

# Lean Supply Chain Management and its Impact on Organisational Competitiveness

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**Abstract**— The increased competition and the rising interconnectivity of today's business environment demand new methods for supply chain management. One such method is lean management, which emphasizes adaptability, flexibility, as well as strategic and operational alignment between the different links in the supply chain. However, there is a significant knowledge gap regarding the context, and the implementation of lean supply chain management programs in different countries around the world.. This paper aims to fill the gap via a survey study, by examining the relationship between the implementation of lean supply chain management and business competitiveness in the context of the Greek economy that currently goes under major changes. Findings show that lean supply chain management leads to a strong competitive advantage, especially through cost and waste reduction. Further, it was found that lean supply chain management results in meeting customer requirements, increased profitability, reduction of inventory levels, the introduction of just-in-time systems and increased sustainability. However, organizational structure, employees' resistance to change, organization's rules, procedures and policies, as well as the lack of robust and professional relationships with suppliers, are obstacles to be overcome when implementing lean supply chain management systems.

**Keywords**— *Supply Chain Management, Lean Management, Sustainability, Business Competitiveness*

## 1. Introduction

Supply Chain Management is a promising tool with a great impact on the efficiency of today's businesses and the wider assurance of quality processes in the highly competitive environment of modern economies. Lean supply chain management eliminates business activities and processes that do not add value. This improves performance and flexibility w[1]. Ref.[2], also refers that lean supply chain management creates a holistic framework that reduce costs and improve customer services through efficient management. The aim of this paper is to examine the relationship that exists between the implementation of lean supply chain management and competitiveness. Based on this

aim, the following research objectives were formulated:

- To examine the extent to which companies implement lean supply chain management in their processes
- To determine the benefits stemming from the integration of lean management in the supply chain
- To determine the obstacles which exist in the implementation of lean supply chain management
- To examine best practices in the implementation of lean supply chain management
- Make suggestions upon the obstacles and challenges that exist in implementing lean supply chain management

The above research objectives are achieved by carrying out a survey study on a representative sample of relevant companies of the Greek industry. Note that the recent economic crisis in Greece induced major changes in the industry which makes it necessary to investigate this field of study.

The following section presents a literature review on the topic of lean supply chain management and its application by businesses. Next, in the methodology section, an appropriate questionnaire is designed drawing knowledge from similar studies carried out around the world. In the results section, description statistics and correlational analysis are presented. Finally, conclusions are drawn, and recommendations are given to businesses.

## 2. Literature Review

In recent years, the concept of lean management [3], [4] is constantly gaining attention both from researchers and businesses. This is because lean management is related to various tools and methods used to optimize products and services [5]–[7]. The implementation of lean management is largely due to pressures exercised by consumers and markets to achieve efficiency [7]. Lean production is also associated with the improvement of operational and

financial performance [8], the minimization of waste in terms of time [9], cost reduction and increase in quality standards of the organization [6]. Further, recent developments in new methods of open innovation [10], [11] act as driver for lean management towards process improvement.

Ref.[12], summarizes the positive impact of lean management by putting them in following categories: elimination of waste, improved quality, increased product flow, and reduced cost. From the above it can be argued that the integration of lean philosophy in the supply chain management is associated with companies' competitiveness [5]–[8], [13]. This integration results in lean supply chain management. Ref.[14], argue that only companies that have optimized their business processes can be distinguished from the harsh competition that exists today. Ref.[1], add that today's business environment is not only affected by competition, but also by globalization, short product life cycles and diversification of customer requirements and needs. This means that the implementation of lean supply chain management is a crucial factor in achieving competitiveness on behalf of companies.

Ref.[15], compared Toyota's production practices with the typical production process used by European and American automakers. The findings showed that Toyota's production system required half of the workforce, the production area, investments and hours of work to develop a new product compared to a typical production process. This has resulted in Toyota's production being called a lean manufacturing [16]. Lean management consists of approaches, principles and methodologies, which can be applied to an organization's processes either individually or collectively [12]. Thus, the aim of lean management, is to achieve better results faster and in more cost-effective ways.

According to Ref.[14], the five basic principles of the lean philosophy in an organization are: a) creating lean value through proper performance of the right job; b) value delivery only after identifying the stakeholders and forming a robust proposal; c) adopting an extended enterprise approach; d) addressing interdependencies at all levels of the business to increase lean value and e) focusing on people to achieve maximum value and not just on procedures. Ref.[5], suggests that lean supply management has emerged as a result of the relation between the factors that affect a company's competitiveness such as quality, cost, time, speed, productivity, price, customer satisfaction, diversity, flexibility technology, and risk.

