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JIT IN SERVICE SECTOR: LITERATURE REVIEW, CLASSIFICATION AND DIRECTIONS FOR FUTURERESEARCH

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ABSTRACT

JIT is an approach for reducing manufacturing costs while simultaneously improving the quality of a product. Numerous organizations have been benefited in terms of time and cost savings due to JIT practices. However, most of the reported instances of successful and unsuccessful JIT practices lie within manufacturing domain. JIT concepts and tools, originally developed in the manufacturing domain, can be identified, analyzed and altered to fit and benefit service organizations. This paper reviews relevant literature. The objectives of the review are (I) to study the relevant literature in the area of JIT in service sector (ii) to classify the literature (iii) to identify the research gaps in the area of JIT in service sector.

Key words: *JIT, cost, quality, service*

INTRODUCTION

The service sector is expanding very rapidly. Service sector constitutes more than 70 percent of the GDP in many developed economies. According to the 1999 Statistical Yearbook (United Nations, 1999) service sector employment is more than 80% in United States and more than 70 percent in Canada, Japan, France, Israel, and Australia. The extraordinary growth of the service sector has focused attention on challenges of effective management of service organization and operations vastly different from the challenges faced in manufacturing settings. Due to rapid developments in information technology, globalization, changing customer needs/preferences, and the changes in relative wealth between the developed and newly developing economies, the effective management of service systems addressing productivity and quality issues will become even more important in the coming years. The management and marketing systems in the services sector continue to suffer from lack of adequate systemization. The techniques for effective service operations management are not fully developed as in manufacturing. This paper reviews the literature on the applications of JIT in service sector and identifies some research directions for futurework.

LITERATURE REVIEW

The literature is surveyed and classified as literature pertaining to hospital and health care industry, administration, maintenance, service sector in general, human resource management, restaurant, warehousing operations, mail-order operations, finance and public sector. This is schematically shown in Table 1. It may be pointed out here that major literature pertains to health care industry, administration,

and maintenance management systems in the form of conceptual articles and case studies. Some case studies in the field of restaurant, mail-order, warehousing, and finance operations have also been reported. Literature in the form of survey and modeling is very limited and only one empirical study in JIT implementation in public sector has been reported.

Table 1. JIT in service sector: classification of surveyed literature

S. No.	Service sector	Relevant literature
1.	Hospital and Health Care Industry	Anonymous [1, 2] Berling&Geppi [3] De Johns [9] Griesler&Aggarwal [15] Laplante [18] Lynch [10] Noorda [23] Whitson [27]
2.	Administration	Billesbach&Schniderjans [4] Manske [21] Feather and Cross [13]
3.	Paper Work Operations	Feather and Cross [13]
4.	Maintenance Operations	Claire [7] Savage Moore [24]
5.	Service Sector	Chase [6], Giunipero& Keiser [14] Inman &Mehra [16] Duclos et al. [11] Yasin et al. [28] Yasin et al. [29] Krajewski and Ritzman [17]
6.	Manpower planning	Messmer [22]
7.	Restaurant and Hospitality Industry	Shinohara [25]
8.	Warehousing	Carlson [5]
9.	Mail-order operations	Conant [8]
10.	Finance	Lee [19]

JIT IN HOSPITAL AND HEALTH CARE INDUSTRY

Whitson [27] suggested JIT delivery of the items to eliminate inventory in hospital operations. JIT delivery means that the products needed would be available only when they are needed. This assumes that delivery system is reliable. The item would be delivered to the point of use, by passing the warehouse. This would eliminate the storage and excessive handling of the item. If this ideal situation could be realized, it is clear that the number of times that each item is handled would be reduced. The less the items are handled, the less money is spent by the organization getting the necessary items where they need tobe.

