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Role of TPM Paradigms in Achieving Manufacturing Excellence in Industry

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ABSTRACT: Total Productive Maintenance (TPM) is a system that is used to improve and maintain the production and quality of processes, machines, and all other resources. TPM is the major activity of a Quality Management System. In this paper, we will review the different methods and techniques used previously by different authors to study the effectiveness of TPM implementation in Indian industries. Many types of research are performed to understand the need of TPM implementation in Indian industries. However, most of the researches focused only on the barriers and successful factors of TPM implementation. This study will analyze the important factors which are the major reasons to cause issues related to TPM implementation. This review will also discuss the concept of TPM. An overview of TPM, its elements, benefits, and principles will also be discussed in this paper. Several roles of TPM paradigms will be studied and defined that helps in achieving manufacturing excellence in the industries. After studying the brief concept of TPM, we will highlight the need for effective TPM implementation in Indian industries.

KEYWORDS: Total Productive Maintenance (TPM), Overall Equipment Efficiency (OEE), Quality Management System, and Lean.

I. INTRODUCTION

1.1. TPM

Total productive maintenance (TPM) involves and defines the concept of maintaining the plants and the other machinery equipment. The primary goal of the TPM is to increase the production of the necessary product and the equipment in the market at the same time. It also helps to improve the moral values among the employees and provide them the job satisfaction. [16]

TPM brings the maintenance in the business and focuses on the central and vital parts of the necessary business. TPM is a systematic approach that eliminates the waste relates to the production equipment and the machinery related products. TPM checks the machine operators in the daily routine. It also helps to clean the machines to detect the problems which occurred inside the machines. TPM contributes to minimizing the problems in the device which results in them too unfortunate and unexpected productions. It fully utilizes the capabilities of the device and makes them performing right in the future. [22]

1.2. Objectives of the TPM

One of the primary aims of the TPM is to increase the productivity of the machines, and the equipment so that they perform better in the production of the products. To work in a better way, the TPM gives the full support to the workers wherever it is required. It should result in the reliable performance and accomplish the necessary goals in the production management. Another objective of the TPM is to increase the overall equipment efficiency of the plant equipment. TPM helps to maintain the healthy environment between the operatives and equipment to create the possession. [14]

1.3. Overall Equipment Efficiency (OEE)

OEE has the three factors multiplied with each other, and they give one measure called the OEE. [14]

Performance * Availability * Quality = OEE

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Each element contains two connected losses which make the six losses in total. That six losses are given below:

- Performance = 1) running at reduced speed - 2) Negligible stops
- Availability = 3) Failures - 4) Product changeover
- Quality = 5) Start-up rejects – 6) consecutively rejects

The main objective of the TPM is to reduce these losses and identify them in each field of production. The self-managing teams only do this.

Principles of the TPM

The eight pillars of the TPM mostly focus on the active and defensive techniques for improving the performance of the equipment [25].

1. **Focused improvement-** This pillar focus on the development of the work done by machines and the equipment. It concentrated on the self-discipline and sorted out the problems which occurin the workplace.

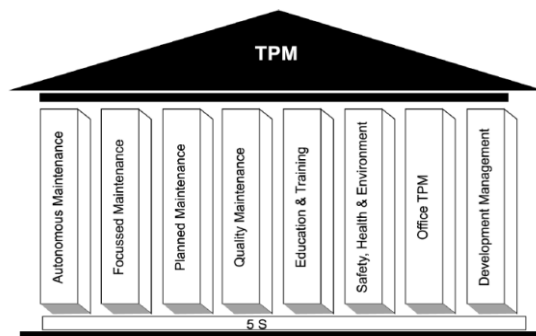


Figure 1: TPM Pillars [2]

2. **Autonomous maintenance-** This pillar helps to take care of the small maintenance of the tasks. It focused on one thing, i.e., to provide the skill maintenance to the people. TPM activities enable to pay more attention to the value-added activity.
3. **Planned maintenance-** It focused on the machines and the equipment and found the problem inside the machines so that the customer cannot face any problem regarding this. This maintenance can be divided into four categories:
 - Preventive maintenance
 - Corrective maintenance
 - Breakdown maintenance
 - Maintenance prevention

With the help of this four maintenance, the TPM provides the better techniques to the machines and the equipment.

