IMPLEMENTATION VIABILITY OF LEAN SUPPLY CHAIN CONCEPT IN THE APPAREL SECTOR OF BANGLADESH

Mimnun Sultana[1] M. M Nazrul Islam[2]

Abstract: *Lean supply chain is the elimination of all waste, including time and one of the best options to enhance supply chain performance. The objective of this study is to reveal the concept, significance, implementation steps, and factors to implement lean supply chain management in the apparel industry of Bangladesh. Very few studies have been conducted to investigate the issue in Bangladesh. This research enriches theoretical contributions to knowledge and practical contributions to business organizations and progressed through physical survey to 17 renowned garments factories in Bangladesh which are in the lean implementation stage. This analysis is very essential due to the increase of economic importance of supply chains in enhancing competitive power in international markets and will stand as a benchmark to implement lean for other apparel industries in Bangladesh.*

Keywords: *Lean Supply chain, apparel industry*

1. Background of the Research

Bangladesh is a well known developing country that is struggling towards economic development. The economic development of Bangladesh started from the basic of agricultural base changing to hi-tech manufacturing sectors that involving the demand of the global economic growth. Readymade garment industry started in the late 1970s, expanded heavily in the 1980s and boomed in the 1990s. The quick expansion of the industry was possible because of the following unique nature of the industry such as the less complicated (easy to transfer) technology, cheap and easily operating machineries (sewing machines) and a large cheap female labor. In global apparel business, Bangladesh contributes less than 8% which consist 80% of total export earnings in our country (BGMEA, 2012). By the coming years, China will lose their competitive advantage so it's high time to tap the undiscovered destinations of potentials. Global Competitiveness such as the conversion of GATT into WTO has changed the global trading environment remarkably. Particularly, the phasing out of the Multi-fiber Arrangement (MFA) and abolition of GSP is a serious challenge to many developing countries. With the abolition of quota and GSP, the trading environment has become fiercely competitive. Bangladesh, whose economy is heavily dependent on this subsector, will now have to compete against textile giants like China and India. Analysis of the internal and external environment suggests eliminating inefficiencies and irregularities distinctively lessening production lead time and wastages from the country's apparel production and exporting processes. Under the highly competitive environment, the garment industry has numerous opportunities for improvement using lean principles

1. Assistant Professor, School of Business and Economics, United International University
2. Deputy Managing Director, Manvill Styles Limited

(Mercado, 2007). This is mainly because of the nature of operation of the export-oriented RMG firms. The improvement of deep-level competitiveness through a reduction in total "production and distribution" time will improve surface-level competitiveness by reducing lead time. Productivity at suppliers needs to improve, not only to mitigate rising wages but also to close the existing productivity gap in comparison to other sourcing countries. Productivity in Bangladesh's RMG factories needs to catch up to the levels seen in India if Bangladesh's suppliers are going to be able to deliver on the unit demand growth. Additionally a gap between customer requirements and supplier capabilities or investment plans is emerging. Buyers want to expand their sourcing product mix into more sophisticated categories. The solution of the above criterion can be lean supply chain and that is why the research sought to find the competitive advantage of lean supply chain management in the garment manufacturing companies in Bangladesh. The study identifies lean performance as a mediator for lean supply chain practices in the context and reveals the influence of lean performance factor on lean supply chain practices. This knowledge can also enrich theories that deal with constraints of innovations or practices among organizations, such as lean philosophy and the theory of constraints. This can add to the knowledge about the value and importance of lean supply chain initiatives to organizations and the society at large.

