JIT IMPLEMENTATION IN SMALL MANUFACTURING ENTERPRISES A REVIEW

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Abstract A large number of studies demonstrate the benefits of Just-In-Time (JIT) manufacturing in the context of large manufacturing companies where the techniques were developed. In an environment of an increasingly intense global competition, Small Manufacturing Enterprises (SMEs) would like to have the same benefits. However, SMEs face certain limitations, as a direct consequence of their size, which may make the prerequisite condition for certain JIT initiatives difficult to satisfy, raising an important question as to the applicability of JIT to SMEs.

Keywords: Just-In-Time, Lean Production, Toyota Production System, and Small Manufacturing Enterprises

PRELUDE

A large number of studies demonstrate the benefits of Just-In-Time (JIT) manufacturing in the context of large manufacturing companies where the techniques were developed. In an environment of an increasingly intense global competition, Small Manufacturing Enterprises (SMEs) would like to have the same benefits. However, SMEs face certain limitations, as a direct consequence of their size, which may make the prerequisite condition for certain JIT initiatives difficult to satisfy, raising an important question as to the applicability of JIT to SMEs.

This paper presents a framework for discussing the barriers to implementation of JIT by SMEs based upon an analysis of six major limitations they experience. Six case studies of companies in various stages of implementation are presented and analyzed using this framework, which is shown to be useful in accounting for the difficulties they have experienced and the JIT components they have chosen to implement.

Problem Definition

JIT success stories in large manufacturing companies, especially in the automotive and electronic industries, abound with stated benefits including reduced inventory, reduced direct labor and increased productivity, which in turn lead to reduction of total costs. In an era of increased competition, especially global competition, small manufacturing enterprises (SMEs) need to access the same benefits, to gain more competitive advantage, especially through reduced costs and increased flexibility and quality. Therefore, it is an important practical and research question as to the extent to which SMEs can adopt the JIT system and gain access to its benefits.

Table 1: JIT Components and barriers to implementing them in SMEs

JIT Components	Definition	SME Limitations	Barriers to SMEs
Production Leveling	To produce the same quantity and mix of items every day	Lack of bargaining power with customers	Unstable demand from customers without any forecast
Pull System	Materials are drawn by the users from the "downstream" stage as needed	Limited machines to establish cellular manufacturing	Difficulties in implementing cellular manufacturing
Good Housekeeping	Workers are encouraged to keep their own work spaces tidy		No barriers
Small Lot Production	To produce in small batches and to reduce buffer	See dependant components (Fig.2)	Depends on implementation of other components
Setup Time Reduction	To eliminate external setup times and to reduce internal setup times	Limited cash to fund improvement projects and limited expertise.	Unable to purchase flexible machines with short setup times

Total Preventive Maintenance (TPM)	To avoid any breakdown from the outset by maintaining the machinery	Limited resources and funds for training	Inadequate personnel and tools
Total Quality Control (TQC)	To make the output right the first time by employing quality at source, line stop and foolproof devices.	Limited funds Lack of bargaining power with suppliers	Difficulties in developing foolproof devices Unable to impose quality upon suppliers
JIT Purchasing	Comprises of JIT deliveries, information sharing, quality at the suppliers and long-term partnerships.	Lack of bargaining power with suppliers	Unable to impose JIT delivery upon suppliers
Line Balancing	To adjust the output of a series of cells to the same rate.		Depends on whether flexible manufacturing is achieved
Flexible Manufacturing	Facilities and workforce can be rearranged according to customer demand. It comprises Standard Operations, Group Technology (GT) and Flexible Workforce.	Limited resources and funds to acquire additional machines	Limited number of machines to form cells, lack of expertise to simplify components.
Small Group Improvement Activities (SGIA)	To empower employees to improve the operations.		It is a normal occurrence in SMEs as communication is freely exercised.

CASE STUDIES ON SME's

Three case studies on different Small Manufacturing Enterprises are presented below along with their Company Profiles and the feasibility of implementing JIT successfully in them.