According to Ref.[5], cost is the most important feature of competitive advantage in the lean supply

chain. The ultimate objective of the lean supply chain is that it can meet the foreseeable demand in the most efficient and thus in the cheapest way. Lean management is also related to the concept of sustainability, in all three pillars: social, economic and environmental [13]. More specifically, concerning environmental sustainability, lean management and the environmental sustainability are governed from the following principles: waste reduction, process-centered focus, high levels of people involvement and participation. Thus, companies following lean principles can create opportunities for green manufacturing processes, adopt environmental-friendly management process and hence improve their environmental performance.

Lean advocates minimizing waste with the goal of creating value not only for customers, but also for all of the company's stakeholders [14]. Ref.[17], revealed that there are challenges that exist in the implementation of lean management in a company's processes. Finally, a key prerequisite for the successful implementation of the lean business model is that business managers understand this philosophy which involves a fundamental change in thinking and advocates a process of continuous improvement. Moreover, a company should first focus on product innovation as it shapes the market dynamics in the early stages and until the establishment of the dominant design. The centre of gravity falls into the process innovation, because the processes depend on the efficiency and profitability of the company while facilitating the attainment of low cost. Last but not least, the involvement of all parties should be ensured when going lean.

### 3. Methodology

It was ensured that questions were clear and easily understand by the respondents. The questionnaire consisted of 19 questions. These questions were split into three sections: a) Section I (questions 1-4) referred to the characteristics of the companies; b) Section II (questions 5-9) referred to the supply chain management of the companies; c) Section III (questions 10-19) referred to the lean supply chain management processes. Questions were Likert scale type from 1-5 and dichotomous type (yes/no) questions. One open-ended question has been added, where respondents could state freely their opinion about lean supply chain management. Last but not least, it should be mentioned that the design of the questionnaire was based on other similar studies as shown in Table 1.

The following table presents the bibliography that was used for each question.

**Table 1.** Bibliography used for each question

<b>Question</b>	<b>Bibliography</b>
<b>To which extent your supply chain management is characterized by the following elements (Q5)</b>	Ref.[18]
<b>To which extent do you implement the following practices in your supply chain management (Q6)</b>	Ref.[19]
<b>Do you implement measurement techniques for the supply chain performance (Q7)</b>	Ref.[20]
<b>Which of the following measures do you implement (Q8)</b>	Ref.[20]
<b>Is your evaluation of the supply chain management based on the following criteria (Q9)</b>	Ref.[20]
<b>For which of the following reasons do you implement/would you consider implementing lean supply chain management (Q10)</b>	Ref.[19]
<b>Have you followed the next stages in order to implement the lean supply chain management (Q11)</b>	Ref.[14]
<b>Which are the benefits from the adoption of a lean supply chain management (Q12)</b>	Ref.[14] Ref.[21]
<b>Which of the following factors are obstacles in implementing lean supply chain management (Q13)</b>	Ref.[19]
<b>To which extent do you believe that the following attributes are essential in order to implement the lean supply chain management (Q14)</b>	Ref.[9]
<b>Overall, do you think that lean supply chain management has resulted / can result in the acquisition of a competitive advantage (Q15)</b>	Ref.[22] Ref.[5] Ref.[23]
<b>Overall, do you think that lean supply chain management has resulted / can result in the increased competitiveness of your company (Q16)</b>	Ref.[22] Ref.[5] Ref.[23]
<b>To which extent the adoption of lean supply chain management has resulted / will result in competitive competences (Q17)</b>	Ref.[24]
<b>How do you think that the adoption of lean supply chain management is linked to competitiveness through the following features (Q18)</b>	Ref.[18]

The questionnaire was sent to a representative sample of companies electronically via Google Forms. Both descriptive and inferential statistics were used. Descriptive statistics were used in order to present the characteristics of the companies, and the opinions of the respondents, based upon the mean and standard deviation. Inferential statistics were used in order to examine whether there are significant differences among the respondents' opinions based upon the characteristics of the companies. The results of the statistical analysis are presented in the next section.

#### 4. Results

Respondents' opinions concerning the supply chain management practices of companies reveal that the supply chain is characterized by process and product standardization and less by cultural change. Overall businesses implement demand

driven supply chains, total quality management and overall equipment efficiency. In contrast, they do not implement to a great extent balancing of the working process in production, manufacturing plant layout and lean procurement. Further, 80.2% of the companies implement monitoring techniques for measuring performance of managing the supply chain.

