A Case Study on Just in Time (JIT)

Swapnil S. Dange[1] Prof. Prashant N. Shende[2] Chetan S. Sethia[3]
[1,3]M. Tech Student [2]Assistance Professor
[1,2,3]Department of Mechanical Engineering
[1,2,3]Yeshwantrao Chavan College of Engineering, Nagpur (An Autonomous Institution Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)

Abstract— Productivity improvement is the one of the basic need of every manufacturing industry, so that Just in Time (JIT) is one of the quality tools that are help to improve the productivity. Just in Time (JIT) has been very popular strategy partly because of its success in Japanese manufacturing, Automobile industries. Analysis of wastages is one of the needs of every industry, so we are using the value mapping analysis to check each value-added and non-value-added activity. Just in Time (JIT) is a system that focuses on inventory control, set up time reduction, waste reduction and continuous improvement to achieve operational excellence. In this paper a single case study is doing in the manufacturing company (Towers making). The main objective of this paper to checking each and every activity to achieve the manufacturing time is less than customer order time. Take a pad and pencil and go out on the shop floor. Pick a product and follow it through the entire manufacturing process from raw materials to shipping. Note every activity performed on the product. Do not get a routing slip to see how the process is supposed to go, but accurately record the process including delays, transportation, inspection, storage, etc. After recording time to calculate Available operating time, performance factor, quality rate and overall equipment efficiency. After calculating overall equipment efficiency to compare with international standard and get suggestions to the case company.

Key words: Just in Time (JIT), Value-added and non-value-added activity, Inventory control, Time reductio.

I. INTRODUCTION

Why Just-In-Time manufacturing when there are dozens of other manufacturing philosophies from which a company may choose? Just-In-Time (JIT) manufacturing distances itself from the competition because no large capital outlays are required. Other methods promote complexity, large overheads, automation, and other "state-of-the-art" technologies, while JIT advocates simplifying and streamlining the existing manufacturing process. Since World War II, traditional American companies have developed a way of doing business that entails top management planning, re-planning, and more planning. Although some planning is good, it ultimately adds no value to the end product. Customers want quality products at competitive prices - they couldn't care less how much planning was required to get that product to them. By implementing JIT, much of the planning disappears and a large portion of the remaining planning is entrusted to the shop floor personnel.

The purpose of this text is to introduce basic JIT concepts and assure you that JIT can work in your company. The transition to JIT often is not easy, but it is almost always rewarding. All employees in the company - from top management to direct labour - must have a clear understanding of the benefits that JIT offers to them and to their company. JIT is not a cure-all for every manufacturing problem. But, if implemented properly, JIT is a no-cost or low-cost method for improving your manufacturing process.

JIT was invented by Taiichi Ohno of Toyota shortly after World War II. Ohno's system was designed to handle large or small volumes of a variety of parts. Many people are intimidated by JIT because of its association with Japan. If these people take a broader look at JIT, they will see that it is nothing more than good, common sense manufacturing.

Ohno and his associates came to America to study our manufacturing processes. They determined that our system was much like the system that Japanese companies were using, but Japanese companies could not afford waste in their systems due to the devastation to their economy caused by World War II. While in America, Ohno learned much about America's culture. One of his discoveries has transformed the world's perspective on manufacturing.

The roots of JIT system can probably be traced to Japanese manufacturing industries. Japan has inherent limitation of lack of space and lack of natural resources. Japanese have developed an aversion towards all kinds of wastes. They view scrap and rework as waste and hence strive for perfect quality. They strongly believe that inventory storage wastes space and results in locking up of valuable material and capital. Anything that does not contribute value to the product is viewed as waste. Thus, it is quite natural for the JIT philosophy to develop in Japan. Apart from eliminating wastes JIT has another important feature utilizing the full capability of the worker. Workers in JIT system are charged with responsibility for producing quality parts Just in Time to support the next production process. The objective of JIT system is to improve profits and return on investment through cost reduction, inventory reduction and quality improvement. Involvement of workers and elimination of waste are the means of achieving these objectives [18]

Legend has it that Ohno got the idea for his manufacturing system from America's supermarket system. Ohno learned the kanban (pull) system from our supermarket system in which customers pulled items from the shelves to fill their shopping carts, thereby creating an empty space on the shelf. The empty space is a signal for the stocker to replace that item. If an item was not bought that day, there was no need to replace it. When item quantities become low, that is the signal for the stockers to order more goods from their suppliers. Customers are content to take just what they need, because they know that the goods will be there the next time they need them.