2. Objective of the Research

The objectives of the research are

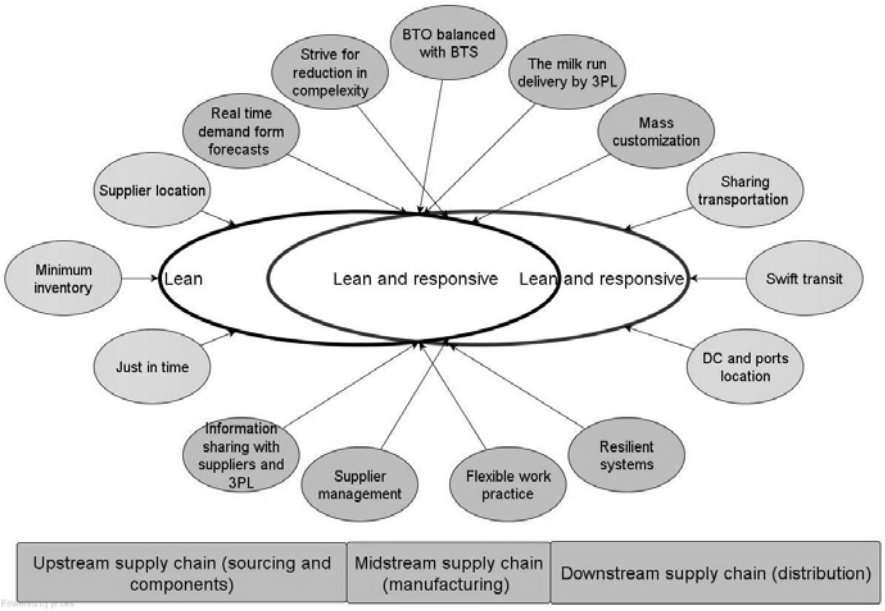
- To go through the intricacies relating to lean supply chain
- To assess the condition in the garments sector in Bangladesh in terms of its conduciveness to the implementation of lean supply chain concept.
- To examine the various forces that can influence the implementation of lean supply chain.
- To determine the stage of the implementation cycle at which the sector under study is ready to accommodate the concept of lean supply chain.
- To forth suggestions in the perspective of the study.

3. Theoretical Concept of Lean Supply Chain Management

The Supply Chain Council (SCC) defines a *supply chain* as "the integrated processes of Plan, Source, Make, Deliver, and Return spanning from the suppliers' supplier to the customers' customer (Husby, Paul C, 2009). The supply chain spans the entire scope of a company's operations, and therefore every function in the company affects it. According to literature the term lean means getting rid of what is unneeded, in other words is to cut fat, for manufacturing, lean means to keep inventory, waste, defects, and time required, at the minimal level. Womack et al. (1991) came up with the following definition for the lean production, which put emphasis on the input and output dimensions of manufacturing, based on his view, lean production is "lean" because it uses less of everything compared with the other traditional manufacturing method, such as mass production, it may use half the human effort in factory, half the manufacturing space, half the investment in tools, half the engineering hours to develop a new product in half time. Lean manufacturing implies a 'zero inventory', just in- time (JIT) approach, that has brought mass production to high levels of efficiency (Womack et al., 1990). The Toyota Production System(TPS) identifies seven major forms of waste as Waste from overproduction (producing more than is required by the customer or marketplace), waste

from transportation (multiple handling or movement), waste of motion of the workers, machines, and handling, waste of waiting, waste of processing, waste of inventory, waste of defects where as the variables that represent the lean supply concept are supplier feedback, just in time delivery by suppliers, supplier development, customer involvement and facilitation of just in time production. The lean supply chain system integrates all the participants in the supply chain supplier, manufacturer, and customer into one value stream, increasing value to the customer.

Figure1: The Lean Supply Chain Model



Source: Husby and Swartwood

2009 Bozdogan (2002) emphasized that the success of lean supply chain management principles derive from 10 basic Lean principles:

- Focus on the supplier network value stream
- Eliminate waste
- Synchronize flow
- Minimize both transaction and production costs
- Establish collaborative relationships while balancing cooperation and competition
- Ensure visibility and transparency
- Develop quick response capability
- Manage uncertainty and risk
- Align core competencies and complementary capabilities
- Foster innovation and knowledge-sharing

Bozdogan (2002) has illustrated the differentiation between conventional versus lean model

adapted into lean supply chain management based on 22 characteristics identified. Refer to Table 1.

