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Just-in-Time Production Systems (JITPS) in Developing Countries: The Nigerian Experience

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ABSTRACT Despite the immense advantages of the JITPS, its adoption in the third world manufacturing is quite limited. Manufacturing sectors in this part of the world are still run on the basis of old production systems that included so many activities that add little value to the final production process. Production processes are therefore slow, wasteful and characterized by avoidable complexities. This paper examines the extent of JITPS in a typical third world country-Nigeria, with a view to identifying the extent of adoption as well as the hindrances on the part of adopting the technique. Structured questionnaires were administered to companies to indicate whether or not they were adopting the technique. We also elicit information on the nature of JITPS adopted by companies as well as the benefits accrue from adopting the method. The findings include that fairly larger companies adopt JIT method more while the relatively smaller ones are still not aware of the existence of the technique. The paper also identifies structural hindrances to the adoption of JITPS, solutions were also suggested to overcome some of these problems.

INTRODUCTION

Just-in-time JIT, as the name implies, is to produce goods just-in-time for use or sale. It is a Japanese manufacturing Management method developed in the 1970s which had its motivation in the Japanese urge to develop better and efficient technique capable of rebuilding their economy after the 2nd World War. Hitherto, enormous defects existed in the manufacturing system that relates to inventory problem, product defects, rising cost of production through wastes and production delays. Indeed JIT is a technique of production that developed out of the need to evolve a defect free process (see Chen and Podolsky 1996). Horngren and Forster (1987) identified four cardinal objectives of JIT as:

- The elimination of all activities that do not add value to product or service
- A commitment to a high level of quality
- A commitment to continuous improvement in the efficiency of an activity and
- An emphasis on simplification and increased visibility to identify activities that do not add value.

According to Hirano (1988), JIT involves five conceptual steps that start with Awareness review (discarding old concepts and turning to JIT way of thinking). This step is followed by the '5 S' for workplace improvement (*Seiri*-proper arrangement, *Seiton*-Orderliness, *Seiso*-Cleanliness, *Seiktsu*-Cleanup and *Shetsuke*-Discipline). The five 'S' leads to flow manu-facturing which replaces lot production characterised with one piece production. The fourth step is that building products on equal quantity on each time levels production; this invariably leads to standard operation which is capable of maintaining flow. The result of this system revolution is what is referred to as JIT.

The basic benefit of this technique is thus its ability to increase the organization's ability to compete with others and remain relevant over the long run, since with JIT, they can develop a more optimal process for their firms. JIT also reduces production costs through increased efficiency within the production process; and it reduces waste of materials, time and effort. A number of other economic benefits of JIT such as lower inventory investment, (Wilkinson 1989: Buffa 1984) and large space savings (Sage 1984); are among its visible outcomes. For example, General Motors reduced its inventory level by 17% within five years after applying a JIT Production System (Uribe 1986). In addition, JITPS has also enhanced the production flexibility and employee morale (Schonberg 1982; Buffa 1984).

Despite these benefits, the application of JIT production system in the third world countries is minima because of several operational and systemic deficiencies.

In this paper, we examine, using the available evidences, the level of adoption of JIT in Nigeria and by so doing assess the existing JIT practices inn the country so as to discover the extent of its adoption and how workable the technique is for a typical third world manufacturing sector.

Objectives

Despite the advantages of JIT and efforts and exhortations of the Federal Government of Nigeria to overhaul the manufacturing sector, there are indications that there are fewer manufacturing companies in the country that are adopting JIT. Thus this study had been conducted with the following objectives:

- To identify the benefits of a JITPS in companies currently adopting the technique in Nigeria
- To identify the factors that hinder the adoption of the technique among companies not applying it;

Just- in-Time Production Technique: The Nigerian Experience

Since the launch of National Productivity Day in 1991 by the Federal Government of Nigeria, local productivity has strongly been sensitized on the need for productivity improvement in both the public and private sectors of the economy. The National Productivity Day according to Obi (1995) "is aimed at rekindling our awareness of the need for productivity improvement in both manufacturing and non-manufacturing industries". Efforts have been directed towards mobilizing local initiatives at reducing inefficiency and unproductive time in the production process so as to improve the process and the quality of the product or service.

Since improving productivity has been a matter of interest to both government and scholars, the task that lies ahead for Nigerians is to promote the concept of JIT more widely, get more manufacturing industries to implement it and expand the concept to departments other than just the production line and to industries other than manufacturing. Experts have been involved to conduct workshop and practice-oriented seminars on JIT. This is expected to assist the country to sustain her productivity growth and enable the more effective use of capital.