4. **Quality maintenance-** It focused on the quality of the product through detection free manufacturing. It mainly concentrates on the improvement of the equipment in a systematic way. It detects those parts which cause a problem and affects the quality of the product. It tries to eliminate the current quality concerns and then move them to possible superiority matters.
5. **Cost deployment-** It mainly focused on the cost deployment under the production management. It checks the preliminary cost systems that are essential for maintaining the value which is necessary for the substance and the maintenance of the equipment.

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6. **Training and the Education-** It aims to provide the multi-skilled employees to the production management. They focus on to motivate the employees to work and perform better functions in the efficient and the polite manner. The education is also given to the workers to upgrade their skills so that they could perform better in the workplace. It focuses on to train the employees and allow them the necessary education to do the workfor the high quality.
7. **Safety healthy environment-** It focuses on providing the good and safe workplace to the employees. It provides them the right surrounding area which is not damaged by any development or the procedures. This pillar plays the vital role in the production sector. This component maintains the committee which handles all the works and tasks and provides a safe working place to employees. The manager of the production management looks after the functions which are related to the security. They also create the awareness among the employees by inducing the various competitions related to the safety mottos, Quiz, drama, and the posters.
8. **Early equipment management-** This pillar refers to the office structure. This component can handle the other elements also like pillar one, two, three and four. It mainly focused on the productivity and the efficiency of the production maintenance. In this pillar, process and the procedures are analyzed to perform the activities inside the management. [29]

1.4. Elements of TPM

There are five parts of the TPM program [10]:

Operator self-maintenance: It includes the program of cleaning, lubrication, general checking and minor conservation which is completed by the production workers.

- **Conduct Planned Maintenance:** It creates and develops the planned maintenance events. It also establishes the standards for each equipment, and it also checks the equipment related to safety, quality, production and the cost. It creates the maintenance plan for each necessary equipment according to the time, condition and the productive conservation.
- **Small Group Kaizen Activities:** It focuses on the losses and eliminates the losses present in the OEE. It also often to guide the minor group activities.
- **Education and Training:** It main focuses on the education and the training of the employees and to provide them the awareness. It also helps to improve the skill levels of the employees and the workers.
- **Maintenance Prevention:** It mainly focuses on the management system of the production management. It emphasizedthem to participate in the new equipment projects and concentrated on that equipment that requires less maintenance.

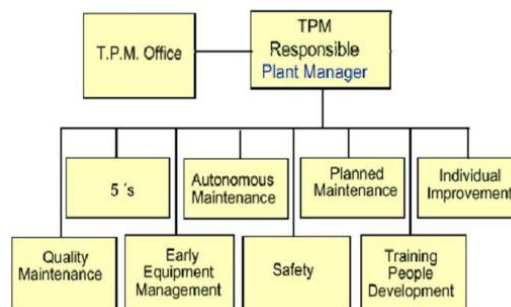


Figure 2: Office TPM [27]

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1.5. Benefits of TPM

Following are the advantages of the TPM:

- **Improve efficiency:** TPM helps to improve the effectiveness of the production management and eliminate the significant losses in the industry.
- **Reduction in the cost:** TPM contributes to reducing the cost of the production management and makes the optimum use of the resources for the benefit purpose in the industry.
- **Improve the quality:** TPM helps to enhance the quality of the production by minimizing the losses and by detecting the problems inside the production management.
- **Employee Ownership:** With the implementation of the TPM in the industry, the employees and the workers do autonomous maintenance of their machines. It brings the possession among the employees, and it also proceeds them to an overall improvement in the organization. TPM also helps to improve the working environment in the association.
- **Customer satisfaction:** TPM also pays attention to the client satisfaction. It produces the high-quality products and the delivery of the goods at the specified time. These two things increase the customer satisfaction. The appreciation of the client is the main thing in an organization. If the customers are not satisfied by the association, then it will show the substandard performance of the company.