Table 1: The comparison between conventional and lean model

Illustrative Characteristics	**Conventional Model**	**Lean Model**
Number & structure	Many; Vertical	Fewer, clustered
Procurement personnel	Large	Limited
Outsourcing	Cost-based	Strategic
Nature of interactions	Adversarial; zero-sum	Cooperative; positive-sum
Relationship focus	Transaction focused	Mutually-benefited
Selection length	Lowest price	performance
Contract length	Short-term	Long-term
Pricing practices	Competitive bids	Target costing
Price change	Upward	Downward
Quality	Inspection-intensive	Designed-in
Delivery	Large quantities	Smaller quantities(JIT)
Inventory buffer	Large	Minimized, eliminated
Communication	Limited; task-related	Extensive; multi-level
Information flow	Directive; one way	Collaborative; two-way
Role in development	Limited; build-to-print	Substantial
Production flexibility	Low	High
Technology sharing	Very limited; nonexistent	
Dedicated investment	Minimal-to-some	
Mutual commitment	Very limited; nonexistent	
Governance	Market driven	Self-governing
Future expectations No	No guarantee	Considerable

Source: Bozdogan (2002)

Due to some increasing concerns and needs to the lean supply chain effectiveness, there are general guide lines on the importance of lean supply chain.

4. Methodology

The methodology of the research was based on theory and process observation to apply lean supply chain management in garments sector and this research used empirical as well as quantitative information from seventeen (17) renowned garments factories as Ananta, IDS, Standard, jamona, Panash, Helicon, Apex, Adury, DBL, Hoplun, PN Composite, Palmal, Radial group, KDS, Leny, Toyo, Valiant of Bangladesh implementing lean. The key performance indicators of garments factory have been identified with each process to monitor the process and to quickly adjust for all disruptions or deviations from the pre-set standard before the product is passed to the next process. The improvement ratios are taken from process improvement after implementation. The implementation strategies and factors have been identified discussing with the team leader of lean project and production manager in the factories.

The researcher has seek the feedback and the advice of the people from the apparel industry and some academicians about the suitability of the research, who confirmed that the instrument is fit to the garments manufacturing companies' environment setting, at the same time the research selected only items that are relevant to the lean supply concept. Limitation of the research is "since the organizations are in the initial stage of lean implementation, so the improvement ratios do not include the optimum outcome of lean benefits".

5. Literature Review

Global supply of fashion clothes suffer the undesirable combination of changing demand, short life cycles and long supply lead times, which often results in excessive obsolescence or shortages (Fisher et al., 1994). Lean production is being supported by Just-in-time, which is a philosophy of continuous and forced problem solving, lean production supplies the customer with exactly what the customer wants, when the customer wants it, without waste, through continuous improvement (Smadi, 2012) . The concepts and techniques under the lean label were basically the same as those of just-in-time a decade earlier (2007). Companies store inventories to enable continuous deliveries and overcome problems such as demand variability, unreliable deliveries from suppliers, and breakdowns in production processes. Excess inventories are seen as "evils" because they hide problems such as defects, production imbalances, late deliveries from suppliers, equipment down time and long setup time (Liker, 2004). The Toyota Production System evolved into just-in-time production (JITP), and is at present known as lean production. JITP is lean production (DeGarmo, Black & Kohser, 1999; Nicholas, 1998; Rothenberg et al., 2001). JITP's mission is "to reduce inventory slowly, identify problems, then change policies and practices to remove problems, having done so, then reduce inventory a little bit more" (Nicholas, 1998). The role of purchasing as one of the determinants of lean production has evolved dramatically in the recent past, due to both the increased level of outsourcing and the globalization of the business environment, requiring the development of advanced supply management capabilities (Olsen & Ellram, 1997). In order to create a strong supply chain, the logistics between successive partners need to be integrated. Many researchers regard this as important for supply chain operations in general (Vaart & Donk, 2008). One evidence on supply chain study related supply chain improvement, more towards focusing on issues and challenges to logistics and supply chain improvement (Rosena, Harlina & Sabariah, 2008). However, they do not specifically focus on lean supply chain itself. The Lean supply model prescribes long-term relationships between customers and suppliers; based upon a close integration of physical and information flows, adopting practices such as EDI exchange, cost transparency, JIT with Kanban, codesign, etc. A study that empirically explores the supply strategies of European manufacturing firms within the third edition of the International Manufacturing Strategy Survey was conducted by (Cagliano et.al, 2004), they identified four clusters on the basis of the supplier selection criteria and the integration mechanisms adopted. Corsten and Will (1995) described lean production tenets as kanban systems, standardized work, teamwork, just-in-time inventory practices, continuous production flows, zero defects, integrated product development, continuous process improvement, and production islands.