To apply this concept to manufacturing, Ohno devised a system whereby the usage of parts is determined by production rates. Materials are pulled through the plant by usage or consumption of the parts in final assembly. To obtain maximum results, Ohno decided to move the machines closer together and form manufacturing cells. The JIT system continued to evolve, with the central thrust being the elimination of waste. Ohno's system has become a totally flexible system in which production rates are determined by the end user rather than the producer.

II. LITERATURE REVIEW

The main focuses on product quality, product delivery time and cost of product. The objective of this paper is to increase the productivity and quality of work by implementing the JIT [1]. This author take the semi structured interviews were organized and thus relevant data can be collected. The conclusion of this research indicates that JIT system can lead to many advantages to the company [2]. The fundamental focus of JIT is the systematic elimination of non-value added activity and waste for the production process [3]. The flux used in submerged arc welding after use generates wastages of flux i.e. slag. It is generally thrown away as waste after use. So this slag collected and mixed with some additives and reused. Waste reduction is important issue in today's context. The main objective of the waste reduction is to minimize waste while the resource management aims to maximize the utilization of resources [4]. This author focus on Buffer stock removal, cellular manufacturing, group technology, layout improvement, set up time reduction, worker motivation, W.I.P. reduction. This paper contributes to the Just in Time (JIT) literature by providing a better understanding of why firms consider JIT adoption to be beneficial [5]. This paper stressed on long term benefits resulting from waste elimination, and continuous improvements to systems, programs, products, and people. This paper presents the concepts, implementation strategies and benefits of Just in Time (JIT) based quality management in detail [6]. The main focuses on producer consumer relationship separated by a Buffer, to a simultaneity constraint. JIT system focuses on waste reduction and continuous improvement to achieve operational excellence [7]. This is based on the application of activity based management. To check each activity and reduces the non-value adding activity [8].

There is reasonable consensus among researchers that Just in Time (JIT) is a philosophy of continuous improvement in which non-value-adding activities are identified and removed in order to reduce cost, improve product quality, improve performance, improve delivery, add manufacturing flexibility and stimulate innovation in workplace [11, 12, and 13]. When the JIT principles are implemented successfully across many parts of an organization, a significant competitive advantage can be enjoyed. Enhanced efficiency from waste reduction in order taking, purchasing, operation, distribution, sales and accounting [14, 15]. Operationally, JIT production requires that waste be identified and eliminated in the following areas: waste from overproduction, waste created by waiting or idle time, waste of motion, transportation waste, processing waste and waste from product defects [16, 17].

III. ELEMENTS OF JUST IN TIME (JIT)

- Buffer stock removal [1,6,8]
- Cellular manufacturing [6]
- Continuous quality improvement [6,3]
- Kanban system [5,6,8,10]
- Kaizen [6,7,8]
- Layout improvement [1,6,8]
- Total productive maintenance [1,6]
- Work in process (WIP) reduction [1,6,8]
- Preventive maintenance [1,6]
- Set up time reduction [1,6,8]
- Group technology [6]
- Multifunctional workers [4,6]
- Small lot size [6]

IV. BENEFITS OF JUST IN TIME (JIT)

- Reduced labour cost [1,6,8]
- Reduced number of parts [6,812]
- Reduced scrap and rework [6,8,9]
- Reduced material handling [5,6,16]
- Reduced set cost [6,8]
- Increased communication [2,3,4,6,7,8,9]
- Increased efficiency and responsiveness [1,6,8]
- Increased resource utilization [6]
- Increased productivity [1,6,8]
- Increased team work [4,6,15]
- Increased innovation [6]
- Improved worker motivation [6,12,13,14]
- Integrate different manufacturing activity [6,8,10]
- Increased product quality [1 to 16]

V. CASE STUDY

This part provides case study information that will be referred to as 'ABC Limited' and its introduction to JIT manufacturing. This case study is part of a larger study that focused on manufacturing strategy. The case study was conducted over 15 days and calculates the efficiency of 5 days. Data was collected taking semi-structured interviews conducted in case company, checking activity during plant visits, and production and marketing reports.