1.6. Need for TPM in Indian industries

The TPM strategy is the best strategy in the manufacturing industry which modifies the techniques in the organization. It also provides some methods to the marketing sector to improve the quality of the work. Now in the modern generation, many industries faced the problems regarding the cost reduction. TPM helps to reduce the cost of the organization and provides them the optimum use of the resources by reducing the cost of the assets. TPM also improves the development of the manufacturing technologies. TPM is the best technique which in the manufacturing industries. Now the various Indian companies and the industries implemented the method of TPM in their work or the production management. With the supremacy, strength and the magic of TPM, they can achieve the international acknowledgment in the world. It helps to improve the number of things in the organization in term of employee's skill, moralities, ethnic changes, machine condition, maintenance, and operation integration. It also helps to complete the demands of the customers and focuses centrally on the satisfaction of the customers. They concentrate on the high quality of material and deliver the product at the specified time. It also measures the customer satisfaction level.

II. LITERATURE REVIEW

Kedar, A.P., et al. (2008) reviewed the theoretical aspect of Six Sigma, BPR, TQM, ISO and lean series of standards that highlights the differences, similarity, and potentiality of all these methods to enhance the performance of the organization. The methods such as ISO, Lean, TPM and TQM demand self-thinking by the organization because these methods provide desired outline. Organizations need to take special care while deciding the approaches to be used [1].

Batimalay, K., and Santhapparaj, A. (2009) analyzed the research that studied the status of OEE in TPM implementation in Malaysian industries. The authors developed a theoretical framework to determine the TPM pillars, which influence OEE. TPM is a total productive maintenance and is work on the principle of a series of pillars. It contains eight step of the pillar. These pillars include autonomous maintenance, focused maintenance, planned maintenance, quality management, educational training, safety and security, health and environment, office The next is OEE; it stands for the Overall Equipment Effectiveness. It is a central measurement for measuring the growth of TPM implementation programs. OEE depends on the three main pillars of the TPM which includes the planned maintenance, quality and education, and training. The education and training pillar increase the skills of the overall maintenance. So, we can say that the OEE is not an independent variable, rather it depends on the TPM's pillars. They conducted a survey by collecting data using Questionnaire from 70 industries of Malaysia. The SPSS technique was used to analyze the data, which shows that the TPM pillars have a significant influence on OEE [2].

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Bon A. T. and Ping L. P., (2011) analyzed the comparison of TPM and OEE evaluation. TPM is a useful tool that helps in the firms to attain manufacturing process. The TPM is a strategic instrument management that focuses on building a qualitative product with an increase in the efficiency. Its goal is to achieve the effective result in term of product quality. It believes in the continuous development of the product that can be achieved with the help of all the employee's work as a single unit. Continuous work can improve the efficiency and the quality of the product. TPM has ninety percent of accessibility of product with 95 percent of efficiency and 99 percent of quality. Therefore, more than eighty percent OEE standard considers being the top class, based on the performance. At several firms where maintenance is viewed as an operational cost to be decreased and not an investment is increased, then the maintenance reduced their competitiveness by throughput and performance [3].

Ng, K. C., et al. (2012) analyzed that PM is a well-known innovative approach to maintaining strategy, which holds the potential for improving the overall effectiveness of equipment. According to the study, the potential pitfalls frequently caused the TPM implementation failure and development of new policies and strategies. There are many factors that are the reason of failure. The lack of knowledge in the training and education leads to the failure of implementation of TMP. The reason for this failure is that the training management did not want to invest in the organization. Either they did not have much capital cost, or they thought that investing money on training is wastage of money. The money issue is the main barriers faced by the employees in any organization. The other failures include job security of employees, lack of tools provided to the employees at the workplace, resistance to the cultural environment, lack of communication from top management, etc. This implementation reflected the lack of concrete system, which convinced all level of the workforce [4].