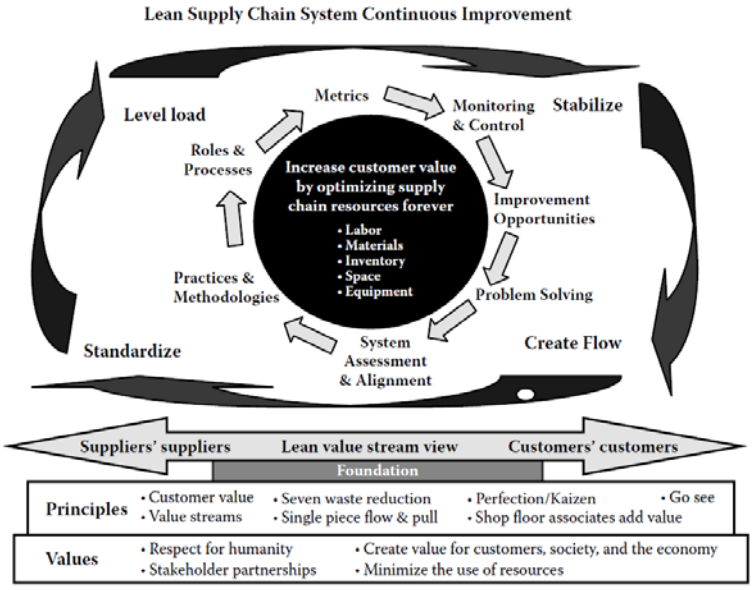
6. Implementation of Lean Supply Chain Model

With an improvement strategy and methodology in place, a vision set, and customer value improvement understood, it is time for implementation. This is the hard work of leadership: holding the organization accountable, challenging the organization to pursue perfection, coaching, and providing needed resources to achieve the goal. Implementation of transformational change to supply chains requires a three- to five-year time horizon. Changes in practices must be implemented and institutionalized. Leadership needs enough supply chain understanding to know when midcourse corrections are needed. This includes changing team members. Improvement progress should be integrated into every operational review with business unit leaders being expected to report on progress. The implementation steps are given below:

Step 1: The core infrastructure and collaboration network need to be analyzed internally.
Step 2: The selection process of partners need to be analyzed. The globalization of the supply
chain has brought cultures with very different business philosophies to the same bargaining table. Cultural differences can sometimes affect the selection of partners.

Step 3: The phenomenon of criterion to select suppliers for optimum supply chain performance will be identified. A collaborative, long-term relationship is most profitable over time. This will include all aspects of procurement including supplier selection and evaluation, creation and renewal of supplier agreements, requisitioning, purchase order processing and monitoring, receiving and quality control, claims, invoice control, and statistics.

Figure 2: Lean Improvement cycle



Source: Husby and Swartwood, 2009

Step 4: The lag time out of the design process will be calculated by feeding "at once" work and future delivery orders into the supply chain incrementally instead of waiting until the whole collection is put together. Introduce some measure of collaboration into:

Step 5: Product development: Collaborative product commerce (CPC) aims to reduce communication costs, delays and rework by giving each node in the supply chain access to design information at any time**.** Demand management does not belong to marketing and sales only. It involves production, logistics, supply chain planning and finance as well. For Sales support design of pre- and post-sales will be supported around the customer.

