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Is lean synergistic with sustainable supply chain? An empirical investigation from emerging economy

Suresh Kumar Jakhar^{a,*}, Himanshu Rathore^b, Sachin Kumar Mangla^c

^a Indian Institute of Management Lucknow, Lucknow, 226 013, India

^b Indian Institute of Management Rohtak, Haryana, 124001, India

^c Plymouth Business School (PBS), University of Plymouth, Plymouth, PL4 8AA, United Kingdom

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ABSTRACT

In the extant literature some researchers have agreed upon the nature of inter-relationship between lean and green as synergistic whereas other have termed it as coincidental or even dichotomous. We submit that the inconclusiveness in the relationship between lean and green arises from not investigating it from a holistic standpoint. In this study, we address this gap by adjudging the relationship of lean systems with holistic supply chain context which includes sourcing, production and logistics. The proposed hypotheses are grounded in the resource-based view of the firm. We examine the relationship in the context of emerging economy such as India. Results obtained using structural equation modelling method indicates that lean implementation positively influences the implementation of sustainability practices for supplier selection and production but negatively impacts sustainability practices for delivery and logistic services. We conclude that the relationship between lean management and sustainable supply chain management is not straightforward. Gain at some place may cause loss at other places. Therefore, the net impact must be seen in totality and segmented analysis is the cause of inconclusive findings.

1. Introduction

Industrial sector, all around the world, has borne witness to the panoply of process management practices that have been adopted in order to restore operational efficiency in the firm and ensure its claim in the competitive market. Firms have seen the transition from the, yesteryear practices like business process re-engineering, six sigma and total quality management to the more recent practices like Enterprise resource planning systems, data mining, lean six sigma and “Lean startups” (Benner and Tushman, 2015). The transformation in the nature of these practices is necessitated by the changing needs of the markets, customers and society. In the emerging economies alone there has been rapid growth of about 671% from 1970 onwards (Drake and Spinler, 2013). This exponential demand has fired up the economic and industrial activity, and as a consequence, it has proliferated manifolds. However, this revved-up industrial activity at the current levels of technology is, purportedly, not ecologically sustainable (Sarkis and Zhu, 2018). A news report suggests that if emerging economies alone, start consuming at the rate of United States, we would need an extra of four ‘planet earths’ to satiate our requirements and needs (McDonald, 2015). Moreover, industrial growth has resulted in an endless series of

hazardous ecological ramifications like smog, acid rain, global warming and loss of biodiversity all across the world (Sarkis and Zhu, 2018), the costs of which have been, invariably, borne by the ‘people’. In the wake of these developments, two phenomena have occurred; first, the consumers have started demanding greener products and services and second, resource efficiency in economic activity has gained immense amount of importance (Groening et al., 2018). They have increasingly been perceived as the pivotal drivers of sustainability and long term corporate health (Ba et al., 2013). In an attempt to address the adverse environmental implications of the economic activity and at the same time enhancing its economic viability, researchers have started exploring ‘lean practices’ and their impact on sustainability (Zhu et al., 2018). ‘Lean’ is a philosophy built around ‘waste minimization’. It is administered by imbuing a ‘bundle of practices’ which aim endlessly to achieve higher levels of resource efficiency in the system and try to culminate any non-value added activities (Carvalho et al., 2011; Netland and Ferdows, 2016). Various researchers have explored lean practices and their impact on the sustainable performance of a firm. Literature abounds with contradictory findings of whether lean practices abet and abut the sustainable foundations of a firm (or) they inhibit and impede a firm’s sustainable performance. For instance, the

* Corresponding author.

E-mail addresses: skj@iiml.ac.in (S.K. Jakhar), fpm02.004@iimrohtak.ac.in (H. Rathore), sachin.kumar@plymouth.ac.uk (S.K. Mangla).

likes of King and Lenox (2001) and Dües et al. (2013) propounded that lean practices and sustainable performance of a firm are two sides of the same coin whereas Biggs (2009) and Angell (2001) attributed these mutual gains to serendipity. In their seminal paper, Zhu and Sarkis (2004) also warned that manufacturing organization with Just-in-Time (lean practice) implementation may be in conflict with internal environmental management practices which leads to degradation in environmental performance. Moreover, all the research on lean practices until now has been focused on the impact of lean systems on standalone aspects of the supply chain such as manufacturing, supplier selection or distribution and logistics. The only study is by Zhu and Sarkis (2004) and they have considered JIT and quality management as moderator of the relationship between green supply chain practice and organizational performance. We extend this line of enquiry and propose that it is imperative that the impact of lean practices on sustainability is studied in the context of the whole supply chain and not just in terms of any single aspect of the supply chain. Firms are not only accountable for the environmental damages caused by them but they are also answerable for the activities of their upstream and downstream partners (Rao, 2004). Thus it is pertinent that firms are studied in the light of supply chain management entities rather than standalone business entity. Lean principles are inward-looking and focus on the internal processes of a firm whereas supply chain management encompasses an outward-looking approach which focusses on pan-firm operations and processes (Hajmohammad et al., 2013). Since their underlying principles are entirely different, it is reasonable that their effects are independent in nature. Their effects could be synchronous or dichotomous. Heretofore there has been no study that explores the impact of lean practices on sustainability from the holistic context of supply chain management. In this study, we attempt to fill this gap by determining the impact of lean systems on sustainability from the purview of all supply chain management functions such as sourcing, manufacturing and distribution. The proposed relationship is explained by Resource based View of the firm. We applied structural equation modelling approach with maximum likelihood method of estimation. Empirical survey data obtained from Indian manufacturing organizations are used to test the proposed hypotheses. Rest of the paper is outlined as below.