Kalbande, D.R., and Thampi, G.T. (2012) analyzed the study that elaborates on the implementation of TPM to enhance the overall equipment effectiveness in any manufacturing organization. The planned maintenance can give the best result for increasing the efficiency of the given product. The operators in the organization can produce a good quality of product with the help of a machine. By using the machine, the operators can produce a huge amount of product in less time. Hence it increases the efficiency of the product. To produce a large amount of product is not the only goal of the company, but also to maintain that product is the main issues that faced by many organizations. Maintenance can reduce most of the hazard that happens in the company. There are many fields in which loss occurred. Huge losses occur on the manufacturing shop floor due to the problems in strategy. These losses occur due to maintenance process, tooling problems, personal, operators, and non-availability of components in time, etc. to achieve the zero tolerance for losses, break down, defects TQM is becoming effective day by day [6].

Bakri, A., et al. (2013) analyzed the research that defined the practical applications of TPM in the manufacturing industry. TPM is a maintenance program which provided a strategy for maintaining equipment and plant to its optimum level of effective operations. To maintain the quality of the product, care is important factor. The continuous care of product gives the best result. In manufacturing industries, the maintenance is the big and the crucial issue. The maintenance procedure involves the efficiency, reliability, accessibility, of the product that directly affect the service, cost, and service of the product. Any product must have three properties that are essential to make that product reliable. These properties are CDQ, means a Cost-effective product, Delivery of service and Quality of product. As a productive maintenance, TPM carried out by all employees in small group's activities and viewed as an equipment maintenance. The implementation of quality initiatives means the large-scale human requirement, technical and human resources were running the company's project [7].

Ng, K. C., et al. (2013) identified the critical success factors of Total Production Maintenance tool implementation. These success factors include top level commitment, cultural change, training and development, clear vision and mission, language problems, and effective communication. The paper provided a literature review which identified the success factors of TPM in a semiconductor industry of Malaysia. Despite all company, there is one company named I-Fab Semiconductor Company, unlike all the company, this company focus only on these pillars that include planned maintenance, autonomous maintenance, equipment improvement and the skill training. The uniqueness of this semiconductor company creates a self-managing team also known as SMT for manufacturing plant. It is an approach that deals with the day to day activities in the company. The research initiated by the process of the production line and implemented continuous improvements for equipment effectiveness. The study stated that OEE is the important

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measure to evaluate the effectiveness of TPM implementation. The research concluded that the main challenge for the success of TPM implementation observed by this research is the lack of commitment from top management. The human-oriented factors also play a vital role in the success of TPM implementation [8].

Sukarma L.,(2014) defined the integrated production system operation. The critical analysis operation of production system has achieved the superior performance in manufacturing. There are mainly four models of World Class Manufacturing (WCM) and three Manufacturing Excellence (ME), which makes an impact of TPM, TQM and JIT (Just-In-Time) individually. The four model are a first model, second model, third model and the integrated suggested model. The first model focus on the customer relationship, second model focus on the manufacturing and quality management, third is focused on supplier relationship, and the integrated model is used problem-solving, ensuring the employee involvement at the workplace, etc. WCM has changed over time with the increasing of competition in the industry [9].

Singh, K, and Ahuja, I, (2014) determined the extract and evaluation factors to influence the implementation of TQM and TPM on the performance of business. The combination of TPM-TQM and individual TPM improved the performance of manufacturing in the Indian manufacturing industry. TPM, the total productive maintenance helps to maintain the business's product and functions that sustain the profits for the company. It provides the effective program that made a contribution to the performance of business. It increases the quality of product and improves the quantity of efficient product. TPM worked on a team-based strategy that focuses on the relationship between the operations and the department of maintenance with zero defects, better design, and less breakdown. The TPM-TQM strategy in the manufacturing industry needed some modification by adapting some methodologies to service marketing and related to other situations [10].