The main reasons for implementing lean supply chain management were cost reduction, inventory reduction, increased profitability and obtaining a competitive advantage. The steps respondents have followed to implement the lean supply chain management, were primarily:

- Creation of an action plan needed to achieve the desired future state
- Agreement with all participants of the supply chain
- Assessment of the current state of the supply chain

- Creation of the current state map
- Evaluation of all suppliers and buyers

In addition, participants stated that the main benefits of lean supply chain management are cost reduction, increased profitability, reduction in inventory, and the introduction of a just-in-time system, sustainability, and the introduction of common solutions to problems and reduction of related costs. Companies in the selected sample believed that the major obstacle in implementing lean supply chain management were financial resources, organizational structure, resistance to change by employees, organization rules, procedures and policies and lack of robust and professional relationships with suppliers.

The results also revealed that in order to implement lean supply chain management, the respondents believe that production and delivery of the whole supplier network must be synchronized. Overall, almost all respondents (98%) believe that lean supply chain management results in the acquisition of a competitive advantage. In addition, almost all respondents (95%) believe that lean supply chain management increases the competitiveness of their company. This includes product reliability and flexibility. The primary

features that link lean supply chain management with competitiveness are cost reduction and waste.

Inferential statistics and correlation analysis were carried out in order to examine whether company characteristics are correlated with the respondents' opinions. In order to choose the appropriate statistical tests, the normality of data test was employed using Kolmogorov-Smirnov test. From Table 2, it can be seen that almost all of the variables do not follow the normal distribution. The Kuskal-Wallis test was then used to assess whether the industry sector in which the company operates affects the respondents' opinions. Results reveal that the industry sector influences whether the supply chain management of a company is characterized by cross-enterprise collaboration. Further, it also is a factor for whether companies implement measurement techniques for the supply chain performance. Additionally, type of industry affects the opinion of the respondents that seem to benefit from lean supply chain management. Lean supply chain management results in more flexible of production processes and seems to be linked to increased competitiveness through demand management capability. This in turn may eliminate any obstacles related to implementing changes in the supply chain management.

**Table 2.** Correlation between competitive competences and competitiveness features

		Product quality	Product Reliability	Flexibility of production processes	Ability to achieve cost leadership
Demand management capability	Pearson Correlation	.556**	.465**	.397**	.288**
	Sig. (2-tailed)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.004</b>
	N	99	100	100	100
Reduction of cost and waste	Pearson Correlation	.411**	.451**	.396**	.425**
	Sig. (2-tailed)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
	N	100	101	101	101
Standardization products, & processes	Pearson Correlation	.338**	.385**	0.155	.372**
	Sig. (2-tailed)	<b>0.001</b>	<b>0</b>	0.123	<b>0</b>
	N	100	101	101	101
Standardization	Pearson Correlation	.244*	.319**	.353**	.385**
	Sig. (2-tailed)	<b>0.014</b>	<b>0.001</b>	<b>0</b>	<b>0</b>
	N	100	101	101	101
Cultural change competency	Pearson Correlation	0.147	0.169	.367**	.319**
	Sig. (2-tailed)	0.144	0.09	<b>0</b>	<b>0.001</b>
	N	100	101	101	101
Cross-enterprise collaboration	Pearson Correlation	0.181	.344**	.385**	.487**
	Sig. (2-tailed)	0.071	<b>0</b>	<b>0</b>	<b>0</b>
	N	100	101	101	101

Further, it was examined whether the number of employees affects survey responses opinions. For this reason, the Kuskal-Wallis test was used. The number of employees was shown to affect whether supply chain management is characterized by demand management capability and by industry standards adoption. Moreover, number of employees are a determinant of whether the companies implement the various practices concerning their supply chain management such as total productive maintenance, manufacturing plant layout, lean procurement and continuous improvement. Further, the number of employees affects whether companies implement or will consider implementing lean supply chain management in order to gain competitive advantage. Using the Pearson correlation test, correlational analysis was carried out. It seems that product quality is not linked to cross-enterprise collaboration and to cultural change competency. In addition, production flexibility processes are not linked to product and process standardization. Finally, cultural change competency is not linked to product reliability. In all the other cases, there is a strong positive relationship between competitive competences and the competitiveness' features.

