

An Interlinked Methodology for Rapid and Better Production, Quality and Efficiency using Total Productive Maintenance, Kaizen and Lean Manufacturing

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Abstract—In this project we are going to merge some important methodologies for the improving overall plant's efficiency, Production and Quality these methodologies are Kaizen, Lean Manufacturing and Total Productive Maintenance. Total Productive Maintenance belongs to system of maintaining and improving The Men, Machines, Equipment and process which is essential for the better production and quality we are applying Kaizen and Lean Manufacturing for the Continuous Improvements and Elimination of the Wastages respectively. We are also merging these three techniques and applying as a single process of working for the efficiency improvement, Better and Rapid Production, Quality Manufacturing. These three methodologies merging together Total Productive Maintenance belongs to The product, the process that allows the product to be produced, the companies that is giving the proper conditions which actually needed for the appropriate process to work, the leadership that guides the companies & confirming statement to being superior throughout the organization. Kaizen improvements are technically implemented in sequenced by using Plan Then Do Then Check and then Act (PDCA) and a popular misconception is that lean is suited only for manufacturing. The lean thinking can be applicable in every field Lean can be applicable to implementation in every business and every process. It is a tactic or a cost reduction program, by a way of thinking and acting for an entire organization.

Keywords— TPM, Kaizen, Lean, Rapid Production Rate, Quality for Efficiency, Interlinking of methodology,

INTRODUCTION

In this project we are going to merge some important methodologies for the improving overall plant's efficiency, Production and Quality these methodologies are Kaizen, Lean Manufacturing and Total Productive Maintenance. The nature of Kaizen helps to improve working method and practice continuously. It's a common knowing fact that in Japanese, Kaizen means continuous improvement. The word suggest improvement that embrace all levels of an organization from workers to higher level of management and entails relatively little expense. The Toyota has been known as the first company that has started Kaizen and also implement it in a success full way. The application that Toyota used was called "Toyota Production System", where all good implements are recompensed. Kaizen improvements- there are some concepts to understand kaizen. First of all, it should be known that 'Kaizen provides the tools to Management'. Basically, management has two sides: First one is maintenance side and second one is improvement side. Maintenance refers to maintain current technological facilities like machines, systems, working methods, managerial and operating standards through training, review, regular maintenance and discipline. Improvement refers to elevate current standard in all possible and available fields. The management should be classified all the subjects or matters as in the maintenance or improvement side. Kaizen should be applicable in a little improvement side. kaizen signifies small improvements as a result of ongoing efforts, typically applied by using Plan-Do-Check-Act (PDCA). Lean is not only a technique but it is thinking "used to accelerate and minimize the cost of any methodology by removing the waste in either manufacturing or service." The wastes are all the things and working practically which is non-value added cost or unneeded wait time within the process may be caused by defects, excess production, and miss planning etc. Lean Manufacturing is also called Lean Production, is a philosophy that was originally developed in the Toyota Motor Company, and also known as the Toyota Production System or TPS. Basic goals of Lean are "better quality, low all kind of cost, short cycle times, flexibility, and relentless efforts to remove waste out from the organization, and make the product or provide the service as all value being defined by the customer." The result is reduced production cycle time, and greater efficiency. It also provides tools for reducing variability for the Continuous Improvements and Elimination of the Wastages respectively. A popular misconception about the lean is that it is suited only for manufacturing but it's not

true. The Lean can be applying in every business and every process. It is not only a tactic or a cost reduction program, but a way of thinking and acting for an entire organization. Total Productive Maintenance belongs to system of maintaining and improving your Men, Machines, Equipment and process. Total Productive Maintenance (TPM) is a tool that ensures timely and cost-effective equipment repair. It can be used in all businesses, including offices, but is particularly useful in the manufacturing sector which is essential for the better production and quality.

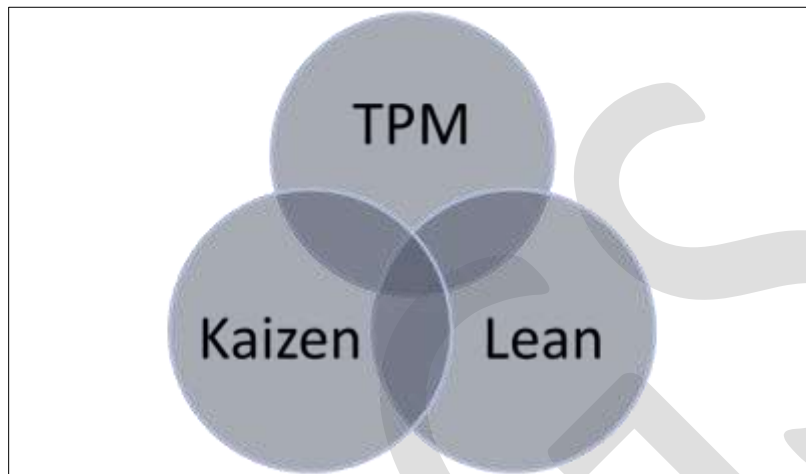


Figure 1- Methodologies Integration

By the combination of these three techniques and applying as a single process of working for the efficiency improvement better and Rapid Production, Quality Manufacturing. These three methodologies merging together Total Productive Maintenance belongs to The product, the process that allows the product to be produced, the companies that is giving the proper conditions which actually needed for the process to work, the leadership that guides the organization, and commitment to excellence throughout the organization.

