

# A Framework For Lean Manufacturing Implementation

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**Abstract:** The lean implementation initiatives can be categorized as roadmap, conceptual/implementation frameworks, descriptive and assessment checklist initiatives. A literature review on the lean initiatives has examined 2 initiatives. A set of rules is proposed to evaluate these initiatives with respect to nine factors impacting lean implementation. The evaluation has proved that the implementation frameworks have highest association with lean factors. However existing lean initiatives are not demonstrated in a structured nature. The failure in managing lean implementation process is often consolidated to poor mind-set and inadequate understanding of the lean concept itself. In this project an attempt as been made to proposed a framework to overcome some of the limitations. The proposed framework is constructed as a project-based framework with detailed four implementation phase. Appropriate practice and decision tools are prosed and assigned to each phase. However the proposed framework is at conceptual stage. It requires further implementation to be validated. This paper aims at providing a lean implementation framework, which takes into consideration the strengths and weaknesses of the existing framework, for easy and effective lean manufacturing implementation by the managers/practitioners. A review of 22 existing lean implementation frameworks has been done to identify the strengths and weaknesses of existing models. A lean manufacturing implementation framework is proposed by leveraging these strengths and mitigating the weaknesses. The novelty of the proposed framework is that it provides easy to understand steps to be followed during pre-implementation and post-implementation phases for easy understanding and self-assessment at critical milestones.

**Index Terms - Continuous improvement, kaizen idea, 5s kaizen, lean manufacturing**

## I. INTRODUCTION

Lean manufacturing is an integrated sociotechnical system, which comprises a package of management practices that can be applied to eliminate the waste and reduce the variability of suppliers, customers and internal resources and processes (Anvari, Zulkifli, Yusuff, Ismail &Hojjati, 2011; Shah, Chandrasekaran&Linderman, 2008). Lean concept has been widely accepted in this service and manufacturing industries. Numerous literatures have reviewed the lean benefits and applications. The terms lean was first coined by Krafcik (1988). Subsequently, Womack, Jones and Roos (1991) used the term lean production to describe the Toyota production system (TPS).

Womack and Jones (2003) stated that lean principles can be applied in any industry. Different types of organizations have implemented lean manufacturing. Nevertheless, Marvel and Standridge (2009) argued that few organizations attain significant improvements by applying lean. As the improvement remains localized, those organizations are unable to sustain the continuous improvements. Baker (2002) reported that the success percentage of UK organizations on lean implementation is less than 10%. It is believed that the main reason of unattainability of lean benefits is the incomplete understanding of the lean concept and the purpose of the lean practices. Some companies misapply the lean practice. The main reasons of the misapplications areas; 'use the same set of tools on each problem'. Incorrect application of lean concept leads to waste of the organizational resources and reduction in employees confidence in practicing lean (Marvel &Stand ridge, 2009). It is suggested that scope and content of lean manufacturing should be holistically verified prior to any lean implementation. Some managers and employees presumed that the factor behind Toyota success was about the cultural roots, but not lean practices. Despite criticism raised by other organizational management, Toyota as a successful leading organization in lean application has demonstrated high performance with its production system established in all multinational manufacturing sites. Although lean benefits are extensively recognized from Toyota's success stories, the current roadmaps and frameworks look incomprehensible from the view of practitioners. Complications of lean implementation and technical barriers. Therefore, the aim of this paper was to propose a comprehensive project-based implementation framework for lean transition in a practical manner. The proposed framework was built as a project-based implementation approach of detailed four phases. The paper anticipates enhancing the lean transformation process through the implementation framework proposed. The structure of this paper is organized into seven sections after the introduction, the second section summarises the research methodology. The third section reviews the existing lean implementation initiatives. The fourth section attempts to quantify success factors of lean implementation. The fifth section presents a set of rules to assess the lean initiatives. The sixth section introduction a comprehensive structured frame work proposed for further research purpose.

## II. METHODOLOGY

This paper aims to provide a more meaningful and effective path for lean transition within an organisation. To achieve the aim of this paper, four objectives were developed as illustrated in the previous section. Lean implementation initiatives were cross-examined through reviewing the literature. The main success factors for lean implementation were highlighted. Reviewing all lean initiatives was not feasible, however as far as possible the most widely published and relevant initiatives were reviewed in this paper. According to Cooper (1988), it is suggested that the literature review can be elaborated based on the purposive selection approach in which only related articles pivotal to the research topic were chosen to be reviewed. It means that the selected literature review specifically focused on the presentation of lean initiatives and process description.

Green, Johnson, and Adams (2006) stated that the most efficient way for searching the literature is the electronic databases. There are many different databases available for searching. Therefore, it is important to search the appropriate databases that serve the objectives and the topic of the paper. There are publications that conducted a literature review to propose a roadmap and conceptual framework for lean implementation (Anand&Kodali, 2010; Anvari et al., 2011). In this research, the literature review and selection of the appropriate sources on lean implementation initiatives were conducted in two stages. The first stage aimed to search for relevant databases and select the relevant publications. The inclusive databases were Emerald, Elsevier, Springer, Science-direct, IOS Press, EBSCO Host Academic Search Premier, Inderscience, World Scientific, Academic Journals, Journal of Industrial Engineering and Management, American Society for Engineering Management and book publications. The filtering process of the selected databases utilized combinations of keywords to search for the article titles. The key words used for the search included 'lean manufacturing implementation', 'lean transformation', 'transition to lean', 'lean framework', 'lean roadmap' or 'applying lean'. Seventy publications which contained information relevant to lean manufacturing implementation were obtained at this stage.