Kart, O., and Kut, A. (2014) aimed to build a web based application to handle fundamental TPM pillars. This application use data collection device with real-time production to transfer the data from manufacturing machines to the system. After that, the system was monitored on dashboards. The results of the study were published. 6 Sigma and Kanab principles can be integrated into the system for the future work [11].

Kaur, M. (2015) determined the Analytical Hierarchy Process (AHP) that had study the paradigms of TQM-TPM in the environment of uncertainty. It included the integration of TQM-TPM where the manufacturing indicated the productivity, quality, cost, flexibility, competency between employee and product delivery. The AHP is used to define the 'synergistic' implementation in the manufacturing industry. The product attributes, and the quality growth depends upon the competencies of the organization being related to an effort made to improve the productivity in all aspects of activities by utilizing the resources like human, material, and the machinery. All the manufacturing industry focused on the quality reduction of cost, quality of product determined failure or success in a global market [12].

Madanhire, I and Mbohwa, C. (2015) Examined the implementation of TP's impact on an organization in the form of quality and productivity. The company did not concentrate on the machine to achieve the higher profits and productivity and focus on their workforce that driven the production functions. An integrated management system included technicians and operations [13].

Stamm, M. L., et al. (2015) The aim of this research was to search for the history of the automobile industry. The study determines the 'Toyota' industry. Toyota had designed a manufacturing system that combined the contents to address the drivers and required the market saturation. Toyota operated in most superior manufacturing paradigms. The driver enhanced the scarcity of resources that amplified the needs for more sustainable solutions in the long term. The more system approaches were applied to solve global optimization issues in a complex non-linear environment [14].

Gupta, P, et al. (2015) determined the optimization of the TPM (Total Productive Maintenance) system. Today the manufacturing industry facing a lot of pressure to decrease the manufacturing cost and give a quality product in the market at regular interval. TPM is a maintenance policy that aggregates the equipment and converts into the manufacturing process. There are several numbers of companies that use TPM process in their manufacturing plant. It gives them an advantage in various ways like in term of quality, reliability, delivery of services, cost effective, the flexibility of product and many more advantage in the production unit. It cannot be used all the time; it takes at least

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three years to make the effective TPM process in the organization. TPM continuous efforts of employees from top management to low management give the effective results. The quality improvement of product, waste reduction and the complete, efficient production system is a leading manufacturing revolution of India. Several companies have started the implementation of some business strategies i.e. TPM, TQM (Total Quality Management), etc. to attain an excellent operation to manufacturing a product [15].

Rahman, C. M. L (2015) focused on the case study to evaluate the impacts of TPM implementation over the production scenario of observed semi-automated manufacturing company and mean downtime analysis (MDT) was performed to measure mean downtime reduction. To accomplish the objectives, the case of a semi-automated manufacturing company of Bangladesh was taken. Statistical analysis and Pareto analysis of downtimes were performed to detect the most influential downtime factors hierarchically. The results of the study concluded that production improvement techniques and modern maintenance management are needed to increase the volume of production and improve the maintenance procedure [16].

Gupta, P. Vardhan, et al. (2015) evaluated the aspects and success factors of TPM implementation and initiatives considered by Indian industries to gain the manufacturing excellence. The research indicated that with the implementation of TPM, Indian industries improved in the employee morale, technological upgradation, employee skill level, machine condition and customer satisfaction. The Indian companies also improved their overall equipment effectiveness (OEE) over 30% and even 95% OEE is also achieved by some companies [17].

