

RESEARCH ARTICLE

JIT in Healthcare: An Integrated Approach

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Abstract

Cost, quality, patient satisfaction etc. are some important issues facing healthcare industry. Hospitals are searching continuously for innovative ways to contain costs without sacrificing quality and meet the patients' needs. One successful solution has been the adoption of JIT manufacturing systems which involve many functional areas of a company such as manufacturing, engineering, marketing, and purchasing. JIT concepts have successfully been implemented in manufacturing organizations. There is a reasonable consensus among researchers that JIT is a useful approach for reducing costs and improving quality and can be applied to service environments also. This paper reviews the relevant literature and explores the integration of JIT techniques and practices into health care services. Based on this, some research directions are identified.

Keywords: JIT elements, Implementation, Service sector.

Introduction

In a constantly expanding global competition, emerging new technologies, improved communications, the increased public funds being absorbed by hospitals, the improvements in productivity, the reduction in operating costs, the better quality of services, and the modernization of treatment methods have modified the framework in which hospitals develop and operate. When the largest percentage of public expenditure on health is absorbed by hospital, then the need for proper utilization of hospital resources appears today to be particularly urgent. JIT is an approach which has benefited manufacturing sector in this regard. In the literature [1,2] it has been said that although the characteristics of service systems vary from a manufacturing system but JIT techniques can be applied to service environments also. The basic philosophy behind JIT in manufacturing represents a uniquely organized set of activities, which can be utilized to produce both low cost and high quality products. Global competition is forcing the companies to improve the quality of their products and customer services while reducing cost. It is

said that the implementation of JIT in service sector will facilitate the achievement of benefits long recorded by manufacturing sector. In this paper, relevant literature is reviewed, characteristics of health care production system are compared with a typical manufacturing system and it has been shown that how JIT principles can be integrated in these conditions and what benefits can be achieved. In the end, some concluding remarks and directions for future research are given.

JIT System

The basic idea of JIT was originally developed and formalized into a management system by Toyota Motor Company of Japan. Since then JIT concepts are being applied in a variety of industries across the globe. Survey and case studies of industries of United States, the United Kingdom, Germany, Italy, Korea, Hong Kong and India [3-6] have shown growing acceptance of JIT. JIT is an approach, which is demand driven and encourages flow type production. It is also described as a drive to simplify the manufacturing system in order to quickly detect the problems and force

immediate solutions. JIT has been continuously defined and updated by many researchers. JIT can be summarized as a system to eliminate waste and achieve excellence in an entire organization. The sole purpose of JIT is to eliminate waste. Anything that does not add any value to the product is termed as waste. Waste may also include anything that is not necessary for the manufacturing of a product or is in excess.

Literature Review

The literature concerning the issues and production line approach in healthcare systems, JIT system, and applications of JIT to service systems is reviewed in this section. De Vries et al. [7] suggested to apply production line approach to hospital system but at the same time mentioned some differences between manufacturing operations and hospital operations. Delesite [8] and Royston [9] said that health care is confronted with the similar challenges as manufacturing systems i.e. efficient utilization of resources, cost, quality, waiting time and in process time for patients, use of new technology and specialization, work load on staff etc. and can improve quality of service by using tools and techniques used in manufacturing operations. Kakati [10] suggested dynamic personnel scheduling as a key to improve hospital performance as in hospital services like in some other services for example restaurants, mass transit industries, repair shops etc. there is problem of demand fluctuations. According to a survey conducted, waiting time was the third most important factor which patients look for next to the doctor's competence and cost of service. Through a case study, it was shown that dynamic personnel scheduling can help in controlling demand fluctuations. Jolhe [11] studied some aspects of hospital capacity planning through a case study of a public hospital. Hospital capacity planning included such requirements as number of doctors, nurses, operation theatres, clinical laboratories, etc. Chadha and Singh [12] stressed the capacity control over lumpy pattern of patients in hospitals. The issue again is long waiting time for patients. For this, queuing methodology and shift

