International Journal of Mechanical Engineering Research And Development (IJMERD)

ISSN 2248 – 9347(Print)
ISSN 2248 – 9355(Online),
Volume 3, Number 2, April - May (2013), pp.61- 67
© PRJ Publication, http://www.prjpublication.com/IJMERD.asp

IJMERD

© PRJ PUBLICATION

RELATIONSHIP AND COMPARISON BETWEEN IN JIT, TQM AND TPM: A REVIEW

Sanjay Paliwal[1], Amit Raj Varshney[2] and D.S.Awana[3]

[1]Department of Mechanical Engineering
Sunder Deep College of Engineering and Technology
Ghaziabad (U.P.), India

[2]Department of Mechanical Engineering
Sunder Deep College of Engineering and Technology
Ghaziabad (U.P.), India

[3]Department of Mechanical Engineering
Sunder Deep College of Engineering and Technology
Ghaziabad (U.P.), India

ABSTRACT

Purpose – During the last decades, different quality management concepts, including total quality management (TQM), TPM, six sigma and lean, have been applied by many different organizations. Although much important work has been documented regarding TQM, TPM and lean, a number of questions remain concerning the applicability of these concepts in various organizations and contexts. Hence, the purpose of this review paper is to describe the relationship and differences between the concepts, including an evaluation of each concept.

Design/methodology/approach – Methodology is based on a literature review.

Findings – While TQM, TPM and lean have many similarities, especially concerning origin, methodologies, tools and effects, they differ in some areas, in particular concerning the main theory, approach and the main criticism. The lean concept is slightly different from TQM and TPM. However, there is a lot to gain if organizations are able to combine these three concepts, as they are complementary. TPM and lean are excellent road-maps, which could be used one by one or combined, together with the values in TQM.

Originality/value – The paper provides guidance to organizations regarding the applicability and properties of quality concepts. Organizations need to work continuously with customer-orientated activities in order to survive; irrespective of how these activities are labeled. The paper will also serve as a basis for further research in this area, focusing on practical experience of these concepts.

Keywords- Quality management, TPM, Total quality management, Lean production
Paper type- Research paper

1. INTRODUCTION

Today has been an increasing awareness and implementation of practices associated with Total Quality Management (TQM), Just-in-Time (JIT), and Total Productive Maintenance (TPM). Nevertheless, there has not been a careful examination of the common and unique practices associated with these programs. On the other hand, many researchers believe and argue conceptually the value of understanding the simultaneous use of different manufacturing programs. For instance, [22] contend that maintenance management may well be the biggest challenge facing companies that implement TQM, JIT, and computer-aided manufacturing. Similarly, [13] discusses the importance of considering the integration of JIT, TPM, quality control, and factory automation with worker participation. Furthermore, [15] believes that TQM and TPM are the two pillars supporting the JIT production system.

We develop a framework for TQM, JIT and TPM and examine the comparison and relationships between the use of these practices and manufacturing performance. TQM, JIT and TPM have similar fundamental goals of continuous improvement and waste reduction [25], [19], [20], [21]. Together the practices of TQM, JIT, and TPM form a comprehensive and consistent set of manufacturing practices directed towards improved performance. Therefore, manufacturing plants are likely to combine the implementation of TQM, JIT, and TPM practices. However, most of the studies on TQM, JIT, and TPM investigate these programs separately. Only a few studies have tried to explore the relationship between TQM and JIT empirically [09], [26]. Also, some studies indirectly consider all three programs while focusing on only one of them. For example, [18] indirectly examines the relationship of TPM with JIT and TQM when investigating the implementation and impact of TPM. They find that TPM has a positive and significant direct relationship as well as an indirect relationship through JIT with low cost, high levels of quality and strong delivery performance.

The conceptual research cited above provides evidence of a renewed interest in the study of manufacturing programs with an emphasis on their simultaneous investigation. While researchers recognize the value of investigating interrelated entities simultaneously, there is no study that provides empirical examination of the joint implementation of TQM, JIT, and TPM practices. Therefore, in this research we seek to examine these manufacturing practices within a single theoretical framework. Our goal is to identify the differences between high and low performing manufacturing plants with respect to their implementation of TQM, JIT, and TPM practices.

2. LITERATURE REVIEW

We considered the entire literature on TQM, JIT and TPM focus only on empirical work in this paper. The empirical studies that we draw upon are studies in the last 10 years that have sufficient grounding in the literature and assessment of measurement used in empirical analysis. We consider the research on TQM, JIT, and TPM and develop a single framework for the practices.

