

The Impact of Just-in-Time (JIT) in Inventory Management System and the Supplier Overall Performance of South African's Bed Mattress Manufacturing Companies

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Abstract

Just-in-Time (JIT) is an inventory management approach of having the exact amount of inventory goods arriving at the exact time when needed. This paper investigates the impact of this approach on South African Inventory Management systems and the organization as a whole, by comparing two companies producing same products (bed mattress), with different suppliers, and with different inventory management system. Company X has not implemented the Just-in-time approach, while, Company Y has implemented the JIT approach. This paper will provide insight knowledge on the benefits and challenges of this approach, how it can be implemented to improve the performance of a company. Mixed-methods research design has been utilized as a part of this investigation, and descriptive statistics were used to summarize the data collection. From the study conducted it may be concluded that not implementing the JIT system is the causes of lower performance rates, compared to the performance of the company that has. The JIT approach has methods or guidelines on how the company can improve its inventory management system and improve the performance of the company. It is then recommended that organizations in the manufacturing industry implement the Just-In-Time method in their inventory management systems.

Keywords

JIT, Inventory Management, Suppliers, Transportation, Logistics, Performance

1. Introduction

1.1 Background of the Topic

Inventory also known to as the goods and materials that a business stores and uses to achieving its production goals. Inventory management is a discipline primarily about specifying placement of stocked goods (Mwangi, 2013). Stock management includes diverse capacities inside an organization specifically; giving merchandise to meet the client requests and separate from vacillations in that request, to decouple different parts of the creation procedure, to exploit amount rebates, and to support against swellings and value changes (Heizer and Render, 2014). It is a costly resource in the organization, in this way it is basic that it is overseen accurately for the organization to be viable, to build its efficiency levels, and to kill exercise in futility and materials and have low generation costs. Inventory management is important because organizations will ensure assets and stock are well managed and demand forecasting is greatly enhanced to avoid unplanned procurement.

Appropriate inventory levels depend on the production schedule as a managerial response to market demand. Having an excess of inventory in the organization can lead to increase in costs, however having less inventory can lead to a loss in sales, which will then decrease the productivity levels of the organization. With that begin said, it is therefore important for the organization to “strike a balance between inventory investment and customer service”, as it is one of the objectives of inventory management (Heizer & Render, 2014). Inventory management has now been practiced in organizations in combination for optimizing inventory movement, information-sharing between buyer and seller, lean production strategies, and supply chain management concepts, with Just-In-Time (JIT) begin the main current inventory system.

Heizer and Render (2014) described Just-in-Time as having the exact amount of inventory goods arriving at the exact time when it is needed. It is vital to have the minimum inventory necessary in the organization to keep the production line running. As this strategy will lead to the company being more efficient and keep their waste at minimum level, which leads to a reduction in inventory costs, as goods will only arrive when needed in the production process. Harrison and Hoek (2011) described JIT as a philosophy of inventory management that decreases wastes levels and increases the quality of a company.

This study will focus on the impact of JIT in the inventory management systems of two South African mattress manufacturing companies.

1.2 Purpose and Values of the Study

The main goal of this research study is to show the effects of JIT system on Inventory management systems, to highlight both the positives and negatives effects of JIT on inventory. As this information will provide knowledge as to why it is important for organizations to implement JIT and which organizations will benefit mostly from this system.

This paper will provide guidelines of how to implement the system, in such a way that inventory is handled correctly and the performance of the organization improves. This investigation will also provide a difference between how JIT impacts not only the inventory management system but also the performance of the two companies. This research will also provide knowledge on who are the important personnel and the role they play in the implementation of JIT in organizations, and how it can be maintained to continuously improve the performance and quality of the organizations.

1.3 Scope and Limitations

The study was conducted at two manufacturing companies referred to as Company X and Company Y, for the purpose of this study, as companies’ names cannot be disclosed. Both companies are furniture manufacturing companies that are based in Gauteng, South Africa. Therefore, this study will only focus on one product which is the bed mattress, and the most purchased products.

2. Literature Review

This section deals with theoretical literature of the study related Just-In-Time in relation to Inventory Management system in South Africa. The main aspects reviewed encompass the JIT concepts as well as the related concepts and relevant theories related to the study were discussed. The literature reviewed provides the framework for the study.