RESEARCH METHODOLOGY

The first step was to carry out a survey of companies in the country to determine whether the companies were using JIT. Some of the JIT companies that did not respond to the first mailing were sent reminders so as to encourage the filling up of the questionnaire and to render any further assistance it required within one month, returns were received from 18 JIT and 21 non JIT companies.

Two sets of questionnaires were thereafter prepared, one for companies applying JIT and the other for companies not applying JIT. The questionnaires were first pre-tested on two JIT consultant and two academicians. Based on our discussion with some local JIT consultants and practitioners, the local electronic and electrical industry is the most popular area of JIT application. Both sets of questionnaires together with a short write up on JIT were sent to some companies because of our inability to determine whether or not they adopted JIT.

Consequently, the questionnaires were mailed to about 208 companies which were sourced from a listing provided by Nigerian Industrial Directory and Nigerian Manufacturers Association.

Although the response rate of 19% was low, this nevertheless was considered satisfactory in Nigeria. Only 16 of the JIT and 18 non- JIT replies were found to be useable while the rest were found to be incomplete.

The data collected from 16 JIT companies and 18 non-JIT companies were analyzed using comparative percentages.

Table 1 shows that most of the respondents come from large sized companies. Imman and Methar (1990) found that many small companies cannot afford JIT due to costs of training preventative maintenance and cost of consultants. However, it appears that large size alone is not the only factors that decide whether a company adopts JIT or not.

Table 1: Size of respondents companies in term of sales

Annual Sales	*JIT Companies*	*Non-JIT Companies*
Between 1m to 5m	1	5
Between 5m to 10m	3	3
More than 10m	12	10
Total	16	18

THE BENEFITS OF JIT APPLICATIONS IN NIGERIA

Table 2 shows that a number of benefits have been realized in implementing JIT Companies in Nigeria. Sixty-nine percent of the JIT Companies adopters experienced a significant reduction in inventory costs. Apparently despite Nigerian

Table 2: Types of benefits experienced by firms that adopted JITPS

Type of JIT Benefits	*Frequency*	*Percentages*
Lower Inventory Investment	11	69
Large Space Savings	11	69
Increased Flexibility	8	50
Increase in Employee Morale	7	44
Reduction in Lead Time	7	44
Improvement in Productivity	5	31
Reduction in Customer Complaints	5	31
Reduction in Defects	4	25
Reduction in Machine Downtime	4	25
Reduction in Setup time	4	25

Source: Author's Survey.

manufacturers being heavily reliant on imports for raw materials and inputs, a JITPS can still allow most of the firms to enjoy some of these benefits.

Sixty-nine percent of the respondents benefited from large space savings with two firms having as much as 40% space savings. Such savings are suspected to have resulted from

- better factory layout thereby reducing travelling distance;
- better quality of service which reduces the need to keep inventory;
- reduction in setup time thereby reducing the need to keep inventory; and
- Produce inventory as and when required.

Besides these, JIT also allows for flexibility in the local environment. 50% of the respondents indicated that the increase in flexibility enable a faster response to changes in the environment and the subsequent development of a competitive advantage. One firm remarks that not only is demand continuously changing but customers are also demanding for better quality and a greater diversity in the product range. To meet this challenge, firms seek to respond more rapidly to market demands resulting in a shorter product life span (Chendall 1991). Thus the risk of inventory (finished good) obsolescence is substantially reduced as JIT discourages inventory build-up.

44% of the respondents also felt that there is an increase in employee morale as this is something intangible, unlike the other benefit, there is a responsibility that some of the compa-nies do not feel the increase in morale when in fact, there is an increase. At any rate, the responses show that such a benefit is possible with a JITPS in use.

44% of the respondents also enjoyed a reduction in lead-time after implementing JIT. One company managed to shorten lead-time by 67% after having implemented JITPS for 4 years. The survey also revealed that 31% of JIT applicants experienced productivity improvement.

31% of the companies surveyed claimed a decrease in customer complaints, as compared with 25% who claimed a decrease in defects. This indicates that customers are satisfied not only with the better product quality, but also with the company's ability to cater to their changing needs in a timely manner.

Three types of the benefits that received the equally least response rate 25% are reductions in set up time, defects and machine downtime. Some JIT applicants noted that setup time is reduced from a range of 5% to 50% of the pre- JIT situation. One firm noted that setup time could be cut by 13.5% whilst maintaining plant efficiency at an average of 99% indicating that reductions in setup time is possible without impairing the production process.

