International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 02 Issue: 07 | Oct-2015 www.irjet.net p-ISSN: 2395-0072

Relationship of 5S and Manufacturing Performance with Mediator of TPM and TQM

B. Devaraj Naik[1], Lakhan Patidar[2], Pradeep Kumar Soni[3]

[1]*M. Tech. Scholar, Department of Mechanical Engineering, Maulana Azad National Institute of Technology, (MANIT), Bhopal, Madhya Pradesh, India*

[2]*Ph. D. Scholar, Department of Mechanical Engineering, Maulana Azad National Institute of Technology, (MANIT), Bhopal, Madhya Pradesh, India*

[3]Assistant Professor, *Department of Mechanical Engineering, Maulana Azad National Institute of Technology, (MANIT), Bhopal, Madhya Pradesh, India*

Abstract - ***In the present scenario, manufacturing productivity of a company is an important issue for its success and long time stability in the stern competitive global market. Concept of 5S has been developed synergistic with TPM and TQM to improve the manufacturing performance as a result of intense global competition. 5S practice is a well-recognized key to quality and productivity and for improving the work environment, so it becomes the starting point of a TQM or TPM programmed. In this paper a hypothesis based conceptual model has been developed that identifies the relationships among 5S, Total Quality management (TQM), Total Productive Maintenance (TPM) and manufacturing performance. This conceptual model will help the academic and industry personnel to have better understanding on the relationship between the practices and step by step implementation to improve manufacturing performance. The structural equation modeling (SEM) techniques may be used to examine the relationships of the practices.***

Key Words: *5S, TPM, TQM, hypothesis, SEM, manufacturing performance.*

1. INTRODUCTION

A manufacturing program can be successful only when there is an improvement in its manufacturing performance and is aligned with the business strategy. Similarly, the works of various authors like Ahmad, M. [1], Ngadiman, Y. [22], and Seth, D [26] all hypothesized that consistency among organizational design characteristics leads to higher performance. The 5S practice is a technique used to establish and improve work environment and total quality thus it becomes a base for continuous improvement in the organizations. 5S stands for five Japanese words: Seiri, Seiton, Seiso, Seiketsu and Shitsuke [23]. They mean organization, neatness, cleaning, and standardization and discipline respectively. The original concept was developed by Osada [23] in the early 1980s. It has been widely practiced in many Japanese firms, both at houses and industrial establishments as housekeeping activity. Moreover suitable implementation of 5S can push ahead an organization in the highly competitive market [7]. 5S has been successfully implemented in Japan over the past three decades and more recently in India [18].

However Total Quality Management (TQM) has been adopted as a result of intense international competition [1]. Companies that conduct international competition have stressed on TQM philosophy, procedures, tools and techniques. Further in step with the international competition desires higher levels of quality actions to satisfy the client satisfaction [21]. TQM is a management philosophy that helps in managing an organization to enhance the effectiveness and performance to realize world category standing for the past twenty years [15]. Furthermore, TQM may be a set of useful management practices that are applicable throughout the organization and in gear to confirm whether the organization systematically meets or exceeds client necessities. Psomas, E.L [25], stressed that introducing TQM practices in a company may be a long-run commitment. The successful implementation and adoption of TQM practices requires planning, time and efforts [25].

However, the concept of TPM has been adopted in several industries across the globe to enhance the manufacturing performance by involving everyone. Furthermore TPM is an associated innovative approach to maintenance that optimizes instrumentality effectiveness, eliminates breakdowns and promotes autonomous operator maintenance through regular activities involving the full work force [17]. The origin of TPM may be derived back to 1951 once preventive maintenance was introduced in Japan. The idea of preventive maintenance was taken from USA. Nippondenso was the first company to introduce preventive maintenance widely throughout the plant in 1960. Preventive maintenance is the concept where in, the operators developed products using machines and the maintenance group was dedicated with work of

maintaining those machines. However, with the automation of Nippondenso, maintenance became a problem as more maintenance personnel were required [33].

Total productive-maintenance (TPM) may be a tried and winning procedure for introducing maintenance issues into structure activities. It involves the work of both operational and maintenance staff as a team to cut back wastage minimize time period and improve the quality [6]. Furthermore, TPM may be a manufacturing-led initiative that emphasizes the importance of:

(1) People with a 'can do' and continual improvement attitude and
(2) Production and maintenance personnel working together in unison.

However, TPM is considered to be one method of improving quality and consequently is a supplementary method to other quality techniques [2]. TPM also has succeeded very well in making maintenance into an overall company-wide issue by concentrating on continuous improvements, autonomous small group activities training and education, communication and the flow of information [20].

2. LITERATURE REVIEW

2.1 Five S (5S)

The understanding of 5S is elaborate and established in Japan as it emerges from an approach that sees it as life wisdom, practiced everyday [23]. Because of this foundation 5S has been included in management practice and contributes to cost-effectiveness by maximizing both efficiency and effectiveness. The implementation of 5S can also uncover hidden problems that may have otherwise - remained unnoticed [9]. Some of the important benefits of implementing 5S are described in Table 1 [29].