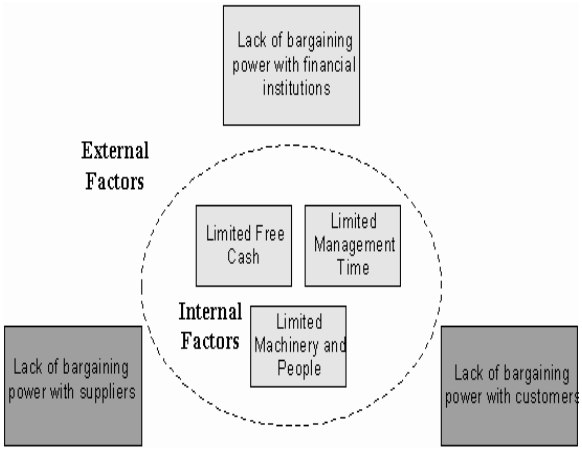
Company – A

Profile

Company A produces electrical cables with some fittings for the automotive industry. They excel in JIT operations, and are able to attain a 1-day lead-time for most products, thus considerably reducing their finished goods stock. While their manufacturing process is quite simple, their success can be mainly attributed to their full commitment to JIT. Their operations are significantly influenced by the JIT concept. Cellular manufacturing with kanban systems is neatly arranged. SGIA is employed but rather informally, due to extensive communication between people from different levels of management.

Analysis

The major problems in Company A come from both their suppliers and customers. Customers' daily call-ups vary significantly. Fortunately, Company A has been able to shorten its manufacturing lead-time, and thus does not need a large amount of buffer stock. In regard to supplier relationship, Company A has no other choice but to keep at least three days raw material for production as most local suppliers will not comply with less than three days lead-time. The problems of limited management time and limited resources were solved when Company A chose to outsource some of their work. This reduced the need for additional workers and released management time, allowing them to concentrate on improvements in their core business. Limited free cash is not perceived as a big problem because the process is low tech and Company A utilizes employee suggestions in an informal way.



Company – B

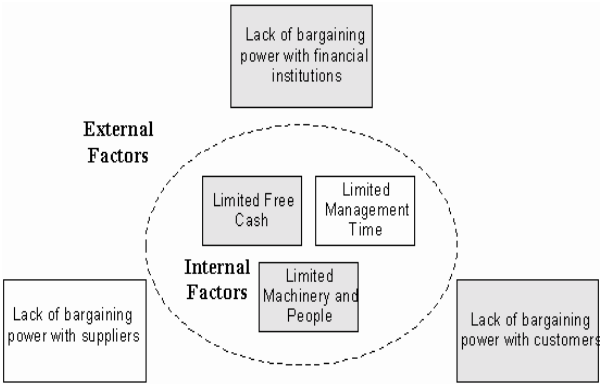
Profile

Company B's core business for more than 60 years has been to produce pressed metal parts, involving some assembly, mainly for the automotive industry. Since their customers ensure that they will use up to two months forecast demand, they are currently running a large batch production schedule. They purchase their raw materials also in large quantities but deliver their products a JIT basis. On the shop floor, they utilize numerical control machines and robot welders, which require long setup times. Machines are arranged according to their functions. Computers are used extensively to schedule a push production system. With such a system, Company B has implemented JIT only in its quality aspects and in providing JIT deliveries from stock.

Analysis

It seems that Company B has all aspects of the internal barriers to implementing JIT. However, it may be that a lack of management commitment toward JIT implementation is the root cause: the managers do not believe that the benefits of the implementation will exceed the costs. This lack of commitment definitely affects the company's allocation of funds, machinery and workers for the implementation, resulting in inadequate resources as shown in Fig below.

In regard to external barriers, although pressures from customers for JIT delivery are high, Company B has not responded by applying the whole idea of JIT. Instead, they have adopted a make-to-stock policy with two months buffer stock. They perceive that such a policy is much safer to cope with fluctuating daily call-ups from customers. However, this is not the only difficulty. Currently, Company B is operating with multi-purpose machines and some robotics equipment. With such machinery, it is very difficult to implement cellular manufacturing and other JIT components in a small business. JIT Purchasing is not required at Company B, as they run production in large batch sizes, and thus lack of bargaining power with suppliers is not appropriate in this case.



