

Just in Time/Lean Purchasing Approach: An Investigation for Research and Applications

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Abstract—The concept of Just in Time (JIT) has been studied for more than 20 years, so there are lots of the academic articles and case studies which give the objectives, the backgrounds, the principals, and the techniques of Just in time. The objective of this paper is to gain further knowledge into the JIT/Lean purchasing approach and to identify future research directions. We will concentrate on JIT purchasing and the Lean purchasing, since the JIT purchasing is an important concept of the lean management, therefore in the first part, we will discuss about the JIT purchasing, as well as the advantages and disadvantages of this technique. In the following part, we will focus on the lean purchasing concept to show how the lean purchasing played an important role in the supply chain.

Index Terms—Just in time purchasing, lean purchasing, lean supply chain, lean management, lean production, and lean implementation

I. INTRODUCTION

The technique of just in time (JIT) was first published by Toyota Motor Corporation of Japan as part of its Toyota production System ([1]). In 1954 Japanese giant Toyota implemented this concept in order to reduce wasteful overstocking in car production.

JIT can be defined as a system, based on providing the right item at the right time in the right quantity at the right place by eliminating wasteful practices ([2] and [3]). It is a philosophy as well as a technique that guides a manufacturing company in organizing and managing its business more effectively, and in planning and controlling its operations more efficient.

Just-in-time is a movement and idea that has gained wide acceptance in the business community over the past decade. As companies became more and more competitive and the pressures of Japanese continuous improvement culture forced the companies to find innovative ways to cut costs and compete. The idea behind JIT, or lean manufacturing, is to have the needed supplies at the exact moment. In order to accomplish this goal a firm must constantly seeks ways to reduce waste and enhance value. The objectives of JIT are to eliminate waste and improve the flow of materials.

The first article relating to JIT was published in the International Journal of Production Research in 1977, titled Toyota Production System and Kanban System,

Materialization of Just-In-Time and Respect-for-Human system by [1].

The just-in-time system is no longer a new concept in the manufacturing world today. In the face of intense global competition, many firms are looking at improving techniques to manage their manufacturing operations. A comprehensive survey of just-in-time practices in the United States found that 45 percent of the contacted firms had implemented JIT programs and another 22 percent were planning to implement JIT the following year. JIT has evolved as a novel manufacturing concept based on a philosophy of trust and commitment of the entire organization. The benefits of implementing a JIT system impact all entities involved in supply-chain management.

II. THEORETICAL BACKGROUND

In today's competitive global business environment, the goal of all manufacturing systems is long-term survival. A manufacturing company's survival in an increasingly competitive market closely depends upon its ability to produce the highest quality product at the lowest possible cost and in a timely manner with shortest possible lead time. The Just in Time purchasing was born in this environment.

Under JIT manufacturing, the JIT purchasing is done in small batches and ideally from a single source as opposed to purchasing large batches from multiple sources. Ansari and Modarress ([4] and [5]) have studied this technique for a long time, based on some companies' cases, including General Motors, Hewlett-Packard, Honda, Nissan and Sony. They reveal that implementing JIT purchasing can increase up to 43 percent the product quality and up to 21 percent the productivity.

Many studies indicate that the purchasing function is one of most importance for successful JIT implementation ([6], [7], [8] and [9]). JIT purchasing is an extension of the internal JIT system, is the inevitable requirements and conditions for implementing JIT production. The fundamental difference between traditional and just-in-time (JIT) strategies lies in the approach taken in the intermediate stages of production ([10]). The traditional approach adopts a functional organization designed to minimize manufacturing costs for the particular component. A JIT system organizes the intermediate processes to respond directly to demands from later stages of production.

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III. JIT PURCHASING

A. Characteristics of JIT Purchasing

Comparing the traditional method, the JIT purchasing has some characteristics. The concept of “lean supply” has been reviewed and analyzed by many authors ([11]). They focus on identifying those practices characterizing of JIT purchasing, which ultimately aim at transferring JIT production systems upwards into the supply chain. Hale Kaynak ([12]) mention that the Characteristics of JIT purchasing can be broadly categorized into two groups: external and internal. The internal is related to the organizational commitments, including training, team-working and managing. The external characteristics of the JIT purchasing can be summarized as purchasing in small lots with frequent deliveries, mutual consistent improvement by the buyer and supplier, supplier cooperation and efficient communication.

B. Benefits of JIT Purchasing

Many articles have already been published discussing the various advantages of JIT. Since the JIT purchasing is an important part of the overall JIT program and produce the main benefits such as lead-time reduction, reduction in inventory level, the quality improvement of the incoming parts and improvement in relationship with the suppliers.