Step 6: Processes have to extend customer relationship management (CRM) activities out into the supply chain. Lean SCM will establish a customer-centric supply chain. Process will map the value stream inside each partner organization and throughout the supply chain so that everybody understands what adds value for the end customer and what does not. Lean SCM will determine what each customer values, and use these metrics to design products, services and touch points. Lean SCM will devise a map of customer segments based on these metrics. Use it to focus company service efforts around processes that support and encourage the buying behavior of the firm's top customers. Figure out how to apply them to less profitable marketplace segments. Lean SCM will develop and implement the solution and combine the metrics and relationship-building capabilities of CRM with the electronic links provided by today's Internet technologies.

Step 7: Process will be monitored, measured and refined. Waste will be eliminated from manufacturing, logistics, receiving and distribution. Detailed return, recycle and repair programs that enable the efficient management of product life cycles will be developed. Returns management is a reverse logistics function that affects almost every link in the supply chain. It can provide companies with a wealth of information on product performance, ease of use, defects and consumer expectations.

Step 8: People have to observe the collaborative technology and business process collaboration by Collaborative planning, forecasting, and replenishment (CPFR) and Collaborative product commerce (CPC) to measure the level of the lean supply practices. CPFR is the implementation of data and information transfer tools that facilitates timely, interactive communication of demand forecasts and inventory statuses among a chain of trading partners. It enables channel retailers, distributors, transportation providers, and manufacturers to synchronize supply with network demand from one end of the channel to the other. In the past, supply chains were burdened by isolated forecast, planning, and inventory systems, and consequently lacked accurate and timely demand information as well as visibility beyond immediate trading partners. CPFR simplifies and connects overall

channel demand planning with a single, real-time plan of forecast and supply. CPC requires businesses to execute product management processes in relation to how they will impact the production, planning, and distribution of products required by supply chain partners to meet specified or documented customer demand. It includes, and frequently improves upon, the traditional product management processes for cost, quality, and features.

Step 9: The goal of lean is continuous improvement. The process will go for a SCOR Model or improvement process (SCOR creates an "as is" and a "to be" state process).

SCOR defines a supply chain as "the integrated processes of Plan, Source, Make, Deliver, and Return spanning from the supplier's supplier to the customer's customer. SCOR assessment accomplishes the following:

1) Quickly identifies performance gaps through benchmarking.
2) Eliminates analysis time and effort through predefined cause and effect relationships embedded in its three-level logical structure.
3) Provides solutions designed to close performance gaps through best practices.
4) Defines enablers (including IT) required to support best practices.

7. Key Performance Indicator (KPI) of Garments Factory

Lean manufacturing key performance indicators are measurements and metrices that support and facilitate achieving critical goals of the organization. Key Performance Indicators (KPIs) are the measurements which are selected by a company to give an overall indication of the performance of the business. Lean Manufacturing KPI are very important for understanding and improving manufacturing performance; both from the lean manufacturing perspective of eliminating waste and from the corporate perspective of achieving strategic goals.

Table 2: Assessment of the Key performance Indicators before lean implementation

Assessment of Current situation						
#	**KPI**	**U/M**	**KDS**	**Lenny**	**Toyo**	**Valiant**
1	Cost per standard hour	Taka	22.53	48.15	21.35	34.19
2	Labor Utilization	Percent	45%	54%	48%	28%
3	Machineries Utilization	Percent	10%	21%	9%	8%
4	Productivity	Pieces	6,788	22,900	8,000	6,302
5	Performance	Percent	30%	59%	32%	35%
6	Cut to Ship Ratio	97%	96%	95%	93%	97%
7	Average monthly worker-earning	3,633	3,530 (780 incentive included)	2,468	2,400	3,633
8	Throughput time 1st bundle	2,019	4,692	1,223	1,174	2,019
9	Unnecessary activities	31,460	133,837	13,280	59,016	31,460
10	Inventories & WIP	55,900	426,000	103,413	955,403	55,900
11	Order Changeover	1.520	1,200	480	5,316	1.520
12	Wasteful motions	21%	25%	32%	29%	21%
13	Line Balancing	80%	76%	57%	71%	80%
14	Cost of Rejects	$9,759	$46,127	$12, 130	$ 23,649	$9,759