2.1 Just-in-Time (JIT)

As mentioned, JIT is defined as having the precise amount of stock needed at that exact moment. According to a study undertaken between 1981 and 2000 in the US, it was found that manufacturing companies with less stock in the warehouse are more efficient than those with more stock in the warehouse. Thus, it is found that keeping moderate stock in the warehouse empowers an organization to work insignificant costs of holding costs and also keep setup cost at absolute minimum, takes out undesirable lead time and deliver products according to clients arrange. This enables an organization to accomplish total quality control (TQC) as proficient and powerful store network administration.

The implementation of the Toyota production system (TPS) was the first event that led to the discovery of the JIT system and used it to reduce inventory and lead-time while increasing quality of production. JIT is defined as, “an inventory management aimed at improving a business’ financial performance by reducing excess inventory and its associated cost” (Sungard, 2007). The implementation JIT inventory system requires a long-term and good relationship with suppliers, as they play a crucial role in supplying inventory as they reach a critical minimum level.

This system is viewed as the most critical component in reducing costs within an organization, as it has benefits such as lower inventory levels, which decreases the inventory holding cost (Phung, 2011).

The Just-In-Time philosophy has three aspects in it, namely; JIT Production Management, Total Quality Assurance and Total Preventative Maintenance, which will also be discussed in this section.

2.2 JIT Aspects

The primary objectives of the JIT production management aspects within the JIT system is to emphasis the change from Job-lot production to more high volume recurring manufacturing processes through severe reduction of waste. In this case, waste is defined as any activity that does not add value within the organization or does not contribute in achieving objectives of the organization (Cox & JHB, 1986).

The study that was conducted by Robison and Voss (1987) showed that the application of JIT manufacturing techniques has indicated that the zero defects programs generate the most significant benefits, increasing the total quality assurance levels within the organization.

2.3 JIT Objectives

Just-in-Time system has four main objectives: (1) to produce or deliver good just in time for them to be sold, (2) to produce or deliver subassemblies just in time to be turned into a finished product, (3) to produce or deliver fabricated parts just in time to turn them into subassemblies, and lastly, (4) to deliver purchased materials just in time to turn them into constructed (Roger, Cheng, and Podolsky 1996). The mentioned end goals can be achieved using different techniques. This study will focus on the *push vs pull* techniques.

The *push* technique can be described as a process in which the final stage in the production line activates the retraction of the required parts at needed times from the proceeding centers. Employees will then obtain the right amount of needed parts to complete the order. Sequentially, work centers supply parts to the final assembly line then the manufacturer replaces them. The “push” of work-in-process stockroom to offset the lead times is eliminated, while the requirements of safety stock or Economic Order Quantities are met (Phung 2011).

2.4 Implementation of JIT

To implement JIT system effectively, organizations need to establish a good working relationship with their suppliers. Resources and materials need to arrive just in time as they are needed, therefore the company is required to have a supplier that is reliable to ensure that inventory will arrive in time. Phung (2011) has described different procedures that companies can use to select the most reliable supplier for them to effectively implement the JIT system, these procedures include the following, however the list below is not exhaustive:

- The supplier is required to have an effective production control system in place, this will help suppliers to properly follow their schedule and have an appropriate backup plan when the schedule is negatively impacted.
- The suppliers need to have good working relationship with their own subcontractors to ensure that they deliver on time.
- The supplier needs to have a control over its production process, to ensure that the products they supply will conform to specifications.
- The supplier is required to have a good communication channel, which will enable them to inform its customers of any expected delays and changes in then schedule.
- The supplier is required to have good inquiry department that will be able to take orders, keep track of orders and update buyers of any changes in their orders and the expected delivery dates.

2.5 Supplier Relations

Once the company has used the above-mentioned supplier screening methods, a working relationship can be established. The relationship between the supplier and the organization should have two-way streamed communication, so the supplier can have knowledge on what the organization does and what products they require from them. In this way both parties can contribute or have inputs on how to improve the other’s operation ways (Phung

2011). It is vital that the two parties form working rules, these may include that time scale that is allowed for one party to get notifications from the other about any delays in the schedule (this mostly applies in the supplier side, as it is essential for them to notify organizations of any delays in the process of supplying with them with necessary products). For the organization to properly implement JIT it is essential that they carefully check the deliveries made to them, to ensure that products do not contain any errors and that each product that has been delivered has correct documentation. The organization may decide on how often to conduct a review on their suppliers to ensure that the agreed procedures are being met and that the supplier provides a quality service to them. (Phung 2011).

