

## **Just-In-Time (JIT) Manufacturing: A Panacea for Low Productivity and Idle Inventory in Nigerian Industries**

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**Abstract:** Nigerian Industries over the last few years have operated below expected manufacturing/production levels owing to operational processes and management decisions adopted, which has not proved effective. The consequence of this has resulted in moribund industrial activities and in most cases, led to the comatose nature of such industries. Such manufacturing process adopted, which results in wastage in material, low productivity and/or idle inventory are expected to be replaced by well efficient production process, which would work to bring its advantage and thus, enhance industrial activities in Nigeria. This study presents, a philosophy/system, the Just-In-Time (JIT) manufacturing philosophy, which is one of the Japanese management techniques, to be adopted and implemented by Nigerian companies. The study attempts to assess manufacturing in Japan and Nigeria and also reaches a compromise on how to implement the JIT manufacturing philosophy in Nigerian industries thus, enabling such industries enjoy the dividends of the philosophy.

**Key words:** Just-In-Time (JIT) manufacturing, productivity, inventory, Nigerian industries

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### **INTRODUCTION**

Just-In-Time (JIT) manufacturing is a systems approach to developing and operating a manufacturing system. It is a management philosophy and not a technique and it originally referred to the production of goods to meet customer demand exactly, in time, quality and quantity, whether the customer is the final purchaser of the product or another process further along the production line (University of Cambridge, Institute for Manufacturing, 2008). JIT is not a new concept because it has been an inherent feature of the Japanese manufacturing industry adopted for quite some time and it is a manufacturing system based on the total elimination of waste in the form of time, resources and material when producing. It requires that equipment, resources and labor are made available only in the amount required and at the time required to do the job. It is based on producing only the necessary units in the necessary quantities at the necessary time by bringing production rates exactly in line with market demand. Summarily, JIT means making what the market wants, when it wants it. JIT has been found to be so effective that it increases productivity, work performance and product quality, while saving costs. Adopting a JIT system is also sometimes referred to as adopting a Lean Production System.

The JIT production philosophy is founded upon three fundamental principles: Elimination of waste, continuous quality improvement and encouragement of worker participation in operations planning and execution. JIT seeks to minimize the need for raw materials, Work-In-Process (WIP) and finished goods inventory by focusing on reducing setup times, coordinating JIT deliveries from suppliers with production needs, balancing productive capacities of internal processes, respecting people and maintaining a continuing commitment to achieving the highest level of quality at all stages of the business transaction.

The productivity level in terms of labour and products, of industries which have adopted the JIT philosophy has been found to increase. Accordingly, an increase in productivity is characterized by a shift of the production function and a consequent change to the output/input relation. Productivity may be thought of as a measure of the technical or engineering efficiency of production. In general, productivity refers to measures of output from production processes, per unit of input (Wikipedia: The Free Encyclopedia, 2008a). Labour productivity, is measured as a ratio of output per labour-hour, an input. Labour productivity can be measured in physical terms or in price terms (Wikipedia: The Free Encyclopedia, 2008b). More savings, which means more

capital would be available to industries which use JIT philosophy. So, two firms or countries may have equal total factor productivity (productive technologies) but because one has more capital to use, labour productivity will be higher. Low productivity is usually associated with improper management decisions or techniques.

Inventory is a list for goods and materials, or those goods and materials themselves, held available in stock by a business. Inventory are held in order to manage and hide from the customer the fact that manufacture/supply delay is longer than delivery delay and also to ease the effect of imperfections in the manufacturing process (Wikipedia: The Free Encyclopedia, 2008c). When there is an increase in demand for a product from a company and the company is able to meet these demands, there would be the need for its inventory to be restocked regularly. On the contrary, where there is low productivity, the inventory of such company would be idle and represent capital that has been tied down or waste.

A lot of literature exists on the JIT manufacturing management philosophy. Gihan *et al.* (1994) introduced the basic concepts of a Just-In-Time (JIT) manufacturing system which covers the planning stage for JIT manufacturing system through to the quality for JIT manufacturing system. At the planning stage, an understanding of the objectives of JIT and the goals and objectives of the JIT system is required. The goal of a JIT approach is to develop a system that allows a manufacturer to have only the materials equipment and people on hand required to do the job. Quality control concentrates on quality at every stage of manufacture including the purchase of raw material. Quality is an integral part of a JIT program. They noted that, to increase the supplier quality two methods are used in a JIT system; Supplier Quality Engineering (SQE) and Receiving Inspection (RI).

SQE is used to evaluate supplier capability, help suppliers develop process control, resolve quality issues with suppliers and certify that suppliers qualify for JIT production. RI provides an inspection service for purchasing.