C. Scheduling Flexibility

The First benefit is mentioned by [13], the JIT purchasing can help reduce the lead-time, owing to the lead-time reduction, the delivery frequency can be increased and the order sizes can be reduced. The manufacturing is more flexible than before. Compared to traditional purchasing approaches, delivery lead times under the JIT system are considerably shorter. The flexibility prevents confusion in the manufacturing plant and offers unique competitive advantages to manufacturing firms since they are capable of adapting to changes in the environment more quickly. Lead-Time reliability is usually much better for JIT systems. This implies higher levels of customer service and lower safety stock requirements for the company. Lower levels of safety stock contribute significantly to reduced working capital requirements for the firm.

D. Reduced Inventory Levels

The second benefit is the reduction of inventory levels and storage space requirements ([14]). JIT purchasing facilitates reduction in inventory levels and the associated inventory holding costs. Toyota has been able to reduce inventory levels to such an extent that their inventory turnover ratios have gone up to over 60 times per year, compared to corresponding ratios of 5 to 8 reported by most American manufacturers.

This generates an upward shift in the amount of information shared with suppliers, as lower inventories, combined with more frequent deliveries and lower lot sizes. This needs the buyer to provide suppliers with a

more accurate production schedule and operation-related information to maintain a high level of lead-time reliability.

E. Improved Quality

The third, quality improvements of incoming parts, raw materials and delivery processes are likely to lead to a reduction in the number of suppliers. According to [15] product quality and productivity have substantially improved through JIT purchasing, although these vary with the period of implementation. The lowering the number of suppliers will cause an increase in the product volume for the remaining suppliers and will enable the buyer to concentrate on added-value activities with his suppliers rather than coordinating them ([8] and [16]).

F. Relationship between the Buyer and Supplier

During the last decade or more, industrial supply structures have undergone significant changes derived from an evolution from adversarial relationships to co-operative relationships based on the generation of trust. This new relationship includes an ability of suppliers to respond quickly to customer needs, consistency and quality of production, and, flexible deliveries ([17]). A JIT purchasing program involves close technical cooperation with suppliers. This particularly means the cooperation between manufacturing and design engineers. Because of smaller lot sizes and frequent delivery schedules, suppliers are in a position to receive quick feedback regarding any potential manufacturing or design problems. Also, manufacturing is in a position to implement engineering changes quicker because of the reduced inventory levels. Some analysis report that the supplier quality improved since the JIT system was adopted.

G. Limitations of the JIT Purchasing

JIT Purchasing is quite difficult to implement. The switch to a JIT system presents formidable challenges. Marketing must be prepared to change their behavior when their customers are using the JIT system. Some of the common problems associated with implementing the JIT system are as follows.

The first, for some material or the incoming parts, the JIT purchasing takes a signal supplier, which could increase the risk of out of stock if the supplier has some problem of supplying. Ansari and Modarress ([15]) suggest that the ideal number of suppliers for each material, or class of materials is one, which enable avoid waste and improve the quality. Newman ([18]) suggests that the single sourcing policy may have some long-term problems, such as the technological trust and the loss of supplier identity.

Little batch purchasing will increase the transport frequency and the logistic fees, which will increase the purchasing cost. For this problem, the better solution is that the supplier places a stock near the manufacture.

Since implementation of the JIT purchasing strategy

needs the cooperation between the supplier and buyer, the lack of the communication of the two partners will decrease the efficiency of the supply chain. Under JIT purchasing, the buyer and supplier need to share the information of the manufacturing in order to assure the accurate information of the supply and demand.

The shift of responsibilities from the manufacturer to the supplier, associated with JIT sourcing implementation, does not encourage suppliers to adapt JIT supply and promote internal changes in their organizations ([19]). Helper ([20]) suggests that it is important to encourage both supplier and customer to develop capabilities of JIT production as well as JIT delivery. By motivating suppliers to adopt JIT production/delivery, the firms can obtain improvements in quality and delivery, and suppliers have to learn to respond to the increasing demand of its customers, which lead to cost reduction ([21]). The relationship must be buyer dominant, buyer-supplier interdependent or a combination. The focus on proactive supplier development in a close and long collaborative relationship is appreciated and the firms must support innovative suppliers.

The following section of the paper outlines the purchasing activities in Lean production concept.