2.6 JIT Advantages and Disadvantages

Barlow (2015) explained the benefits of implementation JIT within an organization;

- **Less space needed:** There is a reduction in the amount of space the company will need, and that space can be utilized for other reasons that will improve the organizations and also free up space for movement.
- **Waste reduction:** A faster dispatch of inventory prevents the material becoming damaged and turning into waste. This again decreases costs by preventing investment in unnecessary stock and reducing the need to replace unused damaged stock.
- **Decrease Costs:** JIT helps companies not have to make major invests in ensuring that its inventory is safe while is in the storage, as inventory will only arrive when needed and be utilized in that moment.

While there are benefits of implementing JIT, there are also disadvantages that the company needs to be aware off, as they could possible turn into reality. Barlow (2015) explained them as follows:

- **Risk of having a shortage of inventory:** By not carrying much inventory, it is imperative that you have a reliable supplier, who will ensure that you have necessary inventory and at the right time. It is important to have good supplier-customer relationship and have agreements on how inventory will be ordered and delivered.
- **Less control over the delivery times:** You are required to have trust that your suppliers will deliver as agreed. As this could affects your ability to meet your customer's demand and needs, and if they are not satisfied with the service you could lose them to your competitors.
- **Intensive planning is necessary:** With JIT inventory management, the company needs to understand their sales patterns and trends. Therefore, you need to take into account your demand levels, making sure that your suppliers can meets those demands.

2.7 Logistics

Lai & Cheng (2016) defined Logistics refers to all transportation movement of raw materials acquisition to the point of final consumption. Lai & Cheng (2016) described that main aspects of Logistics as being customer service, order processing, inventory management and transportation, of which will be described below;

- **Customer services relates** to how the movement of goods and services is managed and its level of quality. It is about maintaining and implementation the seven that is, ensuring that right products reaches the right customers at the right time, and the right condition and right quantity at the right time, at the right (lowest possible) costs.
- **Order processing** includes activities such as including collecting, checking, entering and transmitting order information. It is how organizations share information about logistics. The data collected will then be will used for purposes such as market evaluation, financial planning, production scheduling and logistics operations.
- **Inventory management** is involves ensuring that organizations have enough inventory to meet its demand.
- **Transportation** is concerned with the ways in which physical inventories are moved between different parties, such as, raw materials suppliers, distributors, retailers and end customers, in a supply chain.

2.8 Inventory Management Systems

Inventory management strategies are essential for the high-performance capabilities of an industry because their prosperity and cost lessening of the company's consumption require enhanced production network execution and information to the representatives (Lambert, 2008). Appropriate implantation of these strategies can profit the organization.

Inventory Techniques:

- ***Re-order point (ROP)***

This system enables an organization to know when to order and when to not order. This can be accomplished through the use of quantitative techniques which require appropriate stock administration (Apte, 2010). Re-ordering level is critical for ideal effectiveness and being successful prompting high store network execution and consumer loyalty. Heizer and Render (2014) clarifies that ROP the organization will just request when the stock achieves a specific level and that the request will be gotten instantly. ROP brings down the stocks by and large, more receptive to changes sought after, is suitable for generally varying kinds of stock inside a similar firm and automatic age of a recharging request at the proper time. Therefore, the following equation can be used:

$$\text{ROP} = \text{Demand per day} \times \text{Lead time for a new order}$$

- ***Economic Order Quantity (EOQ)***

EOQ empowers organization to design their stock recharging or reordering on an opportune premise, for example, month to month, quarterly, half yearly or yearly premise. This system enables an organization to have negligible capacity expenses or zero holding costs inside their distribution centers since stock is coming in and going out promptly. EOQ is the request amount that limits add up to holding expenses and requesting costs for the year. EOQ and ROP are imperative instruments that company can use to guarantee that stock supply does not hit a stock out as clarified by Gonzalez and Gonzalez (2010). Determining the economic order quantity will ensure that the supply chain of these organizations are replenished on a timely basis and delivered to the final consumer.

2.9 Inventory Management Challenges

Integrating demand planning and inventory planning has been listed as one of the inventory management challenges. Stock counts on a daily basis, weekly, monthly, quarterly, half yearly and yearly basis are highly encouraged because this stock is money for the organization (Management Study Guide, 2013). To keep the Inventory Management system up to date Enterprise Resource Planning (ERP) or Material Resource Planning (MRP) are recommended.

