



STUDY OF IMPLEMENTATION OF JUST IN TIME INVENTORY MANAGEMENT TECHNIQUE IN MANUFACTURING INDUSTRY

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ABSTARCT: Manufacturing industry deal with the converting the raw material into the finished product, there are several activities which are associated in this process and all this processes are associated with the several expenses which are Machining expenses, labour expenses, electricity expenses, inventory expenses, marketing and operational expenses etc. among this all cost the inventory expenses hold the more than 50% of the total expenses and 70% cost of the product MRP, due to this inventory is most important for manufacturing industry for lowering the product price as well as for quality of product. Poor inventory management can create several problems for the manufacturing industry which are higher inventory related cost, storage issues, no optimum level of inventory, poor efficiency, higher wastage and longer delivery period. This all problem is cause create unbalance in the process and leads to reduces the product quality as well as it directly affect the profitability of the company, also it directly increase the product price and leads to lesser customer satisfaction level because customer want product with lesser price and good quality. This study aim is to analysis the inventory related issues that industry faces also analysis the effectiveness of just in time inventory management technique with its all benefits, lacking and effective method for implementation.

Key Words: Just in time, overstocking, understocking, customer satisfaction, inventory management.

INTRODUCTION

Manufacturing industry is dealing the converting the raw material into the finished product, there are several processes are associated with the converting the raw material into the finished product. All this process is associated with some expenses which are inventory expenses, labour expenses including all salary and wages, marketing and operation expenses, machining expenses, electricity expenses and other expenses. Among all this expenses inventory expenses hold 50% of it and in product selling price it holds 70% of the expense. Therefor inventory is crucial things for manufacturing industry to decided the product price also for generating the positive revenue. Poor inventory management can create lots of problem in the manufacturing industry which are increase overall cost related to the inventory, increase the wastage and scarp, storage issues, longer delivery period, understocking and overstocking. This all are the problem that manufacturing industries are faced while managing the inventory level and this all problems are created unbalanced in

process which leads to decrease the efficiency of the production process. Among all this problem overstocking and understocking is most common problem that manufacturing industries are facing in present time. Most of manufacturing industries are still struggle in maintain the optimum level of inventory. Overstocking of the inventory causes the increase wastage and scrap which is directly affect the profitability of the industry, also overstocking cause create problem related to the storage. Understocking of the inventory cause breakdown of the production process and this leads to increase the production time also it increases the expenses related to the production. Therefore, it is essential for manufacturing industries to manage the inventory in efficient way for reducing all problems related to the inventory.

There are lots of inventory management techniques that companies are implement for managing the inventory level, in which common methods that companies are used are Economic order quantity, just in time, Demand forecasting, Kanban, LIFO, FIFO and ABC analysis. Among all this method this study is based on the implementation of the just in time in the manufacturing industry. This research is all about review the benefits and lacking of the just in time and also find out the ways to implement just in time method effectively in manufacturing industry.

The working principle of the just in time method is that purchase the inventory when its needed in a process, this method is found out in Japan and it's a part of a Toyota production system. In present time just in time concept is most widely implement in a Indian manufacturing companies because of its advantages. There are more benefits of the just in time inventory management technique which are lesser storage cost, lesser storage related issues, lesser overall cost related to the inventory, no overstocking and lesser wastage incurred during the manufacturing process, because of this all benefits just in time inventory management technique is most widely and commonly used in the currently in manufacturing industry. Compared to the other method just in time has more benefits, while taking about the other method all method are has more disadvantages which are higher storage related issues, overstocking, understocking, higher inventory investments and more wastage incurred during the manufacturing processes. Apart from all this advantages just in time has one advantage is that there is no skilled team required for managing the inventory, due to this all reason just in time is most efficient method for manging the inventory level in a manufacturing industry.

As per the principle of the just in time, manufacturer order the inventory when its needed due to this reason in most of cases the overall production and the delivery period is longer also with the just in time manufacturer cannot able to fulfil the instant and unexpected demand of the customer because period between the order and receiving inventory takes to much time, therefor it is directly affect the overall production time and delivery period, in some cases longer delivery periods leads to reduced the customer satisfaction level. This studies aim is to identifying the parameter which are affect the production time while implement just in time also find out the ways to implement just in time more effectively. This study is not only reviewing the effectiveness of just in time but also analysis the what kind of problem that manufacturing industries are facing while managing the inventory level also identify the what kind of problem that are associated which other inventory management technique this including benefits and lacking.

REVIEW OF LITURATURE

- Very few research papers on JIT implementation in Indian context are available for reference, at present. Lohar (2011) has conducted the survey of JIT implementation in Indian industries and found that the JIT has the potential to increase the operational efficiency, quality and organisational effectiveness of Indian industries, while some basic elements of JIT have been slightly difficult to implement in existing production system of industries. Study depicts that to gain the benefits of JIT, Indian industries should be willing to modify their procedure for dealing with supplier, analysis of operations to identify the areas of standardisation, simplification and automation and reengineering of operational processes and procedures are some important issues, which should be examined prior to Figure 1 Objectives of JIT PAGE 280 JOURNAL OF ASIA BUSINESS STUDIES VOL. 8 NO. 3 2014 implementation of JIT. It has been concluded that if these issues are not properly taken care of, the JIT efforts are sure to come across buyers-and supplier-related problems.
- Singh and Garg (2011) have explained about JIT movement, its concept, elements of JIT, motivational factors for JIT and benefits of JIT. Manoj (2011) has conducted his research in ago manufacturing units in Kerala (KAMCO) and found that philosophies like JIT have become imperative for survival

and growth of any manufacturing company, rather than just an option. Road map for adoption of JIT in KAMCO has been explained in study.

- Pisuchpen (2012) has investigated the effect of varying number of kanban cards, mean inter-arrival time of demand and locations of the bottlenecks on the performance integration of JIT flexible manufacturing, assembly and disassembly systems using MANOVA. The study emphasised the interactions between the variables and their effects on system performance for improving performance processes. The research highlighted that minimised WIP can be obtained by higher percentage average fill rate, lower WIP, small average part cycles times and increase in kanban cards, while simultaneously retaining full customer satisfaction.
- Danese et al. (2012) in their research work developed six hypotheses on the relationships between JIT production, JIT supply, efficiency and delivery performance. Authors concluded that JIT production practices have positively affected both efficiency and delivery. JIT supply practices positively moderate the relationship between JIT production and delivery, while there is no significant moderating effect when considering the impact on efficiency.
- Chen and Tan (2013) have shown that organisation ownership not only impacts the implementation of JIT and operations performance but also impacts the relationship between JIT implementation and operations performance: Moreover, the results revealed that, for firms operating in China, the implementation frequency of JIT practices varies with organisation ownerships. The foreign and joint venture firms (JVs) were found to have a higher level of JIT implementation and can also achieve better performance from JIT implementation than state-owned and private-owned firms. Also, JIT implementation was found to have a significantly positive relationship with operations performance in all types of ownership firms.
- Malik et al. (2011) have conducted their research on JIT-based quality management in Indian manufacturing industries, and after employing various statistical techniques in their survey, it has been depicted that the degree of difficulty in implementation of JIT-based quality management was found to be 3.18 on a scale of zero-five, implying that implementation of JIT-based quality management in totality is reasonably difficult in Indian industries.
- Kumar and Grewal (2007) have discussed the critical elements of the JIT in the context of Indian service industries. The study has been analysed by sending a questionnaire to about 60 service industries in Chandigarh, Delhi, Punjab, Haryana and Himachal Pradesh. On the basis of 30 responses received, authors identified critical elements of JIT. Attempt was made to examine the degree of importance and degree of difficulties, of these critical elements in Indian service industries. The results revealed that JIT played an important role in service industries. Authors suggested that elements that were less difficult but more important should be implemented in the initial stage.
- Mahadevan (1997) discussed the readiness of Indian industries in implementation of JIT. The survey was conducted by sending a questionnaire that identified 14 critical factors and participating organisations were asked about importance of these factors. It has been found that automobile industry in India made significant changes in many areas like JIT purchasing, implementation of TPM and multi-skill labour. These factors contribute towards VOL. 8 NO. 3 2014 JOURNAL OF ASIA BUSINESS STUDIES PAGE 281 successful implementation of JIT in manufacturing industry. Management's commitment and participation of workers are the critical success factors
- JIT has garnered a great response from the manufacturing organisations worldwide since its evolution, and a very large number of manufacturing organisations are adopting JIT manufacturing, especially in developed and developing nations. JIT is a critical initiative to meet demand of customer on price, quality and lead times. JIT addresses entire production system over the entire life cycle and builds a concrete, shop floor-based mechanism to prevent various manufacturing losses and wastes (Ahuja and Khamba, 2008). Major aims of JIT are to eliminate all accidents, wastes, defects and breakdowns at the workplace. JIT is the foundation for world class manufacturing, as it facilitates the effective implementation of world-class lean manufacturing practices