Ramlan, R., et al. (2015) carried out a survey to measure the availability, quality and performance rate of TPM implementation in a manufacturing company. For this purpose, they collected the 12 months' data for the corrugators's machine to analyze it using Microsoft Excel by representing the outcomes graphically. Then the authors compared the results with the world standard OEE requirements. The results showed that the overall improvement in the availability of TPM was 5 % above the world standard OEE whereas the quality and performance rate were decreased by 10% and 5% respectively [18].

Djatna, T., and Alitu, I. M. (2015) analyzed the research was conducted to identify the challenges in TPM implementation in the manufacturing industry. For this purpose, the authors analyzed the equipment condition and response of action by top management in a wooden door manufacturing company. The study revealed that the main challenge to the success of TPM implementation is the slow decision-making by top level management. The case company in this research has employed OEE in its TPM implementation. The Association Rule Mining approach of data mining was used by the authors to measure the relationship between OEE and required the response of action for the condition of machine usage. The ARM generated rules using a priori algorithm for predictive maintenance strategy. ARM is association rule mining used to find the rules that give computed the relationship between the measurable OEE indicators with the requirement of the response [19].

Rashid A. and Tjahjono, B., (2016) Defined the importance of the Enterprise Systems and Simulation integration. It determines the improvement of production planning in short period. The 'Monolithic Manufacturing Systems' determined regarding human-computer interaction. There are three major imperatives such as Business, Operational and architectural. In each case, the future delivery dates were predicted through ERP-simulation integration. In this paper, structural changes have been done to address some uncertainties and presented an effort in the direction by creating a gap between ERP-Simulation integration [20].

Nzewi H. N., et al. (2016) defined the relationship between the TPM and the performance of selected Aluminium firms in Anambra state. The focus of this study is to find the relationship between the employee commitment and maintenance autonomy. The correlation values defined the autonomy in the decision had a positive relationship with the employee. The maintenance autonomy was important in eliciting commitment from the organization's employee [21].

III. FINDINGS

The table below shows the findings of our review performed in above section. It includes the methods and techniques used by different authors to evaluate the performance of TPM implementation in manufacturing industries and their relative outcomes.

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Table 1: Summary of literature review

Authors/ Year	Methods/Techniques	Outcomes
Batimalay, K., and Santhapparaj, A. (2009)	Studied the status of OEE in TPM implementation in Malaysian industries. SPSS technique was used to analyze the data	TPM pillars have a significant influence on OEE
Bon A. T. and Ping L. P., (2011)	Analyzed the comparison of TPM and OEE evaluation	TMP has 90% accessibility of product with 95 % efficiency and 99% quality. Therefore, above 80% OEE can be achieved.
Ng, K. C., et al. (2013)	Identified the critical success factors of Total Production Maintenance tool implementation in a semiconductor industry of Malaysia.	The main challenge for the success of TPM implementation is the lack of commitment from top management.
Kaur, M. (2015)	Analytical Hierarchy Process (AHP) to study the paradigms of TQM-TPM in the environment of uncertainty	Manufacturing industry focused on the quality reduction of cost, quality of product determined failure or success in a global market
Ramlan, R., et al. (2015)	Surveyed to measure the availability, quality and performance rate of TPM implementation in a manufacturing company.	Overall improvement in the availability of TPM was 5 % above the world standard OEE whereas the quality and performance rate were decreased by 10% and 5% respectively
Rahman, C. M. L (2015)	Mean downtime analysis (MDT), Statistical analysis and Pareto analysis to measure mean downtime reduction of automated manufacturing company of Bangladesh	Production improvement techniques and modern maintenance management are needed to increase the volume of production and improve the maintenance procedure.
Gupta, P. Vardhan, et al. (2015)	Evaluate aspects and success factors of TPM implementation in Indian manufacturing industries	Indian companies improved their overall equipment effectiveness (OEE) over 30%,and 95% OEE can also be achieved.
Nzewi H. N., et al. (2016)	Studied the relationship between the TPM and the performance of selected Aluminium firms in Anambra state.	The correlation values defined the autonomy in the decision had a positive relationship with the employee.