Source: DCG-ASDA/GEORGE Lean Project, Jan2011 to April 2013

The above table represents the current scenario of the key performance indicators of garments factory.
The table 3 represents some of the recorded achievements after lean implementation as given below:

Table 3: Achievements of Lean Implementation

Sl	Key-Result	KDS	Lenny	Toyo	Valiant
1	Increased Labor Utilization	65%	42%	58%	60%
2	Increased Machineries Utilization	100%	28%	70%	55%
3	Reduced Rework time Improved Right First Time	72%	51%	43%	32%
4	Reduced Throughput time	44%	56%	70%	65%
5	Reduced unnecessary labor	All helpers	All helpers in cutting	All helpers	All helpers
6	Increased Productivity Sewing-Finishing	Productivity	145%	28%	105%
7	Increased Productivity cutting room	Productivity	25%	119%	145%
8	Reduced Absenteeism	-67%	-91%	-62%	-78%
9	Reduced Labor Turnover	-60%	-90%	N/A	-91%
10	Reduced Overtime	Less 10 hours/week	N/A	Less 10 hours/week	Less 8 hours/week

Source: DCG-ASDA/GEORGE Lean Project, Jan 2011 to April 2013

8. Critical Factors for Lean SCM Implementation

Culture: The first and most important enabler in this list is culture. It is the predominant attitudes and behaviors which characterize the functioning of a group or organization. Culture impacts everything that happens in our organizations from the way customer service representatives behave to the way employees respond to problems.

Skills: Skills required for design, management, and improvement of supply chains are required enablers. Skills are sometimes confused with training. Training is essential, but practice and mentoring are also required to build and sustain continuous improvement competencies. Learning basic problem solving is one thing, but it is quite another to execute it by applying this knowledge

Metrics: It is imperative that key performance indicators (KPIs) correctly capture and focus our attention on important areas of performance. The importance of establishing a *balanced* set of metrics for measuring supply chain performance is predominant. This concept of balance ensures that no one performance characteristic is overemphasized.

Leadership: Making decisions is the role of leadership, who should be focused on the decisions only leaders can make. By encouraging and expecting people at all organizational levels to make decisions that are within their scope of authority, everyone becomes committed to organizational goals and projects. Before making a decision or committing to a specific improvement project goal, leaders must ensure that their executive teams understand the answers to the following questions:

• Where are we as a company?

• Where do we need to be?

Rewards: The lack of alignment of metrics and rewards is frequently an obstacle to supply chain performance. Sustainable supply chain competitive advantage is not achievable in organizations with conflicting metrics among various functions. If manufacturing is measured mostly on cost, they are likely to make it a higher priority than service and inventory to meet their objectives. When sales are measured only on top-line sales, they are likely to sell
products that are easier to sell regardless of the profit margin or capacity available.

IT Systems: Effective information systems are fundamental to institutionalizing the processes, practices, data, and metrics that support continuous improvement. Effective continuous improvement activities are data driven and availability of data expressed through supply chain metrics is critical to process analysis and decision making.

Other factors: The other factors which influence the implementation of lean are the nature of manufacture (discrete or continuous manufacturing process), socio-economic and political aspects (like competitor products, customers, regulation, suppliers, employees, companies skill, knowledge, experience, political stability etc.), nature and conditions of linking industries supplying inputs to the focal industry (suppliers motivation to implement lean, suppliers economic condition, vertical integration) etc.