As indicated by Sandeep K. (2007) inventory management can bring outlandish misfortunes the business dependably has stock outs, absence of legitimate warehousing designs, conveying the wrong merchandise to the clients and in addition absence of appropriate documentation for products obtained. Thusly, it is fundamental that workers comprehend the stock administration strategies to guarantee the organization gets an incentive for its cash. The unplanned positioning of inventory inside your warehouses which leads to time being wasted as employees will have to spend time locating stock.

3. Research Methodology

The basis of methodology and data collection strategies is the information obtained from the literature reviewed in the previous section. Data collected was not manipulated or altered in anyway. Company X is a manufacturing company located in Randfontein and Company Y is located in Johannesburg, both in the Gauteng Province.

3.1 Research Design, Population and Sampling

A mixed-methods approach has been utilized as a part of this investigation. Mixed-Method Research is an approach for analyzing information that incorporates assembling, dismembering, and fusing (or mixing) quantitative and subjective research (and data) in a singular report or a longitudinal program of demand (Johnson et al., 2018). Descriptive statistics was used to summarize the data collection.

The quantitative research methodology inquired about if and how the participants knows the inventory management techniques being used, and how that knowledge can be translated into numeric value. This required the use of structured questionnaires. Qualitative research methodology provided a depth of understanding on issues that are not possible using quantitative research, through the use of case studies.

From both companies X and Y, the sampling size was the same, five employees from production lines were asked and three from management. Questionnaires were handed out physically and the response rate was 100% for both companies.

4. Findings and Discussions

4.1 Company X and Company Y Supplier Location Profiles

Company X and Company Y were selected and data regarding its material procurement, sources of material, location of suppliers and transportation costs from the suppliers to the companies was examined. The companies currently have three suppliers that are in different areas. These suppliers provide both with the main material needed to produce bed mattress.

Table 1. Supplier Location for Company X

Supplier Name	Supplier location	Material being supplied	Distance between Supplier & Company X
1. Supplier A	Edenvale	Bannell Spring unit	71,8 KM
2. Supplier B	Industria West	Foams	33,5 KM
3. Supplier C	Boksburg	Steel edge support	71,6 KM

Table 2. Supplier Location for Company Y

Supplier Name	Supplier location	Material being supplied	Distance between Supplier & Company Y
1. Supplier 1	Germiston	Bannell Spring Unit	14,5 KM
2. Supplier 2	Randburg	Foams	10,8 KM
3. Supplier 3	Sandton	Steel Edge support	14,4 KM

Each supplier is required to deliver that particular material to the premises of Company X and Company Y. The distance from the different suppliers to the manufacturing company varies, therefor costs will not be the same. Below are the maps representing the locations of Company X and Y in relation to their respective suppliers.



Figure 1. Map of Company X Located in Randfontein Relative to its Suppliers

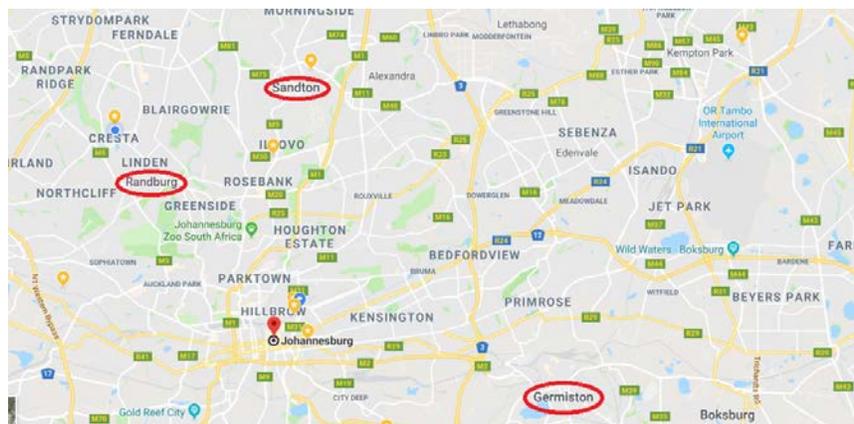


Figure 2. Map of Company Y Located in Johannesburg Relative to its Suppliers

During the data collection, it was found that each supplier charges according to the distance travelled per truck, from the supplier to the manufacturing company. Due to the different supplier locations, the time to get the materials will also vary, depending on the lead time and the distance. Lead time can be defined as the time the company to place an order and for the supplier to receive that order, process it and actually release it for the delivery process to take place (Heizer & Render 2017).