Dorene Lynch [10] reported JIT and stockless approach to provider- supplier relationships has proven to be a win-win proposition for the partners that have implemented it in many manufacturing industries and healthcare organizations as well. This strategy will fundamentally impact the entire cost structure

with in the hospital supply distribution chain. The sweeping changes the health care industry experienced during the 1980s are leading creative material managers to seize the initiative to improve the current operating costs of their hospitals. They do not want to be left behind "holding the inventory"

Laplante [18] stated that over the past two decades, many industries have converted to a stockless inventory system to reduce the amount of money tied-up in inventory that is waiting to be used. Some of the benefits of this system such as costs saved because employees are not being paid to handle the merchandise unnecessarily. Other ways that this system saves money is by freeing up space that was previously used to store inventory. This can be direct savings if the space used to inventory supplies is leased. Alternatively, the space can be converted into productive space.

According to DeJohn [9] and Anonymous [1, 2] health care industry has changed drastically over the past twenty years. Hospitals no longer simply charge for products and services used and then request reimbursement. Under the new prospective reimbursement scheme, only an efficient and effective hospital is likely to generate a profit. Hospitals and healthcare organizations must now look more closely at each department in order to save money due to reduced reimbursements and capitatedcontracts.

Griesler and Aggarwal [15] observed that within this environment, cost containment has become the strategic focus of successful hospitals. The material management area offers a tremendous opportunity for cost containment. Consequently, many healthcare organizations have turned to their materials department to reduce costs and create more space for revenue making opportunities. The supply chain in the healthcare industry has lagged behind the supply chain in other industries Whitson [27]

Berling and Geppi [3] reported that because materials management costs are affected by all the members of the supply pipeline, the manufacturer, the distributor and hospitals need to develop closer relationships with distributors. By reducing the number of distributors, it deals with and by shifting part of its inventory to a principal vendor, the hospital can reduce its inventory and cut material management costs.

Hospitals and healthcare organizations are seeking continuously towards some innovative ways to reduce costs. One way to cut costs and generate profit is to improve the efficiency of inventory management. Many industries recognized the potential to reduce inventories through the implementation of philosophies such as just-in-time (JIT) delivery. Are the inventory management approaches that lead to improved efficiency in other industries capable of effecting cost reductions for healthcare organizations too? To answer this question, the CDS pack and JIT systems used at Lake Mead Hospital are discussed in this case study conducted by Noorda [23]. The results of the study showed that CDS system saved large amount of money that was tied up in inventory and was now available for use in other areas.

JIT IN ADMINISTRATION

Billesbach and Schniederjans [4] emphasized the adoption of JIT principles in administration. They were of the view that inefficiencies in support services and administrative operations could offset productivity gains in manufacturing; hence organizations need to adopt a holistic approach to manage operations and re-assess all administrative functions and activities and their impact on the company as a whole. According to them, not all JIT techniques used in manufacturing setting were applicable in an

administrative setting, but certain JIT methods like under capacity scheduling, re-layout and merger of operations, standardization, multifunctional workforce, worker centered quality control etc., lend themselves to the administrative arena. They identified corresponding target areas for wasteful activities like storing, moving, expediting, scheduling, and inspecting in manufacturing as against batching/filing, mailing/transmitting, rush ordering, routing/prioritizing, proofing in administrative settings.

Billesbach and Schniederjans [4] have also reported the results of JIT adoption in an administrative setting by two separate divisions of a Fortune 500 company (Nashua Corporation, Nashua, NH). The organization was selected because it had a successful JIT manufacturing program in many of its divisions. It had been found that JIT principles could be applied successfully in an administrative setting. The importance of providing information to the appropriate person at the right time and in the right amount as well as elimination of wasteful activities was viewed as a vital component for organizational success. An implementation strategy for JIT-ADM has also been suggested. In this regard, two conflicting areas of concern have been found. Firstly, it has been found that duplication of efforts is a waste of organizational resources and should be eliminated or reduced. The second concern involves the elimination or reduction of a bureaucratic structure that inhibits information flow.

Manske [21] studied the case of an organization which had earlier implemented JIT on the shop floor soon found that the administrative areas were the main bottleneck in improving client service. In administrative areas, JIT principles helped in reduction of processing lead times and space requirements, and bring about improvements in quality, productivity and operating costs. An analysis indicated that the bottleneck was mainly due to the functional organization in the administrative departments, involving a long processing chain in handling offers. Nearly 70% of the activities in the departments were not adding value at all. The solution was to setup processing centers based on functional integration. Several tangible benefits were obtained: reduction in administrative lead time, reduction in administrative lead time, reduction in labor cost, reduction in infrastructure cost, reduction in the number of copies and forms, reduction in space requirements, and reduction in transaction volumes.