rescheduling and layout changes is suggested. The study supported the use of Industrial engineering techniques in non-conventional and non-industrial areas like health care organizations. Bahauddin [13] presented an outline of some applications of industrial engineering techniques at hospitals in USA. The issues again were productivity improvement, identification and cutting of unnecessary costs, improvement of utilization of resources, and enhancement of efficiency and effectiveness. Industrial engineering techniques, which had been employing in manufacturing industries since quite long time are yet to be utilized effectively by service industries in India. Applications of queuing theory in radiology scheduling and work-study in nurse staffing have been explained. It has been suggested to apply the similar thinking to other departments of the hospitals. Use of computer simulation in some complex situations can be helpful. Cote and Daugherty [14] described the use of project management tools like PERT/CPM to improve the month end reporting process which in turn will help in the better management of hospital's financial and operational resources According to Giokas [15], the improvement in productivity, the reductions in operating costs, the better quality of services, and the modernization of treatment are the issues facing Greek public hospitals in a constantly changing socio-economic environment. The results also indicated that at least 4.1% of health care costs in the gross domestic product were due to inefficiencies created by hospitals. Ramani suggested a decision support system (DSS)-enabled materials management process at some hospital. Cost and quality were the issues facing the hospital. The study focused on reducing the operating expenses without compromising the quality of service. A DSS-enabled materials management process was recommended to achieve the objectives. The hospital reported savings of 12% to 15% in the cost of hospital supplies due to savings in material purchase cost, savings in the clerical cost of placing purchase orders, and rationalization of inventory holdings. Mehra and Inman [1] suggest that service operations can effectively use production techniques and examine the use of JIT concepts in service

environments. According to them, inventory reduction and improved customer service would be the major benefits achieved from implementation of JIT systems in the service industries. Some studies [16-21] have suggested the use of JIT in paper work, administration, maintenance, restaurant, mail order warehousing operations and staff management etc. Yasin et al. [2] investigated JIT implementation practices and performance in manufacturing and service organizations in the US. On the basis of literature review and field study, four research hypotheses were developed and tested using survey from 130 manufacturing and 61 service firms. Manufacturing and service firms that had engaged in modifications such as operator and management training and improving 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 the accounting or purchasing department initiate this effort. The research also reinforced the role of suppliers and customers in 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.

Justification for JIT in Healthcare

Healthcare services are much like manufacturing, in the sense that both employ processes that add value to the basic inputs used to create final product. JIT focuses on the process and not on the product. It can therefore be applied to any group of processes whether manufacturing or service. The philosophy behind JIT is continuous improvement of processes. The ultimate goal of JIT is to attack waste. This goal can be achieved by eliminating non value added activities. This will help in improving productivity to a large

extent. We think healthcare services in humanistic terms and manufacturing in technocratic terms. That is the reason why manufacturing industries are considered to be progressive and efficient while healthcare service industries are by comparison primitive and inefficient. But today the time has changed. Healthcare industries are also becoming more and more dependent on technology and JIT like systems can help in making healthcare industries more progressive and efficient. Specifically, how would JIT be different in an operation that produces health services rather producing parts? This issue perhaps best addressed by analyzing the major characteristics of JIT in manufacturing operation and then comparing them with healthcare operations. Such an analysis is summarized in Table 1. The overall objectives of JIT remain the same and the operation requires the participation and cooperation of all functional groups in both environments. Additionally, the output of a quality product or service is the desired end product in both the cases. Long cycle times are problems for manufacturers. In the healthcare operations, it is waiting time plus the in process time that effects the quality of service and JIT elements of flexibility and continuous improvement will help in reducing this time. Other differences between the two environments are noted in storage. In manufacturing, JIT emphasis is primarily on the incoming material and subassembly storerooms. In health care operations, storage facilities are central supply stores containing medicines and surgical instruments and equipment's etc. The production control in manufacturing is done by engineering, quality, purchasing, suppliers, and workers. There is limited control on production in health care services as production process is driven by specialists. There is no simple line of command structure as the key personnel in the production process is medical specialists.