RESEARCH METHODOLOGY

Research Design

In order to provide a comprehensive understanding of a just in time inventory management technique across with its advantages, disadvantages and method to effectively implement in manufacturing industry, the research design for this extensive project embraces both qualitative and quantitative research methodologies. To delve into the complex facts of inventory and operation departments experiences, view and opinion regarding the concept of Just in time and other inventory management techniques, qualitative data will be used. Rich qualitative data will be provided via in depth interview with the department of companies which are closely working with both inventory and operation department, because both departments are closely working with each other or can say closely interlinked with each. The departments employees including supervisor, Quality inspector, inventory purchaser, Executive of Operation department and also a director of a company. By using this method, we are able to accurately capture the complexity, benefits and lacking of the just in time inventory management technique.

A quantitative methodology will be used to collect structure data on just in time method. We were disseminating survey with scaled questions to a wide spectrum of employees of manufacturing industry, so that we may measure the satisfaction level, preferences and perception regarding inventory management technique. The quantitative design makes easier to do statistical analysis which enable the discovery of correlation, trends and important connection between variables. This data driven methodology improves the project capacity for making suggestions that are supported by solid evidence and generalizable findings.

This extensive effort attempt to provide a through and well-rounded examination of the just in time inventory management technique in manufacturing industry sector, By combining the both qualitative and quantitative research approach. Its makes use of each approaches advantages to offer a comprehensive perspective of inventory and operation departments employees experience, difficulties. The project findings will be both reliable and representation of the various perspective and aspect present in manufacturing industry.

Sources of data

It is crucial to use a variety of data sources while performing a thorough project that is focus on many aspects of the just in time inventory management techniques such as its advantages, disadvantages, and method to implement effectively. Main information survey, interviews and observation will be used to gather the primary data while directly interaction with employees of manufacturing industry such as supervisor, executive of operation, quality inspector, storekeeper etc. this helps to gain insight of experience, perception with just in time inventory management techniques. Questions are used in surveys to enable the quantitative evaluation of satisfaction, difficulties and perception regarding the just in time inventory management technique. Responses will be divided into a group based on the inventory management technique used in their current manufacturing industry. Utilizing the academic literature review gives theoretical frameworks, best practices and empirical studies pertaining to manufacturing industry which are used just in time technique procedure a strong foundation. It Guarentes that the study makes use of already known information and can build on earlier research.

For doing trend analysis and identification areas where improvements or changes have taken place over a time, historical data such as prior performance measurement and records of operational efficiency will be crucial. The comparable project may create a thorough and evidence-based study of the inventory management techniques in manufacturing industry's strength, weakness and difficulties across implementation of just in time in manufacturing industry. The project is able to give well informed recommendation and suggest creative solution for improving the overall efficiency of the just in time method, because to this project multidimensional approach.

Data collection method

our data gathering technique ensure the breadth and depth of our research in the effort to gain a thorough understanding of our research area “implementation of just in time in manufacturing industry”.

As a main quantitative data gathering technique, survey method will be used and this method allowing us to systematically obtain the data related to the just in time inventory management technique like what are the benefits of it, what are the lacking and what is best approach for implementing the just in time in manufacturing industry. This strategy will be complemented by interviews of the employees of manufacturing industry, including the core member of production and inventory department.

In order to supplement our findings with current knowledge and insight we will also make used of secondary data sources, searching publicly accessible research paper, scholarly literature and industry publication.

Population

Small scale, medium scale and large-scale manufacturing industries employees which are working for more than 1 years and closely working with the operation department like supervisor, executive members, storekeeper and quality control inspector are the centre of the our extensive research projects. The varied group consist of people who are engaged with the manufacturing industry for more than 1 years. We gather the data from the different manufacturing industries and this all industries are located in different regions, each of this companies offers a distinctive view point on research.

Sampling method

For choosing the participants a convenience sampling strategy under the non-probability sampling methodology will be used. The convenience sampling approach was selected because it is accessible and practical which is in line with nature of business. Where it might be difficult to reach a representee and diverse sample.

Participants in this technique will be chosen based on the accessibility and willingness to participate. This all participants are the employees of any of the manufacturing industry and having a experience of more than 1 year. The objective behind is to effectively collect the variety of view point from the wide spectrum of employees, obtain the insights from the employees of different manufacturing industry. Although there is no guarantee that the sample taken will be entirely represented the all-manufacturing industry, this sampling strategy makes data collecting quickly and easy, which is crucial for the study's scope and applicability.

Sampling Frame

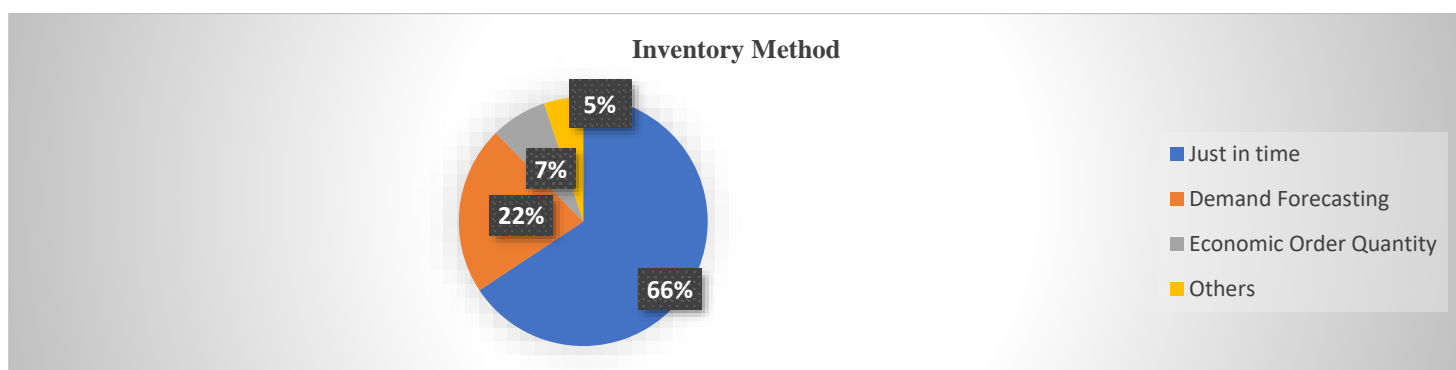
Target group:	Employees of Manufacturing industry
Criteria:	should have work experience of 1 year Mandatory to closely working with operation department
Sampling selection:	convenience method under non probability sampling technique
Data collection:	survey and interviews

Data collection Instruments

An experience with implementation of inventory management technique survey serves as the primary component of our quantitative data collection method. This poll is to create to collect data systematically on just in time inventory management technique. There are questions in it that let respondent rate how satisfy they were with just in time method while managing inventory. These respondents are the people who are work with any of manufacturing industry and having a experience of more than 1 years and employee should be on higher level than workers. These respondent's included supervisor, quality inspector, purchaser, director, executive member etc.

DATA ANALYSIS

Which Inventory management technique currently used in your organization for managing the inventory level?