Table 3. Lead Time and Transportation Costs for Company X

Supplier	Lead time
Supplier A	14 Working days
Supplier B	7 working days
Supplier C	14 working days

Table 4. Lead Time and Transportation Costs for Company Y

Supplier	Leadtime
Supplier 1	14 working days
Supplier 2	5 working days
Supplier 3	10 working days

4.2 Survey Results

The tables below show how each company rated the overall performance of suppliers. The results were obtained by sending structured questionnaires to Inventory Control Department, where questions were structured to find the following key performance indicators.

Each questionnaire had four questions, a Likert Frequency scale of 1-5 was used, where 5 is Very Frequent and 1 being Never. All the tables below represent the average ratings of the interviewees.

Table 5. Overall performance of Company X and Company Y suppliers

Questions	Co. X's suppliers		Co. Y's supplier	
	f	%	f	%
1. How often does the supplier miss its delivery time/date?	4	80	2	40
2. How often does the supplier deliver incorrect material?	2	40	2	40
3. How often does the supplier deliver material before its delivery time (early deliveries)?	2	40	4	80
4. How often does the supplier charge you incorrectly (wrong invoice)?	1	20	1	20

Scale: 1 = never, 2 = very rarely, 3 = occasionally, 4 = frequent and 5 = very frequent

During the data collection from both companies, the management and employees were asked about their knowledge on the Just-In-Time inventory management system. Five employees from both production lines of the two manufacturing companies were asked and three management personnel were asked. The Likert Three-point Scale method was applied. The results are tabulated below;

Table 6. Knowledge on JIT system (Company X)

Questions	Management average Response		Employee average Response	
	f	%	f	%
1. Do you what is the JIT system?	3	100	2	67
2. Has your company implemented the system?	1	33	1	33
3. Do you know the benefits of this system?	1	33	1	33
4. Has this approach brought any changes in the company?	1	33	1	33

Scale: 3 = More than I would like, 2 = About right, 1 = Less than I would like

Table 7. Knowledge on JIT system (Company Y)

Questions	Management average Response		Employee average Response	
	<i>f</i>	%	<i>f</i>	%
1. Do you what is the JIT system?	3	100	3	100
2. Has your company implemented the system?	3	100	3	100
3. Do you know the benefits of this system?	3	100	3	100
4. Has this approach bought any changes in the company?	3	100	3	100

Scale: 3 = More than I would like, 2 = About right, 1 = Less than I would like

A structured questionnaire was handed put to find out how the current inventory management approach applied affects the production line, space utilizations and production costs. Management could answer how the inventory system affects the production costs, while employees at the production line were asked about the space utilization and the production line efficiency. Employees questions were different from the management, reason being is that they are the ones who are at the production line most hours of the day, if not the whole working day. Both companies were asked same questions, still using the same sample size. The Likert Likelihood Scale was applied in this section. The results are as follows;

Table 8. Company Performance According to Management

Questions	Co. X's response		Co. Y's response	
	<i>f</i>	%	<i>f</i>	%
1. Does the distance between you and supplier negatively affect your production time cycle?	3	75	1	25
2. Does the inventory levels being stored in your company negatively affect your production costs?	3	75	2	50
3. Does the inventory levels stored negatively affect the total units of finished goods produced?	3	75	2	50

Scale; 4 = To a Great Extent, 3 = Somewhat, 2 = Very Little, 1 = Not at All

The above-mentioned questions were studied from a negative perspective, to determine the negative effects of the current inventory management system.

Table 9. Company Performance According to Employees

Questions	Co. X's response		Co. Y's response	
	<i>f</i>	%	<i>f</i>	%
1. Does the time you spend fetching material negatively affect your production cycle?	4	100	2	50
2. Does the inventory levels around negatively affect your movement?	3	75	1	25
3. Does the inventory levels around negatively affect the production line?	2	50	1	25

Scale; 4 = To a Great Extent, 3 = Somewhat, 2 = Very Little, 1 = Not at All

It is important to remind that the purpose of this study is to show the impact of Just-In-Time system on inventory management, provide knowledge on the relationship between the two (JIT and inventory management) and how it can benefit the organization, and mostly show how JIT can improve the approach of handling inventory in the company. The data collected simply gives an idea of how the two companies are performing with their current inventory management system.