XYZ Enterprises has been promoted by the family or Mr. ABC in the year 1993 and is engaged in the activity of manufacturing Line Towers, Microwave Towers, Sub Station Structure and Railway Electrification. It has two manufacturing facilities, both situated in the same Industrial area. XYZ Ltd. factory's raw material storage is spread over the vast area about 400 meters square. All the raw material is unloaded by trucks here in this storage, the storage have its own toll to weight the steel angle bars and other products while either coming in the factory or while outgoing. All the necessary paper work is done and the documents are safely placed in order. There is a supervisor and some helping staff that works in the storage and takes care about all the necessary jobs in the storage.

- Unit 1- Has hot dip Galvanizing facility with both sizes of 7000 mm long
- Unit 2- Has the Fabrication facility and galvanizing facility with a bath size of 10000 mm long.
- Unit 3- Has the Fabrication facility only.

A. Process carried out:- The following are the process carried out:

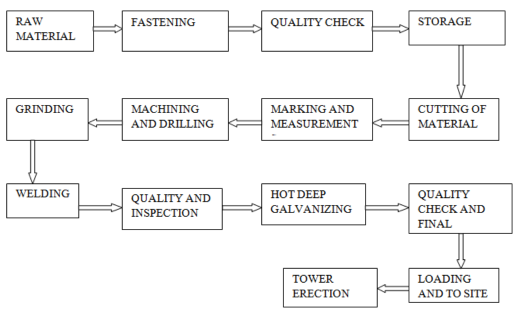

Fig. 1 process carried out in the industry

B. Checking each and every activity in industry:-

To identify waste in your company, a value-added analysis should be performed. We must always be aware that any activity that does not add value to a product is waste. There are specific methods for performing a value-added analysis but we will use a simplified approach for our purposes. Take a pad and pencil and go out on the shop floor. Pick a product and follow it through the entire manufacturing process from raw materials to shipping. Note every activity performed on the product. Do not get a routing slip to see how the process is supposed to go, but accurately record the process including delays, transportation, inspection, storage, etc. Following table I show the value-added and non-value-added activity with time in minute,

Sr. No.	Name of Activity	Value Added Time (min)	Non-value Added Time (min)
1	Place the raw material in warehouse	5.30	
2	Place it for more time		30
3	Raw material input for cutting	5	
4	Keep the plates outside separately		4.37
5	Move them by crane	3.48	
6	Pick and place on CNC machine	2.10	
7	At same time of CNC machine; punching, stamping and notching is done	1	
8	Keep the plates outside separately in store		10
9	Pick and place on crane	0.30	
10	Move by crane	2.50	
11	Then put them on manual notching machine	0.45	
12	Do the notching operation	0.10	
13	Move them by crane	3.20	
14	Pick and place on finishing operation	7.35	
15	Keep the plates outside separately in store		20
16	Move them by crane	2.49	
17	Place them on manual and automatic End Milling machine	2	
18	Do End Milling on half job		12
19	Pickup the job and put it again in position reverse of the previous		2.10
20	Again do remaining half End Milling		12
21	Store them outside		5
22	Move them by pallet truck to second shop	10	
23	Put them on Grinding machine	1.20	
24	Do the grinding	10	
25	Store them outside		30
26	Move by crane	6.28	
27	Put on Hot Bending and Cold Bending machine	3	
28	Do hot bending and cold bending	30	
29	Put them on crane and move in fabrication shop		5.39
30	Again some punching is done	3.40	
31	Then move them by pallet truck to galvanizing section	4.25	
32	Galvanizing is done	90	
33	Check out the thickness of galvanized plate	0.30	
34	Inspect them by using tachometer	0.10	
35	Then place on the crane	1.5	
36	Move them by crane	6.35	