IV. LEAN PURCHASING

According to the lean purchasing, supplier network is considered as a key source of competitive advantage ([22]) by fostering close working relationships with a limited number of suppliers, and promoting open communication among supplier partner networks, and developing a long-term strategic relationship orientation for achievement of mutual goals.

Starting point, in lean purchasing, is typically to map the current purchasing value stream and its intersection with other processes, functions and suppliers so this allows to identify the waste. It is just a matter of good leadership and organizational self-discipline to understand the root causes of waste, and eliminate non-value-added activities and processes, simplify and together with suppliers create a future value stream in the process. A flow of information is hence needed to be created while establishing a pull of information and products with suppliers ([23]).

A. Advantages of Lean Purchasing

As perceived by different authors, key benefits that Lean purchasing provides to organizations have been summarized as the followings:

- a. Optimized processes result in less interfaces and more degrees of freedom for strategic purchasing tasks.
- b. Low-waste value chains thanks to the integration of suppliers, according to consumption requirements.
- c. Increasing the efficiency of the purchasing organization through low-waste processes, suitable standards and function-appropriate qualifications.

- d. Shortening of innovation cycles and creating the prerequisites for zero-defect processes through the early integration of strategic system partners in the development process.
- e. Competitive products thanks to cross-functional cooperation in value engineering, standardization.

B. Internal Lean before Lean Purchasing

Baudin ([24]) suggests that the companies must be first lean and show the successful results of their own lean work before involving and motivating suppliers in the Lean process. Procurement and purchasing are usually the final functions to be included in the lean work ([25], [26] and [27]). According to [22], internal Lean within purchasing is one of the key members that allows the firms to double their own productivity and to help their suppliers do the same. The author also suggests that the first goal is to remove all intercompany waste, or waste due to the inability of the different value stream members within organization to share strategies and integrate their key internal processes. And the second is to remove intra company waste or waste due to the inability of suppliers, in order to be more efficient in their own internal processes. It is essential for the purchasing managers to:

- a. Establish a lean organization (e.g. lean promotion office) with clear set goals, clear responsibilities ([28]) and a strategy of change ([29]): The aim is to support the procedures and culture within purchasing.
- b. Standardize the stable processes and visual management: It is about making processes and communications simple, clear, stable, visual, and direct ([30]).
- c. Employ the methods that are concerned with lean production tools such as SMED, work cells, teamwork, 5S, and Kaizen events in order to increase productivity and focus on value-added activities, rather than administration.

C. Purchasing Strategy and Supplier's Integration along the Entire Value Stream

It is obvious that for the companies wishing to adopt lean production, they cannot be simply the only single company, they must ensure that not only they are lean, but also their supplier network is lean. It is in this context that the important point is to set the strategic purchasing for lean production for firms to double their own productivity, and to integrate the value stream (supplier network) ([22]).

a. Strategic purchasing

Creating a win-win scenario or purchasing partnership is crucial part of purchasing strategy in Lean concept ([31] and [22]). According to [31] this partnership can be defined as "an agreement between a buyer and a seller that involves a commitment over an extended time period, and includes the sharing of information along with a sharing of the risks and rewards of the relationship". That means the buyer's goal is no longer to maximize its own profits and minimize the profits of the supplier (Table I).

TABLE I. POTENTIAL ADVANTAGES OF JAPANESE STYLE SUBCONTRACTING ([31])

Management	
-	Reduced supplier base is easier to manage.
-	Increased mutual dependence lowers risk of losing supply source and creates greater stability through increased supplier loyalty.
-	Reduced time looking for new suppliers/gathering competitive bids.
-	Allows for joint planning and information sharing based on mutual trust and benefit.
-	Loyalty may increase supplier attention and customer service in areas such as: <ul style="list-style-type: none"> • Lead time reliability • Priority in times of scarcity • Increased attention when problems arise
-	Greater cooperation from suppliers to support the firm's strategy.
Technology	
-	Partners may be more willing to share/give access to technology.
-	Partners may be more willing and capable of participating in product design based on knowledge and commitment to the other partner.
-	Supplier knowledge/involvement in design may: <ul style="list-style-type: none"> • Improve quality • Reduce time to market for new products/design changes
Financial	
-	May share business risks through: <ul style="list-style-type: none"> • Joint investment • Joint research and development • Sharing of financial risks associated with market shifts
-	Information sharing/forecasting may reduce inventory levels.
-	Long-term commitment of a partnership may lead to more stable supply prices.

b. Suppliers integration

Lean purchasing employs a high integrated small number of effective supply partners for key materials in order to ensure a constant and efficient supply of materials. Bicheno ([32]) defines that lean practice is to work with few and reliable suppliers that offers a wide range and large volume of materials/products. It is all about reducing the supplier base and components, increasing resources to the remaining key suppliers. That means identifying suitable strategic suppliers for lean work ([33]). Only suppliers with short delivery times are integrated into the value stream. The firms should encourage suppliers to make the lean transformation and involve them in lean activities. It enables the firms to fix problems, share savings and increase quality goals with their supplier network ([23]) that enables to develop the correct and most effective supply channels in the long term. Because in the context of lean concepts, the safety and flexibility of supply in the supply chain are to be rated higher than the cheapest price.

