



Relationship Between Lean Scm Practices and Green Scm Practices - An Exploratory Study in Manufacturing Industries

B.L.Lakshmi Meera

Assistant Professor, KCT Business School, Coimbatore KCT Business School, Kumaraguru College of Technology, Chinnavedampatti, Coimbatore, Tamilnadu, India.

Dr.P.Chitramani

Professor ,Avinashilingam School of Management Technology, Coimbatore

ABSTRACT

The purpose of this study is to develop a useful framework to evaluate the relationships Green SCM practices and Lean SCM practices.

A survey questionnaire was developed to conduct a survey using 200 manufacturers in Tamilnadu as the sample of this study. Through the analysis of the survey, the results of this study indicated that the comprehensive model is valuable and that there are significant relationships among the variables under study. Furthermore, the results of applying the MANCOVA model in the analysis showed how ISO 14001 certification would covary with lean adoption and influence the dependent variables.

To be high performing organization the manufacturing firms need to leverage Lean and Green philosophies to drive continuous improvement across their business, supply chain partners and the natural environment.

KEYWORDS : Lean SCM practices, ISO 14001 certification, Green SCM practices.

Introduction:

The field of supply chain management has evolved over the years and manufacturing has been a vital driver in any supply chain (Jain et al., 2010). This is because, consistently, manufacturing firms have learnt to improve their supply chain management practices and have produced various success stories in the market (Debra Hofman, 2011).

In this research, Lean SCM and Green SCM practices in manufacturing firms have been given priorities as it can foster sustainability. The Green paradigm has opened the gate for revisiting various established strategies of supply chain management with a new lens of sustainability. The concept of "lean manufacturing" is also widening to the new concepts of "lean enterprise" in order to optimise performance and improve competitive advantage. Lean and Green are generally considered alone or in isolation within the supply chain. However, in recent years, a more complex strategy of 'eco-efficiency' or 'lean-and-green' approach to SCM has evolved (Jain, 2011). This type of strategy derives benefits beyond mere regulatory compliance and helps members of the supply chain meet better efficiency and profits.

While higher levels of environmental performance can be achieved through the green practices, lean will result in lower material and labour cost and greater production revenues, which leads to a profitable organization. In spite of these contradictions and similarities, lean and green initiatives in supply chain can enable organisations to develop a sustainable supply chain. This research work addresses Lean supply chain management and its concurrence with Green supply chain management. The research is also an attempt to prove empirically prove the relationship between these practices.

Investigation of the relationship between Lean adoption, ISO 14001 certification, Lean SCM practices, Green drivers, Green support practices, Green SCM practices and Organisational performance has been carried out at the firm level.

Literature Review:

Lean Practices: Lean supply chain strategies focus on waste reduction. This facilitates manufacturing firms to eliminate non-value adding activities related to excess time, labor, equipment, space and inventories across the supply chain (Taylor, 1999; Li Suhong, 2002; Corbett & Klassen; 2006). Such strategies enable firms to improve quality, reduce costs, and improve service to customers (Womack & Jones, 1996; Larson & Greenwood, 2004).

The assimilation of lean by manufacturing firms is captured as Lean adoption. Lean adoption in organisations is a phased process of as-

similation of Lean practices which starts from implementation of tools and technologies to convergence into a Lean enterprise. Lean adoption in organizations has been studied in this research based on the study by APICS (2004).

APICS, Oracle, and Supply Chain Vision & Georgia Southern University (2004) research on Lean SCM practices attempt not to represent any particular firm, which is usually the methodology in Lean based studies; it demonstrates APICS' efforts to provide the insight into current issues and adoption level in Lean supply chain. The research also categorizes Lean SCM practices as demand management, standardization, value addition, culture and collaboration. The "Lean Supply Chain Management Practice Process Framework", which forms the basis of this research, is an inspiration of the above research. This framework of practices can be used by firms to identify the potential gaps in their processes. Implementers and practitioners can use this tool to identify every single aspect of the firms' process strengths and weaknesses and can focus their efforts on those areas where improvement will drive benefits. Various practices that form the framework of Lean SCM practices are Demand Management, Cross enterprise collaboration, Lean Culture, Process Standardisation, Industry standardization and Waste elimination/ value addition.

Green Practices: Firms around the world are adopting environmental management systems and certifying them by international standards. ISO 14001 is becoming the most prominent standard for assessing environmental management in Indian firms. It provides guidelines by which firms design and implement an environmental management system that identifies the organizational environmental policy and the environmental prospects of its operations (Morrow & Rondinelli, 2002). Potoski and Prakash (2005), Russo (2002) and Melnyk (2003) and Kang (2005) found that the adoption of an ISO 14001 certified EMS improved environmental performance. Dahlstrom et al., (2003) and Matthews (2001) have shown contradictory results.