Company – C

Profile

Company C has the same core business as Company B with different major customers. In 1993, their major customer, Toyota, chose them to be a JIT showcase supplier, and they have been working under the JIT system ever since. Starting with a focus on one cell implementation, the company has now successfully implemented most of the JIT components in the production area and has enjoyed various JIT benefits.

Analysis

From observation on the shop floor, it was clearly seen that Company C has achieved a thorough JIT implementation. Fluctuating demand from customers has been alleviated by their ability to shorten their manufacturing lead-time. Thus, they have only a small "emergency stock" to cope with fluctuating demand. Major problems with suppliers dealing with quality and delivery are solved, as the help of their major customer, Toyota, heightens their leverage over suppliers. Even though limited free cash hinders them from purchasing roll-on roll-off dies, they have made use of videotaping techniques and employees' ideas to reduce setup times. With a full commitment from management and help from their major customer, success in JIT implementation is very impressive.

BARRIERS TO CONFORM TO GENERAL IMPLEMENTATION GUIDELINES

Because this study used only companies with a reasonable degree of JIT success, evidence of barriers to conforming to general implementation guidelines is not abundant. A lack of top management commitment was not evident, except in Company B's case. As most of the managers, except for Company B's, seemed to have a clear understanding of JIT philosophy, it can be said that education was not a big problem for them. In regard to planning, it seems that these companies have to plan a gradual implementation. Exception is Company C as it had assistance from engineers from Toyota. The only company that used a pilot project was Company C. It is interesting to note that Company C uses a holistic approach with thorough planning with help from Toyota, while others undertook an incremental implementation.

CONCLUSIONS

The cases highlight the diversity of experience of companies with similar aims. Company A has successfully implemented JIT even though they do not have support from their customers, compared to Company C. In similar business areas and having similar customer types, Company C has decided to adopt JIT, while Company B deems it to be infeasible. Such diversity is shown in different production policies taken by these companies – make-to-order, make-to

stock and assembly-to-order – which are quite interesting to observe in regard to different industry types and their market place.
Based on an analysis of the cases both individually and collectively, a number of conclusions can be drawn in regard to the applicability of the JIT manufacturing system to SMEs and the usefulness of the limitations framework presented here.

The Applicability of the JIT Manufacturing System in SMEs

All companies in the case study have implemented JIT to some extent and gained some benefits. The case studies show that a number of JIT techniques, such as crosstraining, good housekeeping and SGIA, can be readily adopted by SMEs. This indicates that JIT ideas are quite applicable to SMEs. However, JIT must not be seen as merely a set of "ready-for-use" techniques for improvement. It must be understood as a guiding philosophy that helps a company to find its own ways to improvement. JIT components, which require the greatest degree of cooperation from outside parties, present the greatest difficulty and all the companies retain buffer stock at a level greater than the JIT ideal.
In terms of the benefits that these companies enjoy, future prospects are even more promising as more and more companies are adopting JIT. This means that there will be more companies requiring JIT delivery, which will be best supplied by JIT suppliers. Also, adoption of the JIT concept will extend to suppliers further upstream in the supply chain, which means that the implementation will be easier for SMEs.

EVALUATION OF THE BARRIERS

Most of the barriers to JIT implementation faced by the case companies can be accounted for as the result a combination of the six limitations of SMEs. Thus, the framework presented here has at least some ability to predict which components that will be feasible given an analysis of the limitations faced by the focal company. There is some evidence of the effects of dependencies among JIT components. However, different approaches in implementing JIT, modification of components, and other factors have blurred the relationships. The available evidence from the case studies is not representative enough to prove the existence of all the dependencies depicted.

The list of environmental factors may increase as the number of cases grows. Thus, it may be impossible to provide a complete model that includes all possible factors, which could be used to analyze and prescribe what a company should do to attain the best possible practice for its condition.
Nevertheless, the authors suggest that the SME limitations framework presented here is sufficiently predictive of JIT implementation choices that, when combined with a situational analysis of a given company, it would be useful for a company embarking on JIT implementation to examine each of these limitations. The case studies show that the barriers are not completely insurmountable and individual companies may use such an analysis to find their own path to JIT with minimum risk of failure.

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