JIT IN PAPER WORK OPERATIONS

Feather and Cross [13] conducted a case study of JIT applications in administrative work of Contracts Maintenance Organization (CMO) of Wang Laboratories, USA. The CMO was in charge of administering maintenance contracts. It faced problems due to heavy work backlogs, and long throughput time of over two weeks, caused mainly by batch processing. The JIT implementation was based on the following principles: establishing a product oriented flow, one-at -a-time processing, flow balancing around bottleneck, elimination of buffers and effective work scheduling. After a study of the CMO's regional offices, five major workflows were identified, related to pre-ship, post-ship, maintenance contracts renewal, charge call and maintenance revenue charge process. The bottleneck operation was defined as the administration of changes in the existing maintenance contracts or accounts administration. Several steps were taken to achieve JIT like operation. The backlogs were purged of incorrectly routed work. The work was classified into fast and slow categories. Accounts administrators were appointed to process fast track transactions, to be handled one at a time. Paper work and folders were considerably reduced.In the

southern region, where pilot JIT was implemented, throughput time reduced by over 60% and backlogs reduced by over 80% without any additional labor. The fast track operation productivity went up three times. Full implementation in all the regions gave a one-time gain of millions of dollars, which earned regular interest income. In line with JIT philosophy, the organization sets a new target of reducing the throughput time of 95 percent of all the transactions processing to one day, and identified slow transactions as the major area calling for improvement.

JIT IN MAINTENANCE OPERATIONS

Benson stated that "many of the jobs in manufacturing are actually disguised as service jobs; the largest component of internal lead-time for a manufacturer is often in a service department. If JIT is going to dramatically reduce the overall flow time, the supporting service departments cannot be ignored."

Claire [7] illustrated the case of JIT implementation in the maintenance area of manufacturing company. Although the firm does not fit within any taxonomy as a service industry, maintenance can be considered "service" within the firm. JIT application is within the maintenance function, especially MRO goods. The EOQ system of the company for managing MRO goods was totally antiquated, generating piles of purchasing related paperwork, obsolescence rates and inventory levels were too high, and service to all users needed improvement. As a result, Company began the implementation process for a JIT system. The goals of this system were to eliminate warehouse, reduce inventory, improve service, improve quality, and lower price levels. The benefits reported were; long-term relationship with vendors, single sourcing, improved quality, improved service, lower prices, simplified ordering and receiving procedures, and decreased costs including purchasing and administrative costs, carrying costs, labor costs etc.

JIT principles were applied to the customer service center of Northern Telecom, which is located in Research Triangle Park, North Carolina [24]. The center repaired printed circuit packs (PCPs) which became inoperable in digital switches. The operation was labor intensive. The center faced problems, which caused quality errors, high WIP, long repair cycle time of one week, and an 85 percent customer service level. In 1987, JIT was started at the center with a strong commitment from plant management and with the appointment of a JIT program coordinator. The key elements of JIT were; development of a quality mindset, involvement of employees and improvement of communication, development of work cells, and use of flexible workforce. The immediate results were quite remarkable: 100 percent customer service level, 89 percent improvement in quality, 75 percent reduction in WIP and two day repair cycle time forPCP.

JIT IN SERVICE SECTOR IN GENERAL

Chase [6] proposed a new way of viewing service operations and showed a classification scheme for service systems and suggested a framework for developing a production policy for the service system. Given the fact that activities in many service systems are sequentially identical to the activities in

manufacturing systems, it can be intuitively asserted that service operations can effectively use production techniques to improve their output and, hence, profitability.