Another advantage brought up by a small percentage of the respondents is that a JITPS enables better visual control as the shop floor becomes neater. In a JIT environment, the rapid detection of machine or human errors is enabled by the greater visibility afforded by the small lot sizes in the system.

On the whole, the survey findings seem to be consistent with the empirical research and experiences of other firms in the United States, United Kingdom and Japan. Thus, a JITPS can offer a range of benefits to the local firms and the three most important and commonly experienced benefits are reduction in inventory carrying cost, large space saving and increase in flexibility.

Factors Hindering JIT Application

Despite the relentless effort research has shown that the promotion of JITPS among Nigerian companies has not been very effective in terms of implementation. Hence, this paper places more emphasis on factors that hinder the implementation of a JITPS. To facilitate analysis, the factors hindering JIT application will be analyzed in terms of 5 categories, namely supplier factors, personnel factors, product factors, production factors and others.

(i) Supplier Factors: The lack of control of timing of overseas supplies shipment is the most serious problem faced by both JIT and non- JIT companies as seen from the comparative chart in figure 1. Seventy-five percent of JIT and 8 on non- JIT respondents quoted this factor as being

most important. Although the current JIT literature deems this as an excuse for not applying JIT, the importance given to it by the JIT manufacturers indicate that it should be given serious consideration as Nigeria does not have much natural resources and has to rely on overseas suppliers; to overcome this hindrance, a JIT applicant indicated that they employed JIT on partial basis i.e. buffer inventory for raw materials from overseas is still being stored. Reducing such inventory level can also be kept to a minimum by better materials planning and providing the overseas suppliers with production plans so that the overseas suppliers would be able to produce and deliver the goods timely to its customers in Nigeria.

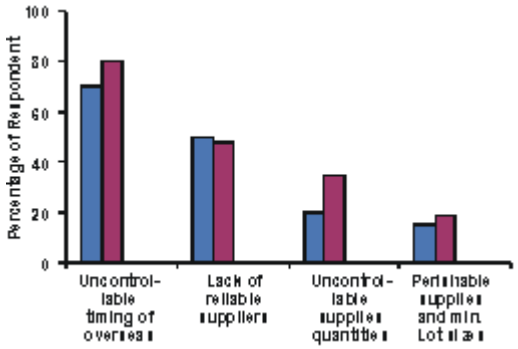

Fig. 1. Supplier factor

The second most important hindrance is the lack of reliable suppliers (in terms of quantity and cost). Fifty-six percent of the JIT respondents indicated that this is a serious problem faced by their companies because if a supplier delivers a bad batch, the whole production line will have to stop. A JIT applicant indicated that a solution lies in implementing a stricter qualification for suppliers. Another solution is to work closely with suppliers by supporting them to build up their quality and responsiveness and this can be justified by having a long-term relationship with them. A fair price must also be provided so that suppliers are motivated to enhance their quality and delivery times.

In addition, companies may resort to having outgoing quality inspection at the suppliers place rather than have the incoming quality inspection so that poor quality products may be detected and corrected earlier.

Twenty-five percent of JIT and 39% of non-JIT respondents noted that the unpredictability of supply quantity for each shipment creates a problem for their implementation of a JITS. There is the need to ensure that the quantity supplies are exactly what the company has ordered, in order for the production line to run smoothly.

Following this line of argument, JIT companies were expected to place importance on this factor since they do not hold or do not hold sufficiently large buffer inventors in their stores. Any shortages in supplies shipped may cause inventory shortages in the production line and there would be delays in the delivery of goods to the customers. However, only 25% of the JIT respondents consider this factor to be hindrance to them. One reason as mentioned earlier, is that companies employing JIT adopts JIT on a partial basis. Another reason lies in the nature of their required materials. For instance, if the materials required take little time to manufacture, or are very specialized or complex, suppliers would be able to supply them more readily in the quantities requested. Lastly the supplies problem is felt less with more efficient materials planning by the JIT companies or with better ability to predict possible shipment quantities they can adjust their operations accordingly. The survey indicated that perishability and minimum lot size of supplies is not a major problem. Only about 20% of the respondents from both JIT and non- JIT companies cited this as a problem. One explanation is that the remaining 80% of each respondent group uses supplies that are not perishable, or come in a variety of lot sizes. Another explanation is that even if perishable supplies are used, the companies have established some form of production plan that could fully utilize the materials once the pack is opened.

