

THE IMPACT OF LEAN SUPPLY CHAIN ON PRODUCTIVITY OF SAUDI MANUFACTURING FIRMS IN AL-QASSIM REGION

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Abstract: The objective of this study is to identify the contribution of the lean supply chain (LSC) to manufacturing firms in the Kingdom of Saudi Arabia (KSA). Out of the population of the study, 150 firms were selected from the Al-Qassim region to encompass the sample of the study. Four variables include waste elimination, cost reduction, manufacture–supplier relationship, and manufacture–customer relationships were constructed as predictors of productivity. A questionnaire-based survey was conducted to collect the study variables. A total of 75 questionnaires were distributed in the sample, of which 69 were returned. All of them were valid for the statistical analysis. The results of the study confirmed the hypotheses that the constructed predictors could predict the productivity of the manufacturing firms in the Al-Qassim region. That is, there were statistically significant impacts of LSC dimensions on the productivity. The study contributes to the body of supply chain (SC) literature by providing evidence on the positive impact of LSC on productivity in an Arabian context, particularly in KSA. However, the study was conducted in one industrial region in the KSA, therefore the generalization of the findings may not be applicable to other firms in the same country or other countries.

Key words: lean supply chain, productivity, manufacturing firms

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Introduction

Globalization, improvement initiatives (Achanga et al., 2006), competitive advantage (Cagliano et al., 2006), organizational need to underpin performance (Vereecke and Muylle, 2006), increased production costs (Gamme and Aschehoug, 2014; Moyano-Fuentes et al., 2012), manufacturing transition from market orientation to customer orientation (Gorane and Kant, 2015), organizations' need to enhance performance (Arif-Uz-Zaman and Ahsan, 2014), increasingly demanding customers (Thatte et al., 2013) and the intensive attention paid by Western firms to Japanese initiatives regarding lean practices (Manzouri et al., 2013) were practical examples of factors that resulted in the introduction and adoption of LSC philosophy. Several objectives of LSC philosophy have been highlighted in the literature. Examples of these objectives include reduction of waste by the optimal use of resources, introduction of products with high-level quality, reduction of costs, and achievement of quick responsiveness to customers' demands

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and needs (Rahman et al., 2010; Sharma et al., 2015). Consequently, the LSC concept has gained great attention from researchers and managers.

Numerous studies have been conducted in order to explore the relationships between LSC and different factors. One of the most important relationships investigated by researchers was the relationship between LSC and productivity. The results indicated that LSC has a positive impact on a product's quality, productivity and customer responsiveness (Rahman et al., 2010), productivity maximization (Agus and Hajinoor, 2012), cost performance (Hallgren and Olhager, 2009), waste elimination and productivity (Taj and Berro, 2006), and productivity of manufacturing firms (Jasti and Kodali, 2016; Taj and Morosan, 2011). One can conclude that LSC positively predicts the productivity of manufacturing firms. According to Konecka (2010), productivity is one factor among others that stimulates the introduction of the lean concept. Despite the fact that lean principles have been extensively introduced and adopted by many manufacturing firms in different countries, the research on the relationship between LSC and the productivity of manufacturing firms, particularly in regions within non-Western settings, and in particular the Kingdom of Saudi Arabia, is still scarce. Consequently, the aim of this research paper is to identify the association between LSC practices and the productivity of manufacturing firms in the Al-Qassim region. The structure of the current paper consists of five sections. A literature review and hypotheses development can be seen in section 2. Section 3 is dedicated to the research methodology, followed by the data analysis and results in section 4. The discussion and conclusion are presented in section 5. The last section includes research implications, limitations and future research.

Literature Review and Hypotheses Development

Lean Supply Chain Definition and Objectives

Lean in a supply chain context is a term that means eliminating non-useful activities through the supply chain (Singh and Pandey, 2015). The main purpose of lean as cited by Antunes et al. (2013) is the enhancement of performance of industrial firms following two major factors, namely the elimination of waste in an organization's processes and the introduction of humans in order to benefit from their capabilities. Simchi-Levi and Kaminsky (2007) defined the lean supply chain as the integration between lean concepts and supply chain management. Similarly, Drohomeretski et al. (2014) defined a lean supply chain as the application of a lean manufacturing concept in the supply chain context. Several objectives are deemed as factors that lie behind the introduction of the lean concept into supply chain management. Examples of these objectives include the elimination or reduction of non-value-added or wasteful activities and the enhancement of supply chain responsiveness along with the reduction of cost (So and Sun, 2010), the improvement of quality and productivity (Hu et al., 2015), in addition to meeting customers' needs and performance boosting (Prajogo et al., 2016).

