THE KEY TO LEAN PERFORMANCE: IMPLEMENTING A DAILY SHOP-FLOOR CONTROL SYSTEM USING STANDARDIZATION AND VISUAL MANAGEMENT

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ABSTRACT

Proposed this paper is a standardized shop floor control (SFC) model which has been developed to control and enhance processes improvement in both Small and Medium Enterprises (SMEs) and multinationals based in Morocco. The key contribution of this paper is a framework, “Lean Shop Floor Control System” (LSFCS), which responds efficiently to many common Lean Manufacturing (LM), Lean Leadership and SFC requirements by regrouping four main dimensions that are standardization, visual management, daily audits, and kaizen. The LSFCS framework is principally constructed by considering the outcomes achieved during researches submitted by the same authors in connection with LM deployment in Morocco and national culture impact on Lean Leadership and LM maturity. The practical aspects of the LSFCS model provide a useful daily agenda for the practical managers, and which it designed to monitor and control processes effectiveness and enhance the Lean Leadership culture supposed as the critical factor in the success or failure of any LM program. Keywords: Reliability, Spiritual Intelligence, Validity, Work performance

Keywords: Model, Process Excellence, Lean Manufacturing, Standardization, Visual Management, Shop Floor Control, Audits, Continuous Improvement, Kaizen, Morocco.
1. INTRODUCTION

Increased globalization and competition greatly influence the way manufacturing companies in different parts of the world respond to pressures for improved quality and efficiency and reduced costs and lead times. LM, inspired from the Toyota Production System (TPS), is for many companies worldwide the benchmark (Ringen et al., 2014, p.242). For today, most manufacturing companies build and develop their production system on LM. It is claimed that lean is not an option, it is mandatory for both SMEs and manufacturing firms operating in global markets (Saurin and Ferreira, 2009, p.403).

However, LM as a way to achieve process excellence implies a radical change in how company control and improve its shop floor operations. A major component of any lean program is a SFC process using lean-thinking tools such as San Gen Shugi, routines, standardization, problem solving, visual management, and knowledge management (Valero, 2006, p.2). Similarly, in order for companies to succeed his lean program, daily contact with the shop floor and daily audits capabilities are at least two of the important components that companies must integrate on its SFC systems. So, a sustainable effectiveness in daily operations cannot be achieved until LM attitudes and tools are integrated into a unified, coherent and dynamic SFC system whose single purpose is to continue to provide better value to customers.

Unfortunately, improving existing SFC systems in consistence with LM requirements is a critical task and an emerging research topic in LM and management systems literatures. In the same way, despite the growing number of publications on LM tools, standardization is one of the most powerful but least used lean tools in SFC. Thus, in order to develop an understanding and a practical basis for the application of LM within the context of SFC this paper discusses the development of a model of SFC based on standardization’s effectiveness who is entitled “Lean Shop Floor Control System “ (LSFCS) and with the intention of application in a systematic and process-oriented industrial approach. Especially, the objective of LSFCS described here is to develop the key principles for a smart SFC and therefore to close, as much as possible, the gap between lean toolbox and the outcome to sustainable continuously improving organization.

The paper is divided into three further sections followed by a reflective conclusion. The following (second) section explores current thinking on LM within the context of SFC, with a concentration on standardization. The third section extends and suggests the LSFCS conceptual model with an examination of the practical nature of each model element. Finally, the reflective conclusion will draw the analysis together, providing pointers to the way the conceptual model can be used to guide the empirical study of SFC in any organization.
2. LITERATURE REVIEW AND RELATED RESEARCH

2.1. Lean Manufacturing

Attempting to define LM is like shooting at a moving target. LM is a generic process management philosophy derived originally from the Toyota Production System (TPS) (Anvari et al., 2011, p.1585). LM takes on many forms, often dictated by each company's size and goals. Some of LM programs are modeled after the lean operating system made famous by Toyota, where the objective is to reduce cycle time and improve output (Valero, 2006, p.1). LM as a prominent quality management practice utilizes fewer inputs to create the same outputs, eliminating waste to provide more value to producer and consumer (Dora and Gellynck, 2015, p.272). LM has been proven to significantly improve companies’ operational performance with respect to cost, quality and delivery.

Nevertheless, by considering the outcomes achieved during researches submitted by the same authors in connection with LM deployment in Morocco, most LM implementations still fall short of the expectations (Larteb et al., 2015; Larteb et al., 2015). Equally, and more broadly, although many companies have applied lean concepts across their operations, more than 90% of them failed to recognize measurable improvement in performance except Toyota and his little group of suppliers (Liker, 2004; Elnadi and Shehab, 2014).