The earliest JIT were introduce in 1977 [27] and several years later, the impact of JIT practices on manufacturing performance was recognized. JIT is a manufacturing system with the primary goal of continuously reducing and ultimately eliminating all forms of waste [27], [20], [6], [25]. The focus is on minimizing raw material, work-in-process, and finished goods inventory with a view to cutting inventory costs and also helping to expose other more serious inefficiencies in the manufacturing cycle [28]. Two major forms of waste work-in-process inventory and unnecessary delays in flow time [6] can be addressed through the implementation of JIT practices, such as set-up time reduction and pull system production. The success of JIT was proven through its application at Toyota Motor Corporation [03], [04]. Today, JIT practices are common in manufacturing and JIT was proposed as a new management technology principle for 21st century manufacturing [02]. TQM began to be introduced in the US around 1980, primarily in response to severe competitive challenges from Japanese companies. TQM is a manufacturing concept aimed at continuously improving and sustaining quality products and processes by capitalizing on the involvement of management, workforce, suppliers and customers, in order to meet or exceed customer expectations [07], [12], [21]. Based on the review, quality management frameworks typically emphasize the importance of cross-functional product design and systematic process management. The stresses include the involvement of customers, suppliers and employees to insure quality products and processes. A comparison of the practices of TQM discussed in six empirical studies [24], [09], [21], [01], [05], [23] leads to the identification of nine practices that are commonly cited as part of a TQM program. These practices are cross-functional product design, process management, supplier quality management, customer involvement, information and feedback, committed leadership, strategic planning, cross-functional training, and employee involvement. In the literature, quality management frameworks typically stress the importance of cross-functional product design and systematic process management.TPM Introduced in Japan through Nippon Denso Company, part of the Toyota's group, in 1971. TPM is considered as evolution in preventive maintenance, originally conceived in the United States in the 1950s. The conception of TPM was an answer to the demands of a more and more competitive market that obliged the companies to draw some attitudes, such as: eliminating waste, always obtaining the best performance of the equipment and reducing interruptions or stops of production. Hence, TPM is a manufacturing concept designed primarily to maximize equipment effectiveness throughout its entire life through the participation and motivation of the entire work force [19]. To maintain equipment effectiveness, daily maintenance by operators is crucial. Unexpected breakdowns can be prevented through carefully-planned maintenance and the improvement or development of equipment. To conduct this maintenance, cross-functional training is necessary to improve operator skills. It is also important that all employees from management to the shop floor are committed to the maintenance process, providing the time and resources to improve equipment performance. More generally, emphasis on maintenance may also be reflected by the emphasis given to technological acquisition and improvement and the development of proprietary equipment.

3. COMPARISONS OF JIT, TQM, AND TPM

Table 1. General characteristic comparison of JIT, TQM, and TPM

Characteristics	JIT	TQM	TPM
Originality	Japan	US	Japan
Emphases	- Waste reduction including inventory - Continuous improvement - Customer responsiveness including flexibility	- Customer satisfaction - Employee involvement - Continuous improvement	- Machine and equipment downtime - Machine and equipment efficiency
Supporting factors	- Administrator deployment - Team employment - Employee involvement - JIT flow - Pull system	- Administrator deployment - Team employment - Education	- Administrator deployment - Maintenance activity - Employee involvement
Inclusion	- Line balancing - Setup time reduction - Batchsize reduction - Skill development - Consistency of quality control - Continuous work improvement - Pull system - Long-term supplier relationship - Preventive maintenance	- 7 traditional QC tools - 7 new QC tools - Statistical methods - Cross functional administration - Quality control circle activity	- Individual improvement - Autonomous maintenance - Planned maintenance - Operation and maintenance development - Initial phase management - Quality maintenance - TPM in office - Safety, hygiene and
Usefulness	- Increase product quality - Decrease manufacturing defective - Increase customer responsiveness - Reduce inventory - Increase accuracy of demand forecast - Reduce manufacturing costs	- Increase customer satisfaction in quality - Decrease operations wastes	- Increase efficiency of machines and equipment - Increase product quality - Reduce loss of setup - Reduce maintenance time and cost

General characteristics of JIT, TQM, and TPM are shown in **Table 1.**

Table 2. Similarities and Differences of JIT, TQM, and TPM

Characteristics	JIT	TQM	TPM
Objectives	- Inventory control - Lead time reduction - Defective rate reduction	- Cost down and quality improvement - Customer satisfaction increase	- Increase machine efficiency - Maintenance system establishment
Accent	- Machine and operator management	- Operator management	- Machine management
Wastes	- 7 wastes	- Defects - Inventory	- Machine breakdown - Set up time - Defects
Employees	- Multi skilled workers - Employee involvement	- Educated workers - Employee involvement	- Self maintenance workers - Employee involvement

