Just-in-time purchasing:
An investigation for research and applications

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Abstract

Just-in-time (JIT) purchasing is a systems approach for developing and operating the purchasing function. JIT purchasing along with the total quality management in many industries has been successful in reducing inventory and increasing the overall effectiveness of purchasing function and hence the productivity of manufacturing. JIT purchasing methods are successful not only in Japan, but also in many countries like, South Korea, Taiwan, USA, UK, Germany, France, Hong Kong, etc. JIT purchasing has tremendous effects on the operations of production, distribution, and accounting. An attempt has been made in this paper to review the literature available on JIT purchasing with an objective to establish a framework for improving the effectiveness of purchasing function. In addition, some future research directions on JIT purchasing are indicated. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

JIT purchasing means providing materials to the production facility just as they are required for use. It goes against most of the traditional ideas held by manufacturing, purchasing, and materials management. JIT purchasing is integral and is typically incorporated when describing JIT management practices. The precision involving quality, timing and quantity required of operations within a JIT manufacturing system is equally important for operations upstream from the JIT manufacturer. With JIT purchasing, suppliers become extended operations of the JIT manufacturer. The importance of JIT purchasing in the overall JIT management system is demonstrated by the magnitude of parts by a typical manufacturer. In 1985, purchased materials for all US manufacturers amounted to 60% of total sales revenue. Japanese manufacturers typically have a much higher percentage of total manufacturers [1]. Research and applications concerning JIT-purchasing techniques has been reported in various studies [2–6].

The fundamental aim of JIT purchasing is to ensure that production is as close as possible to a continuous process from receipt of raw materials/components through to the shipment of finished goods. The success and resulting performance of
The purchasing system is based upon cooperation between the purchaser and supplier. Some of the elements of this system are as follows [5]: (i) smoothed flow of materials between suppliers and buyers, (ii) order cost reduction, (iii) stock reduction, (iv) quality, and (v) product simplification.

JIT purchasing practices are characterized by a small supplier base whose firms are located close to the buyer’s plant, make frequent deliveries, and are considered long-term “partners” with the buying company. Under these operating conditions, supplier relations are built on a high degree of mutual trust and openness. Both the buyer and the supplier must share information and also protect its confidentiality. When entering a long term relationship, it is important that the buyer selects suppliers that have consistently exhibited high levels of quality and delivery reliability [2,6]. A number of articles have been published [4,5,7,8] on the practice of JIT purchasing; however, most are descriptive in nature but leave little in the way of specific and implementable ideas. They are simply dealing with one or two methods installed in an environment about which the reader is given in-depth research leading to a more insightful understanding of the concept, but also provide little concrete knowledge. Researchers build models to enhance our understanding of the subject, but then often fail to show the application of these models in actual manufacturing environments. Further, the models often are restricted to a single JIT purchasing method or technique and overlook the wholeness concept which Schonberger [5] and Hall [4] have emphasized.

Realizing the importance of JIT purchasing both in manufacturing and service industries, an attempt has been made to review the literature available on JIT purchasing with the objective to bring the most pertinent factors of JIT purchasing to the fore and future research directions. Also, a framework has been proposed to improve the overall effectiveness of JIT purchasing function and hence the whole organization. The organization of the paper is as follows: Section 2 presents the review some of the literature available on JIT purchasing. Some future research directions on JIT purchasing are presented in Section 3. Section 4 deals with a framework for solving the problems of JIT purchasing. Finally, summary and conclusions are presented in Section 5.

2. JIT purchasing: An overview

The JIT purchasing concept attempts to reduce replenishment lead time by utilizing suppliers located close to the using plant and by ordering small quantities, which in turn reduces a supplier's workload per period. The most important aspects of the JIT purchasing concept focus on new ways of dealing with suppliers and a clear-cut recognition of the appropriate purchasing role in the development of corporate strategy. Suppliers should be viewed as “outside partners” who can contribute to the long-run welfare of the buying firm rather than as outside adversaries. The major actions focus on attempts to reduce the ordering cost and replenishment lead time values. Hahn et al. [3] noted that more systematic empirical research is needed to assess the costs and benefits of JIT purchasing systems. Such research should provide new dimensions and opportunities for refining existing purchasing and materials management theory.