37	Place them to warehouse	2	
38	Jobs are coloured country wise	2.29	
39	Store at warehouse		45
40	Shipping by trucks	15	

Table 1

Table 1 showed us that 40 total activities take place before the customer receives the part. Only 29 of these activities add value, therefore all other activities must be considered waste. Even though some of these wasteful activities are absolutely necessary, they are still waste and should be viewed as such. We will now streamline the manufacturing process, using JIT techniques that will be discussed in-depth later. Table II shows that non-value-added activities,

Sr. No.	Name of Activity	Time (min)
1	Place it for more time	30
2	Keep the plates outside separately	4.37
3	Keep the plates outside separately in store	10
4	Keep the plates outside separately in store	20
5	Do End Milling on half job	12
6	Pickup the job and put it again in position reverse of the previous	2.10
7	Again do remaining half End Milling	12
8	Store them outside	5
9	Store them outside	30
10	Place it for more time	5.39
11	Keep the plates outside separately	45

Table 2

C. Calculating the OEE from table I and II:

Value Added = Total Process Time = 3.73 Hrs =223.8 min
Non Value Added =3.01 Hrs = 180.6 min
Total Time = Total Process Time + Non Value Added
= 223.8 + 180.6
= 404.4

D. Calculating For One Shift:-

1) Available Operating Time (AOT)

AOT = 1 Day * 1 Shift * 8Hrs
= 8 Hrs
= 7.5 Hrs (Take Half Hrs Allowances)
= 450 min

Availability Factor = Total Process Time =404.4 min
Availability = Valuable Operating Time / AOT
= 404.4 / 450
= 0.89
= 89%

Availability factor = 89%

2) Performance Factor (PF)

Designed Cycle Time = 6.41 Ton / Hrs
Output = 23.422 Ton

Performance rate = [(design cycle time*output) / operating time]
= [((60 min / 6.41ton) * 23.422) / (404.4 * 60)
= 0.5421
= 54.21%

Performance factors = 54.21 %

3) Quality Factor (QF)

Scrap = 2%
Total Amount of Defect = 0.47 Ton
Production Input = 23.90 Ton
Quality rate = (production input – quality defects) / (production input)
= (23.90 – 0.47) / (23.90)
= 0.98
= 98%

Quality Factor = 98%

E. The Overall equipment effectiveness:-

*OEE = Availability*Performance rate*Quality rate*
= 0.89*0.5421*0.98
= 0.47
= 47%

Therefore, the Overall equipment efficiency of plant is 47%. It is very important to recognize that improving OEE is not the only objective. The beauty of OEE is not that it gives you one magic number; it's that it gives you three numbers, which are all useful individually as your situation changes from day to day. And it helps you visualize performance in simple terms-a very practical simplification.

Following table III shows the calculation of OEE to shift wise,

Date	Shift	VA (min)	NVA (min)	VOT (min)	AF (%)	I/P	O/P	Scrap
01.04.2014	1	223.8	180.6	404.4	89	23.90	23.42	2%
02.04.2014	1	232.2	165	397.2	88	24.80	24.30	2%
03.04.2014	1	228	150	378	84	24.35	23.87	2%
03.04.2014	2	216	161.4	377.4	83	23.07	22.61	2%
04.-4.2014	1	252	168	420	93	26.92	26.38	2%
Average		**230.4**	**165**	**395.4**	**87.4**	**24.61**	**24.11**	**2%**

Performance rate	Total defect	Quality factor	Total efficiency
54.21%	0.47	98%	47%
57.21%	0.49	98%	49%
59%	0.48	98%	48.56%
56.08%	0.46	98%	45.61%
58.79%	0.53	98%	53%
57.07	**0.49**	**98%**	**48.88**

Table 3

	OEE Company	OEE world class
Availability	87.4	90%
Performance	57.07%	95%
Quality	98%	99%