Drohomeretski et al. (2014) summarized lean supply chain objectives as the elimination of sources of waste in the supply chain, improvement of customers' value delivery, supply chain partners' involvement, collaboration with suppliers and customers, in addition to development of effective suppliers. For the current study, supplier and customer relationships, reduced cost, and eliminated waste were taken as four dimensions of the lean supply chain.

Lean Supply Chain Dimensions

With regard to lean supply chain dimensions, Khorasani et al. (2015) indicated that a lean supply chain is marked as a new way of thinking about cooperative and collaborative supplier relationships. For Özkna et al. (2015), the elimination of wasteful activities is one dimension of the lean supply chain philosophy. Agarwal et al. (2006) regarded the elimination of waste as one dimension of a lean supply chain. Daud (2010) argued that a lean supply chain is related to concepts such as cost and inventory reduction, customer satisfaction improvement, and customer responsiveness enhancement. Drohomeretski et al. (2014) considered the relationship with suppliers and customers as a main aspect of a lean supply chain initiative.

The Impact of Lean Supply Chain on Productivity

On the basis of lean supply chain positive outcomes, numerous studies have been carried out to investigate lean supply chain aspects and their relationships with other variables such as productivity, quality, customer responsiveness and cost performance. Rahman et al. (2010) argued that lean supply chain practices enhance the level of a product's quality, productivity, and customer responsiveness. Özkna et al. (2015) carried out a study to investigate the impact of introducing lean practices into supply chain management processes. Their results revealed that lean supply chain practices result in effective inventory management, the elimination of wasteful activities, a reduction of errors and the maximization of productivity. Agus and Hajinoor (2012) stated that lean principles, such as continuous improvement, results in productivity maximization.

On the other hand, Chavez et al. (2013) confirmed the positive relationship between lean practices and cost. Hallgren and Olhager (2009) found a significant influence of lean practices on cost performance. Taj and Berro (2006) found a positive relationship between waste elimination and maximization of productivity of manufacturing firms in the USA. In their study on the implementation of lean practices in the Indian industrial sector, Jasti and Kodali (2016) indicated that one of the most critical factors of enhancing the productivity of manufacturing firms is the adoption of lean thinking. The current study assumes that basic concepts of a lean supply chain – such as supplier as well as customer relationships, reduction of cost and the elimination of wasteful activities – have a positive influence on the productivity of manufacturing firms.

As a result, the following hypotheses were introduced:

H₁: The supplier relationship boosts the productivity of Al-Qassim manufacturing firms.

H₂: The customer relationship boosts the productivity of Al-Qassim manufacturing firms.

H₃: The reduction of cost boosts the productivity of Al-Qassim manufacturing firms.

H₄: The elimination of waste boosts the productivity of Al-Qassim manufacturing firms.

Research Model

Constructs, hypotheses and the path of the suggested relationships of the current research are pictured in the research model depicted in Figure 1. According to the figure, four dimensions of LSC were postulated to have a statistically significant impact on the productivity of the manufacturing firms studied.

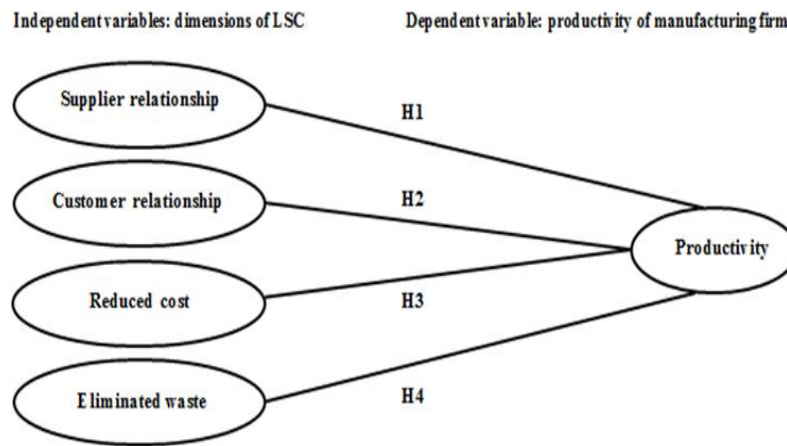


Figure 1. Research Model

Research Methods

Data collection

The research population embodies all manufacturing Saudi companies located in the Al-Qassim region – 81 firms. Out of these, 75 firms were selected as a sample to represent the entire population. Data collection was completed using a questionnaire distributed to the sample of the research either by e-mail or by hand. Out of the distributed questionnaires, 69 were returned valid for statistical analysis purposes.

