ISSN: 2278-4632
Vol-10 Issue-11 No.03 November 2020

Inducing Agility in a Truck Tyre Manufacturing Plant via Just–in–Time Practices

1. Prashant Sharma (Department of Mechanical Engineering,SS College of Engineering, Udaipur, Raj, India)
2. Dheeraj Soni (Department of Mechanical Engineering, SS College of Engineering, Udaipur, Raj, India)
3. Kailash Patidar (Department of Mechanical Engineering, SS College of Engineering, Udaipur, Raj, India)

Abstract

In the case of sophisticated businesses, amazing developments in manufacturing management have been noticed in recent times. JIT (Just-In-Time) is one of the most important production management tools. It not only allows a manufacturing unit to function with the least amount of inventory feasible, but it also makes material handling device operations easier with efficient batch load. In truth, JIT is a revolutionary idea, and the issue is implementing it for efficient working capital management. It doesn't use cutting-edge technology or difficult ideas; instead, it focuses on removing needless layers of complexity from the manufacturing process, resulting in little inventory holding. The application of JIT- techniques for a Y- box rubber tread extruder in a premier Indian truck tyre manufacturing plant is discussed in this article. The Y–box extruder is a crucial equipment in the truck tyre production process because it can extrude two separate materials to make a tread rubber with two side walls on both sides. Because of their various purposes, the tread rubber and side wall rubber are made of distinct materials. In this study, a diagnostic assessment of the die changing time of this Y–box extruder is presented, as well as a target performance monitoring table for various decreased values of die changing time. The findings of this review are rigorously reviewed to provide a thorough argument for including a reduced cycle time for this important die shifting process, as well as various implementation approaches. JIT, Manufacturing Management, Inventory, Truck Tyre Manufacturing.

Introduction

In order to achieve agility in the scheduling process of production systems, He et al. 14 [2002] focused on delayed product specifications. He emphasised the necessity of delayed product differentiation in attaining low-cost short-cycle manufacturing. It is, without a question, a possible cause, but it is not the only one. Instead of an integrated approach to agile engineering, the whole effort has been centred on scheduling. Sawik et al. 23 [1993] emphasised flexible flow lines, while Silver et al. 26 [1985], Gupta11, and Krishnan[1998] emphasised inventory and production planning decision systems in achieving agility in the industrial system. However, since they are one of the key factors of agility, an integrated approach is overlooked. The advantages of delayed product diversification, according to Gupta et al. 11-12 [1991],[1998], include lower safety stock only and faster customer reaction time. He et al.15 [1996] claimed that modular designers want to replace a unique integrated element with an assemblage of common components that may be created in the machining stage or obtained straight from suppliers when designing. Because modular designs increase the number of assembly operations and the time it takes to complete them, they may necessitate the addition of more assembly stations to the system. This occurrence changes the production system to a long cycled manufacturing system rather than a short cycled manufacturing system, which is a distinguishing feature of agile manufacturing. Kausiak18 [1989] suggested using a digraph G to depict assembly sequences, with each node representing a component or subassembly and an arc representing a precedence connection between two nodes. A subassembly or assembly is defined as any node having more than one edge incident to it. An assembly is always represented by the diagram's root node. The promise of fast prototyping technology for achieving short cycled production was discussed by Hull C.

ISSN: 2278-4632
Vol-10 Issue-11 No.03 November 2020

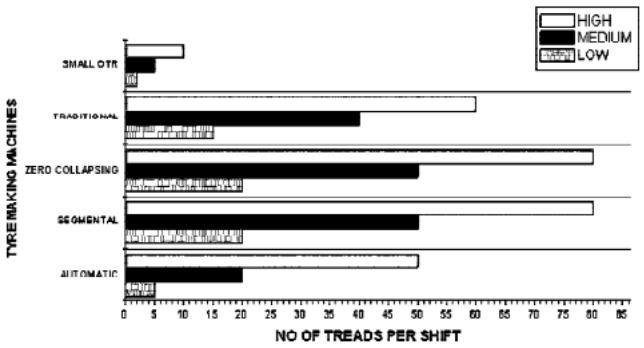
et al.16 [1995]. He suggested that fast prototyping has enormous development potential since it can replace a lot of current technologies. Dong7 [1998] has placed a strong emphasis on intelligent rapid prototyping approaches for quick response production. Hansen, D13 [1993], discussed the best production tactics for multi-line facilities in order to achieve proactive manufacturing. Comb.,J.W.6,et al., [1994] explored layered manufacturing for achieving complicated profiles in a short amount of time to fulfil client demands.