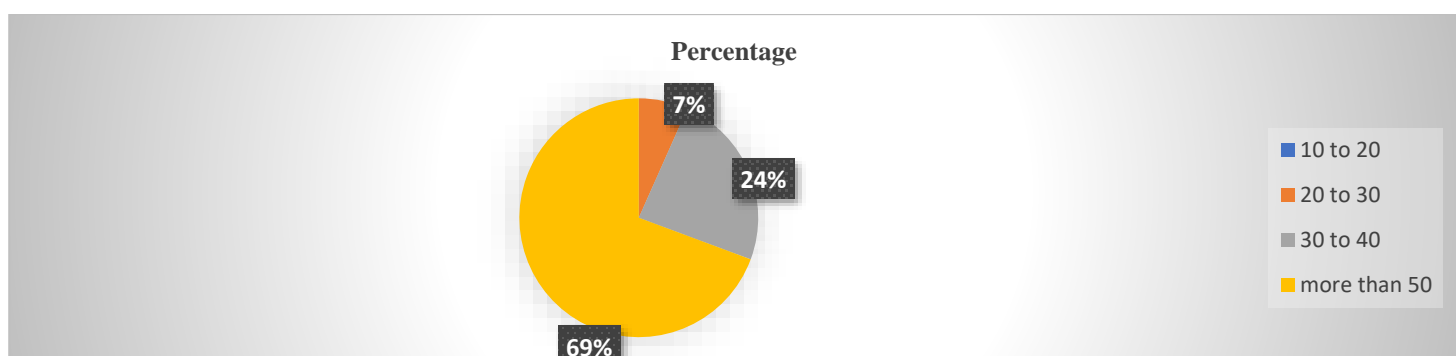


Inventory management technique can be classified according to the participants data into 4 groups which are shown in figure.

A summary of survey participants companies and their implement inventory management techniques are shown in figure. The information provides data on companies and their used method for managing the inventory level. Companies which are implement the just in time techniques are account for greatest percentage of the 150 respondents with 66%. This implies that in current manufacturing scenario just in time is most widely and commonly used method.

Companies which are implement Economic order quantity are 7% of the total sample data. This huge gap between the implementation of just in time and EOQ are provide information that how much the inventory management techniques affect the overall progress of the companies. 22% of the total sample are using the demand forecasting method to manage the inventory level. While 5% of the total are implement other method to manage the inventory level this are included LIFO, FIFO, ABC analysis, MRP, etc.

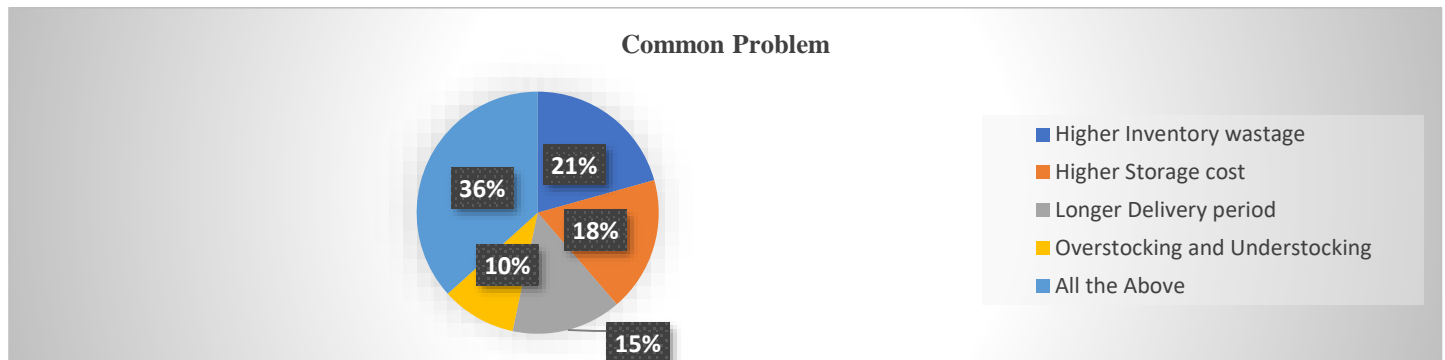
Inventory expense percentage out of the total expense incurred during the manufacturing of the product?



Manufacturing industry deal with many expenses which are included electricity cost, inventory cost, labour cost, machining cost, land cost, transportation cost, marketing cost etc. out of this all cost what percentage of the total cost the inventory cost hold are shown in figure according to the different participants companies data.

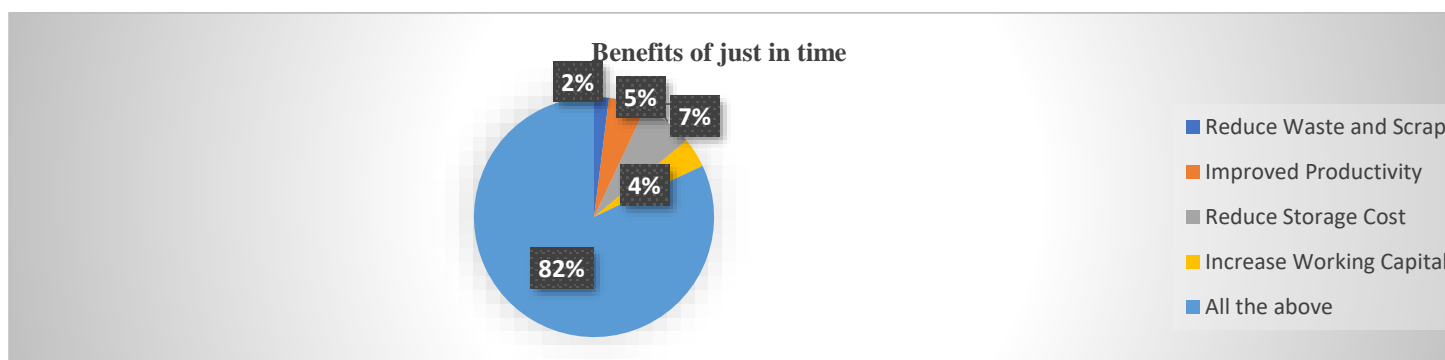
Figure shows that there is not a single company that deal with the inventory expenses less than 10% of the total expenses. 24% of the total 150 sample are state that the expense of the inventory in the total expenses is near about 20 to 30%, while highest 69% companies are state that the expense of the inventory is about more than 50% of the total expense. This data are useful for getting the information about how much the inventory management is important for companies to gain the benefits via managing it in efficient way.

Common inventory management problem that manufacturing industry faced while managing the inventory level?



Common difficulties that many organization are faced while managing the inventory are classified according to the participants data. Figure show the difficulties that manufacturing industry are faced while managing the inventory level. According to the data out of 150 respondants 21% of it are facing problem of inventory wastage higher than required. 18% are have problem with the higher storage cost while 15% of the total are facing the problem with higher production time leads to longer delivery period. 10% companies are facing problem with understocking and overstocking. Highest percentage of companies 36% among the 150 are facing problem with all problem that other companies are face which are storage problem, wastage problem, overstocking and understocking and delivery issues.

Benefits of the Just in time inventory management system while managing inventory level in manufacturing industry?



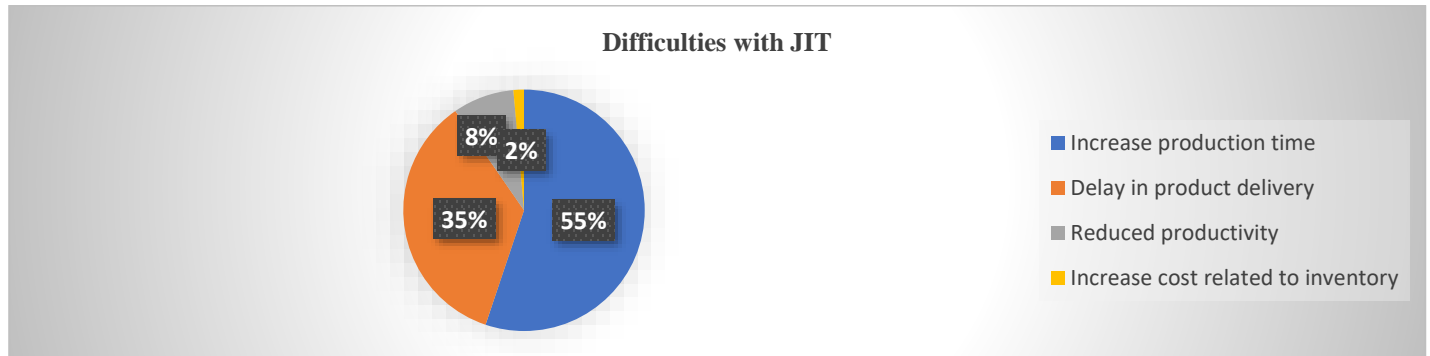
Data are represented the benefits that companies are get while implement just in time inventory management techniques. All the data are shown in figure are represented only companies which are used just in time for managing the inventory level. All the benefits are shown in figure.