Research Methodology:

The researcher decided to run Multivariate Analysis of Covariance (MANCOVA) on the variables that include Lean adoption, ISO 14001 certification, Green driver, Green support practices, Green SCM practices, Lean SCM practices and organizational performance.

Hence to understand the relationship between lean adoption, ISO 14001 certification, Green drivers, Green SCM practices, Lean SCM practices and organizational performance.

MANCOVA is more powerful than the separate univariate tests (Hair

et al., 2008). Moreover, this technique is selected over Independent Samples T – Test or ANOVA because the multivariate formula for 'F – static' was based not only on the sum of squares between and within groups as in ANOVA but also on the sum of cross products. That is, it takes covariance into account as well as group means among the dependent measures.

The sampling frame was identified as the members list of Confederation of Indian industries (CII), Tamilnadu. The target respondents were firms satisfying both the criteria that they are involved in manufacturing of products and have implemented lean and green practices.

Respondents from the organisation that they represent need to have some knowledge and experience in the area of lean and green, hence probability method or system sampling would not fit the subject of analysis. A hybrid of subjective selection and snowball sampling was adopted to draw out 200 respondents on different levels across various industry sectors to participate in the study. The sample was found adequate as indicated by Hair et al., (2006) and Lei & Wu, (2007).

Analysis and Interpretation:

The researcher investigates the extent of Lean adoption, ISO 14001 certification among the manufacturing firms and the influence of Lean adoption on Lean SCM practices, Green drivers, Green support practices, Green SCM practices and Organisational performance in the presence of ISO 14001 certification. The empirical results of the same are presented in this section.

Further for interpreting the results, there are four different test statistics namely, Pillai's trace, Wilk's Lambda λ , Hotelling-Lawley's trace, Roy's Greatest Root, each with its own associated F statistic. Pillai's Trace is the most robust of the four tests since it is least sensitive to departures, from the assumptions (Olson, 1976; Johnson & Wichern, 2002) and Hotelling's Trace is the most common and traditional test, where the fixed factor is formed of two groups. Wilk's Lambda is the most common and traditional test when there are more than two groups formed by the fixed variables and Roy's Largest Root is seldom used. The table 1.3 shows the results of the multivariate test.

Table 1.3: Multivariate Tests^a

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
ISO Certification	Pillai's Trace	.349	6.503 ^a	15.000	182.000	.000	.349
	Wilks' Lambda	.651	6.503 ^a	15.000	182.000	.000	.349
	Hotelling's Trace	.536	6.503 ^a	15.000	182.000	.000	.349
	Roy's Largest Root	.536	6.503 ^a	15.000	182.000	.000	.349
Lean Categories	Pillai's Trace	.520	4.282	30.000	366.000	.000	.260
	Wilks' Lambda	.530	4.529 ^a	30.000	364.000	.000	.272
	Hotelling's Trace	.792	4.777	30.000	362.000	.000	.284
	Roy's Largest Root	.646	7.883 ^b	15.000	183.000	.000	.393

A perfect fit model will generate all the four test F statistics identical, while in this model all four statistics have produced same F values for ISO 14001 Certification and different for Lean adoption levels. However, F statistic produced is significant at 0.05 levels for both ISO 14001 certification and lean adoption levels. ISO certification as indicated by Hotelling's Trace F = 6.503 is significant at 0.05 level; Wilk's Lambda as indicated by F = 4.529 is significant at 0.05 level. Therefore, the researcher concludes that there exists main and interaction effect on the dependent Lean SCM practices, Green drivers, Green support practices, Green SCM practices and organizational performance. Based on the above the researcher deemed to have accepted the MANCOVA model.

Multivariate η^2 was 0.349 for ISO 14001 certification and 0.272 for

Lean groups. This indicates that approximately 34.9% of the multivariate variance of the dependent variables is associated with the ISO 14001 certification and 27.2% variance with Lean adoption groups.

Conclusion:

The research is of importance as the proposed framework is expected to uncover many neglected relationships that are of interest to managers. This could further encourage managers to implement these practices and improve the organization's sustainability.

The goal is to maximize the conscious implementation of lean and green by raising the awareness of the linkage between lean and green on the organizational performance. The researcher asserts that the potential benefit of linking Lean and Green is an efficiency driven strategy for organizations. The influence of Lean adoption on Lean SCM practices, Green SCM practices and Organisational performance in the presence of ISO 14001 certification signals that it is the prime time for Lean and Green Thinking to be integrated into the supply chain.

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