



Industrial Engineering and Service Science 2015, IESS 2015

## The relationship between lean and sustainable manufacturing on performance: literature review

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### Abstract

The aim of this paper is to explore and evaluate previous work focusing on the relationship and links between Lean and sustainable manufacturing. Several frameworks are explored and discussed. Their relationships include correlation, overlapping area, difference, integration and classification based on sustainability dimensions. This paper also examines impact of lean and sustainable manufacturing to improve performance. Many evidences suggested that Lean is beneficial for Sustainable manufacturing, dominantly on perspective environment and economic aspect. This paper identify major research gaps for integrated lean and sustainable manufacturing to improve performance business and modeling as a methodology approach. To do of 58 key research papers have been reviewed for the research contribution, methodologies, country of research, and date of publication. This paper provides a quantitative descriptive analysis and qualitative thematic analysis to provide an analysis of relationship lean and sustainable manufacturing and its impact on performance.

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Peer review under responsibility of the organizing committee of the Industrial Engineering and Service Science 2015 (IESS 2015)

*Keywords:* lean manufacturing, sustainable manufacturing, performance, literature review

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### 1. Introduction

Many papers that address the connection of lean and green touch on the efficient use of energy (and resources) and the reduction of waste and pollution [1, 2]. Bergmiller and McCright [3] identify the correlation between green operations and lean results. The relationship between total lean results and total GWRT (Green Reduction Waste Total) is a remarkable finding that implies that the lean companies in this study who have opted to complement their lean system implementation with a broad set of GWRT are realizing significantly better results in both green and lean

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categories than the other lean plants in the study. This finding not only suggests that lean and green systems can co-exist, but provides evidence of synergy, by virtue of the fact that GWRT improve both green and lean results [3].

Verrier et al [8] presents a simple repository based on a sound analysis of the literature and on three questionnaires which can be used by all kinds of companies. This repository enables the companies to measure the correlation between their lean and green actions, and to benchmark their position on lean and green policies in order to identify the best practices to adopt [4]. The results of survey and study of Alsatian SMEs (small medium enterprises) have provided a tool that can be used to target and promote best practices for lean-oriented sustainable development, and to improve competitiveness. In this research, value stream mapping (VSM) as a tool for identifying environmental impacts has been analyzed as well as the measurable effects of 5S, cellular manufacturing, Single-Minute Exchange of Die (SMED) and total productive maintenance (TPM) on the environmental impacts [5]. Brown et al (2009) said that innovation is necessary to the achievement of sustainable manufacturing systems. The transformation will require an in depth knowledge of system wastes that goes beyond the largely time-based wastes (muda) to include muda of the environmental and societal variety [6]. So some researchers developed lean concept to achieve sustainable manufacturing, for example Dombrowski et al [7], Aguado et al [8], Faulkner and Badurdeen [9].

Due to all these reasons this study, we carry out a literature review with a view to identifying the interrelationships between lean and sustainable manufacturing and analysis in the performance on the three key dimensions of sustainability: environment, economy, and social.

## 2. Method

The aim of this paper is to structure the research field on lean and sustainable manufacturing in the context of relationship, benefit and its effect on performance and point out the most important gaps. Therefore, this review covers academic papers in the period between 2000 and 2014. This review includes the following major research databases: Emerald, Scencedirect, IEEE, Springer and Proquest. The database search yielded hundreds of articles. Each of the articles was examined to ensure that its content was relevant from the perspective of the aims of our research. The examination and selection of the articles is based on the criteria that only those of which main contribution revolves around the interrelationships among Lean and sustainable manufacturing on performance will be selected. The result of this process was that 58 articles were eventually selected for in-depth evaluation. In order to the descriptive analysis we selected categories: year, author's country, journal, methodology and sustainable dimensions. The results are structured in two parts: firstly, we provide a quantitative descriptive analysis to get an overview on the research agenda on Lean and sustainable manufacturing. Secondly, this paper presents a qualitative thematic analysis to provide an analysis of relationship lean and sustainable manufacturing and its impact on performance.

## 3. Results of the descriptive analysis

The most important journals for lean and sustainable manufacturing identified are the Journal of Cleaner Production (14), IJPE (4), POM (4), CIRP (4) and followed by IJOPM (3), JIEM (3), JOM (3). The most dominant author's countries are USA (36%), UK (14%), Germany (7%), and followed by India (5%). Research about lean and sustainable manufacturing seems to have been the object of growing attention from researchers up to 2014. The number of articles published from 2000 to 2014 had been increasing. The drastic increase occurred from 2011 and continued to rise until 2014. The distribution of articles based on date of publications are 2000 (2%), 2001 (4%), 2003 (4%), 2004 – 2006 (2%), 2007 (4%), 2008 – 2009 (5%), 2010 (2%), 2011 (11%), 2012 (13%), 2013 (20%), and 2014 (25%). Based on 58 articles reviewing, the most important source of empirical evidence in the sample is qualitative approaches: survey and case study (34 articles), literature review and conceptual papers 18 articles, modelling 2 articles [10, 11] and multi method 4 articles. Fig. 1 shows the result of descriptive analysis.

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