Figure are represented that what are benefits of using just in time technique, out of 90 participants companies only 2% of it are state that just in time reduced their wastage of inventory, 5% of the sample companies are state that just in time is beneficial for improving the productivity by lowering the input and maximize the output. 7% of the total sample participants are state that just in time can lower the storage cost and it is beneficial in storage related issues. 4% participants companies are state that just in time can increase the working capital while maximum percentage of companies which are 82% of the total are state that there is

more benefits while using just in time which are lower storage cost, improved productivity, reduce scrap, increase working capital.

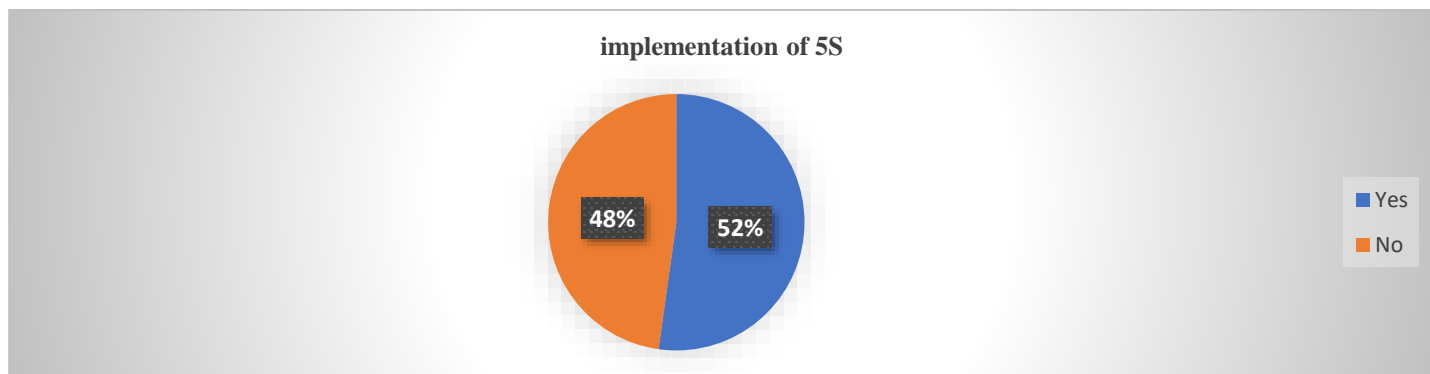
This data are useful for identify the effectiveness of just in time inventory management technique while implement in a manufacturing industry, also it shows the all benefits that companies are get while using.

Most common Difficulties that manufacturing companies faced while managing the inventory with the just in time technique?



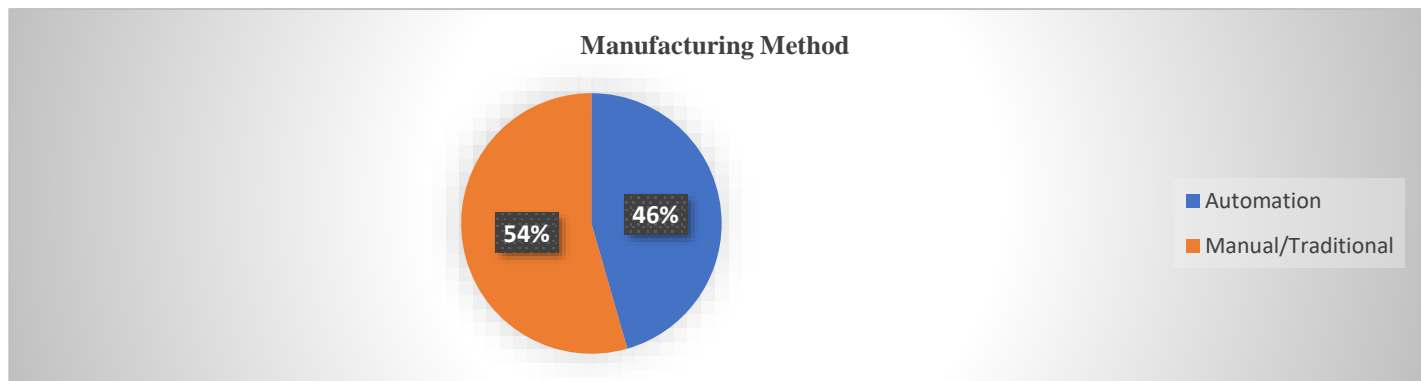
Difficulties that companies are commonly faced while managing the inventory level with just in time are shown in figure, and figure are only represented the companies which are implement just in time technique in their respective company. Figure are shows that out of 90 sample companies 8% are state that there is productivity issues while using just in time. 2% of the total are state that just in time can increase the overall cost related to the inventory while 35% companies are state that there is delivery issues while using just in time and 55% companies are state that just in time method increase the overall production time due to unavailability of raw material.

Did your organization Implement 5S principle while managing the inventory with just in time inventory management system ?



Data are represented only companies which are implement the just in time inventory management technique. Data are in figure are shows that how many companies are implement 5S principle while using just in time. Figure are shows that out of 90 companies which are implement just in time only 52% companies are implement 5S principle while rest of 48% are not implement it.

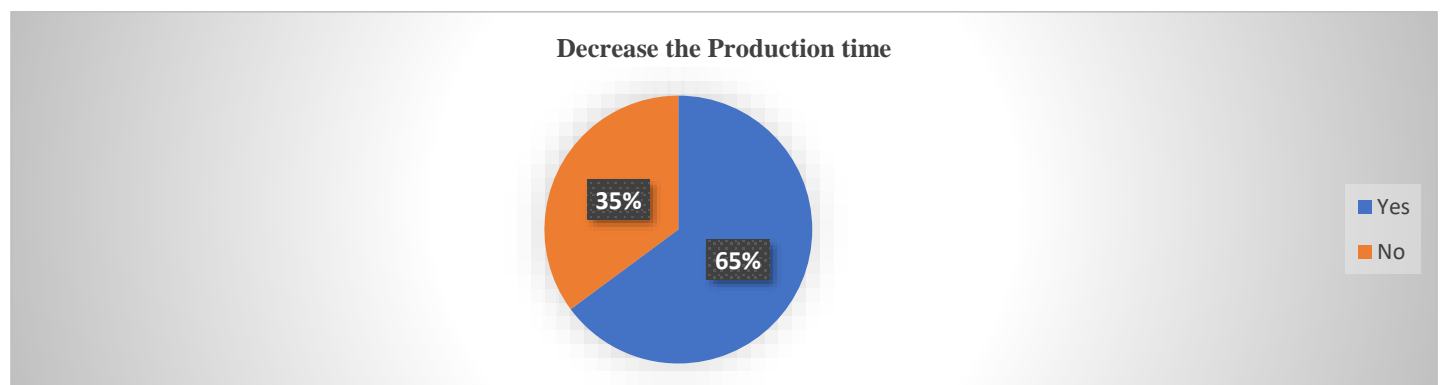
Which kind of Manufacturing process that organization used while managing inventory with just in time inventory management technique? (Manual/Automatic)



Data are in figure are represented the manufacturing method that companies are using for manufacturing the product, this data are only represented companies which are implement the just in time inventory management technique. Figure are shows that among the 90 companies which are implement just in time 46% are have automation in their manufacturing method while 54% of the companies are still using manual or traditional method in manufacturing process.

