCM, agile manufacturing).

The integration of this model with tools that have more a process control view through statistical instruments or through a major focus on the production processes driven by the supply chain management can constitute a valid study research.

REFERENCES