One Y Box Extruder Condition

Serial no	*Tyre making machine*	*Low no of treads/shift*	*Medium no of treads/shift*	*High no of treads/shift*
1	Automatic	5	20	50
2	Segmental	20	50	80
3	Zero Collapsing	20	50	80
4	Traditional	15	40	60
5	Small OTR	2	5	10

Methodology

JIT techniques are used in the agile manufacturing system. Through the use of short cycled manufacturing activities, all types of inventories and storages are reduced to a minimum. The number of treads generated every shift may be significantly enhanced by using JIT procedures for a y box extruder. The statistics below provide a comparison of the number of treads produced each shift in a truck tyre production plant employing different tyre producing machines under one Y box extruder and two Y box extruder circumstances.



Results

According to the results of the study, the majority of papers on agile manufacturing deployment are conceptual.

Further investigation finds that some of the papers examine the factors connected with the agile manufacturing philosophy's implementation. Unfortunately, there is no agreement among academics on the proportional relevance of this characteristic in the agile manufacturing implementation. As a result, it's important to identify the crucial factors connected with each of the agile engineering philosophy's core principles, which may vary depending on the industry. The frequency of citation was considered as the primary factor in determining the relevance of these factors in our research. Given the uncertainty surrounding the terminology employed by the various academics, the researchers had to rely on their best judgement in identifying and grouping the variables described in the papers. As a result, some of the variables may not be mutually exclusive, and they may interact in certain circumstances. As a result, at least in analogous circumstances, a mathematical model is necessary to estimate the relative agility of various production techniques.

ISSN: 2278-4632
Vol-10 Issue-11 No.03 November 2020

There has been little study done in many tyre manufacturing facilities, particularly for one of the leading rubber product producing corporations that also manufactures aero tyres. when all production variants are examined, together with all conceivable process sequences in the manufacturing facility

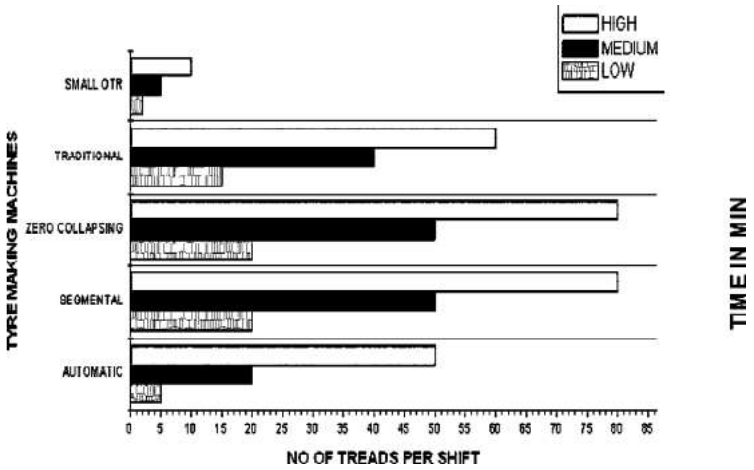
A model of this kind has been developed in order to get a preliminary ideal of the agility condition of the involved industrial units.

MONITORING GOAL PERFORMANCE

JIT techniques are used in the agile manufacturing system. Through the use of short cycled manufacturing activities, all types of inventories and storages are reduced to a minimum.

The number of treads generated every shift may be significantly enhanced using JIT procedures for a y box extruder.