Conclusion

A zero-waste environment requires the support of many pillars which must be constructed. It takes time and effort to achieve the correct corporate strategy and complete overhaul of the workforce culture. Moving from traditional production lines to a just-in-time (JIT) team concept will only be complete when all workers have been involved in all aspects of the continuous improvement culture. In any world-class apparel organization, much more effort is required from the manufacturing and production managers, engineers and other staff members in terms of support and services. This requires an entirely new business mindset. Lean is a powerful methodology utilized to reduce wastes in processes, thus reducing lead time and costs. When implementing Lean, significant training is needed to ensure that the team is fully knowledgeable and has the necessary resources. However, due to time restrictions and the need to manage Lean projects, it is useful to develop fully supportive case studies to facilitate the instruction. Case studies can be used either throughout the training to further reinforce concepts or as conceptual overviews. The needs and concerns towards the effectiveness of supply chain

management systems are vital, so the study of current trends is important in order to benefit supply chain performances.

References

1. Bodoganz (2002), Lean Supplier Networks, Massachusetts Institute of technology, ppt slides.
2. Cagliano, R., Caniato, F., & Spina, G. (2004). Lean, Agile and traditional supply: how do they impact manufacturing performance?. Journal of Purchasing & Supply Management, 10, 151-164. http://dx.doi.org/10.1016/j.pursup.2004.11.001
3. Charles Dagher, 2010, "Productivity and Social Enhancement Project – Bangladesh", GTZ-ASDA Pilot Project.
4. DeGarmo, E. P., Black, J. T., & Kohser, R. (1999). Materials and processes in manufacturing (8th ed.). New York: John Wiley & Sons.
5. Fisher, M. L., Hamond, J. H., & Obermeyer, W. R. (1994). Making supply meet demand in an uncertain world. Harvard Business Review, (May–June), 83-93.
6. Fulerton, R., & Mc Watters, C., (2000). The production Performance Benefits from JIT Implementation. Journal of Operations Management, 19(1), 81-96. http://dx.doi.org/10.1016/S0272-6963(00)00051-6
7. Husby and Swartwood 2009, Fix Your Supply Chain , How to Create a Sustainable Lean Improvement Roadmap, Taylor & Francis Group
8. Lamming, R. C. (1993). Beyond Partnership: Strategies for Innovation and Lean Supply. Hemel Hempstead, UK: Prentice-Hall.
9. Liker, J. K. (2004). The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer. New York: McGraw-Hill.
10. Mercado, G. (2007), Question Garments- Ask the Lean Manufacturing Experts Applying Lean in the Garment Industry, Thomas Publishing Company.
11. Naylor, J. B., Naim, M. M. and Berry, D. (1999) 'Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain', International Journal of Production Economics, 62, 1-2, 107-118.
12. Nicholas, J. (1998). Competitive manufacturing management: Continuous improvement, lean production, and customer-focused quality. New York: Irwin- McGraw-Hill.
13. Olsen, R. S., & Ellram, L. M. (1997). A portfolio approach to supplier relationships. Industrial Marketing Management, 26, 101-113. http://dx.doi.org/10.1016/S0019- 8501(96)00089-2
14. Rothenberg, S., Pil, F., & Maxwell, J. (2001). Lean, green, and the quest for superior environmental performance. Production and Operations Management, 10(3), 228- 243. http://dx.doi.org/10.1111/j.1937-5956.2001.tb00372.x
15. Van der Vaart, T., & van Donk, D. P. (2008). A critical review of survey-based research in supply chain integration. International Journal of Production Economics, 111, 42-55. http://dx.doi.org/10.1016/j.ijpe.2006.10.011
16. Womack, J. P., & Jones, D. T. (1996). Lean Thinking: Banish Waste and Create Wealth in Your Corporation (Revised and Updated 2003 ed.). New York: Simon & Schuster.
17. Womack, J., Jones, D. and Roos, D. (1990), The machine that changed the world, Macmillan, New York.
18. Ziad Moh'd. Ali Smadi, 2012, The Lean Supply Practices in the Garments Manufacturing Companies in Jordan, International Business Research Journal Vol. 5, No. 4