Instrument

Questionnaires based on a 5-point Likert scale measured LSC practices using suppliers' relationships (SR) (three items), customers' relationships (CR) (three items), (Koh et al., 2007), eliminated waste (EW) (three items) (Rahman et al., 2010), and reduced cost (RC) (three items) (Perez et al., 2010). Overall productivity was measured based on a scale developed by Rahman et al. (2010) (three items) in which respondents were asked to rate the level of productivity of their company on a scale ranging from worst in the industry (1) to best in the industry (5).

Validity and Reliability

Validity refers to the degree to which a measure accurately represents what it is intended to measure (Nunnally, 1978). Construct validity refers to the degree to which inferences can legitimately be made from the operationalizations in a study to the theoretical constructs on which those operationalizations were based (Agarwal, 2011). Construct validity was computed using factor analysis. On the other hand, reliability refers to consistency of measurement over time or stability of measurement over a variety of conditions (Drost, 2011). The reliability of the questionnaire was assessed using Cronbach's (α) coefficient. According to Al-Tit and Hunitie (2015), a value of 0.70 or more is enough for a scale to be reliable and average variances extracted (AVE) of at least 0.5 are considered desirable (Hair et al., 1999). The results of validity and reliability tests are shown in Table 1. Based on these results, the measurements employed in the current study were valid and reliable.

Table 1. Scale validity and reliability

Scale and factors	Items	α	Loadings		AVE	M	SD
LSC practices		12	0.810		0.63	3.72	0.74
Waste elimination		3	0.790	0.741		3.67	0.81
Cost reduction		3	0.801	0.720		3.74	0.71
Supplier relationships		3	0.786	0.687		3.69	0.88
Customer relationships		3	0.809			3.77	0.71
Productivity		3	0.831		0.702		0.91

Hypotheses Testing and Results

In order to identify the explanation power of each independent variable, productivity was regressed on LSC dimensions. According to hypotheses 1–4, manufacture–supplier relationship, manufacture–customer relationship, cost reduction as well as waste elimination were assumed to boost the productivity of the manufacturing firms. The results shown in table 2 indicate that lean supply chain dimensions can explain about 60% of the variance in the productivity of the manufacturing firms. The first hypothesis was accepted. Hence, relationship with suppliers has a significant impact on productivity ($B = 0.361$, $t = 4.412$, $p < 0.05$).

The second hypothesis was also supported. That is, there is a significant impact of relationship with customers on productivity ($B = 0.392$, $t = 5.110$, $p < 0.05$). In relation to the third hypothesis, the results revealed a significant impact of cost reduction on productivity ($B = 0.437$, $t = 5.212$, $p < 0.05$). Finally, the fourth hypothesis was accepted, i.e., there is a significant impact of waste elimination on productivity ($B = 0.483$, $t = 6.331$, $p < 0.05$). Consequently, it was concluded that all lean supply chain dimensions have a significant impact on the productivity of manufacturing firms in the Al-Qassim region in Saudi Arabia.

Table 2. The impact of LSC dimensions on productivity

Hypotheses	Independent variables	Beta	t
H ₁	Supplier relationships	0.361*	4.412
H ₂	Customer relationships	0.392*	5.110
H ₃	Cost reduction	0.437*	5.212
H ₄	Waste elimination	0.483*	6.331
R		0.771	
R ²		0.594	
F-ratio		11.63	