Levitt [20] suggested a production- line approach to service. Services are thought in humanistic terms and manufacturing in technocratic terms. That is why manufacturing industries are forward looking and efficient while the service industries and customer service are, by comparison primitive and inefficient. Once service in the field receives the same attention as products in the factory, a lot of new opportunities become possible. The solution is to take a manufacturing approach to this activity i.e. the approach that substitutes technology and systems for people. Highly automated and controlled conditions are to be generated in providing services like an assembly line of a car manufacturing company.

Weiters [26] while justifying JIT in service industries illustrated that JIT system is not only for reducing the inventory. Most service organizations will not find physical inventory reductions as a major source of financial justification, there are other significant attributes of JIT that offer benefits to these organizations. It eliminates waste, promotes fast changeovers, streamlines the operations, establishes close supplier relations and adjusts quickly to the changes in demand so that products and services can be provided quickly, at less cost and in more variety. The system-wide approach of JIT has greater role to play in services than in manufacturing. Productivity of our service sector becomes even more critical as it gains a larger segment of our economy.

Giunipero and Keiser [14] described an actual operating case of a large firm in the communication business. Company not only strived to apply JIT to purchased items utilized in the service (Communication), but they also included installation process within the JIT function. It was found that service environments represent the ultimate "pull" situation in that the demand for an end product (service) is totally dependent on real-time, direct customer demand. However fulfilling the requirements generated by this "pull" on a real-time basis may not be feasible due to potential exposure to lost sales. Therefore service firms may have to look elsewhere, cycle time for example, to apply JIT principles. In the service environments, cycle time hinges on information flows- from customer through all functions of the firm to the end product. These aspects were being dealt in this case. Preliminary results obtained from this study indicated significant benefits-improved internal and external communications improved supplier performance, reduction in total number of suppliers, and warehouse space requirement reductions (from 40 down to 5). It also highlighted some of the key differences as well as similarities that a non-manufacturing firm will likely face when implementing a JIT purchasingprogram.

Inman and Mehra [16] studied the process of JIT implementation in a small package company in the air cargo industry. The company was retaining an inventory of quasi-MRO goods (shipping airbills, sorting bags, tubes, and employee uniforms). While utilizing an EOQ/ MRP inventory system, company saw their inventory investment swell from $ 16 million to $34 million. Company although a service industry looked for alternate techniques, such as JIT, to manage materials in their operation. Although the firm sought to reduce the inventory, it was not the sole aim of the firm. Improved service, quality, communication, and pricing also provided the justification for JIT implementation in the service environments. Improved communication, enhanced forecasts, improved quality, improved service, reduced prices, improved processing of paper work, decreased traffic time, sense of team spirit were the benefits reported as a result of JIT implementation. The case study showed that in order for JIT to be

successfully implemented and continue to function smoothly, a firm foundation is required. Quality, teamwork, education and communication were the factors that appeared critical when implementing JIT system. In contrast to manufacturing operations, JIT implementation in service operations appeared to require a greater degree of communication as well as effective coordination of activities among people. In service operations, there are more people and fewer machines, hence, breaking down human barriers becomes very essential to successfully implementing JIT.

Inman and Mehra [16] through some case studies examined the potential for JIT within service industries. These case examples showed that while all the firms under study sought to reduce inventory, it was not the sole aim of any of the firms. Improved service, quality, communication, and pricing also provided the justification for JIT implementation in the service environments. Benefits resulting from JIT adoption by service firms and service environments were many and therefore justifying JIT on the basis of inventory reduction alone is unnecessary and probably considered secondary when compared with the multitude of other potentialbenefits