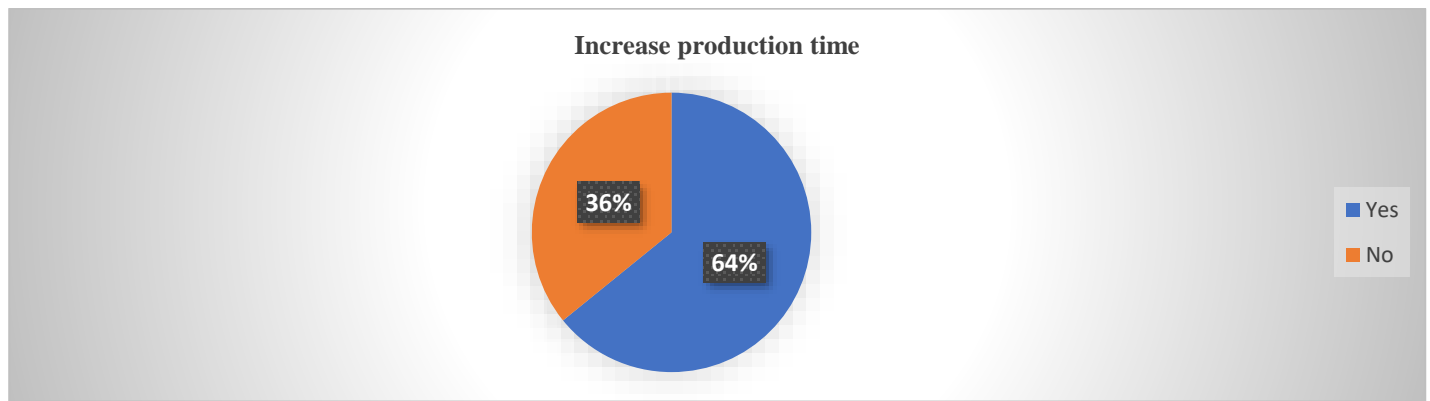
This data are useful to identifying the effect of automation in the overall effectiveness of the just in time technique weather it improve efficiency of just in time technique or not.

Effect of implementation of 5S and Automation on the overall production time while using just in time technique?



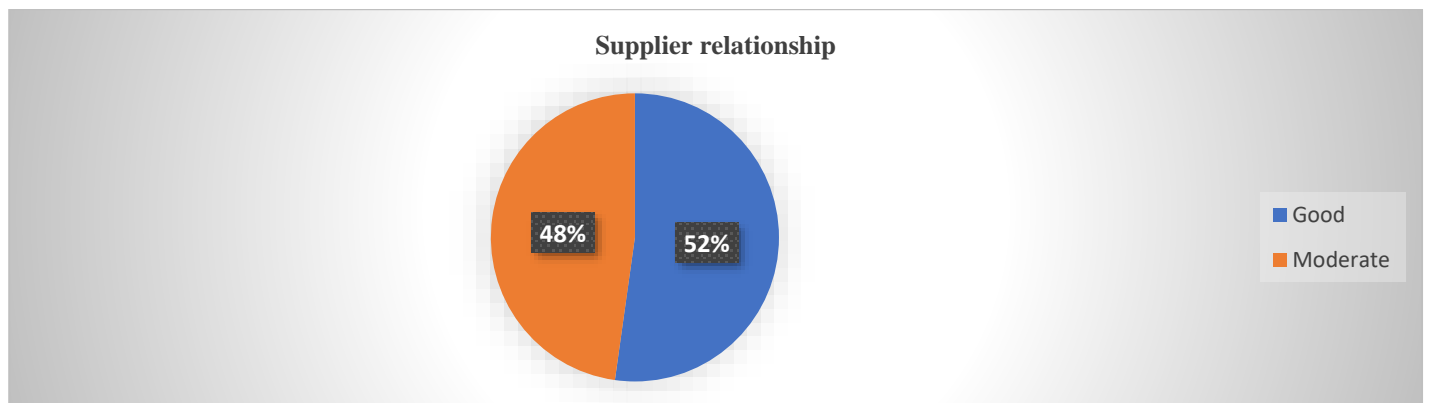
This data is only represented the companies which are implement the just in time and also implement the 5S and Automation. Figure shows effect of the 5S and Automation in a overall product on time weather it lower the production time or not. 65% of the total 37 participants companies are state that implementation of 5S and Automation while using just in time can lower the overall production time while 35% of the total are state that there is no such a good effect of 5S and Automation in a overall production time.

Effect on overall production time while using just in time inventory management technique without implement the principle of 5S and Automation in manufacturing process?



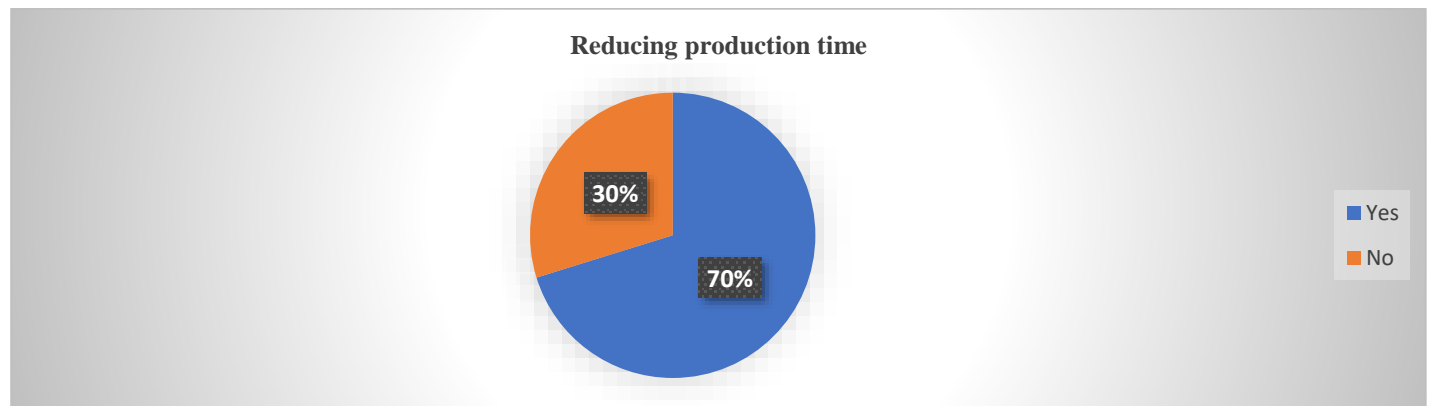
This data is represented only companies which are implement just in time method and not implement 5S and Automation principle. Data are in a figure are shows that implementation of just in time without apply principle of 5S and automation can affect the overall production time or not. Figure shows that out of 53 companies which are implement just in time and not implement 5S and Automation principle 64% of the companies are state that without 5S and Automation overall production time is increase while 36% of the total are state that there is no increased in overall production time.