JIT and TPM were originally found in Japan whereas TQM was established in US. JIT emphasizes waste reduction, continuous improvement and customer responsiveness. There are 7 wastes in JIT, which are waste from overproduction, waste of waiting time, transportation waste, inventory waste, waste of motion, and waste from product defects. TQM stresses customer satisfaction underlying quality by using employee involvement. TPM highlights machine and equipment maintenance in order to increase machine efficiency and decrease machine downtime. The factors supporting JIT, TQM, and TPM are quite similar. They are administrator deployment, team employment, and employee involvement. JIT extends the supporting factors to JIT flow and pull system whereas TQM does education and TPM does maintenance activities. There are many tools used in making JIT, TQM, and TPM active. They are shown in Table 1. The main objectives of JIT, TQM, and TPM, which are quite similar, are cost reduction and quality enhancement. To achieve the main objectives, JIT goes to inventory control, lead time reduction and defective rate reduction, whereas TQM aims at cutting costs by improving quality and TPM targets increasing machine efficiency and establishing maintenance system. The wastes considering in JIT are the well known 7 wastes whereas the wastes in TQM are defects and inventory; and the wastes in TPM are machine breakdown, set up time and defects. About employees, all three concepts have a similar idea in educating employees and having employee involvement. Table 2 shows the similarities and differences of JIT, TQM, and TPM.

4. RELATIONSHIP AMONG JIT, TQM, AND TPM

The relationship among JIT, TQM and TPM was constructed based on the review and survey. First, [17] state that Kaizen would help in developing JIT, TQM and TPM activities effectively. [16] Proposes that 5S would be a foundation of JIT, TQM and TPM implementation. Further, based on the pillars of TQM and TPM, 5S shows as a column of the houses of TQM whereas it shows as a foundation in the pillars of TPM. Moreover, JIT would be a supporting activity of TQM implementation. [11] State that a kanban system is an important part of JIT and Poka-Yoke is an element in quality control. Quality control is a pillar of TQM house. [14] State that visual control is an important technique in machine maintenance. Further, [10] state that Quality Control (QC) tools are basic tools of TQM. For the TPM, [19] states that preventive maintenance is an action in planned maintenance and planned maintenance is one of the pillars in TPM house. Based on the above review, 5S, Kaizen, preventive maintenance, Kanban, visual control, Poka-Yoke, and QC tools were main issues of the survey. Thirty people who work in the companies employing JIT, TQM, and TPM in Thailand were interviewed. By analyzing the data collected, a relationship model and supporting activities were constructed 5S and Kaizen were the foundations of JIT, TQM, and TPM, whereas Poka-yoke and preventive maintenance were the basic of JIT and TPM. Kanban seemed to be the key of JIT whereas visual control was essential for TPM. Lastly, QC tools were the vital tools for TQM.

5. CONCLUSION AND DISCUSSION

The purpose of this paper is to describe comparison and relationship between TQM, TPM and lean. This study is one of the few to empirically demonstrate the importance of joint implementation of manufacturing programs. The findings from these empirical analyses

demonstrate the importance of implementing the practices and techniques belonging to all three programs. Each component of our integrating framework represents a different aspect of improvement initiatives aimed towards product, process, and equipment development. There exist different configurations of practices that are best suited for improving specific performance dimensions, however, each of these configurations consists of practices belonging to all three programs and includes both socially and technically oriented practices. This demonstrates that the components of our framework are mutually supporting in achieving high levels of manufacturing performance. Plant management should take into account the possible effects of contextual factors on performance. In particular, the type of production process being used can differentiate between high and low performance. Production involving one-of-a-kind products may be more difficult to manage but the implementation of compatible practices can help improve performance regardless of the process type being used. While our results suggest that implementation of manufacturing practices can mask the effect of contextual factors on performance, future studies should investigate the possible interaction effects of contextual factors and manufacturing practices on performance. A variety of future research studies are possible including longitudinal studies and more detailed examination of the relationships among the three programs. While this study provides a foundation for examining TQM, JIT and TPM within a single framework, it is only through further research that a full understanding of the relationship among TQM, JIT and TPM will be obtained.