*p-value < 0.05,
Response variable: productivity

Discussion and Conclusion

The objective of the present study was to assess the impact of four dimensions of a lean supply chain, i.e. relationships with suppliers and customers, cost reduction and waste elimination. The findings of the research accepted the hypotheses that relationship with suppliers, relationship with customers, cost reduction and waste elimination have significant impacts on the productivity of manufacturing firms in the Al-Qassim region in Saudi Arabia. Similar results were found by numerous related studies. Ghosh (2013) explored the adoption state of a lean supply chain in a regional sample consisting of 400 plants in India, and examined the impact of lean dimensions on the operational performance of these plants. Their results indicated that the lean dimensions result in high productivity in Indian plants. Sharma et al. (2015) investigated the impact of lean practices on the performance of manufacturing firms in India and found that the most important factor that affects firms' performance is the strategic partnership with suppliers. Gamme and Aschehoug (2014) concluded that the most important results of the introduction of lean concepts are reduced costs, increased productivity and stable process. Moreover, Arif-Uz-Zaman and Ahsan (2014) found a significant impact of lean philosophy on productivity in different industries. Parveen and Rao (2009) argued that the main benefit of lean in the supply chain context is to eliminate waste. Carvalho et al. (2010) stated that the relationship with suppliers as one practice of the supply chain resulted in an elimination of business activities' waste. Furthermore, they added that relationships with customers as an LSC practice

generates a reliable operation of the supply chain, which in turn affects the operational performance of manufacturing firms. Considering the above-mentioned findings, the study concluded that lean supply chain aspects, i.e., supplier and customer relationships, cost reduction and waste elimination, significantly affect the productivity of manufacturing firms.

Implications and Limitations

The study provides extended evidence that organizations have to take lean supply chain practices into their consideration when seeking enhanced productivity. The main contribution of a lean initiative is to implement value-added tasks throwing off unnecessary activities, which in turn induces reduced costs. These aspects when combined with supply chain practices such as integration of supply chain partners, i.e. suppliers and customers, engender a reliable operation of supply chain practices. The overall effects on the manufacturing processes come to light as a productivity enhancement outcome. This study was conducted using a sample from one industrial region in the KSA; therefore, the generalization of the results should be applied to other regions with caution. Further research is required to cover other industrial regions in the kingdom in order to understand the impact of LSC practices on manufacturing firms' productivity. Future studies can investigate the impact of other lean supply chain practices on productivity using a larger sample size from regions all over the kingdom.

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WPLYW WYSZCZUPLENIA ŁAŃCUCHÓW DOSTAW NA PRODUKTYWNOŚĆ SAUDYJSKICH FIRM PRODUKCYJNYCH W REGIONIE AL-QASSIM

Streszczenie: Artykuł przedstawia wpływ wyszczuplenia łańcuchów dostaw w regionie Al-Qassim na produktywność. Dla celów badawczych przyjęto cztery zmienne: usuwanie odpadów, redukcję kosztów, relację producenci-dostawcy oraz relację producenci-klienci. Badaniem objęto 69 firm i poddano je analizie statystycznej. Otrzymane wyniki potwierdziły sformułowaną przez autorów hipotezę. Oznacza to, że występuje znaczący wpływ stopnia, w jakim zastosowano wyszczuplenia łańcuchów dostaw na produktywność. Badanie stanowi przyczynek do dalszych badań w tym obszarze.

Słowa kluczowe: wyszczuplone łańcuchy dostaw, produktywność, firmy produkcyjne

精益供應鏈對AL-QASSIM地區沙特阿拉伯製造企業生產力的影響

摘要：本研究的目的是確定精益供應鏈（LSC）對沙特阿拉伯王國（KSA）製造企業的貢獻。在該研究的人群中，從Al-Qassim地區選擇了150家公司來包括該研究的樣本。四個變量包括廢物消除，成本降低，製造-供應商關係，以及製造 - 客戶關係作為生產率的預測。進行了基於問卷的調查以收集研究變量。樣本共分發了75份問卷，其中69份被退回。所有這些都適用於統計分析。研究結果證實了構造的預測變量可以預測Al.-Qassim地區製造企業的生產率的假設。也就是說，LSC尺寸對生產率有統計學上的顯著影響。該研究通過提供關於LSC對阿拉伯語境，特別是KSA的生產力的積極影響的證據，有助於供應鏈（SC）文學的主體。然而，研究在KSA的一個工業區域進行，因此，研究結果的概括可能不適用於同一國家或其他國家的其他公司

關鍵詞：精益供應鏈，生產力，製造企業