Ansari and Modarress [9] presented major problems in purchasing that include lack of support from suppliers, lack of top management support, low product quality, lack of employee readiness and support, lack of support from carrier companies, lack of engineering support, and lack of communication. Of these, poor supplier support, closely followed by inadequate understanding and support by top management, are the most severe problems encountered in implementing JIT purchasing.

The use of jointly determined objective standards in examining the work done within both the buyer’s plant and the supplier’s plant generally results in significant long-term improvement in quality, cost, and delivery performance. Manoochehri [10] presented the relationship between suppliers and the JIT concept. He estimated the number of suppliers, the relationship with suppliers, sharing information with suppliers, and geographical dispersion. Schonberger and Ansari [6] proved that the JIT purchasing can improve the quality. The potential benefits
of JIT in the area of purchasing include the following: low scrap costs, low inventory carrying costs, design flexibility, low overhead costs, high quality, and improved productivity. A conceptual model is presented in Fig. 1 to illustrate the JIT purchasing system and the major issues involved with reference to suppliers and buyers linkages.

Schonberger and Gilbert [11] explained Japanese JIT purchasing practices and their benefits. The characteristics of JIT purchasing are: few suppliers, nearby suppliers, frequent deliveries in small lot quantities, long-term contract agreements, close relationships between buyers and suppliers, and the use of company-owned or contract shipping. The buyers benefits of JIT purchasing are: reduced inventory carrying costs, reduced cost for parts, few suppliers to contract with, reduced expediting, reduced travel and telephone costs, fast detection of defects, less need for inspection (of lots), quick response to engineering changes, and reduced rework, late deliveries, production control and supervision.

The neglect of research in analysing the structure, participants, processes and relationships of the marketing center has been emphasized by Salmond and Spekman [12]. They pointed out that there is a need for more research to understand the dynamics of the relationships between suppliers and buyers. According to Vonderembse et al. [13], suppliers have traditionally been selected based on the “best” bid, with unit cost as the primary criterion. Changing circumstances, however, is making the process of supplier selection a multiple criteria decision. Product quality, product performance, delivery reliability, and availability are now rated more important than product cost when selecting vendors. Increasing productivity of purchasing authority, decreasing inbound shipment

Fig. 1. A conceptual model to illustrate the supplier–buyer relationship under JIT purchasing.
size, reductions in the number of motor carriers used, and decreasing lead times are all prevalent tendencies. In most of these areas, firms which have implemented JIT are evolving at a faster pace than non-JIT companies. Also, although paperwork continues to increase, JIT users are experiencing less of an increase than non-JIT users. There are noticeable changes in the structure of the purchasing organization as well. Increased communications with other functional areas and suppliers are common. Furthermore, many purchasing departments are viewing suppliers as strategic partners and are acting accordingly. The number of suppliers per firm is being reduced. Suppliers are also accepting longer contracts are making valuable suggestions, and are being recruited as members of product design and continuous improvement teams [13].

Herbig and O’Hara [14] show how partnerships are critical to the success of JIT purchasing on which competitive ability so often depends. The research concludes that partnerships will continue to increase in number and that OEMs will certainly reap the benefits of what is necessarily an open, shared approach to business. As interaction between these suppliers and their customers deepens, other techniques have been jointly instituted, such as barcoding and electronic data interfacing. Some partnerships have developed “customer-linked strategies” which represent a comprehensive, integrated set of marketing, operations and information policies and practices designed to satisfy mutually the requirements of important customers in their markets. However, the number of partnerships available for loyal, committed suppliers will be small in relation to former times when multiple sources were pursued by manufacturers. Ever shortening product life cycles require that the activities between engineering, procurement and manufacturing become concurrent.

Martel [15] stresses the role of purchasing in a world-class manufacturing firm by developing a reliable supplier base through supplier partnering and certification. Supplier partnerships have demanded increased communications and teamwork, and these partnerships are leading the way to a win–win scenario for both buyer and supplier. Purchasing uses partnering as a competitive weapon, and it is one of the keys to success and long-term survival.