The second stage involved scrutinising the abstracts and keywords of the selected articles. It revealed that lean implementation concepts varied in the scope of study. For example, Smeds (1994) focused on managing change towards lean enterprise; Jina, Bhattacharya, and Walton (1997) focused on applying lean principles; Crabill et al. (2000) emphasised on transition-to-lean roadmap; Womack and Jones (2003) used time frame for lean leap; Anand and Kodali (2010) developed a lean conceptual framework; Anvari, Norzima, Rosnay, Hojjati, and Ismail (2010) suggested a lean roadmap; and Powell, Alfnes, Strandhagen, and Dreyer (2013) introduced an ERP-based lean implementation process. Some of the works came from various areas of knowledge and disciplines such as simulation and training for lean implementation, impacts of lean implementation on the competitive advantage, management accounting systems impacts on lean implementations and lean principles in IT services. As a result, 28 articles with different types of initiatives were eventually selected. The initiatives were found in the forms of sequential description, diagrams and assessment checklist. An in-depth study into each initiative was conducted to highlight the critical factors of lean implementation. Proposing a set of rules to evaluate the lean initiatives with respect to the main success factors was included. The expected final outcome of the paper was to propose a lean implementation framework in a project-based structure. principles; Crabill et al. (2000) emphasised on transition-to-lean roadmap; Womack and Jones (2003) used time frame for lean leap; Anand and Kodali (2010) developed a lean conceptual framework; Anvari, Norzima, Rosnay, Hojjati, and Ismail (2010) suggested a lean roadmap; and Powell, Alfnes, Strandhagen, and Dreyer (2013) introduced an ERP-based lean implementation process. Some of the works came from various areas of knowledge and disciplines such as simulation and training for lean implementation, impacts of lean implementation on the competitive advantage, management accounting systems impacts on lean implementations and lean principles in IT services. As a result, 28 articles with different types of initiatives were eventually selected. The initiatives were found in the forms of sequential description, diagrams and assessment checklist. An in-depth study into each initiative was conducted to highlight the critical factors of lean implementation. Proposing a set of rules to evaluate the lean initiatives with respect to the main success factors was included. The expected final outcome of the paper was to propose a lean implementation framework in a project-based structure.

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## III. IMPLEMENTATION OF LEAN MANUFACTURING

As a result, 28 articles with different types of initiatives were eventually selected. The initiatives were found in the forms of sequential description, diagrams and assessment checklist. An in-depth study into each initiative was conducted to highlight the critical factors of lean implementation. Proposing a set of rules to evaluate the lean initiatives with respect to the main success factors was included. The expected final outcome of the paper was to propose a lean implementation framework in a project-based structure. As can be observed, the new framework developed must combine best practices derived from successful initiatives of lean implementation in SMEs and the finding of the review of the existing frameworks in order to overcome the limitations of these frameworks. Thus, this framework was constructed on the basis of an investigation of successful initiatives of four SMEs and perfected through the review of the existing frameworks in the literature. In short, these frameworks are derived from the experiences of large companies. They are therefore unsuitable and cannot guarantee the desired results for SMEs. Subsequently, there are a real need for a new framework for lean implementation designed on the basis of the own experience of SMEs in lean implementation as presented.

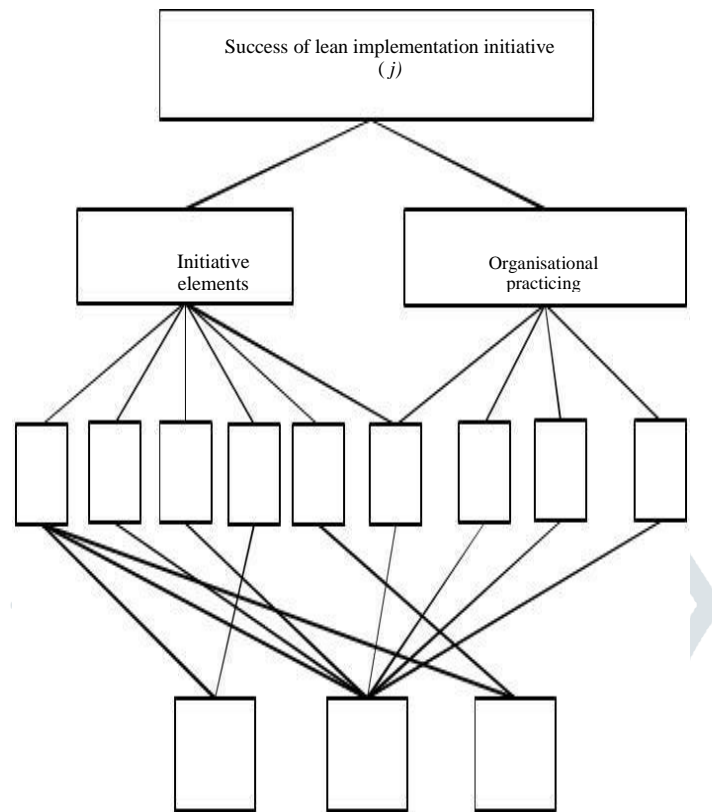


Figure 1 Lean implementation initiative

Table 4.1: Descriptive Statics

Step 1	Establishing a sense of urgency
Step 2	Creating a guiding coalition
Step 3	Developing a vision and strategy
Step 4	Communicating the change vision
Step 5	Empowering broad-based action
Step 6	Generating short-term wins

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