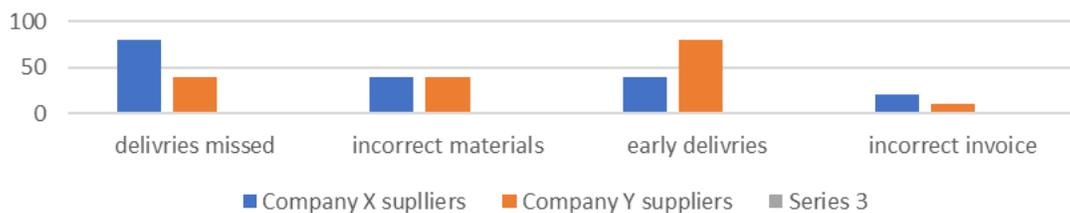


Figure 3. Percentage Response for Overall Performance of Suppliers

From Figure 3 above, the results indicate that suppliers of Company Y perform better than those of Company X. this is indicated by the following;

- Percentages of missed deliveries of Company Y is lesser than of Company X’s suppliers. This is because of the distance between the premises of Company Y and its suppliers, from table two, it is indicated that the distance between Company Y and Supplier 1,2, &3 is much lesser than the distance between Company X an Supplier A, B,&C. Therefore, Company Y can get its material in lesser time and lesser costs.
- The percentage of early deliveries is higher in Company Y, which is also justified by the distance between the Company Y and its suppliers.
- The chart indicates that both companies have faced a situation of receiving incorrect material from their suppliers at the same level of percentages.
- Company Y has lesser situations of having an incorrect invoice from its suppliers.

The above indicators clearly show that Company Y has a better performing supplier.

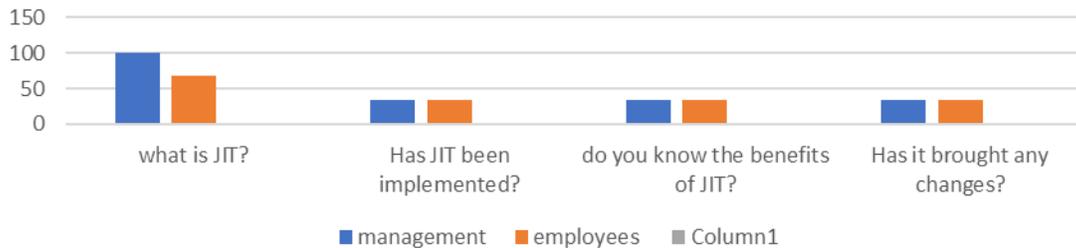


Figure 4. Percentage Response in terms of Knowledge of JIT in Company X

The results from Figure 4 indicates that the whole management team is aware of the JIT system, but its implementation of this system is not visible, as in table 6 management indicated that the implementation is lesser than they would prefer. This leads to the organization now being aware of what benefits this system could bring to the organization. More than half of the interviewed employees know about the system and also indicate that it is not implemented in the organization.

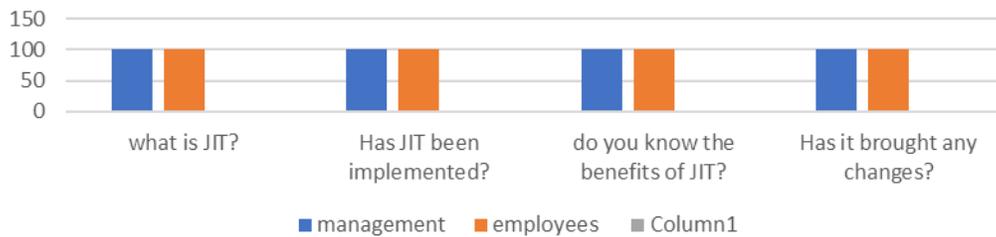


Figure 5. Percentage Response in terms of Knowledge of JIT in Company Y

Figure 5 clearly indicates that Company Y is fully aware of the JIT system and has implemented it fully. All interviewed employees are aware of Just-In-Time and state that they are aware of its benefits and have noticed changes in the organization since the implementation of this approach.