According to Freeland [16], a 1988 survey of JIT practices in the US found that 45% of the companies contacted had formal JIT-purchasing programs. Another 22% planned to implement JIT purchasing in 1989. Some of the major findings of the survey are: (i) the longer JIT purchasing is in place, the greater the perceived benefits, (ii) quality is the most important criterion in selecting those parts to be purchased on a JIT basis, (iii) the distance between supplier and buyer is not an important criterion in deciding which parts to purchase on a JIT basis, but being geographically separated is a major impairment to the implementation process, (iv) JIT purchasing does not imply single sourcing, and (v) contact agreements between buyer and seller for JIT purchasing are more inclusive than agreements for non-JIT purchasing. In the following section, some of the drawbacks of the existing literature on JIT purchasing and future research directions are discussed.

3. Future research directions

The integration of the design elements of the purchasing/production system to promote the efficient flow of materials is an essential aspect of JIT systems. According to Hahn et al. [3], close examination of fundamental inventory and purchasing theories, however, indicates, the JIT purchasing concept is to be well founded in the existing theory. It is essential to develop mathematical models for determining the number of suppliers, the relationship with suppliers in terms of service level and respective costs involved, sharing information with suppliers, geographical dispersion, determining the level of finished product required, the frequency of deliveries by suppliers serving JIT producers and transportation optimization.

The neglect of research in analysing the structure, participants, processes and relationships of the marketing centre has been emphasized by Salmond and Spekman [12]. This points out an anecdotal nature of the evidence of these closer, long-term relationships, and the need for more research to understand the dynamics of the
relationships. Foster and Horngren [17] discussed the justification such as a simple system and more accurate cost information for changes in cost accounting for JIT purchasing. Therefore, there is a need to develop a cost management system to facilitate JIT purchasing. The development of expert systems especially to JIT purchasing systems is essential considering the dynamic environments in which the systems are operating.

Empirical models that measure the costs and benefits are essential to evaluate the performance of JIT purchasing systems. The empirical models should relate the variables/parameters such as delivery lead time and manufacturing overhead costs. Nevertheless, the same methodology can be used for non-value-adding items to study the performance of JIT purchasing in any production system. Based on the review and the scope of JIT purchasing, the integration of JIT purchasing with other functional areas has been identified as the most pressing concern for improving the overall effectiveness of the manufacturing organization. Some of the strategies/techniques used for this are concurrent engineering (CE) and information technology (IT). The application of CE and IT in the design of a JIT purchasing system and some of the key strategies/techniques for solving the problems of JIT purchasing are presented in the following section.

4. A framework for solving the problems of JIT purchasing

A conceptual model is developed and shown in Fig. 2 to illustrate the application of concurrent engineering (CE) principles in the design of a JIT purchasing system. As noted earlier, the integration of purchasing function with other functional areas such as design, production, distribution and accounting should play a significant role in the design of a product using CE that would result in a most cost effective and reliable JIT purchasing system. JIT purchasing includes low order cost, small lot size ordering, very few suppliers, perfect quality, low overhead cost (nonvalue adding activities), and effective and efficient transportation and material handling systems. These factors should be taken into account while designing a JIT purchasing system. Suppose, smaller lot ordering requires a cost effective ordering system incorporating EDI and EFT under repetitive production/ordering environment. To achieve low ordering cost of materials, the product should have few components, the design of a product should consider that the components are available in proximity to facilitate an effective transportation system and hence the JIT purchasing. Conversely, the design of a product should take into account the issues of production, marketing, distribution and purchasing function as well. The
other factors that would support a JIT purchasing system using CE are proximity of the suppliers and use of own transportation systems. These factors should be taken into account while designing a product in the JIT purchasing environment.