In fact, many companies focus on the visible elements of LM like methods and tools and tend to change the layouts and processes of their production. However, the critical factors for the sustainable success of LM are generally rather organization-related than technology-related (Dombrowski et al., 2012, p.436). More specifically, many enterprises fail to implement their LM sustainably because they don’t have a good, reliable control system to monitor and supervise their shop floor (Liker, 2004; Womack, 2008). LM implementation necessarily means and implicates the control of operations and thereby the identification, analysis, proposition, formulation, validation, application and respect of best practices and standards in the shop floor. As a matter of fact, in order to implement successfully a LM-based production system, a SFC system has to be provided and a sustainable performance in daily operations can only be achieved, when all shop floor activities are fully under control and deeply audited in all relevant areas.

2.2. Standardization-based Shop Floor Control

LM’s success implies a radical change in how companies control their shop floor. It’s a precondition for the implementation of LM. For Dombrowski (2012), the implementation of a SFC system coherent with LM requirements marks a fundamental transition of the enterprise’s principles, methods and tools (Dombrowski et al., 2012, p.436). According to Hanenkamp (2013), LM defines an organizational framework with standardized processes and activities which must take place on the shop floor (Hanenkamp, 2013, p.41). As a set of leadership practices, tools, and behaviors, LM creates a closed loop system for focusing on process and driving process improvement. This system is, in effect, a behavioral recipe for disciplined adherence to process. For Mann (2009), LM is a pure SFC system of three core elements: 1) visual controls, consisting of frequently updated process performance charts, 2) standard accountability processes, and 3) standard work for leaders (Mann, 2009, p.22). Likewise, Asif (2010) emphasizes that integration of SFC systems creates an enabling context for the institutionalization of lean practices due to: 1)
standardization - a requirement that reduces process variations, 2) development of structures (such as integrated procedures and work instructions) that remove variations from a process, 3) development of routines which allow the execution of similar practices over time, and 4) development of social structures (teamwork, behavioral alignment, and regular management reviews to facilitate integration) (Asif et al., 2010, p.157). Yet, in order to develop an understanding and a practical basis for the application of LM within the context of SFC, Hanenkamp (2013) present the SFM hexagon process model for shop floor management implementation based on six step process that are: 1) Visual management, 2) Standards and abnormality control, 3) Problem solving, 4) Change point management (CPM), 5) Communication, and 6) Efficiency improvement (Hanenkamp, 2013, p.41). Still, trying to describe the LM organizational and operational requirements, Wardle (2014) define five elements of SFC requirements that are : 1) Objectives: Measurable targets bases on KPIs on shop floor level, 2) Standards, 3) Visualization: Visualization of standards, current situation, targets and transparent documentation of problems and measures, 4) Communication: Regular and prompt communication with standard contends, routes and times, and 5) Qualification: All methods are qualified, trained and established and can be passed on by the management (Wardle, 2014, p.6). Finally, for Johansson (2013), there are four pillars to put into practices a standardized work process: 1) Standardized work instructions, 2) Audits, 3) Assembly worker involvement, and 4) Training (Johansson et al., 2013, p.154).

So, LM refers to an evolving dynamic SFC process covering the total enterprise which must be governed by a systemic set of principles, methods and practices (Anvari et al., 2011, p.1586). Unfortunately, simply imitating another firm’s plan or organizational structure does not guarantee improved operational performance that depends on a well-designed company-specific SFC system, and the framework provides a means to build that system.

3. LEAN SHOP FLOOR CONTROL SYSTEM MODEL - LSFCS

In order to design a smart SFC system framework that fully addresses the needs of companies, the proposal has been especially developed up on the basis of the outcomes achieved during researches submitted by the same authors in connection with LM deployment in Morocco and national leadership impact on Lean Leadership and LM maturity. In fact, thus researches have pointed out some weaknesses related to the setting and maintaining quality and safety standards in the shop floor. Actually, despite the appropriateness and relevance of standards are crucial in LM implementation, most operations management systems surveyed lack a systematic standardization process. More, thus researches have outlined that companies come up against obstacles trying to develop standardized rules for middle management to control shop floor and apply such tools reliably, once they are adapted to the specificities of their organization. In the light of all that, the need for a standardized SFC system based on setting and maintaining standards, daily direct shop floor contact, and support for continuous improvement is forced and imposed.