REFERENCES

[1] Ahire, S.L., Golhar, D.Y., Waller, M.A., 1996. Development and validation of TQM implementation constructs. Decision Sciences 27 (1), 23–56.
[2] Amasaka, K. 2000. New JIT: a new management technology principle at Toyota. International Journal of Production Economics. 80, 135-44.
[3] Amasaka, K. 2001. A study of flyer advertising affect when TMS-S at Toyota. Proceedings of the 12th Annual Conference of the Production and Operations Management Society, Orland, FL; 2001. 1-8 (CD-ROM).
[4] Amasaka, K. 2003. Proposal and implementation of the “Science SQC” quality control principle. International Journal of Mathematical and Computer Modelling.38, 11-13, 1125-36.
[5] Black, S.A., Porter, L.J., 1996. Identification of the critical factors of TQM. Decision Sciences 27 (1), 1–21.
[6] Brown, K.A., Mitchell, T.R., 1991. A comparison of Just-in-Time and batch manufacturing: the role of performance obstacles. Academy of Management Journal 34 (4), 906–917.
[7] Dean Jr., J.W., Bowen, D.E., 1994. Management theory and total quality: improving research and practice through theory development.Academy of Management Review 19 (3), 392–418. Drazin, R., 1995. Organizational size. In: Nicholson, N. (Ed.), The Blackwell Encyclopedic Dictionary of Organizational Behavior. Blackwell, Cambridge, MA, pp. 399–400.
[8] Flynn, B.B., Schroeder, R.G., Sakakibara, S., 1994. A framework for quality management research and an associated measurement instrument. Journal of Operations Management 11 (4), 339–366.
[9] Flynn, B.B., Sakakibara, S., Schroeder, R.G., 1995. Relationship between JIT and TQM: practices and performance. Academy of Management Journal 38 (5), 1325–1360.

[10] George, S. and Weimerskirch, A. 1994. Total Quality Management:Strategies and Techniques Proven at Today's Most Successful Companies. John Wiley & Sons, Inc,Canada.
[11] Gross, J. M. and McInnis, K. R. 2003. Kanban made simple demystifying and Applying Toyota's Legendary Manufacturing Process. American Management Association, New York.
[12] Hackman, J.R., Wageman, R., 1995. Total Quality Management: empirical, conceptual, and practical issues. Administrative Science Quarterly 40 (2), 309–342.
[13] Huang, P., 1991. World class manufacturing in the 1990s: integrating JIT, TQC, FA, and TPM with worker participation. In: Fandel, G., Zapfel, G. (Eds.), Modern Production Concepts: Theory and Applications. Springer, New York, pp. 491–507.
[14] Higgins, L.R. and Mobley, R. K. 2001. Maintenance Engineering Handbook. McGraw Hill, New York, U.S.A.
[15] Imai, M., 1998. Will America's corporate theme song be just in time? Journal of Quality Participation 21 (2), 26–28.
[16] JMAC America (2010), http://www.jmac-america.com/TPM %20Conference%20-%20JMAC%20-%20Terada.pdf [6 August 2010].
[17] Krajewski, L. J. and Ritzman, L. P. 1999. Operations Management: Strategy and Analysis. Prentice Hall, New Jersey, U.S.A.
[18] McKone, K.E., Schroeder, R.G., Cua, K.O., 2001. The impact of Total Productive Maintenance practices on manufacturing performance. Journal of Operations Management 19 (1), 39–58.
[19] Nakajima, S., 1988. Introduction to TPM. Productivity Press, Cambridge, MA.
[20] Ohno, T., 1988. Toyota Production System: Beyond Large-Scale Production. Productivity Press, Cambridge, MA.
[21] Powell, T. C. 1995. Total quality management as competitive advantage: a review and empirical study. Strategic Management Journal. 16, 15-37.
[22] Roth, A.V., Miller, J.G., 1992. Success factors in manufacturing. Business Horizons 35 (4), 73–81.
[23] Samson, D., Terziovski, M., 1999. The relationship between Total Quality Management practices and operational performance. Journal of Operations Management 17 (4), 393–409.
[24] Saraph, J.V., Benson, P.G., Schroeder, R.G., 1989. An instrument for measuring the critical factors of quality management.Decision Sciences 20, 810–829.
[25] Schonberger, R.J., 1986. World Class Manufacturing: The Lessons of Simplicity Applied. Free Press, New York.
[26] Sriparavastu, L. and Gupta, T. 1997. An empirical study of just-in-time and total quality management principles implementation in manufacturing firms in the USA. International Journal of Operations & Production Management. 17, 12, 1215-1232.
[27] Sugimori, Y., Kusunoki, K., Cho, F., Uchikawa, S., 1977. Toyota production system and kanban system: materialization of Just-in-Time and respect for human systems. International Journal of Production Research 15 (6), 553–564.
[28] Wakchaure, V., Venkatesh, M. A., and Kallurkar, S. P. 2006. Synergies of three letters syndrome for revitalizing manufacturing. Proceedings of International Multi Conference of Engineers and Computer Scientist, Hong Kong, 2006.