Relationship with the supplier of inventory while using just in time technique for managing the inventory. (Good/Moderate)



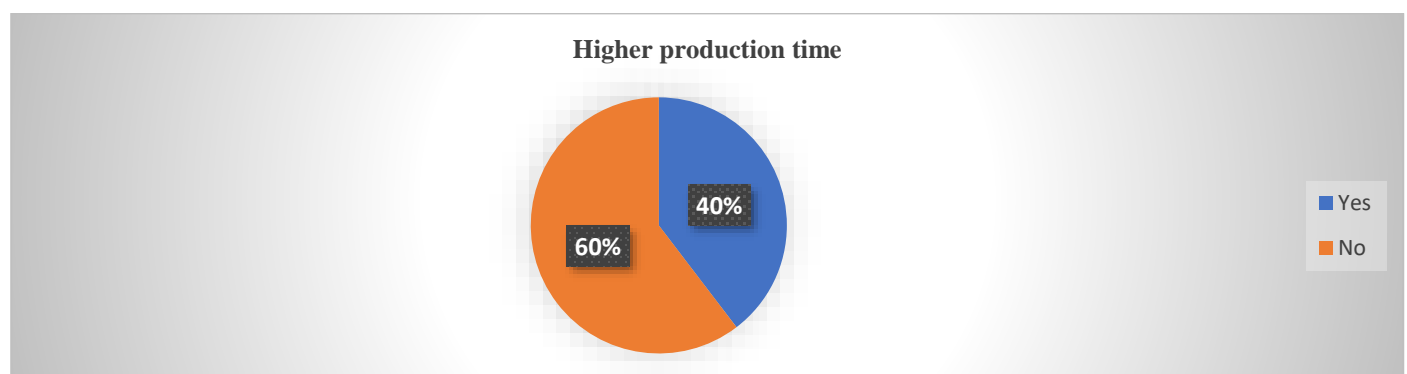
Companies which are implement just in time inventory management technique and their relationship with the supplier are shown in figure. Figure shows the data of 90 companies which are implementing the just in time and their relation with supplier. 52% of the total participants companies are have good supplier relationship while remaining 48% companies have neutral relationship with the supplier. This data are essential for getting insight of effect of supplier relationship on the productivity of the companies while using just in time.

Benefits of maintaining good relationship with supplier in the overall production time and the delivery period?



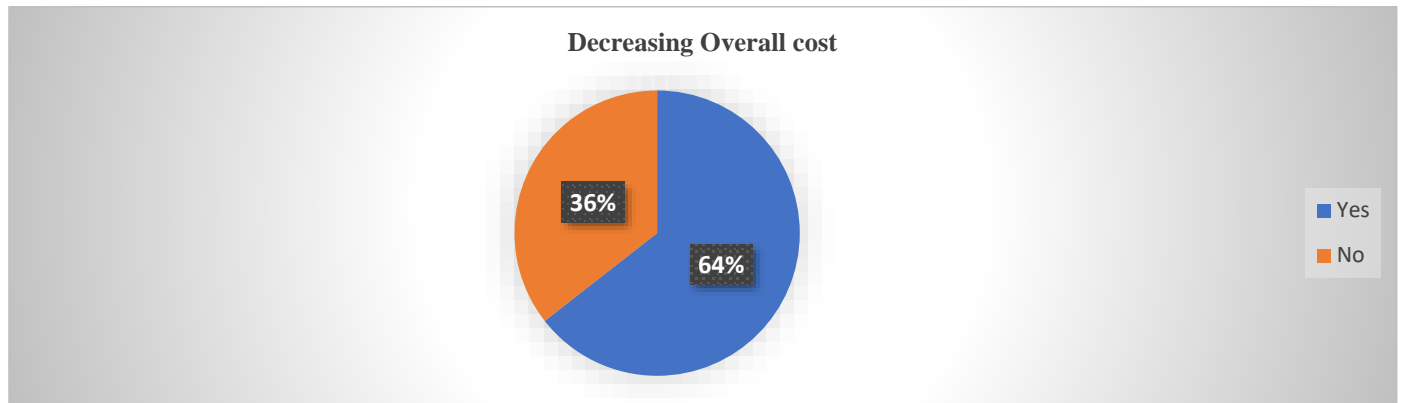
The data in the table are represented the companies which are implement the just in time at the same time have a good relationship with the supplier. Figure shows that whether the good supplier relationship reducing the production time or not. 47 companies are having good supplier relationship and implement the just in time, data in figure are shows that out of 47 companies 70% companies are state that good supplier relationship can lower the overall production time. While 30% companies are state that there is no such good effect of supplier relationship on the production time.

Effect on the overall production time and the delivery period while dependencies on the multiple suppliers for getting inventory therefore supplier relationship is not good but moderate.



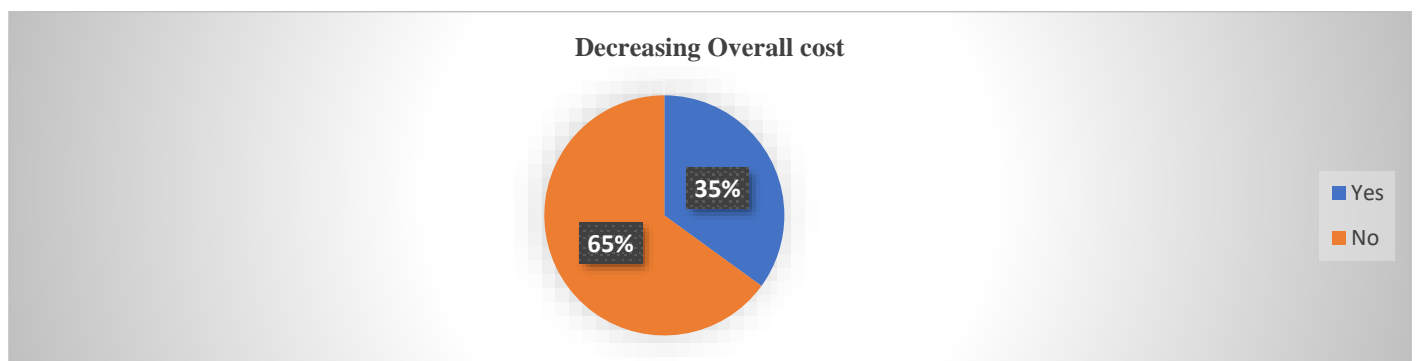
The data in the figure are represented the only companies which are implement the just in time inventory management technique and have neutral supplier relationship. Figure are showing the effect of neutral supplier relationship in the production time. 53 companies' data are in figure which are using just in time and have not so good supplier relationship. Out of this companies 60% of the participants companies are have higher production time while 40% of the companies are sate that there is no effect of supplier relationship in lowering the production time.

Effect of the implementation of just in time inventory management technique on the overall cost related to the inventory including storage cost, order cost, carrying cost and stockout cost weather it is lowering or not.



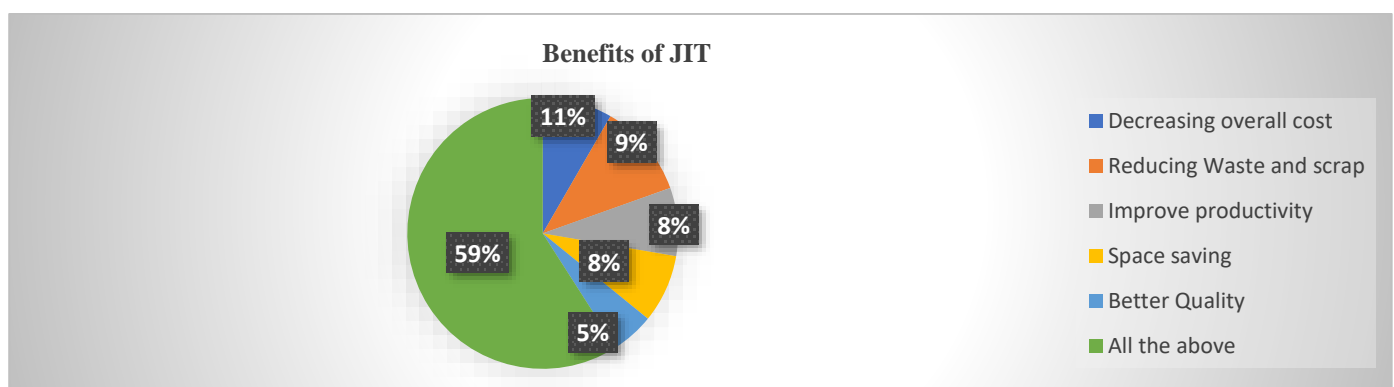
Implementation of just in time and its effect on the overall cost related to the inventory are shown figure weather it lowers the overall cost or not. Figure represented the companies which are implement just in time out of the total sample are collected. Data are in figure shows that there are 64% companies out of 90 are state that implementation of just in time can lower the overall cost related to the inventory while 36% of the companies are not have lower inventory cost while managing inventory with just in time.