Table 4

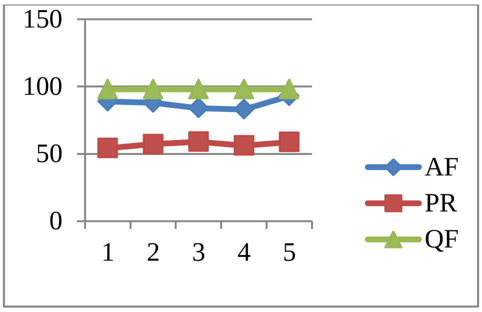

Fig. 2 Graph of AF, PR, and QF

VI. SUGGESTION

- By implementing the JIT we can eliminate the waste and also reduces inventory problem.
- I observed that the in order time required for transfer of component from one machine to another machine is more so we can suggest to use conveyor system to reduce the time.
- The time required after hot bending and cold bending to transfer the component from plate shop to again fabrication shop is more, so arrange the hot bending and cold bending near or in the fabrication shop.
- The performance factor is very less to affect efficiency so reduces non value added activity so the efficiency is increases.
- Using an in-line configuration it is most appropriate for system in which the parts progress from one work station to the next in a well- defined sequence with no back flow.

VII. CONCLUSION

A manufacturing processes and the resource available for producing towers have been studied. From the calculation it is seen that Availability factor to be 87.4% the performance rate 57.07% and the Quality rate is 98%, so the total effectiveness should be 48.88%. This study indicates that the company adopting JIT practices have experienced considerable benefits in all of the measured areas: quality improvement, time based responses, employee flexibility, firm profitability, and inventory reduction. These study results demonstrate that JIT implementation improves competitive performance by lowering inventory levels and reducing quality costs and non-value added activities.

For the future scope of JIT to capture more fully the complementarities that exist amongst JIT implementation and other organizational policies and procedures, including the economic and environmental context that influence both the choice of different manufacturing strategies and their subsequent impact on financial performance.

REFERENCES

[1] V. R. Muruganantham; M. Sindhu Kavi; "Analysis and implementation of JIT in small scale Polymer Industry"; International Journal of Innovative Research in Science, Engg. & Technology, 2014.
[2] Bo Hou, Hing Kai Chan; Xiaojun Wang; " A Case Study of Just-In-Time System in the Chinese Automotive Industry"; Proceedings of the World Congress on Engineering, 2011.
[3] S. P. Vendan, Sakthidhasan; "Reduction of Wastages in Motor Manufacturing Company"; JJMIE, 2010.
[4] Dalgobind Mahto; Anjani Kumar; "Novel Method of Productivity Improvement and Waste Reduction Through Recycling of Submerged Arc Welding Slag"; Jordan Journal of Mechanical and Industrial Engineering, 2010.
[5] Rosemary R. Fullerton; "The production performance benefits from JIT implementation"; Journal of operation management 19, (2001).
[6] Vikas Kumar; "JIT Based Quality Management: Concepts and Implications in Indian Context"; International Journal of Engineering Science and Technology, 2010.
[7] T. Karkoszka, J. Honorowicz; "Kaizen Philosophy A Manner of Continues Improvement Of Processes And Products"; AMME, 2009.
[8] Dr. Shellyanne Wilson; "Just-in-time Manufacturing- By Design or By Default"; POMS Annual Conference, 2009.
[9] Rosemary R. Fullerton; Cheryl S. McWatters; "An Examination of the Relationships between JIT and Financial Performance"; ELSEVIER, 2003.
[10] A. Gunasekaran, R. McNeil, D. Singh; "Activity based management in a small company: A case study"; Taylor and Francis, 2000.
[11] Bonney, M. C; "Trends in inventory management"; International Journal of Production Economics, 1994.
[12] De Hann, Yamamoto; "Zero inventory management: facts or friction?"; Lesson from Japan, 1999.
[13] Singhvi; "Employee involvement in JIT succes: The Eicher experience"; Productivity, Vol. 33, 1992.
[14] Brox, Feder; "Assessing the impact of JIT using economy theory"; Journal of Operation Management, 1997.
[15] Green, Amenkhienan, Johnson; "Performance measures and JIT"; Management Accounting, 1991.
[16] Cheng, Podolsky; "Just-in Time manufacturing-an introduction"; New York: Chapman and Hall, 1993.
[17] Heiko; "Production lead time minimization and Just in Time"; Operations Management Review, 1990.
[18] Martand Telsang; "Industrial Engineering And Production Management"; Reference Book; S. Chand Publication; First Edition 1998.