Healthcare Production System

The following features emphasize the essential uniqueness of healthcare service management and dispel the common belief that JIT can be applied to healthcare services without

Table 1: Comparison between manufacturing and healthcare production system

Criteria	Manufacturing	Healthcare operations
Problems	Poor layout, size of factory. Long product cycle time. Excess inventories. Material handling. Eliminate/expose problems covered by inventory. Reduce inventory.	Poor layout, size of factory. Long service time. Excess inventories. Material handling. Eliminate/expose problems covered by inventory. Reduce inventory.
Objectives	Establish long-term supplier relationships. Involve workers in the quality cycle. Improved material handling. Reduced product cycle time.	Establish long-term supplier relationships. Involve workers in the quality cycle. Improved material handling. Reduced service time.
Quality	Involve workers in the quality cycle. Improved material handling. Reduced product cycle time.	Involve workers in the quality cycle. Improved material handling. Reduced service time.
output	Quality finished product.	Quality health service generated
JIT functional storeroom	All functional personnel(engineering, quality, purchasing, suppliers, workers Incoming stores parts, components, subassemblies etc.	All functional personnel(medical, quality, purchasing, suppliers, workers) Incoming medicines, equipment's etc.
Type of purchase	Majority of purchases: repetitive, rebuys or modified rebuys.	Majority of purchases: repetitive, rebuys, or modified rebuys.

Any attempt to apply JIT to health production systems must also look at unique characteristics of health care production system.

recognition of the uniqueness of the healthcare service delivery system.

Inseparability of Production and Consumption

consumption in healthcare. Simultaneous production and consumption eliminates many opportunities for quality control intervention. Unlike manufacturing, where the product can be inspected before delivery, healthcare services must rely on a sequence of measures to ensure consistency of output. It emphasizes the importance of process control in healthcare services even more so than in manufacturing since healthcare services at times do not deal with a physical product to inspect.

The Customer is a Participant in the Healthcare Service

Customer/patient is always involved in healthcare service production process. Degree of customer involvement is very high. It affects the flexibility and efficiency of operations. Generally high contact process technology is more flexible to accommodate the unique needs of diverse patients. When the flexibility is high, efficiency is often low and costs are higher because the conversion process cannot be standardized. Customer becomes the central focus of production process.

Intangibility

Because healthcare services are performances, ideas or concepts, rather than tangible objects, they often cannot be seen, felt, etc., in the same manner in which goods can be sensed. When buying a product, the consumer may be able to see, feel and test its performance before purchase. With healthcare services, the

consumer must often rely on the reputation of healthcare professional. These less measurable considerations have the potential to greatly influence patients' perceptions and expectations of quality.

Perishability

This refers to the concept that healthcare service cannot be saved or inventoried. For example, unfilled appointment times for a doctor are an opportunity loss. Perishability leads to the problem of synchronization supply and demand, potentially causing patients' to wait or not to be served at all.

Heterogeneity

Heterogeneity of healthcare services in consequences of explicit and implicit service elements relying on individual preferences and perceptions.

Labor Intensiveness

Healthcare service operations are labor intensive. It is apparent that there are many potential differences between manufacturing and healthcare operations. Until recently, healthcare services have been sheltered from competition and have had little incentive to drive out inefficiency. Healthcare providers should not make the same mistakes as manufacturing companies did cutting costs at the expense gaining competitive strength. Over cost cutting may make healthcare providers more efficient over the short run but unable to provide quality health services over the long run. Healthcare service system design is similar to that of manufacturing which indicates that healthcare service industries could benefit from the application of materials management techniques in the same way as have manufacturing operations. Manufacturing and healthcare service organizations both produce a product whether that product is good or healthcare service. The JIT concepts and techniques are equally applicable to both manufacturing and service operations because both are process oriented rather than product oriented.

JIT in Healthcare

Generally, JIT is applicable to operations that are repetitive have reasonably high volume and deal with tangible items such as mails, checks, bills or letters. Many healthcare operations such as administering medications take place frequently but are not repetitive. Other operations however do meet these criteria. The JIT elements that can be applied in health care operations include the following.

JIT Purchasing

A lot of research papers [22-28] have been reported on this issue which has suggested the concept of JIT purchasing and stockless programs in materials management of healthcare operations. JIT purchasing practices in Japan are characterized by a small supplier base whose firms (1) are located close to the buyers plant, (2) make frequent deliveries, and (3) 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 supplier must share information and also protect its confidentiality. When entering into this type of longer term relationships, it is important that the buyer select suppliers that have consistently exhibited high levels of quality and delivery reliability. The concept of JIT purchasing will eliminate the role of central supply and allow inventory costs to remain low.