Duclosetal.[11]suggested the use of JIT in services using Benson's guidelines. Here viewed the current literature reporting many JIT applications in service operations and classified those articles using a modified form of Benson's categories of JIT concepts. Heal so suggested some directions for research to increase the speed of adoption of JIT techniques within service sector.These are some modification in JIT terminology to reflect the service operations, inclusion of service sector examples in operations management course, development of research framework for successful implementation of JIT techniques in service operations through a large scale empirical study to survey a number and variety of organizations to determine the frequency, depth and breadth of JIT implementation in-service operations, applying current JIT research to service environments, development of models for evaluating JIT success, Yasinetal. [28] investigated JIT implementation practices and performance in manufacturing and service organizations in the US. On the basis of literature review and field study, fourresearchhypotheseswere developed and tested using survey from 130 manufacturing and 61 service firms.Manufacturingandservice firms that had engaged in modifications such as operator and management trainingandimproving linkages with suppliers prior to implementing JIT systems experienced less implementation problems and achieved higher level of success that placed less emphasis on these modifications. Results of the study also indicated that in service organizations, procedure oriented modification efforts are more directly linked to promoting JIT success than operations oriented modification efforts. The study also indicated the role of top management in the initiation phase of JIT in contrast to having theaccountingor purchasing department initiate this effort. The research also reinforced the role of suppliersandcustomersin JIT implementation effort. Moreover, in case of service organizations,the involvement of customers proved to be relatively more important to JIT success than involvement of suppliers.

Yasin et al. [29] investigated several facets of the implementation of JIT using a two-tiered empirical approach that included a field study and mailed survey. Five hypotheses were developed and tested using survey from 130 manufacturing organizations, 61 service organizations and 86 public sector organizations in USA. The results of study indicated that while all the organizations types had enacted procedural and operational modifications in support of their JIT implementations, there were some differencesintheimpactthatthesemodificationshadinreducingproblemsduringtheimplementation

and on the eventual outcome of the project. Suggested areas where benchmarking can be utilized by the various organization types to alleviate potential problems in the JIT implementation process and to improve their chances of success.

Krajewski and Ritzman [17] have said that the Just-in-time philosophy also can be applied to the production of services. McDonald's restaurant is using some of the elements of the JIT. In general, service environments may benefit from JIT systems if their operations are repetitive, have reasonably high volumes, and deal with tangible items such as sandwiches, mail, checks, or bills. In other words, services must involve "manufacturing-like" operations. Other services involving a high degree of customization, such as hair cutting, can also make use of JIT systems but to a lesser degree-basically utilizing elements of JIT systems in their operations. The focus of JIT systems is on improving the process; therefore some of the JIT concepts useful for manufacturers are also useful for service providers. These concepts include the following: Consistently high quality**,** Uniform facility loads, Standard work methods, Close supplier ties, Flexible work force, Automation, Preventive maintenance, Pull method of material, Product focusetc.

JIT IN MANPOWER PLANNING

Messmer [22] reported that if an accounting department manages staff like a manufacturer manages inventory, it could increase productivity. The concept of JIT can be applied to staffing through a rigorous process of planning and analysis in which specific tasks and individual workloads are evaluated carefully in order to determine the departmental staffing priorities. Depending upon the requirements, staff can be full time and temporary. Just-in- time staffing's long-term impact is dramatic. Because temporaries are able to focus on specific tasks and are flexible enough to meet sudden demands, they can increase the quantity and quality of work done in your department. As the core staff sees how temporary employees are helping them, they in turn are able to focus their energies on an effective combination of strategic issues and day-to-day execution. This attitude in turn relieves concerns about staffing, overwork, and the dangers of burnout. In other words, staff is managed like inventory management. This concept of JIT staffing is becoming increasingly prevalent in USAcompanies.

JIT IN RESTAURANT AND HOSPITALITY INDUSTRY

Shinohara [25] conducted out a case study of implementing JIT at 'Skylark' restaurant chain. It owned a chain of 300 restaurants. According to the president of the chain, implementing JIT at the restaurant was its best decision. Close examination of the system suggested that restaurant business with its emphasis on customer service, a large variety and quick delivery was ideally suited for JIT. Due to the use of simpler equipment and single item production methods the huge refrigeration facility was emptied. The distribution system was made more responsive. Kanban method was used in production and in keeping the restaurants clean. The switch to JIT produced impressive results. The centralized kitchen was able to serve another 120 restaurants. Free space was released. The inventory was cut to half in just three months ofJITintroduction.Thecustomerservicetimewasgreatlyreduced.JITenabledSkylarktoswitchto

custom production in a highly cost effective manner. This allowed it to open new, Japanese style restaurants and a fast food fried chicken chain.