Thompson (1994) studied the Just-in-time production in small job shops and showed that small job shops have unique characteristics that may constrain their abilities to accept and implement the JIT production philosophy. Small job shops (relative to large manufacturing firms) have a broad product range and meager operating revenues. As a result, they lack the ability to process jobs in a continuous or repetitive manner and are severely constrained in resources such as capital, human power and managerial expertise. He showed that the feasibility of implementing JIT systems in a small job shop can be fully

understood by addressing elements of JIT production and relating them specifically to the intermittent processes and limited budgets that constrain the small job shop. He noted some of the more frequently identified elements of the JIT production strategy as; the education and training of employees in the JIT philosophy; cross-training of shop floor personnel; setup time reduction, Group Technology (GT); Total Productive Maintenance (TPM); Continuous Quality Improvement (CQI); long-term vendor/customer relationships and pull through production.

Henderson (2008), showed how the Japanese companies used JIT manufacturing philosophy to their advantage. He showed that variety was recognized for its cost in the sense that it complicated the manufacturing process. A sunroof on every Toyota Corolla was not only a marketing ploy but a practical manufacturing improvement as having to make two different types of roof and 2 different types of headlining introduced potential problems. Not only did it require a changeover on the press tool producing the basic item, it meant that there was the risk of defectives whilst the first of the new variants was produced and the process settled down. It meant that the research content on the headlining finishing line and on the main assembly track would vary depending on the model mix. This contradicted the goal of a smooth workload throughout the manufacturing plant, which was central to keeping stock and WIP levels at a minimum.

Owing to the present status of industries in Nigeria, it has become imperative to adopt new management approach/system to the existing system of manufacturing used in Nigeria. This new system in the form of JIT manufacturing philosophy, will serve as a solution to the low productivity and idle inventory being experienced in the Nigerian industrial sector. The benefits accruable from the implementation of the new management system would reduce the dilemma faced by the industries to the minimum level if not totally, eradicating them.

## **MATERIALS AND METHODS**

**Assessment of Manufacturing in Japan:** Japan's major export industries include automobiles, consumer electronics, computers, semiconductors and iron and steel. Additional key industries in Japan's economy are petrochemicals, pharmaceuticals, bio-industry, shipbuilding, aerospace, textiles and processed foods. Japanese manufacturing industry is heavily dependent on imported raw materials and fuels (Wikipedia: The Free Encyclopedia, 2008d).

Taking a study of the automobile industry in Japan and the effect of JIT concept in the manufacturing process, it is obvious that the motor vehicle industry is one of the most successful industries in Japan, which has large world shares in automobile, electrical machineries, parts and engine manufacturing. Japan is home to 6 out of top 10 largest vehicle manufacturers in the world. For example, it is home to multinational companies such as Toyota, Honda, Nissan, Suzuki and Mazda. Some of these companies cross-over to different sectors such as electronics to produce electronic equipment as some of them being a part of keiretsu. Japan's automobiles are generally known for their quality, durability, fuel efficiency and more features with relatively cheaper price than their competitors. The company Toyota, for example, is regarded as the originator of the JIT concept into the production system. In the JIT system adopted, waste was eliminated by:

- Just-In-Time items only move through the production system as and when they are needed
- Autonomation, Automating the production system so as to include inspection. That is, human attention is only being needed when a defect is automatically detected whereupon the system will stop and not proceed until the problem has been solved

Sources of waste in Toyota that needed to be eliminated were identified as:

- Overproduction waste from producing more than is needed
- Time spent waiting waste such as that associated with a worker being idle whilst waiting for another worker to pass him an item he needs (e.g., such as may occur in a sequential line production process)
- Transportation/movement waste such as that associated with transporting/moving items around a factory
- Processing time waste such as that associated with spending more time than is necessary processing an item on a machine
- Inventory waste associated with keeping stocks
- Defects waste associated with defective items

Toyota had to change their factory layout. Previously, all machines of the same type, e.g., presses, were together in the same area of the factory. This meant that items had to be transported back and forth as they needed processing on different machines. To eliminate this transportation problem, different machines were clustered together so items could move smoothly from

one machine to another as they were processed. This meant that workers had to become skilled on more than one machine-previously, workers were skilled at operating just one type of machine. Although, this was initially met with resistance from the workforce but it was eventually overcome. Another aspect of the Toyota Production System is the reduction of setup time. Machines and processes were re-engineered so as to reduce the setup time required before processing of a new item can start. In order to have a method of controlling production (the flow of items) in this new environment Toyota introduced the kanban. The kanban is essentially information as to what has to be done. The information listed on the paper basically tells a worker what to do-which items to collect or which items to produce. In Toyota 2 types of kanban are distinguished for controlling the flow of items:

- A withdrawal kanban which details the items which should be withdrawn from the preceding step in the process
- A production ordering kanban which details the items to be produced (Beasley, 2008)

**Assessment of manufacturing in Nigeria:** In Nigeria, there are small family businesses producing traditional craft goods (pottery, carvings, ornamental cloth and leather goods) and more modern consumer goods, such as bricks and other building materials, milled grain and beverages. In the 1970s large-scale enterprises were established, mostly in the south. They include motor-vehicle assembly plants, oil refineries and factories producing textiles, fertilizers, rubber goods, pharmaceuticals, foodstuffs, pulp and paper, cigarettes, aluminum, iron and steel and petrochemicals (Dettermam, 2005).

The Standards Organization of Nigeria (SON) is empowered with the responsibility of ensuring that manufactured products meet the required standards before allowing the products entry into the market. A total number 39,516 Standards Organization of Nigeria Conformity Assessment Programme (SONCAP) certificates and 44, 754 product certificates have been issued since inception of the assessment programmes till date. Also over 1000 Made-in-Nigeria have been certified under the Standards Organization of Nigeria Mandatory Conformity Assessment Programme (MANCAP) between 2006 till date.

MANCAP is designed by the Standards Organization of Nigeria (SON) to ensure that all locally manufactured goods conform to the relevant Nigerian Industrial Standards (NIS) before such goods are presented for sale in the Nigerian market or exported. The figure was

released in the latest statistics from SON which also indicated that a total of 274 products were certified in 2006, 547 products in 2007 and 199 in 2008. Also, revealed in the statistics is sectoral breakdown of the certified products which showed the manufacturing sector amounting to 167 of the 274 products certified in 2006, while the chemical/technology sector recorded 64. The mechanical sector had 25 products certified; textile/leather 3, electrical/electronics 9, while civil/building had 6 certifications. In 2007, the number of certifications in the food sector rose by 100-267. Some 162 products have already been certified in the sector since this year; bringing the total number of products in the sector that has bagged MANCAP certifications to date to 596 (Sola, 2008).

Although, the statistics given above shows a favourable prospect for manufacturing in Nigeria, it is expedient to note that compared to manufacturing in Japan, these statistical data are small. The reasons for the deviations are not far-fetched but the problems militating against industrialization in Nigeria are dilapidating infrastructure and energy. Others are attributed to the ineffective manufacturing processes employed in conversion of the raw materials. Such problems associated with ineffective manufacturing processes or techniques has led to low productivity of the company.

## **RESULTS AND DISCUSSION**

### **Implementation of JIT in Nigerian industries**

**Steps and strategies:** It is essential to note that in order to implement a JIT system successfully in Nigerian industries, their must be the loyalty of all parties involved towards the actualization of the objectives of the system. In addition, to the required commitment, adequate planning, monitoring, coordination and cooperation from the various levels in supply chain channels are also important. In respect to placing orders for supplies and inventory, these industries in Nigeria, should be able to make rapid and precise decisions. The transportation industry and their cooperation is also crucial in successfully implementing a JIT system in Nigeria as it serves as a link between these supply chain channels and the industries. The following are steps to be followed in order successfully implement a JIT system in Nigerian Industries.

**Enlightenment and education:** Nigerian industries should restructure old management techniques and implement new techniques and styles. Restructuring the hitherto existing management technique might not be quite easy on the employees as they would react to this change, but

as a proffered solution to this, the management should review all new concepts with all employees to build confidence and a belief that the new adopted method will work. Education and training of all employees in the JIT philosophy and the cross-training of organization's personnel has a positive influence in setup-time reduction. The ability to reduce the setup time allows the company to reduce its batch (lot) sizes and achieve productivity. These employees can be further enlightened through their active participation in the implementation process of the JIT philosophy in the industries. This would build self-morale and enable them to easily adapt to the new management technique. The self morale would act as a foundation for encouraging them on the need for flexibility in job function and on continuous improvement of their job skills. Furthermore, this would enhance their participation in identifying and correcting all noticeable mistakes immediately and it would enable them achieve production efficiency through maintaining all equipment on an on-going basis. As such, the management can monitor the conducts of the employee to ensure that best operational practices are adopted when the system is implemented.

### **Redesigning or restructuring of work environment:**

Some job practices are synonymous with industrial activities in Nigeria, which do not increase the efficiency of the industrial sector. A look at the Toyota case study, where the factory layout was changed is essential if the JIT system is to be implemented in Nigeria. In order to promote efficiency in factory operations through the restructuring of research environment, the employees must maintain a clean and orderly work environment by placing inventory or raw materials, supplies and tools in a logical, orderly manner. This is obvious from the way an manner machines were rearranged in Toyota (where all machines of the same type, e.g. presses, were previously together in the same area of the factory, which meant that items had to be transported back and forth as they needed processing on different machines). But through the adoption of the JIT system, these different machines were clustered together so items could move smoothly from one machine to another as they were processed. So, in Nigerian industries for example, items that are used most frequently should be located in a convenient location.