Correlational analysis was carried out between the various stages implemented and the benefits from lean supply chain management as shown in Table 3. Results have shown that not all stages are correlated with the benefits from the implementation of supply chain management. More specifically, factors such as implementing changes, documenting results and verifying measures are not linked to sharing information, reduction costs, increased profitability and waste elimination. In addition, the choice of supply chain, which will be optimized, as well as setting goals and indicators in the process, defining supplier of first and second tier, and the recipients of all tiers is not linked to cost reduction, increased profitability and waste elimination. Moreover, the assessment of the current state of the supply chain, creation of the current state map, the evaluation of all suppliers, buyers and leader by means of earlier chosen measures is not linked to cost reduction, to increased profitability and to waste elimination. Yet, cost reduction, increased profitability and waste elimination is correlated to the creation of the future state map and of an action plan.

**Table 3.** Correlation between stages implementation and benefits from lean supply chain management

		Choice of the supply chain	Assessment of the current state of the supply chain	Creation of the future state map	Creation of an action plan	Implementation of changes
Consolidation & restructuring of suppliers and recipients	Pearson Correlation	.563**	.583**	.483**	.434**	.486**
	Sig. (2-tailed)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
	N	100	98	101	101	101
Sharing information	Pearson Correlation	.268**	.373**	.334**	.281**	0.145
	Sig. (2-tailed)	<b>0.007</b>	<b>0</b>	<b>0.001</b>	<b>0.005</b>	0.15
	N	99	97	100	100	100
Reducing inventory levels & just-in-time system	Pearson Correlation	0.173	.318**	0.119	0.185	.204*
	Sig. (2-tailed)	0.084	<b>0.001</b>	0.235	0.064	<b>0.041</b>
	N	100	98	101	101	101
Introduction of common solutions to problems & reduction of costs	Pearson Correlation	.444**	.485**	.345**	.404**	.511**
	Sig. (2-tailed)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
	N	99	97	100	100	100
Implementation of customer requirements	Pearson Correlation	.256*	.321**	.432**	.448**	.307**
	Sig. (2-tailed)	<b>0.01</b>	<b>0.001</b>	<b>0</b>	<b>0</b>	<b>0.002</b>
	N	100	98	101	101	101
Achieve sustainability	Pearson Correlation	.269**	.308**	0.165	.280**	.259**
	Sig. (2-tailed)	<b>0.007</b>	<b>0.002</b>	0.099	0.005	0.009

	N	100	98	101	101	101
Cost reduction	Pearson Correlation	0.142	0.179	.332**	.378**	0.091
	Sig. (2-tailed)	0.159	0.08	<b>0.001</b>	<b>0</b>	0.368
	N	99	97	100	100	100
Increased profitability	Pearson Correlation	0.08	0.134	.342**	.286**	0.073
	Sig. (2-tailed)	0.427	0.188	<b>0</b>	<b>0.004</b>	0.465
	N	100	98	101	101	101
Waste elimination	Pearson Correlation	0.079	0.083	.304**	.237*	0.022
	Sig. (2-tailed)	0.436	0.416	<b>0.002</b>	<b>0.017</b>	0.83
	N	100	98	101	101	101

## 5. Conclusions

The aim of this paper was to analyse the relationship between lean supply chain management and organisational competitiveness. This is based on a survey of companies carried out in Greece. It has been found that practices companies use in their supply chain management are demand driven supply chain, total quality management and overall equipment efficiency, and less lean procurement. This suggests that Greek companies do not effectively use lean management in their supply chain, as they should.

The survey revealed numerous benefits that stem from the adoption of lean supply chain management. To be more specific, lean supply chain management can lead to reduced costs, customer satisfaction, increased profitability, reduction in inventory, the introduction of a just-in-time system, sustainability as well as the introduction of common solutions to problems and reduction of related costs. In addition, it was found that lean supply chain management can lead towards the acquisition of a competitive advantage and increased competitiveness. In fact, the competitive competencies that lean supply chain management can lead to are product reliability and production flexibility. The reduction of cost and waste, such as waste in terms of time and process redundancy, is the main feature that links the lean supply chain management with competitiveness.

This study also contributes at determining the obstacles, which exist in the implementation of lean supply chain management in companies. Based upon the answers of the respondents, the main obstacle seems to be the limited financial resources. The synchronization of both production and delivery through the whole supplier network is the main attribute that is essential in order to implement lean supply chain management. However, in order for companies to successfully

implement lean management, some other attributes are also essential. For instance, companies should adjust their rules and procedures so as to facilitate the implementation of leanness, and to reduce employees' resistance. Companies should also integrate suppliers in the design, implementation, and development phase.

The study also revealed that type of industry sector and number of employees influence respondents' opinions. This means that the lean practices may not always be culturally appropriate for every organization. For this reason, each organization should examine the opinions of employees, suppliers and other stakeholders, as well as the organizational structure, culture, policies and the norms that exist in their particular case.

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