Flexibility

Hospital services are characterized by fluctuations in demand and supply. Healthcare organizations must be able to successfully balance supply and demand for the service. A flexible workforce is an integral element of JIT. Flexible workforce is often defined as workers with the capacity to perform more than one job. Hospitals can apply this concept to its nursing area. The hospitals can redesign their nursing units according to the concept of patient focused care. Medical facilities should have the flexibility to fill prescriptions, perform tests, and treat patients without routing them from

one end of the building to another. This concept includes the use of workers with multiple skills so patients do not have to interact with a new person for every activity or service throughout their day. This is comparable to manufacturing companies in which the implementation of JIT often results in the use of work cells to produce a product or subassembly from start to finish with a small group of workers who are responsible for the entire manufacturing process. Benefits can be reduction in waiting time, better patient service, and better utilization of hospital resources.

JIT Procedures

Waiting time and doctor's attention are the two important factors in patient's satisfaction. Physicians encounter a number of document related processes in their jobs. JIT procedures can improve physicians' use of their time. Procedures that speed up these processes will help physician to concentrate more on his job which will lead to patient satisfaction and will also reduce non value added queue time.

Continuous Improvement and Kaizan

The concepts of continuous improvement and total quality control are embodied in the JIT system with employee involvement and inventory reduction. JIT systems control quality at source with workers acting their own quality inspectors. Due to labour intensive nature of Health care operations and need for employee scheduling to provide services, each hospital staff should be allowed to participate in process. Thus, the staff will get a chance to make suggestions, suggest improvements and receive awards. As regards services, the focus should be placed on labor rather than capital. Organizational approach- JIT is a total organizational approach to improvement and waste elimination, a factor that becomes more important in services because of issue of inseparability. The more each employee knows and understands organization as a whole, the less variance in the service delivery will be.

The following factors will help in the performance of healthcare services and achieving the successful implementation of JIT in health care operations.

Training

Training of the employees plays an important part in implementation of JIT concepts in health care operations. Proper training and empowerment to hospital staff will provide a great deal of flexibility in meeting demand fluctuations and proper use of hospital staff. Training will provide employees the ability to identify and resolve problems and operational weaknesses hindering organizational effectiveness and efficiency.

Technology

JIT system advocates the use of technology as the assembly operations of a car manufacturing company are carried in highly controlled automated conditions. Health care operations are mainly dependent on medical specialists but the use of technology can help in improving the quality of health services to a large extent. Medical specialists are becoming more and more dependent on advanced and sophisticated machines. Patients are getting advice from doctors sitting in abroad and doctors of different countries are communicating with each other on internet. So hospital services are becoming more and more dependent on technological advancements.

Layout

Proper layout plays an important part in providing quality health care services. Layout changes should be allowed in order to improve healthcare operations. Healthcare organizations must remove communication barriers and facilitate effective communication by proper layout. Effective communication means must be developed. Bottleneck during healthcare delivery can be devastating to the quality and success of organization providing healthcare services.

Quality

TQM is one of the most essential requirements for successful implementation of JIT. Medical specialists, nursing and paramedical staff must perform their tasks correctly the first time, which requires adequate education and training. The use of quality circle concept can be helpful in health care service organizations.

Standardization

By standardizing job activities and procedures, resources can be focused on other important areas. The resulting impact on productivity can be significantly higher. Standardization of activities also reduces the time and cost of cross training of employees but the flexibility has to be maintained in order to meet the demand fluctuations.

Simplification

One of the benefits of JIT in manufacturing operations is the reduction in lead time. The effort for lead time reduction begins with order entry and setting due dates.

Simplifying the procedures will help in reduction of order processing time.

Conclusions and Directions for Future Work

Controlling health care costs is one of the most important issues facing the health care industry. This can be done by adopting similar cost accounting methods used in the manufacturing industry and improved supply chain practices through the implementation of JIT systems. The outcome of implementing such methods is one of the areas for future research. There is a huge duplication in medical and surgical products. The effect of the use of the standardization process on the development of best practices at lower cost can be another area for further research. When the manufacturing industry shares many similar business processes with the health care industry especially in the area of supply distribution, inventory control etc., why has the industry been reluctant to implement the same competitive operational processes found in the manufacturing and distribution industries.

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