**Flow manufacturing:** For industries producing several products, this step involves the production of a single piece of product at a given time. In a situation, where the work environment has been restructured and machines rearranged, there is need to have specialized workers or well trained personnel that can handle various machines.

Machines and processes must be re-engineered so as to reduce the setup time required before processing of a new product can start. In the implementation of the JIT system, the research environment should be used efficiently and the production manager should ensure production deadlines are achieved.

**Quality control:** This step of the implementation of JIT in Nigerian Industries includes following efficiency rules to ensure that quality products are produced as economically as possible. The products produced are to be inspected so as to meet the standard requirements by the SON and of course the taste of the customer. These efficiency rules to be put in place by the management of such industries may suggest arranging people, products and machines in a way that maximizes production efficiency. This is in reference to the case study used in Toyota. Furthermore, operations charts, work sequence and maintaining a standard stock of high volume production components have been identified as tools and methods that can be used to improve efficiency.

**Re-training existing personnel and/or employing skilled personnel:** In this implementation stage, a research is responsible for several processes in a work cell. Since, the introduction of the JIT system involves organizational restructuring, it is expedient for workers to be retrained or trained on how to use a particular machine or a different machine. These employees should be properly trained so that they are able to perform on several different machines and should be capable of handling various production processes. It is noteworthy that as a result of the benefits derivable from the implementation of the JIT system, newer machines can be obtained. As such, the need may arise for hiring multi skilled workers.

**Prospects of JIT in Nigeria:** Effective and successful implementation of JIT system would generate the benefits listed below for Nigerian industries. These include the following:

**Reduced idle inventory level:** The reduction in tied down capital promotes reduction of unnecessary waste. This in turn contributes to a more efficient use of production and storage space. The improvements in efficiency reduce set-up, ordering and production time and can represent a significant competitive advantage. This competitive advantage allows a company to compete in terms of price and delivery.

**Improvement in productivity:** This is achieved by maximizing employee contributions and the use of

employee skills, competencies and capabilities. This promotes improved product quality and on time production and delivery of products.

**Improvement in customer relation:** In terms of customer relation, satisfaction level increases as a customer patronizing a company is confident that his job would be met with utmost concern and would be completed within an appreciable time. This can further lead to more patronage of the industry by the public by virtue of the public perception the industry has through implementing the JIT system.

**Challenges of JIT in Nigeria:** Some disadvantages exist for the implementation of JIT manufacturing system in Nigeria as it can present a company with problems and challenges resulting in conflict and dissatisfaction within the organization. These disadvantages include:

**Higher initial cost:** Higher initial costs accompanying the implementation. Emphasis has been laid on the need to restructure the work place. The initial cost of carrying out this restructuring are high and the expenses are the result of money spent in redesigning work stations, assembly lines and implementing new hardware and software that facilitates inventory tracking and corporate communication necessary to maximize efficiency.

**Resistance from employees:** There will be resistance from present employees of the industries because implementing the JIT system means changing the hitherto existing organizational mode of operation. This change would lead to a resistance, which impedes and lengthens the implementation from the current employees as they become uncomfortable and they become reluctant to change or adopting new methods.

**Delayed supplies affect production:** Since, there is always going to be need to have a sufficient inventory, transportation delays on the part of the suppliers, can result in insufficient supplies or low inventory levels. When supplies do not arrive on time, production can stop and production lines can be forced to be shutdown.

## CONCLUSION

The implementation of the JIT system in Nigeria requires encouragement, support and commitment from all levels within an organization/company. The employees should be educated on the benefits of the JIT system. This would involve training the employees on the changes accompanying with the system and in some

cases, involves hiring skilled personnel. The basic objective should be that the layout of a plant be designed to maximize efficiency. The restructuring or redesigning means that employees should display flexibility in job function and they should be actively involved in continuously identifying and implementing improvements to the JIT system.

In addition to this, the workplace must be operated in an orderly fashion and be free from disorganization to ensure timely access to frequently used items. Communication at all levels in the supply chain and within all the related levels of the company is fundamental to the success of JIT in Nigeria. In the same vein, good relationship must be made and maintained with suppliers and this can be achieved through regular face to face meetings and the company sending delegates for the supplier conferences. Nigerian industries can also utilize the JIT manufacturing system so as to eliminate wastage, low productivity and idle inventory currently being faced by some industries in Nigeria.

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