One another study reviewed the previous literature of JIT application to the service operations and introduced the case of JIT application to a restaurant in the USA. The restaurant applied JIT principles to its operations. It achieved a great performance by applying JIT to its operations and the result showed that JIT could be effectively applied to the service operations without investment of information system or automation. It was also suggested that JIT concept should be applied to service organizations such as hotels, hospitals and schools to improve organizational performance emphasizing elimination of waste.

JIT IN WAREHOUSING OPERATIONS

Carlson [5] described a case of JIT applications in warehousing and distribution operations. In this type of service operations, quality, timeliness and cost of services are extremely important to stay competitive. One measures of the effectiveness of JIT application was the reduction of errors and complaints, leading directly to higher productivity. Savings in pick route distance, storage space and the cost of warehousing operations were the other measures. An automobile part distribution center (PDC) located in California adopted JIT, in response to a JIT study request from the parent Japanese Corporation. The part distribution adopted four important measures to achieve a JIT like operation. These were improvement in shipping dock operations, a downsizing programme, a daily reorder system and a short interval pick system. The shipping dock layout was modified to permit a U- shaped flow and staging/loading of one route truck at a time. Downsizing programme aimed at reducing cubic space required for miscellaneous part storage. Twenty sizes of chipboard bins instead of the original four were designed to accommodate the optimum order quantities. Daily reorder system was used to place daily replenishment order to Japan, resulting in reduction of the replenishment lead-time from 52 to 30 days. The short interval pick system was introduced for picking daily emergency orders. This system involved route wise batch picking, using Kanban system for WIP control. The system resulted in the pickers picking 50 lines per batch, compared to 35 lines per batch standard. Productivity was increased by 40% and error rate decreased by17%.

JIT IN MAIL-ORDER OPERATION

Conant [8] discussed the case of JIT application in mail-order operation by a company called Semantodontics in USA. The company sold nationwide by catalog to dentist and had a major production line called personalized printed products. The large number of customer complaints on this product line arose on account of information delays on the amount charged and order delivery days. These were caused by the customer waiting times of three or more weeks and a monthly charging of the customers. Order processing involved booking the order on telephone, invoicing, and customer verification, setting an account (for new customers), proof reading, and type setting. The whole process took about four days, due to the daily batch processing. A JIT like operation was achieved by the use of three order batches per day, elimination of new customer setup process, and faster pace of working in order verification area. As a result, the order processing lead -time went down from four days to four hours. The backlog gotreduced

significantly and a large percentage of the orders were shipped within four days to achieve customer delivery within two weeks. The complaint calls went down sharply.

JIT IN FINANCE

Lee [19] illustrated the case of a finance company to justify the applications of JIT in service industries. West Coast Finance Company (WCFC) located in the mid-wilshire area of Los Angeles, had been in the business of extending loans to small businesses in the area since it was established in 1969. The business had been very successful, showing healthy earnings every year. In the 1990, because of stiff competition in the market, the president of the company analyzed that WCFC must continue to provide good quality services, which included at the highest priority, reducing the lead-time for loan processing. Currently, it took an average 12 business days to get a loan approved. The existing loan process was studied in detail and it was found that some of the activities were not adding any value and in JIT system, it is termed as waste. So a process improvement effort started in line with JIT so that there are only value added operations. In the new process, there was no waiting time between processes and operations, and some operations were performed simultaneously in order to reduce the processing time. The new process took four to five days.

CONCLUDING REMARKS AND DIRECTIONS FOR FUTURE RESEARCH

Service systems are a dominant and growing collection of industries. JIT can play a major role in making service systems operate more efficiently, regardless of how much the service product is "goods" or "services". We have reviewed the literature on applications of JIT in service sector.

Most of the reported literature is at very conceptual level and is in the form of case studies. So there is need for detailed survey and modeling work which can demonstrate the usefulness of JIT in service sector. Certain service operations like materials management, paperwork operations, and administrative activities required in all business operations contribute greatly to the cost of the products. The integration of JIT principles to these areas can help in improving the businessoperations.

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