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IV. CONCLUSION

An overview of TPM is discussed here in this paper along with its benefits, stages, pillars, elements, and its need in the manufacturing industry. The concept of TPM is the most promising technique to be used by the manufacturing industry to improve productivity. Apart from this, the paper also studied the different approaches used in previous studies to understand the barriers and successful factors for effective implementation of TPM in Indian industries. With the implementation of TPM, an organization can increase its productivity and quality can be achieved. This can be only done by the improved work culture of the organization. Therefore, the future research will focus on the solutions to overcome the barriers. The findings of this review presented in this paper concluded that the strategic manufacturing performance to compete and continue to survive in the highly dynamic global market.

REFERENCES

- [1] Kedar, A.P., et al. (2008) "A comparative review of TQM, TPM, and related organizational performance improvement programs" IEEE, Pp: 725-730.
- [2] Batumalay, K., & Santhapparaj, A. (2009). Overall Equipment Effectiveness (OEE) through Total Productive Maintenance (TPM) practices — A study across the Malaysian industries. 2009 International Conference for Technical Postgraduates (TECHPOS).
- [3] Bon A. T. and Ping, L. P. (2011) "Implementation of Total Productive Maintenance (TPM) in Automotive Industry," 978-1-4577-1549-5/11/IEEE.
- [4] Ng, K. C., Chong, Goh, G. G. and Eze, U. C. (2012) "Barriers to Total Productive Maintenance Implementation in a Semiconductor Manufacturing Firm: A Case Study," 978-1-4673-2945-3/12/IEEE.
- [5] Kalbande, D.R., and Thampi, G.T. "Total Productive Maintenance –Accelerating OEE in a Manufacturing Industry leveraging pervasive technologies," Trans-tech applications, Vols 383-390, pp: 4568-4575, 2012.
- [6] Wakjira, M. W., Singh, A. P. (2012). Total Productive Maintenance: A Case Study in Manufacturing Industry. Global Journal of Researches in Engineering, Volume XII (I).
- [7] Bakri A. Hj., Rahim A. R. A., and Yusof, N. M. (2013) "Total Productive Maintenance: Competing or complementary to other initiatives," Applied Mechanics and Materials Vol 315 (2013) pp 472-476, Trans Tech Publications, Switzerland.
- [8] Ng, K. C., Chong, K. E., & Goh, G. G. (2013). Total productive maintenance strategy in a semiconductor manufacturer: A case study. 2013 IEEE International Conference on Industrial Engineering and Engineering Management.
- [9] Sukarma, L. (2014) "The Critical Role of TQM, JIT, and TPM in the Revisiting World Class Manufacturing and Manufacturing Excellence," Applied Mechanics and Materials, 660, pp 959-965.
- [10] Singh, K. and Singh Ahuja I., (2014) "Effectiveness of TPM implementation with and without integration with TQM in Indian manufacturing industries," Journal of Quality in Maintenance Engineering, 20 (4), 415-435.
- [11] Kart, O., and Kut, A. "An Implementation of Real Time Total Productive Maintenance Software" International Conference on Information Society, 2014.
- [12] Kaur, M. (2015) "Justification of synergistic implementation of TQM-TPM paradigms using analytical hierarchy process," Int. J. Process Management and Benchmarking, 5 (1).
- [13] Madanhire, I. and Mbohwa, C. (2015) "Implementing Successful Total Productive Maintenance (TPM) in a Manufacturing Plant," Proceedings of the World Congress on Engineering, 2, London, U.K.
- [14] Stamm M. L., Neitzert T. R. and Singh D. P.K., (2015) "TQM, TPM, TOC, Lean and Six Sigma – Evolution of manufacturing methodologies under the paradigm shift from Taylorism/Fordism to Toyotism."
- [15] Gupta, P., Vardhan, S., and Al-Haque, M. S., (2015) "Study of Success Factors of TPM Implementation in Indian Industry towards Operational Excellence: An Overview," pp. 1-6.
- [16] Chowdhury, R.M. L. "Assessment of Total Productive Maintenance implementation in a semi-automated manufacturing company through downtime and mean downtime analysis" Industrial Engineering and Operations Management, March 2015
- [17] Gupta, P. Vardhan, S., and Haque, M.S.A. "Study of Success Factors of TPM Implementation in Indian Industry towards Operational Excellence: An Overview" IEEE, 2015
- [18] Ramlan, R., Ngadiman, Y., Omar, S. S., & Yassin, A. M. (2015). Quantification of machine performance through Overall Equipment Effectiveness. 2015 International Symposium on Technology Management and Emerging Technologies (ISTMET).
- [19] Djatna, T., & Alitu, I. M. (2015). An Application of Association Rule Mining in Total Productive Maintenance Strategy: An Analysis and Modelling in Wooden Door Manufacturing Industry. Procedia Manufacturing, 4, 336-343.
- [20] Rashid, A. and Tjahjono B., (2016) "Achieving Manufacturing Excellence through the Integration of Enterprise Systems and Simulation," Production Planning and Control.
- [21] Nzewi H. N., Chikezie O. M., and Archie A. E., (2016) "Total Productivity Maintenance and Performance of Selected Aluminium Manufacturing Companies in Anambra State," IOSR Journal of Business and Management (IOSR-JBM) e-ISSN: 2278-487X, p-ISSN: 2319-7668. 18 (1), pp-67-73.
- [22] Jasiulewicz-Kaczmarek, M. (2016). SWOT analysis for Planned Maintenance strategy-a case study. IFAC-PapersOnLine, 49(12), 674-679. doi: 10.1016/j.ifacol.2016.07.788