Peter Hines ([22]) suggests that a transparent system based on sharing of the profit are one of the mainly integration mechanisms. He emphasizes that a coordinated approach with the suppliers based on a shared view of the end customers' demand is necessity for longer term relationships. This is the same point as [34], who states that the firms' long-term success requires considerable interactions and information sharing. Both [32] and [33] emphasize that it is essential for the firms to

create a culture of continuous improvements and knowledge sharing network to improve processes.

c. Supplier association

Peter Hines ([22]) suggests the first and most important mechanism for supplier development and coordination is the supplier association. This is called for a group of a company's most important supplier who have the mutual benefits. Its fundamental benefit is that it brings suppliers together, so that they are able to share best practice and technique usage. Developing supplier association can lead to continuous improvement benefits, reduction of waste and increased value thanks to sharing best practice/strategy, data. A supplier who does not have the resources to develop lean programs can benefit from innovation and training from another firm within the association.

Peter Hines ([22]) also states that a further purpose is to coordinate the flow of information within the association increasingly, which is shared from suppliers to customers and between suppliers. It could help suppliers better understand the requirements of their customer and the end consumers.

All above benefits help the firms better integrate their supplier network. However, a market share is only ensured over the long term through an effective association. It is so essential for the supplier association to build and develop a mutual trust and long-term relationships.

d. Mapping the supply chain around value streams

The mapping refers to analyzing the purchasing processes and activities within the organization and across the supply chain. The aim is to identify areas for improvement in term of quality, delivery and costs. Value stream mapping is the most well-known tool for lean, described by ([32]), to map the current state, the future state of a process and action plan for implementation in both material and information flow. This allows to understand and identify what is value-adding and what is a waste in processes also its causes regarding to customer's desire before removing it so that value flows without interruption of waste.

e. People and teamwork

It takes a while for the firms to implement and achieve sustainable long-term lean results. The hard part is working through people, gaining their participation, and involving everyone in the change.

In Lean, the companies often make the mistake of focusing on Lean improvement tools, rather than people. It is important to understand that continuous improvement and change need to be done through people. Peter Hines ([22]) emphasizes that the employees are seen as a long-term asset. It means the most important part of lean success is through the involvement of people at various levels by sharing their ideas to build energy to move positively ahead in the lean process.

According to [30] the understanding of people and human motivation and the ability to cultivate leadership, teams, and culture are important success factors for lean.

Team leader, the value stream manager, and the lean promotion office, who have experienced Lean through training and application, play an important role to create a better lean organization. As they can help others to create lean processes by transferring their knowledge.

V. CONCLUSION

The purpose of this paper is to review the purchasing in the concept of JIT/Lean system. A major literature review has revealed with the objective to gain further knowledge into the JIT/Lean purchasing approach and to identify future research directions. The review allowed development of the purchasing models for JIT/Lean approach and identification on how the purchasing function also the integration of suppliers evolve along the entire value stream in the supply chain between both JIT/Lean concept.

Despite the advantages and benefits discussed earlier, either JIT/Lean purchasing approaches may be hard for medium sized enterprises to engage in due to size, supplier environment and lack of technology and system adoption. A study by [34] shows that JIT/lean approach is much less used in small enterprises. Large firms have a better chance in achieving such JIT/Lean purchasing. As it is more likely that they have enough resources and high power to proactively work with suppliers and enable to exercise JIT/Lean methods.

Even though, the benefits of JIT/lean purchasing in the perspective of small and medium sized enterprises must be discussed for the researchers. More work is needed, especially on how best to build and enhance JIT/Lean purchasing for the medium sized companies and to further investigate what suitable methods are applicable and what the opportunities and hindrances might be in deployment of the JIT / Lean system in general and JIT/Lean purchasing in particular.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

In this research Ph. Hoang, and X. Cao conducted the research; A. Taghipour supervised the research. All authors had approved the final version.

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