Effect of the implementation inventory method other than just in time in the overall cost related to the inventory including storage cost, carrying cost, order cost and stockout cost.



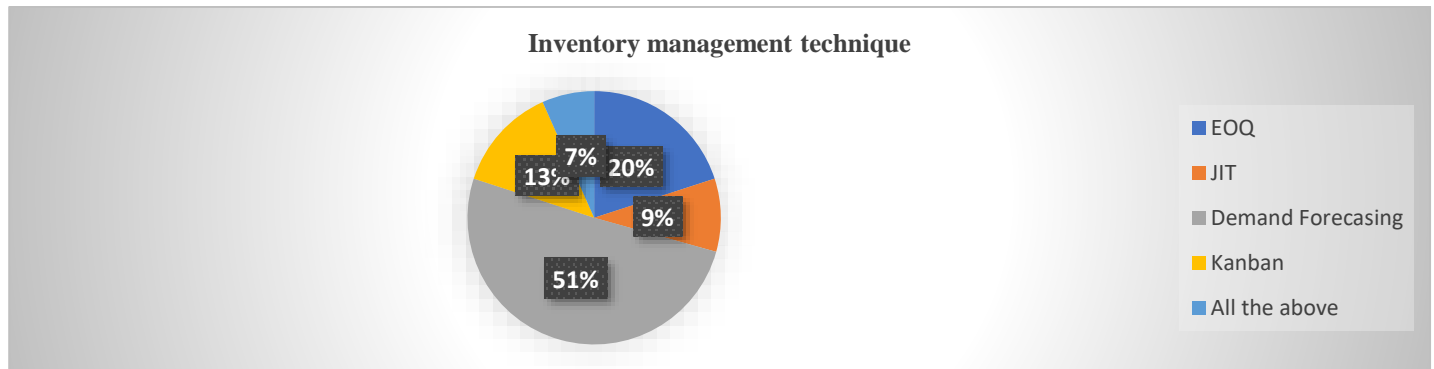
This data is only represented the companies which are not implement just in time in their respective premises. Figure shows effect of implementation pf other method than just in time in a overall cost related to the inventory. Data are in the figure shows 60 sample companies which are implement inventory technique other than just in time. According to the figure 35% of the 60 companies which are not implement just in time are state that they have lower overall cost related to the inventory while 65% of it are state that with the other inventory method overall cost can't be reduce.

Major Benefits of the just in time inventory management technique while implement it in a manufacturing industry.



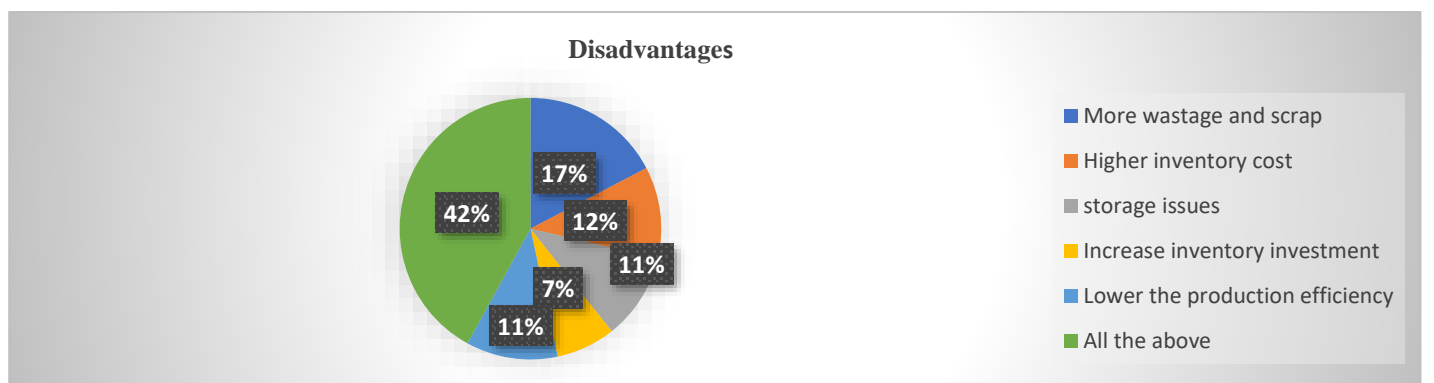
Major benefits of the just in time are represented in the figure, this all data are the common responses of the participants. Figure are shows that all benefits that companies are take while managing the inventory level with just in time. Responses are in figure only represented the companies which are implement just in time in their respective premises. According to the out of 90 companies' responses 9% are state that they have lower overall cost related to the inventory while 11% are state that the just in time method reduce the overall wastage and scrap. 8% companies are have good storage space and less storage related issues. 8% companies are having good operation productivity while 5% are have good quality product production while using the just in time and maximum 59% of the companies are state that there are many benefits of using just in time method which are less storage related issues, good productivity, lesser scrap, and lesser cost related to the inventory also have good quality product due to newly purchase inventory rather than using stored material.

Inventory management technique that is most effective in ensuring the timely delivery of product to the customer and leads to improve the customer satisfaction?



Inventory management technique that most effective in ensuring the timely delivery of product to the customer and result to increase the customer satisfaction level are shown in figure according to the participants companies' responses, most common data are shown in figure. And figure is represented the all-sample companies whether they used just in time or not. Figure shows that out of 150 sample companies 20% of the companies' participants are believe that Economic order quantity is effective in ensuring timely delivery. 9% companies are sate that just in time is effective for managing delivery time while 13% are with the kanban method and greatest percentage of the data which is 51% of the total are believe that demand forecasting is most effective tool for managing the production time and ensuring timely delivery of the product. And 7% of the companies are state that all the method are equally effective to ensuring timely delivery of the product to the customer and enhance the customer satisfaction level.

Major disadvantages of the other inventory management technique compare to the just in time while implement in a manufacturing industry?



Disadvantages of the other method compare to the just in time are shown in figure. Figure are represented the data of 150 sample companies whether used just in time or not. Data in the area shows that the major disadvantages of the other method as compare to the just in time, according to the figure 17% of the total sample companies are believe that other method can produce more wastage and scrap while 12% of the companies are state that implementation of the other method can increase the overall cost related to the inventory. 11% of the companies are state that other method can create the storage issues. According to the 12% companies' other method can increase the inventory investment and 11% are state that other method

reduces the productivity of the production while maximum 42% of the total are state that other method not only increase the wastage but also increase the storage cost, reduced productivity, increase inventory investment and increase the cost related to the inventory.

Hypothesis testing:

We perform an essential study to find significant insight and validate ideas as we go into a data analysis for hypothesis testing within the entire research on the study of implementation of just in time in manufacturing industry. Carefully selected sample, which included 150 numbers of employee belongs to different manufacturing companies and from different region across state. These 150 employees are who working closely with the inventory related department like production department, purchase department, warehousing department etc. these are respondents serve as a foundation for a thorough statistical analysis. By going through this procedure, we want to analysis the just in time inventory management system deeply and also want to compare its advantages and disadvantages with other inventory management and find out the way to implement just in time effectively to minimize its lacking and improving its efficiency.

Inventory cost:

Data in the table are represented effect of implementation of just in time in a overall cost related to the inventory weather it lower or not.

Inventory method used in manufacturing industry	Effect on overall cost related to the inventory		Total
	Lower Inventory cost	Higher inventory cost	
Implementation of JIT	58	32	90
Implementation of method other than JIT	21	39	60
Total	79	71	150

Chi-square Test:

The null hypothesis claims that just in time inventory management system in manufacturing industry cannot reduced the overall cost related to the inventory including storage cost, carrying cost, and order cost. On the other hand, alternative hypothesis claims that implementation of just in time in manufacturing can reduced overall cost related to the inventory and also help to reduce the excess inventory.