To do this, a list of existing LM frameworks focusing on operations and shop floor management has been identified and analyzed. Their limitations have been identified and, with the help of our research findings from a various multinationals” operations management systems studied in the last ten years, a standardized SFC framework was proposed. The proposed framework was then discussed, modified, and validated through a panel discussion comprised of number of experts working in different multinationals based in Morocco, and which are involved in lean and
continuous improvement projects, and with working experience ranged from 20 years to 30 years.

Figure 1 Lean Shop Floor Control System Model (LSFCS)

The system proposed, as reported in Figure 1, is concentrated at four steps which seek to optimize the use and implementation of the model and which are of greatest importance to enable high control levels to be reached across the shop floor. These steps are: (1) standardization of any process, operation or lay-out, (2) visualization of standards in concerned places while simultaneously devoting attention to specific ergonomic and visualization requirements, (3) carrying out compliance audits and routines, and (4) incorporation into a kaizen approach based on daily continuous improvement with the aim of achieving a very high level of control in operations and processes.

The model is principally designed to impact the SFC on three areas. First, to define the relevant standards and the best way of visualizing them; second, to target immediate operation out of control or standard deviation, and third to enhance process excellence and facilitate capitalization of best practices in the shop floor.

Furthermore, the model is created to be innovative through its standardization-based continuous improvement engine (SBCIE) described below and depicted in figure 2 above. In fact, for each step, a needs analysis process is associated. The four processes grouped form the driving force behind the continuous improvement of processes and operations in the model. Thus, the LSFCS across the SBCIE will be more ready to provide additional greater opportunities for shop floor environmental scanning and making solutions accordingly. In this vision, the LSFCS will allow more chance to lock human error and promote learning with agility, thus providing necessary responsiveness to quality risks and envisaged productivity.
4. LSFCS MAIN ELEMENTS DESCRIPTION

4.1. Standardization

Despite the growing number of publications on LM tools, standardization is one of the most powerful but least used lean tools in SFC. In fact, standardization, standardized work or even standard operation procedures is a cornerstone of the Toyota Production System (TPS) (Chowdhury, 2014, p.131). As clarified by Ohno, symbol of Toyota and Japan's manufacturing resurgence after the Second World War, “Standardized work and uninterrupted process flows are the key foundation stones of the Toyota Production System” (Anvari et al., 2011, p.1586). Similarly as Liker (2004) cite Masaki Imai: there can be no Kaizen without standardization and where probed provides substantial differences of meaning (Liker, 2004, p.234).

Standardization can be used in the context of SFC systems and in relation to controlling individual (employee) behavior. In fact, standardization can have a large influence on SFC since it reduces processes deviation that leads to an emergent process of deterioration in quality, infrastructure and productivity. In this case, the process deviation reduction must begin with standardization and documentation of processes, along with the requirement that workers perform processes according to the documents. For this and according to De Treville and Antonakis (2006), LM call for the involvement of workers (usually operating in teams) in the development of standards for two reasons: (a) only the people actually running the process have access to many key types of knowledge concerning how the process operates in practice, and (b) it is generally believed that participation in development of standards will give workers a sense of ownership, increasing their willingness to run the process as documented (de Treville and Antonakis, 2006, p.103).

Generally, there are three categories of standardization: design standardization, process standardization, and leader work standardization (Pernstal et al., 2013,
Standardization benefits are work place structure according to cleanliness, orderliness and safety (minimum waste) and clear definition of the most efficient way to manufacture and to safeguard quality. Likewise, standardization facilitates root-cause analyses and the sharing of lessons learned across replications of common processes. In addition, standardized processes provide relevant and common experiences to employees that are the basis of process improvement (Anand et al., 2009, p.454). Finally, standardized processes increase communication and exchange efficiency in daily operations context enabling mutual trusted and low costs (Kung et al., 2014, p.13).