Table1: Description of Housekeeping Activities

Japanese	English	Description
1st S: Seiri	Sort	It means that at workplace all the irrelevant items /things should be sorted out/ removed.
2nd S: Seiton	Set in order	Items should be arranged properly so that they can be identified and approached easily.
3rd S: Seiso	Shine	It means cleaning the workplace till it is spic and span.
4th S: Seiketsu	Standardize	It means developing and maintaining standard work practices.
5th S: Shitsuke	Sustain	Sustaining the progress made. To ensure success in 5S, discipline must be maintained. Progress made in above four points must be maintained.

2.2 Total Quality Maintenance (TQM)

TQM have been defined in many ways over the years by various authors. However, still there is no universal agreement on these definitions. It's typically accepted that the up to date TQM literature were evolved from works of experts like Deming, Juran, Feigenbaum and Crosby, but there is more than one standard definitions for TQM[30]. It was in the manufacturing sector where TQM was developed rather than in construction industry where its implementation is much challenging. The steady-state process nature of the manufacturing industry makes it different from construction sector which is a one-time process. The uniqueness of construction industry is observed in the following ways [34]:

1. Staff mobility.
2. Diversity in the types, forms, and shapes of construction projects.
3. Geographical dispersion.
4. Contractual relations.
5. Frequent prototyping of projects.
6. The subtle forms of waste that often go unnoticed.

TQM aims at achieving customer satisfaction, cost effectiveness, and defect free work through waste reduction [10**].**

2.3 Total Productive Maintenance (TPM)

The TPM concept was originated in Japan's manufacturing industries, with the aim of eliminating production losses as a result of limitations within the JIT method for production operation [8].

Steps in introduction of TPM in an organization

1. Determination manifesto of importing TPM among operation stratum.
2. Education and advocating of importing TPM.
3. TPM promoting organization and establish career structure demonstration.
4. Basic Policy and Target Setting of TPM.
5. Design the main plan of carrying out TPM.
6. The implementation of TPM (the Kick-Off Meeting).
7. Establish an efficient system for production department.
8. Establish initial management system for new products and new equipments.
9. Establish quality maintenance system.
10. Establish efficiency system for management and indirect departments.

11. Establish management system of safety, health and environment.
12. Full implementation and level upgrading of TPM.

These Steps are implementation in manufacturing industries. [28]

The aim of TPM is to bring the management, supervisors and trade union personnel altogether to take rapid remedial actions as and when required.

Its main objectives are to achieve zero breakdowns, zero defects and improved outputs by:

- Increasing operator involvement and ownership of the process.
- Improving problem-solving by teamwork.
- Refining preventive and predictive maintenance activities.
- Focusing on reliability and maintainability engineering.
- Upgrading each operator's skills.

The TPM strategy includes:

- Maximizing equipment effectiveness.
- Improving quality, Ensuring safety and reducing costs.
- Raising the morale of the team that is implementing TPM [8].

The proposed hypotheses are shown in Table 2.

Table 2: Hypothetical relation between 5S, TQM, TPM and MP

Hypothesis tools	5s	TQM	TPM	Performance
5S	X	H2	H3	H1
TQM	-	X	H4	H5
TPM	-	-	X	H6
Performance	-	-	-	X

3. HYPOTHESES GENERATION

In most of the industries several factors affect the productivity of equipment, in which some are easily recognizable at the earlier of process, while others are unanticipated and affects the equipment productivity negatively [24]. Here some of the hypothesis generated to verify the relationship between 5S, TPM, TQM and manufacturing productivity.

H1: Relationship between 5S and manufacturing performance

5's system helps to organize a workplace to increase the efficiency, decrease wastage and optimize quality and productivity via monitoring of an organized environment [15]. 5S is not only useful for improving the working environment but also they raise process and product quality standards, reduce and optimize lead time, and also reduce operating costs and enhance process performance [19] .5S is a useful method for founding an organization and spreading out a design. It can also improve communication and help employees to develop their characteristics to decrease downtime, lead time, inventory, defects, personnel injury, and associated costs [32]. Most previous studies show a positive relationship between 5s and productivity [12]. Some of the finding also partially correlated with the manufacturing productivity [7]. Therefore accordingly it proposed that

H1: The 5S system has a direct, positive effect and leads to better manufacturing productivity.

H2: Relationship between 5S and TQM

World-class manufacturer place a stress on 5S and TQM implementation and regularly seeking to enhance their business by using various quality control tools [4]. TQM tools and techniques if properly enforced have the ability to form a property competitive advantage. A TQM movement cannot succeed unless workers square measure concerned at numerous business processes and that they square measure being trained to become additional competent [11]. The proof of the correlation between successful implementation of 5S, TQM and competencies are growing [14].Therefore accordingly it proposed that.