Section 2 discusses relevant literature. Section 3 presents theoretical underpinning and hypotheses development. Proposed methodology is described in Section 4. Section 5 presents results and discussion. Finally, conclusion of the study is drawn in Section 6.

2. Literature review

Lean practices are founded on the principles of Kaizen, Kanban and JIT (Carvalho et al., 2011). Rothenberg et al. (2001) stratified the aspects of lean systems in the following categories: i) buffer minimization, ii) work systems, and iii) human resource management. Lean systems aim to reduce the 'slack' by reducing the wastes of transport, waiting, inventory, motion, over processing, over production and defects. This philosophy subscribes to the implementation of 'best practices'. Lean systems continually attempt to improve the best practices by making continuous incremental improvisations (Biggs, 2009). These systems focus on meticulous selection procedure of the workforce. They invest in employees training and development as well (Rothenberg et al., 2001). Such systems entail horizontal organizational structures without much power distance. Lean systems see employee motivation and involvement as pivotal drivers of enhanced efficiency (Rothenberg et al., 2001).

Sustainable practices, basically from the environmental perspective are categorized as pollution prevention and pollution control (Rothenberg et al., 2001). Pollution prevention practices are proactive in nature and they attempt to make fundamental changes in the process in order to curtail the environmental damages. These practices also incur sufficient amount of resources in terms of time and money in implementation. Pollution control activities, on the other hand, are

reactive in the sense that they attempt to make miniscule changes in the resource structure of the firm and incur minimal costs to implement. They are done to curb the after effects of the already occurred environmental damages (Albertini, 2013). There have also been other ways of analyzing sustainable practices. Etzion (2007) categorizes sustainable practices in environmental design, environmental waste and environmental recycling practices.

Various researchers have also explored the relationship of lean and sustainable systems. The findings in this regard are vexed. For instance, Mollenkopf et al. (2010) propagated that incorporating lean principles into their work culture is complimentary to their environmental performance. King and Lenox (2001) explained the synchronicity by suggesting that lean systems make it easier for firms to identify sustainable improvement opportunities by spreading awareness among employees and enhancing information flow. However, literature has a significant number of apologists who feel that lean systems do not improve sustainable performance of a firm or even if they do, such effect is purely coincidental. For instance, Biggs (2009) posited that any such positive association between lean systems and sustainable firms are purely coincidental. Zhu and Sarkis (2004) found that JIT (which is a major component of lean manufacturing) has negative moderation effects on internal environmental management of Chinese manufacturing firms. Furthermore, they caution that organizations must be very careful while implementation of green supply chain practices with JIT philosophies in place. Angell (2001) argued that lean systems and sustainable practices have different drivers and motives. Dües et al. (2013) reasoned out by pointing out that unlike sustainable practices, for lean systems, environment is a resource and not a constraint and thus they are bound to differ. Summarily the discourse on the impact of lean systems on sustainable performance is inconclusive.

There exist independent silos of research between lean systems and sustainability from supply chain aspects such as manufacturing, supplier selection and logistics (Simpson and Power, 2005). The major part of research has been done with the manufacturing aspect of the supply chain (Hajmohammad et al., 2013). The reason for such inclination can be attributed to the fact that 'lean' as a philosophy has generated from and for processes only (Ugarte et al., 2016). There is also research regarding supplier selection aspect (Hajmohammad et al., 2013; Bai and Sarkis, 2010; Sarkis and Talluri, 2002; Sahu et al., 2017). Hajmohammad et al. (2013) state that by implementing lean principles in suppliers, firms can better their environmental performance. For instance, Walmart uses a packaging scorecard to determine the efficiency in packaging of its suppliers. By enhancing the packaging efficiency of its suppliers its ecological footprint is also reduced. Apart from supplier selection, there are studies on the impact of Just-in-time (JIT) and inventory minimization which are crucial aspects of lean systems on sustainable performance of firms. The impact of JIT on sustainable performance in terms of environmental emissions is contentious (Hajmohammad et al., 2013). Ugarte et al. (2016) posit that JIT manufacturing leads to better environmental performance. Tracey et al. (1995) suggest that JIT can be implemented in a way that sustainable performance is bettered but Smith et al. (2005) express their apprehensions about the implementation of JIT to not affect the emissions adversely. The authors suggest that there is a significant link between set-up time reduction and inventory optimization leads to better environmental performance. Galeazzo et al. (2014) also submit that inventory management led to increased total emissions in the supply chain. On the contrary, King and Lenox (2001) found that inventory management lowered the environmental emissions. Such inconclusive findings could be a result of not observing the supply chain aspects from a holistic aspect. Fullerton et al. (2014) suggest that lean principles must be adopted and analysed in an all-encompassing framework of business activities and not just in operations and processes.

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