4.2. Visualization

The terms visualization or visual management are applied in manufacturing as a holistic system supporting visualization information to help teams and individuals to gain a better understanding of their role and contribution within the larger frame of shop floor efficiency (Tjell and Sjitsema, 2015, p.195). Through visualization the employees are more enables to better understand their role and contribution in relation to both their own organizational values and costumer needs (Liketr, 2004, p.157). In fact, visualization can be exploited in different SFC activities and for diverse animation tasks, ranging from alerts on customers complaints, production rate, machinery down, planning to knowledge sharing and learning (Eppler and Bresciani, 2013, p.147). More, the power of visualization to enable effective and seam less collaboration (especially across disciplinary boundaries) even exceeds its potential to improve communication. In fact, limiting the use of visualization to the mere presentation aspect would not do it justice for the realm of management (Eppler and Bresciani, 2013, p.146). That is why the LSFS’s model as a daily SFC system was based on a different understanding which considers the visualization as a powerful tool to reveal process deviation and show positive or negative performance tendency in the shop floor. In fact, the LSFS’s model imposes that every process, operation or implantation being standardized must be visualized and audited on a day to day basis. Through this obligation, each manager or supervisor, even outside his perimeter can use visualization to quickly detect any departure from the normal standard and then undertaking the required action to remedy to the situation in conformity with the standard. That way, visualization appears like an obvious strategy to cope with delayed responses to performance degradation and processes deviation and his principle must remain at the heart of the LSFS model deployment.

4.3. Brigades & Audits

LM is more than just a kit of tools to improve flow and quality. It is a business philosophy, and to be effective over the long run, discipline is essential (Mann, 2009, p.22). LM imposes that every leader must spend some of his or her time focusing on compliance to the standards, and noting the improvement opportunities such focus reveals. In fact, standards compliance is one of the key stones in LM and to be able to perform shop floor efficiency, audits need to be performed throughout all processes to be able to detect potential dysfunctions and therefore improvement areas. These audits should be performed by all management levels including top management on daily basics and per shift to follow up that standards are followed. To do, different attitudes from conventional leadership practices is called for. In this respect, the LSFS’s goal is to emphasize visibly observable discipline and control who cannot be delegated. Especially, the LSFS’s model was created with the intention to create a culture based on daily contact with the shop floor and allows managers to proactively identify
and proactively addresses new provisions for locking processes and minimizing human weaknesses before they escalated to large-scale problems. In conclusion, without good standards and processes of auditing daily work, we cannot know if we are doing the right things with the right way and unless managers in the company ignore about the potential of daily audits, improvement initiatives are less likely to be initiated and the miraculous gains in performance through standards compliance are less likely to be reached (Larteb et al., 2015, p.544).

4.4. Kaizen & Continuous improvement

Successful managers have long since recognized that they cannot simply maintain their standards, but they must constantly seek to improve what they are doing (Mellor et al., 2012, p.12). In fact, continuous improvement is one of the most important parts of SFC systems and is recognized as one of the key principles of LM as developed by Toyota (Glover et al., 2011, p.198). It is through the continuous improvement of standards that organizations can systematically drive out waste and reduce costs (Ringen et al., 2014, p.243). For this, one of the most important parts of the LSFC’s model is doing continuous improvements (step 4) and audits (step 3) are used as a tool to detect potential improvements. Actually, as a daily SFC system, the LSFC’s model was created with the intention to allow manager and supervisor to identify and proactively address opportunities for improvement before they escalated to large-scale problems. More, the SBCIE will incur the top and middle management in a daily kaizen activities to continuously prevent quality and safety risks and improve process flow. This will entail creating a culture of continuous improvement and learning and positioning continuous improvement as a proactive task of management, not just a reaction to difficulties and competitors.

5. CONCLUSION

LM’s success implies a radical change in how companies control their shop floor. It’s a precondition for the implementation of LM. However, improving existing SFC systems in consistence with LM requirements is a critical task and an emerging research topic in LM and management systems literatures.

The SFC system proposed here was developed based on perceived gaps in the process of implementing LM in multinationals based in Morocco, on an extensive review of literature on LM, and on the findings from a various multinationals' operations management systems studied in the last ten years. The guiding objective was to combine characteristics inherent to SFC and LM, such as standardization, audits, dynamism and its direct relationship with organizational continuous improvement.

The proposed model steps were configured to control the sequential order of their execution and provide a guiding principle for practitioners in exercise. The essence of this management framework was to engage the top and middle management in daily SFC and prevents actions to continuously prevent quality and safety risks and improve process flow.

The framework will help companies build a sustainable and comprehensive culture of disciplinary and quality rigor based on strong leadership, prevention-based decision making, and standards compliance focus. Finally, it is important to understand this proposal as a global system rather than a catalogue of tools to be implemented. Following this approach, organizations will benefit from more stable processes and full control of operation rather than reactive problem solving.
REFERENCES


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