(ii) Personnel Factors: Figure 2 shows that the lack of commitment by management is the most serious factor with 44% of JIT and 61% of the non- JIT respondents agreeing on this problem. The successful implementation of a JITPS requires amongst others, redesigning the factory layout and educating the employees on the concept of value-adding activities (Taakeuchi 1981; Wheeler 1988) which will require the use of the company's scarce resources. As such top management must not only initiate the process of change (Sage 1984) but must also be fully committed to such changes.

The lack of commitment and experience by management may be attributed to relative newness

of the JIT concept in Nigeria and this might be a reason why few companies have implemented JIT. Steps must therefore be taken to educate top Management on the benefits of JIT and ways to successfully implement JIT.

Figure 2 shows that inter-departmental conflict of interest is the second most important factor indicated by 38% of JIT and 33% of the non- JIT respondents. This means that coordination among departments is a must before JIT can be implemented. Team effort is of utmost importance. To reduce inter-departmental conflicts one JIT applicant suggested a restructuring of the organization so that lines of communications, cooperation and responsibility can be clearly drawn out.

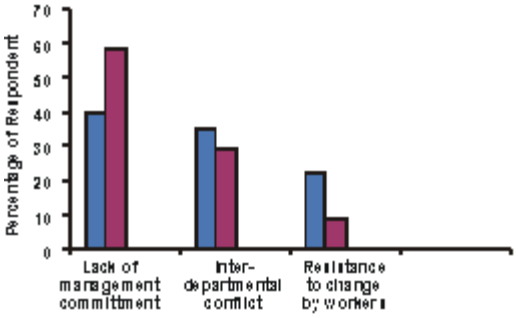

Fig. 2. Personnel factor

Twenty-five percent of the JIT companies found resistance to change by workers a problem as compared with only 11% of the non- JIT respondents. The low percentage of 25% stems from the local culture which emphasizes teamwork and/or the high level of education of the workers. Further with a greater emphasis on education and upgrading of skills, the current generation is probably better educated and skilled as compared with the older generation. The differential in response may point to non- JIT companies' lack of knowledge of how worker resistance can act as a hindrance to the implementation of JIT.

The lack of commitment and knowledge by workers have been cited as hindrances to JIT application. If workers are able to understand the benefits of implementing JIT, they would be more than glad to accept the change. However, workers may not want to see an improvement in productivity, if it means more work for them without any accompanying benefit.

(iii) Product Factors: For the two factors of high product mix and irregularity of demand, responses-from the JIT and non- JIT companies are controversial. Seventy-five percent of the respondents of the JIT group considered product mix as a more serious problem (as shown in Fig. 3), whilst 89% of the non- JIT respondents indicated that irregularity of demand is a more important factor to overcome the product mix problem, one JIT applicant resorted to the standardization of parts so that the standard part could be used interchangeably between various products. Another solution was to adopt Flexible Manufacturing Systems (FMS) so that a greater variety of products can be produced. Solving the problem of the irregularity of demand is more difficult, as one way to overcome this is to keep finished goods inventory which runs contrary to JIT.

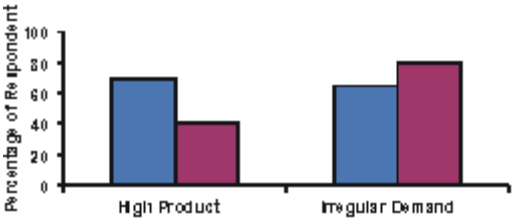

Fig. 3. Product factor

(iv) Production Factors: A low production volume is the most commonly quoted problem by both the JIT (56%) and non- JIT (61%) respondents as indicated by the comparative chart of production factors by one applicant is to adopt EMS and cellular manufacturing systems which allows for a shorter production schedule (Fig. 4).

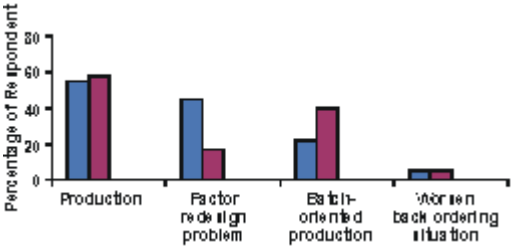

Fig. 4. Production factor

The responses between JIT and non- JIT groups regarding a batch-oriented production process are different. The JIT companies reckon the redesigning of factory layout as a more

formidable problem than having a batch-oriented production process, whilst the non- JIT respondents viewed the batch orientation is a main hindrance to AT application.

The results of the JIT respondents are taken as more representative because they have had the practical experience.45% of the JIT respondents claimed that the problem of redesigning factory.

Layout is a serious problem. Only 17% of the non- JIT respondents had the same viewpoints.