H2: 5S practices is positively correlated with TQM

H3: Relationship between 5S and TPM

5S is the one of the important pillar support TPM. It is important to mention that 5S and TPM have roots in Japanese culture. According to Japanese industrial definitions, there are three main factor affecting work environment. Yaruki (morale & motivation), Yarude(fair competition) and Yaruba (proper work environment conditions)[27]. 5S practice is a well-recognized key to quality and productivity and for improving the work environment, so it becomes the starting point of TQM or TPM Programmers [24]. Therefore accordingly it proposed that.

H3:5S practices is positively correlated with TPM

H4: Relationship between TPM and TQM

TPM is significantly supported by TQM for improving manufacturing performance [16].Study shows that TQM and TPM should be implemented before implementing Lean production [31].Two sets of factors which are essential for the effectiveness of TQM and TPM: universally important factors for all the three approaches like leadership, process management and strategic planning; and approach strategies like leadership

management and focus on customer satisfaction [32]. TPM is a comprehensive improvement originates from the idea of zero defects of TQM which applies to control equipment performance [26]. Therefore accordingly it proposed that:

H4**:** TQM practices are positively correlated with TPM.

H5: Relationship between TQM and manufacturing performance

This is a strong relationship between TQM and manufacturing performance as in industry the benefits of TQM are improved quality, employee participation, and teamwork, working relationships, customer and employee satisfaction, productivity, communication and market share [3]. Most previous studies show a positive relationship between TQM practices and bus manufacturing performance [13]. However, there are so many studies that show TQM did not improve the manufacturing performance [22]. Some of the findings also partially correlated with the business performance [5]. Therefore, accordingly, it is proposed that:

H5: The TQM Practice has a direct, positive effect and Leads to better Manufacturing Performance

H6: Relationship between TPM and manufacturing performance

The essential success factors of TPM like prime management leadership and involvement, maintenance practices and holistic TPM initiatives enhance business performance in Indian business. The study indicates that the TQM and TPM, supported by unit of time practices, have a major potential to enhance producing performance [1]. Therefore, consequently, it's projected that.

H6: A TPM practice is positively correlated with manufacturing performance

4. CONCEPTUAL GENERATION

Based on a review of previous studies, a conceptual model has been proposed to understand the relationship as presented in figure 1

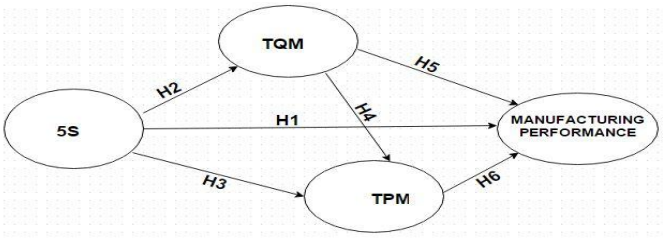

Figure 1: proposed conceptual model of 5S with mediators of TQM, TPM

Structural equation modeling (SEM) techniques are utilized to examine the relationship [1].

5. CONCLUSION

The main objective of this study is to develop the link among 5S, TQM, TPM and Manufacturing performances by hypothesis generation and proposed a conceptual model for researchers. Six hypotheses regarding the relations among 5S, TQM, TPM and manufacturing performance have been specified and conceptual framework have been proposed for future work. It is expected that this paper will serve as a seed, however, it seems to be outdated but fact is that majority of Indian industries still ignores these basic concepts concerned with human psychology and starts implementing TQM, TPM etc. directly and fails to achieve desired results.

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BIOGRAPHIES

B. Devaraj Naik holds a Bachelor's Degree in Mechanical Engineering from JNTUA Anantapur, Andhra Pradesh and pursuing M. Tech. in Mechanical Engineering (Maintenance Engineering and Management) from Maulana Azad National Institute of Technology, Bhopal, Madhya Pradesh (India).

Lakhan Patidar holds a Bachelor's Degree in Industrial and Production Engineering from GEC (U.I.T-R.G.P.V) Bhopal, Master's Degree in Mechanical Engineering (Maintenance Engineering and Management) and pursuing a PhD in Mechanical Engineering from the Maulana Azad National Institute of Technology, Bhopal, Madhya Pradesh (India). His present area of interest includes productivity improvement in industries through modern techniques of maintenance.

Dr. Pradeep Kumar Soni holds a Bachelor's Degree in Mechanical Engineering from SATI, Vidisha, Master's Degree in Energy (Mechanical) Engineering and a PhD in Mechanical Engineering (Production Engineering) from MANIT, Bhopal, Madhya Pradesh (India).Currently, he is working as an Assistant Professor in the Department of Mechanical Engineering, MANIT, Bhopal, Madhya Pradesh (India).He has contributed a significant number of research papers at the international level.