

The 4th International Conference on Electrical Engineering and Informatics (ICEEI 2013)

A Conceptual Model of Lean Manufacturing Dimensions

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Abstract

Lean manufacturing or also known as lean production has been one of the most popular paradigms in waste elimination in the manufacturing and service industry. Thus, many firms have grabbed the benefits to practice lean manufacturing in order to enhance quality and productivity. However, previous research shows that there are various sets of tools or techniques that had been adopted at a certain degree across firms according to their own understanding of lean manufacturing. The scenario resulted with varying leanness measures in order to measure lean practices. This paper describes a preliminary study in developing a conceptual model to measure leanness in manufacturing industry. Thorough literature survey, books and report analysis contribute to the main preliminary analysis of this study. The most common tools or techniques and their usefulness have been investigated. In this research, a conceptual model for leanness measurement in the manufacturing industry has been developed and designed in two main levels, namely the dimensions and the factors. There are seven main dimensions in measuring leanness in lean manufacturing practices such as manufacturing process and equipment, manufacturing planning and scheduling, visual information system, Supplier relationship, customer relationship, workforce and product development & technology. In addition, the model also shows how lean dimensions in the manufacturing system relate to eight types of wastes.

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Selection and peer-review under responsibility of the Faculty of Information Science & Technology, Universiti Kebangsaan Malaysia.

Keywords: lean manufacturing, lean production, leanness, lean indicators, lean assessment, lean model;

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1. Introduction

The word “lean” refers to lean manufacturing or lean production as it uses less of everything, compared to mass production. It only uses half of the human effort in the factory, half of the manufacturing space, half of the investment in tools and half of the engineering hours to develop a new product in half the time [1, 2]. Based on the research conducted by Bayou and Korvin [3], manufacturing leanness is a strategy to earn less input to better achieve the organization’s goals through producing better output, where “input” refers to the physical quantity of resources used and their costs, and “output” refers to the quality and quantity of the products sold and the corresponding customer services. In another review of lean manufacturing, Narasimhan et al. [4], have concluded that the efficient use of resources through the minimization of waste is the essential aspect of leanness as the aim of lean manufacturing is to reduce waste and non-value added activities. Essentially, the core idea of lean manufacturing is to maximize customer value while minimizing waste. The ultimate goal of implementing lean production in an operation is to increase productivity, enhance quality, shorten lead times, reduce cost and so on [5]. These factors indicate the performance of a lean production system. Some claim that lean manufacturing techniques were first identified as a cause of Japanese success. The supported idea is based on the fact that the lean management model was first developed at Toyota Motor Company by the Japanese after the Second World War in their effort to reduce cost. Therefore, the introduction of lean has significantly changed the market and the strategy during its first emergence in the development of the car industry that was pioneered by Toyota Production System (TPS). The success of TPS shows and proves that lean techniques are powerful and significant. The overwhelming scenario has led other companies from different industries such as electric and electronics [6-8], automotive [3, 9], auto and machinery [10], wood [11], ceramic [12], machine tool industry [13] and so on to implement lean in their manufacturing. However, most of the companies have implemented lean and have assessed lean practice in their own unique way. The reason for this scenario lies in their internal issues such as lack of knowledge and their understanding of lean, culture, skills and so on. Other factors such as age [14] and size [8, 10, 14] of the company also contribute to the degree of adoption of lean tools or techniques in one’s company. Thus, these situations have a big implication on the companies by restricting them in the measurement or comparison of their performance across companies and industries. Some of the companies have also given up continuing practicing lean due to the mentioned factors. Therefore, a research should be conducted to identify and determine the determinants or indicators for leanness measurement in the manufacturing companies.

2. Methodology

Thorough literature survey on lean manufacturing and lean assessment has been carried out in order to achieve the objective of this research. The existing and current model of leanness is identified and studied. However, the emphasis of the research is more on the identification of indicators, practices or tools or techniques for the implementation of lean in manufacturing. Keywords such as “lean manufacturing”, “lean production”, “lean assessment”, “lean measurement” and “lean indicators” have been used throughout the literature survey on various databases such as Scopus, Google scholar, ISI Web of Knowledge and so on. The survey has finally resulted in a total of 25 articles for this assessment purpose, which basically focuses more on the determinants and key areas for leanness measurement in manufacturing. The aim of the study is to determine, through literature survey, the most used or common indicator and the usefulness of the indicators in the manufacturing industry. Thus, the frequency of each indicator which has been mentioned by previous scholars has been used as the basic analysis in order to design the conceptual model (see Table 1).

From Table 1, we may summarize that most of the authors have reported that *workforce development* [4, 5, 8, 9, 12, 13, 15-22] and *total quality management (TQM)* [3, 4, 6, 8, 12-14, 17-19, 21-24] are significant in their study on lean practices. However, the rate of frequency has only been categorized as ‘high’ value instead of ‘very high’. The highest value is only fourteen out of twenty five literature studies which have included the mentioned variables as part of their study. Besides, there are only eighteen main articles which have been reported in this study. Indicators with a frequency of less than four have been omitted from the study. As mentioned previously, the aim of this article is to report on the most common and most useful indicators. The basic practices/tools/techniques which have been identified will be validated using the Delphi Method in the next stage of further research.

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