Serial No	*Tyre making machine*	*Low no of treads/ shift*	*Medium no of treads/shift*	*High no of treads/ shift*
1	Automatic	2	10	25
2	Segmental	10	25	40
3	Zero Collapsing	10	25	40
4	Traditional	7	20	30
5	Small OTR	1	2	5



Conclusion

In a truck tyre production plant with a vast product diversity, a single Y box extruder may provide significant operational efficiency without adding a lot of complexity. The sensitivity analysis for reducing die change time is critical for increasing manufacturing output. The decrease of die change time qualifies a manufacturing unit for JIT implementation and for operating a plant at the lowest feasible cost with the fewest risks and expenses. The goal of zero inventory has yet to be reached. It is currently in the early stages of development. Manufacturing industry, on the other hand, may be able to reach SMED (Single Minute Exchange of Die). It is one of the approaches that helps to support technology's short cycle. Methodologies that might be used include:

ISSN: 2278-4632
Vol-10 Issue-11 No.03 November 2020

References

[1] Chattopadhyaya, S. et al 1999, “Smart Layer Approach for Built in Diagnostic”, National Conference on Agile Engineering, Proc. 245-251.

[2] Chattopadhyaya, S., Basu, A.K.,1999, “Facility System Analysis of a Conveyor Belt Manufacturing Unit through A Computer Based Simulation Model”, National Seminar in Applied Mathematics Held on 24th & 25th October, 1999 at the Department of Applied Mathematics, BIT Mesra, Ranchi.

[3] Chattopadhyaya S., Varma, A.,2000, “Design of a Mechatronic Factory – a Case Study on a Conveyor Belt Manufacturing Unit”, Proc., 14th National Convention of Production Engineers IE(I) & National Seminar On “Mechatronics in Manufacturing System, Held at BIT, March, 2000, pp. 97- 103.

[4] Chattopadhyaya., Basu, A.K., 1999, “Facility System Analysis in the Agile Engineering Environment” National Conference on Agile Engineering, Held on 4th & 5th October, 1999 at the Department of Production Engineering BIT Mesra, Ranchi.

[5] Cho, K.Y., et. al,1996, “ System Analysis of a Multi-product product Small Lot Sized Production by Simulation “ a Korean Motor Factory Case. Computers and Industrial Engineering, 30, No. 3, July 1996.
[6] Comb, J.W. et al. (June 1994), “Layered Manufacturing Control Parameters and Material Selection Criteria” Proc. Manufacturing Science and Engineering, Chicago, Illinois, ASME.

[7] Dong Jian (John), 1998, “Rapid Response Manufacturing, Contemporary Methodologies, Tools and Technologies”, Edited by. 1998 Chapman & Hall.

[8] Gordon, J. and Sohal, A.S., 2001, “Assessing Manufacturing Plant: An Empirical Field Study”, International Journal of Operations and Production Management, 21, 233-253.

[9] Grewin,D. and Kolondy,H.,1992, Management of Advanced Manufacturing Technology: Strategy, Organization and Innovation (New York: Wiley).

[10] Gupta,J.N.D. and Tune,E.A.., 1991, “Schedules for a Twostage Hybrid Flowshop with Parallel Machines at the Second Stage”, International Journal of Productions Research, 29, 1489- 1502.

[11] Gupta, S. and Krishnan,V., 1998, “Product Family based Assembly Design Methodology”, IIE Transactions, 30, 933- 945.

[12] Gupta,J.N.D., 1998, “Two-stage Hybrid Flowshop Scheduling Problem”, International Journal of Productions Research, 34, 359- 364.

[13] Hansen,D. “Optimal Production Strategies for Plants with Multiple Shut Down Levels and Multiple Production Lines” IIE Transactions., March 1993.

[14] He,David and Babayan, 2002, “Scheduling Manufacturing Systems for Delayed Product Differentiation in Agile Manufacturing”, International Journal of Productions Research, 40, 2461-2481.

[15] He,D.W.A. and Kusiak, A., 1996, “Performance Analysis of Modular Products”, International Journal of Productions Research, 34, 253-272.