The fear of worsening current backorder situation is not very important as indicated by the low percentage of respondents agreeing on this factor.

(v) Other Factors: Other hindrances indicated by respondents which the questionnaire did not specifically cover were also received. One of such factor is that of priorities. Due to a tight project schedule, the possibility of implementing a JITPS is shelved. One interviewee said that their company was more preoccupied with surviving in the depressed economy in which they are operating.

Secondly, before a JITPS can be implemented successfully, the pre- JIT production system must give a consistent yield and output rate. An inconsistent yield might be the result of quality problems. If JIT is introduced before the quality problems are solved, the production line will always come to a standstill. Therefore, unless quality problem are solved, implementation of JIT will be fraught with problems.

The third hindrance is whether the company is manufacturing custom-made products. The respondent who cited this factor was dealing with back-up power supply which needs to be tailored according to the customer's request.

Ways the Successful JIT Applicants Overcome the Other Implementation Problems

Besides the resolutions of technical problems are mentioned earlier, the sixteen JIT respondents were also being followed up with further interviews to determine how they overcome the other hurdles and difficulties in implementing a JITPS. Most of the firms claimed that the key to success is to overcome the human problems. i.e. the personnel factor. In the first place, the management must be fully committed. As literature indicated, JIT philosophy requires nothing less than a new way of thinking. It is a cultural change that must be led by management (Huge and Sipes 1986; Hernandez 1989). Thus to convince the subordinates to apply JIT, management themselves must first be willing and committed to the application. As the human problems are overcome, the desire and willingness to make things happen would smoothen any hindrances that come along.

Some of the applicants of JIT are subsidiaries of Multinational Corporations (MNCs) whose parent companies have already applied JIT in their own countries. Thus they have access to the knowledge of implementing JIT Other JIT respondents considered JIT education an important key to successful implementation of a JITPS. JIT education was carried out by visiting a JITPS, using a JIT consultant, conducting classes and seminars, watching video tapes a well as having on-job-training.

The JIT companies also conducted preliminary studies to help to smoothen the implementation process. The objectives of the JIT project team were to analyze the philosophy of JIT, its benefits and limitations, and whether the system can be adopted by the company. Generally, companies who have implemented JIT has spent about 3 to 6 months to research on the feasibility before applying JITPS in their companies. About 50% of the JIT respondents had about 4 to 6 people in the JIT project team and others had more than 9 members in the team.

The respondents also claimed that employee involvement is just as critical as management commitment in ensuring the successful implementation of a JITPS. Without management commitment, JIT is merely given lip service and the workers will not be convinced of management's seriousness to practice JIT no matter how committed the management is, workers will fail to see the benefits of using JIT and resist change if they are also involved. As a result, the firms have managed the change process through mainly JIT education. In addition, the normal kind of change management such as counseling and job assurance are also required.

CONCLUSION

This paper focuses on the application of JIT in Nigeria. The survey revealed that JIT is just as workable in Nigeria. However, there is still only handful of companies using JIT. Many companies, especially the smaller ones are still unaware

of its existence, much less the working of JIT. Even if there is awareness, the fear of rim and failures exists as relatively few companies have successfully implemented JIT. Moreover, the benefits achieved locally are not publicized, as there is a dearth of local research into and documentation of such results. Companies applying it and reaping tremendous benefits may not wish to go around proclaiming their achievement, as it would mean sharing a competitive advantage. Apart from these reasons, the reluctance to use JIT may be due to the other factors as discussed previously, i.e. supplier, personnel, product and production factors.

Though hindrances do exist, the survey indicated that these hurdles could be overcome. The prerequisites in achieving successful JIT implementation are management commitment, responsiveness to market tastes and that education and communication would be necessary to achieve general acceptance of a JIT system. Industries in Nigeria cannot exist without relying on overseas suppliers; complete adoption of JIT would encourage local industries to diversify the excess inventory they might have ordered from abroad. Hence, JIT will generate new ideas and ultimately new products. More workshops and seminars promoting and disseminating the JIT concepts, especially to the top management of companies who have not used JIT should be encouraged. In addition, education and training are also required to encourage employee participation and involvement.

The business environment of the 21st hostile can only get more complex, variable and hostile. For manufacturers to adapt to the situation, flexibility is of paramount importance. Though the task of converting the production system to one that uses JIT cannot be accomplished overnight, the existence of hindrances are by no means sufficient to prevent most or many of the companies here from applying JIT. If Nigeria is to develop and be able to compete at the international market, its manufacturing sector has to acknowledge JIT and work towards achieving it.

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