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(A High Impact Factor & UGC Approved Journal)

Website: www.ijirset.com

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- [22] Singh, R., Gohil, A. M., Shah, D. B., & Desai, S. (2013). Total Productive Maintenance (TPM) Implementation in a Machine Shop: A Case Study. *Procedia Engineering*, 51, 592-599. doi: 10.1016/j.proeng.2013.01.084
- [23] Ahmad, M., Zakuan, N., Jusoh, A., & Takala, J. (2012). Relationship of TQM and Business Performance with Mediators of SPC, Lean Production, and TPM. *Procedia - Social and Behavioral Sciences*, 65, 186-191. doi: 10.1016/j.sbspro.2012.11.109
- [24] Paropate, R. V., & Sambhe, R. (2013). The Implementation and Evaluation of Total Productive Maintenance –A Case Study of mid-sized Indian Enterprise. *International Journal of Application or Innovation in Engineering & Management*, 2(10), 120-125.
- [25] Bakri, A. H., Rahim, A. R., Yusof, N. M., & Ahmad, R. (2012). Boosting Lean Production via TPM. *Procedia - Social and Behavioral Sciences*, 65, 485-491. doi: 10.1016/j.sbspro.2012.11.153
- [26] Katkamwar, S. G., Wadkatka, S. K., & Paropate, R. V. (2013). Study of Total Productive Maintenance & Its Implementing Approach in Spinning Industries. *International Journal of Engineering Trends and Technology*, 4(5), 1750-1754.
- [27] Tyagi, A. S., Baag, D., Jaikhami, H., Poullose, J., & Patel, J. (2013). Identification of the Success Factors for the Implementation of Total Productive Maintenance in an Organisation Using Interpretive Structural Modeling (ISM). *Journal of Supply Chain Management Systems*, 2(4), 20-36.
- [28] Jain, A., Bhatti, R., & Singh, H. (2013). Improvement of Indian SMEs through TPM Implementation – An Empirical Study. *Proceedings of International Conference on Advances in Mechanical Engineering*, 786-792.