Observed value (O)	Expected value (E)	$O - E$	$(O - E)^2$	$\frac{(O - E)^2}{E}$
58	$90 \cdot 79 / 150 = 47.4$	11.4	129.9	2.74
21	$60 \cdot 79 / 150 = 31.6$	10.6	112.36	3.55
				$\frac{\Sigma(O-E)^2}{E} = 6.29$

The using chi-square test the calculated value of the chi-square is 6.29 and the tabular value of chi-square is 3.841 at 0.05 significant level. This result concludes the null hypothesis is rejected and alternative hypothesis is accepted. This conclude that just in time in manufacturing industry can reduce the excess amount of inventory leads to reduce the overall cost related to inventory including storage cost, carrying cost, order cost.

Implementation of 5S and Automation

The data in the table are distinguished the companies among two groups weather they implement 5S and Automation or not while using Just in time also effect of 5S and Automation on the overall production time.

Implementation of 5S and Automation while using Just in time method	Effect of 5S and Automation on the overall time of production while using Just in time		Total
	High production time	Lower production time	
Yes	13	24	37
No	34	19	53
Total	47	43	90

Chi-square Test:

The null hypothesis states that while using just in time inventory management system in manufacturing industry implementing 5S and Automation cannot reduce the overall production time and also cannot help to meet unexpected demand of customer. In other hand alternative hypothesis states that implementation of 5S and Automation with just in time inventory management system can not only reducing the overall production time but also help to meet unexpected demand of customer.

Observed value (O)	Expected value (E)	$O - E$	$(O - E)^2$	$\frac{(O - E)^2}{E}$
13	$37 * 47 / 90 = 19.32$	6.32	39.94	2.06
34	$53 * 47 / 90 = 27.67$	7.67	58.82	2.12
				$\frac{\Sigma(O-E)^2}{E} = 4.18$

Using chi-square test the value of calculated chi-square is about 4.18 while tabular value at 0.05 significant level is 3.841 which is lower than calculated value, this is state that null hypothesis is rejected and alternative hypothesis is accepted. And it is concluded that implementation of 5S and Automation while using just in time inventory management can significantly lower the overall production time and help to meet unexpected demand of customer.

Supplier relationship:

Supplier relationship	Effect of Supplier relationship on the overall production time		Total
	High production time	Low production time	
Good Supplier relationship	14	33	47
Neutral supplier relationship	32	21	53
total	46	44	90

Chi-square Test:

The null hypothesis states that maintaining good supplier relationship while using just in time cannot help in lowering overall lead time and not improve customer satisfaction via deliver product timely. In other hand alternative hypothesis states that there is significant relation between customer satisfaction level and supplier relationship, good relationship among supplier can significantly reduce the overall lead time.

Observed value (O)	Expected value (E)	$O - E$	$(O - E)^2$	$\frac{(O - E)^2}{E}$
14	$47 \cdot 46 / 90 = 24.02$	10.02	100.4	4.14
32	$53 \cdot 46 / 90 = 27.08$	4.92	24.20	0.89
				$\frac{\sum(O-E)^2}{E} = 5.03$

Using chi-square test the value produce for calculated chi-square is 5.03 and the tabular value at 0.05 significant level is 3.841 and it is concluded that null hypothesis is rejected because chi-square tabular value is lower than calculated value. And this result states that there is significant relation between supplier relationship and customer relationship, good supplier relationship ensures timely delivery of inventory and leads to reduce the overall lead time and result to timely delivery to the customer.

FINDINGS

- There are two major inventory management method that currently implement in most of the manufacturing companies which are Just in time and the demand forecasting, among this to just in time is most used and implement by the small scale manufacturing industry reason is that the demand forecasting is based on the assumption and required skilled team for predicting the demand efficiently and for this it required lots of cost behind the prediction of demand also the accurate prediction probability of the demand forecasting method is never 100%, due to this there are several risk are associated with the method. While just in time method has more advantage compare to this also it doesn't require skilled team for managing the inventory.
- According to the data more than 50% of the total expenses incurred during the manufacturing process are hold by the inventory expense, thereby it is essential to manage inventory in efficient way for reducing the total expense because the expense is directly affecting the product cost, lesser the product cost leads to more the revenue generate by the companies. So, inventory management is essential for the profitability of the industry.
- Common problem that manufacturing industries are faced while managing the inventory are higher inventory related cost, higher production time, lesser production efficiency overstocking and understocking. Among this all-problem implementation of the just in time can reduce some of the problem which are improve productivity, no overstocking, lesser inventory related cost and good quality product.
- Implementation of just in time inventory management technique is more beneficial in more areas like reduce material handling cost, required lesser storage, no overstocking, lesser inventory related cost, etc. still just in time method has some lacking which are higher production time, delay in delivery, and unexpected demand can't be fulfil. This all problem causes the affect the overall customer satisfaction level, because delay in delivery of the product to the customer directly reduced their satisfaction level.
- Higher production time, longer delivery issues and unexpected demand problem can be fixed via implement the principle of 5S and Automation in the manufacturing process, because while implement the 5S principle enable the manufacturer to achieve standardization in process, leads to reduce the overall time taken in manufacturing, also 5S can arrange all things in such a way that the time and effort are lesser at same time the productivity is higher. Automation in the process leads to

faster the process, reduced the overall time and effort also at same time reduced the human error with all this production process is faster, smoother and efficient. So the implementation of 5S and the Automation in the manufacturing process can be beneficial for reducing the overall production time and also help to meet the unexpected demand of the customer, leads to enhanced the customer satisfaction level.

- Still more than the half percentages of the companies are not implementing the principle of 5S and Automation in their respective manufacturing industries, due to this more than the half percentage of the companies are facing problem with the higher delivery period and higher production time issues while managing the inventory level with just in time method.
- There is also one factor that affect the overall production time and delivery period while managing the inventory level by the just in time that is supplier relationship, study found that the companies which have good relationship among the supplier are having a less production period due to timely received the inventory, while companies which have not good relationship with the supplier are facing the problem with the longer production period. This proved that it is essential to managing the good supplier relationship while using the just in time for avoiding the delay in production process.
- Industries which are having not good relationship among the supplier out of which most of industries around more than half of it are facing the problem in getting the timely delivery of the inventory and this leads to increase the production time.
- According to the study major disadvantages of the other method as compare to the just in time are higher storage cost, storage issues, higher wastage and scrap, lesser productivity, overstocking and poor-quality product.
- According to the study Demand Forecasting is only method that deal with the timely delivery of the product to the customer and enhanced the customer satisfaction level, but still there are many lacking of it are it is not realistic, based on the assumption and the prediction probability is never 100% which is risk for many companies and also it required the skilled team for predicting the demand.

CONCLUSION:

- In present time just in time is most widely used method in manufacturing industry for managing the inventory level compared to the other method. The reason behind the implementation of the just in time is the benefits of it which are lesser inventory related cost (i.e. storage cost, carrying cost, order cost etc.), no overstocking, lesser wastage and scrap, higher operation productivity, good quality product and no needed of the skilled team for managing the inventory.
- With this all benefits there are also big issues that manufacturing industry are faced while managing the inventory with just in time method which are higher production time, longer delivery period and the unable to meet unexpected the demand of the customer.
- Demand forecasting is one method that enable manufacturer to deliver the product to the customer timely also is most efficient method to meet the unexpected demand of the customer, but still this method is not widely used because demand forecasting is all about the assumption based and the prediction probability is never 100%, because of this method is quite risky for managing the inventory level also it required skilled team for analysis the market and do the prediction based on this. Therefore, demand forecasting is not widely used in manufacturing industry.
- Implementation of the 5S principle and the Automation in the manufacturing process while using just in time method can improved the lacking of the just in time method. Implementation of the 5S and Automation help manufacturer to reduce the overall production time and also help to meet unexpected demand of the customer.
- While implement just in time inventory management technique supplier relationship is most important for the manufacturer to reduce the overall production and delivery period, because the good supplier relationship enable manufacturer to received timely delivery of the inventory and this leads to no breakdown in the manufacturing process, thus supplier relationship is essential for manufacturer for reducing the overall production and delivery period for increasing the customer satisfaction via timely delivery of the product to the customer.

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