A list of strategies/techniques is presented in Table 1 for designing a JIT purchasing system and solving the problems of JIT purchasing. In manufacturing environments the purchasing manager should seek to obtain responsibility for analysis of future bought-in requirements expressed by the MRP or other computer-based system and to take responsibility for the extent to which commitments are made for the supply of required materials. The buying and support staff must be subject to an internal performance monitoring system involving the setting of agreed objectives and subsequent measurement. This should be supplemented by regular review by the purchasing manager of each buyer’s activity involving cost status, volumes and tactical planning for improvement. A training plan to promote professionalism in the department particularly by the winning of recognized qualifications should be instituted and encouraged, and budgetary assistance should earnestly be sought where necessary to achieve this. The manager should aim to produce for inspection a departmental manual setting out the principles and practices by which he expects his staff to perform. There is a need for training the staff and purchasing manager by word and behaviour to shed the notion that purchasing material values are sufficiently large to justify a purchasing department, then its function most probably ranks at least equal with most others in the successful running of the enterprise [18].

A manufacturer-supplier JIT relationship results in dramatic changes in the way the supplier performs its operations. Planning is one of the areas most widely affected by JIT. To fulfil a JIT strategy, it is critical that planning be co-ordinated in: sales, purchasing, financing, warehousing requirements. As compared to non-JIT circumstances, under JIT, there must be tighter production schedules and more control over transportation methods and inventories. Additional warehouse space may be necessary, suppliers must be financially secure, and personnel must be conscientious. Extensive negotiations are needed prior to consummating a JIT commitment [19].

The purpose of integration of all functional areas is to improve communication and cooperation in JIT purchasing. Pegels [20] offered suggestions for integrating various functional areas in manufacturing organizations such as to improve the communication and hence improve the material flow. There is a number of other aspects that should be taken into consideration to improve functional-areas integration: (1) top management support, (2) proper organizational structure (for example, matrix organization), (3) appropriate management control system, (4) effective incentive and merit system, (5) encouragement by all management levels, and (6) leadership by all management levels. The organizational culture should be modified in such a way that it includes cooperation and communication in all the functional areas. Joint

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<th>Problems in JIT purchasing</th>
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<td>Technical and financial support and incentives from customers, single source/few suppliers base</td>
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<td>Lack of top management support</td>
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programmes, matrix organization, sign-off stages, CAD/CAM, CE, and programmes management to promote communication and cooperation between functional units. Advances in information technology such as Multimedia, Internet, WWW, CAD/CAM, MRP, EDI and EFT can be used to improve communication and in turn obtain a cooperative supported work to achieve JIT purchasing. When moving from traditional purchasing to the JIT purchasing, there is a need to overcome any sort of resistance from employees. This can be done by suitable education and training programmes on the JIT purchasing together with suitable incentive scheme. The lose of production while moving to JIT purchasing can be overcome by the gradual implementation process. Alternatively, idle workers can be utilized to educate and train them in the new purchasing concepts and techniques.

One of the most frequently discussed ways to reduce the overhead costs associated with the JIT production systems is automation. Robots can have a role in sophisticated materials control systems that automate logistical transactions; lasers can read bar codes and eliminate the need for data entry operators to record movement transactions manually; computer-aided inspection can help reduce the costs of processing quality transactions; a smoothly running material requirements planning system can make the processing of balancing transactions cheaper. Another type of data integration unites manufacturing data bases with those of other functional areas. Most familiar is the link between engineering and manufacturing established by CAD/CAM systems, but there are others with equal or greater potential impact.

5. Summary and conclusions

In this paper, an attempt has been made to review the concept of JIT purchasing and some of the literature available on JIT purchasing with the objective to gain further insights into the JIT purchasing and to identify future research directions. One of the major issues identified from the review of JIT purchasing literature is the integration of purchasing function with other functional areas such as design, production, marketing, distribution and accounting. It has been identified that CE principles can be used for such an integration. Subsequently, a framework has been proposed in this paper to design a JIT purchasing system using the application of CE. Furthermore, a list of strategies/techniques is offered to overcome some of the major problems of JIT purchasing. One of main future directions is the modelling and analysis of JIT purchasing system from the perspective of supply chain management. Furthermore, the application of information technologies such as EDI and EFT play a significant role in achieving JIT purchasing.

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