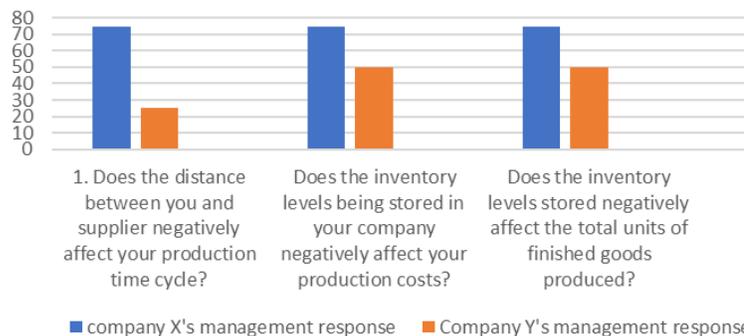


Figure 6. Survey results in terms of percentages Company's performance (management's response)

Figure 6 (above) indicates that Company X (which has not implemented JIT system) has been negatively affected by the inventory levels around the production space. Having stored inventory increases production costs, as the company should pay for the space and ensuring its safety, while also taking a risk of having that inventory being damaged. Company Y indicates less negative effects, as they have already implemented the JIT system in their organizations, but the results do show a need for improvement in how they have implemented they methods, so they could have lesser negative effects.

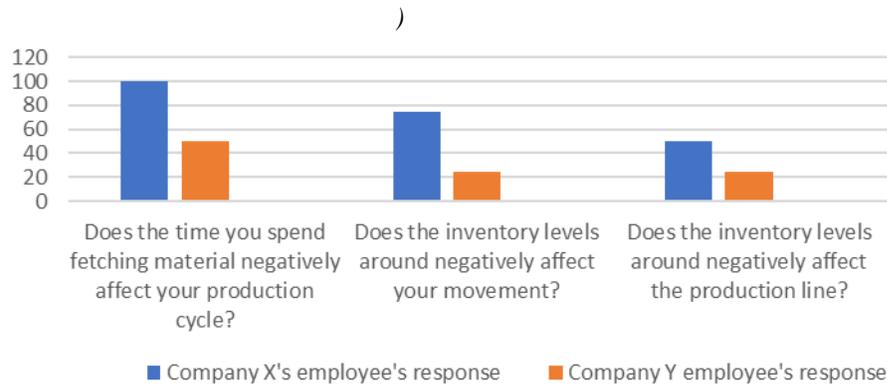


Figure 7. Survey results in terms of percentages Company’s performance (Employee’s response)

The results indicate that having inventory around the manufacturing space can affect your production cycle, as it is seen with Company X’s results. Employees are required to fetch materials when they are needed in the production cycle, which increases the time taken to finish the process of producing that particular product, in this case being a bed mattress. Company Y indicated that employee’s movement is not as negatively affected as in Company X, that is because they (Company X) have less inventory in their premises and they have material near the production line, in the right quantity needed for that day or production cycle.

5. Conclusion and Recommendations

From the study it may be concluded that companies can have lower performance rates, reason being that it has not implemented the Just-In-Time system in the inventory management system. It is also clear that JIT does affect the inventory management system and how the company performance in overall. As results indicated that Company Y performs better and has less production costs, due to the fact they have implemented the JIT system, their employees are aware of this system and have knowledge on the benefits of it. This makes it easier for employees to work with management in efficiently implementing this method. With the above-mentioned recommendations, the company can improve its inventory management system.

Therefore, it is highly recommended that organizations in the manufacturing industry implement the Just-In-Time method in their inventory management systems. This method requires that organizations have a good relationship with their customers, as JIT highly depends on the performance of your suppliers. Close and reliable suppliers make the implementation of the process much easier and more efficiently.

Management of the manufacturing companies are advised to train employees before the full implementation process, as JIT method will require them to change their movements (by eliminating unnecessary movements and non-value adding steps), materials will be closer to the working station and the only necessary materials will be around that work stage. Employees need to understand the value of this method and how it will affect their work processes, by understanding the benefits, they are likely to adopt to this method trouble-free.

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Biographies

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Sambil C. Mukwakungu is an award-winning academic who has been lecturing Operations Management to first year students, Food Production, and Quality Management at the University of Johannesburg since 2009. His passion for teaching and learning has allowed him to make a difference in at least one student's life every year. He is a young researcher who is still establishing himself in knowledge creation with keen interest in Service Operations Management, Lean Operations, Continuous Improvement, as well as business innovation and innovation in Higher Education. He was awarded Best Track Paper Awards in the 2016 IEOM Conference in Rabat, Morocco, in the 2018 2nd European Conference in Paris, France, and his is together with his team from the IEOM UJ Student Chapter a recipient of the 2018 IEOM Outstanding Student Chapter Gold Award for exceptional chapter activities and contributions to the field of industrial engineering and operations management.