Principle & Planning

This bonding of these three technologies are difficult to find in any organization. By this methodology I am looking forward for better results and planned improvements. It can be conquer the profitability and eliminate the losses by the mergence of these three techniques for the better results a sequenced planned implement can take place for the higher productivity and profitability and reduce/avoid to unwanted wastages. Kaizen involves all the employees of the firm, Kaizen improving the methodologies of work, Kaizen Improvements are easy to adopt, many people consider kaizen as a philosophy of ongoing improvement involving industries, it involves from top managers to the labor class. In Japan for competition& success in any industry and plant it is the most important element. It provides the result-oriented view of searching from the Wastes innovation-and method-oriented work practice. In general, kaizen is a system for regularly implementing new innovative idea as a tool, as per company levels; In this competitive market everyone is trying to seek out and exploit and new opportunities and institutional information from new researches.

The Kaizen Principle

The best thing about this basic idea is that it's probably pretty close to the truth. Yet there are a number of further presuppositions there that really open up the way for a whole new type of growth in any area where you wish to apply the Kaizen principle. I think the most suitable aspect of the Kaizen philosophy is the upfront presupposition that in whatever industry you apply it, and no matter how well you do it, it can never be best there is always scope for betterment & it can be achieved by kaizen system. Yet even from state of imperfection, there is no need to be dismayed, or afraid, if you follow the Kaizen principle. Here, we strive towards perfection - we do the best on each time we can to make things better, every way, and every day, to move towards perfection in an evolution of simple endeavors, all the time. Elimination of waste. Waste reduction is an effective way to increase the profitability of any organization. The managers should learn about the problems that happened in industry growth, from a report that reaches them several days or even weeks after the problem exist. In other words, industry is the place where value is added and problems are solved through processes such as taking temporary countermeasures on the spot, find out the root cause and standardize for prevention and recurrence. In short,

whenever there is progressive activity, it will involve team work and continues effort, it will make the clients to be more satisfy in view point of quality, cost, delivery and services.

The Kaizen in Practice

Kaizen appreciate for continuous improvement. It motivates the employer & employee both to think some innovative for better than before. Today Kaizen is being use in each MNC company worldwide as an important pillar of an organization's by this the company getting strong for long-term competitive strategy. Kaizen is continuous improvement that is based on certain guiding principles, Good processes bring good results., Go see for you to grasp the current situation., Speak with data, manage by facts., Take action to contain and correct root causes of problems., Work as a team., Kaizen is everybody's business and much more.

LEAN PRINCIPLE

Lean manufacturing or lean production is a very good approach; Core idea is to maximize customer value while minimizing waste. It's making a fair sense the lean means creating more value for customers with fewer resources. Certainly, lean is centrifugal force for making desired what adds value by reducing everything else. Lean manufacturing is a management philosophy derived mostly from the Toyota Production System (TPS) (hence the term Toyotism is also prevalent) and identified as "lean" only in the 1990s. TPS is regenerated for its focus on elimination of the original Toyota seven wastes to improve overall customer value, but there are varying opinion for implementation, how this is best achieved. It's a world knowing fact, the gradually growth of Toyota, from a very small scale company to the largest automaker company. Lean production is a technique to production and manufacturing developed in core Japan. Toyota, the Japanese car production department was that founded lean production. The overall aim of lean technology is to eliminate the excess using of resources used up in production. By implementing this, lean system uses less of -work place, raw

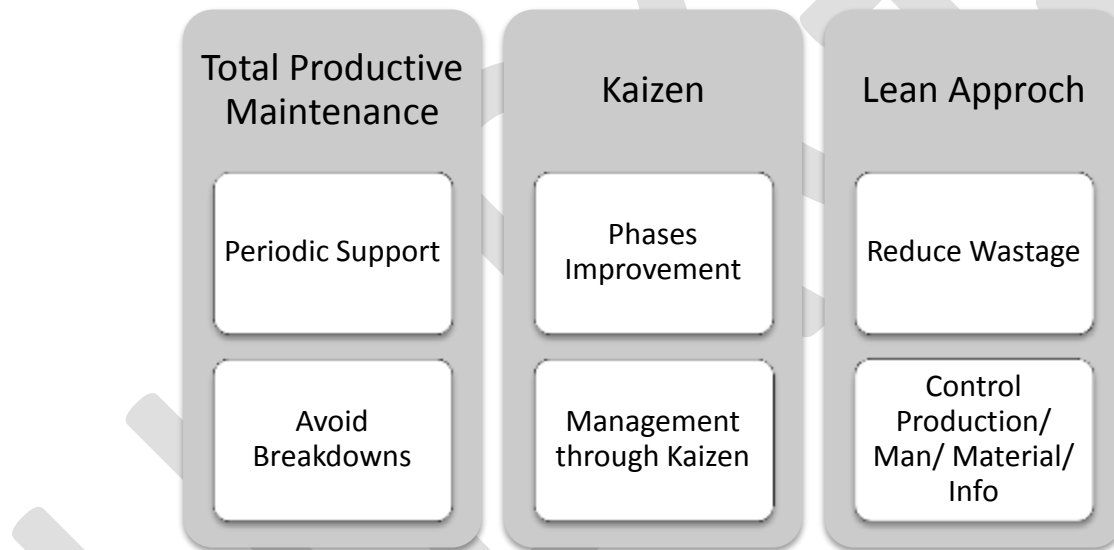


Figure 2- Phases of Methodology

inventory, stocks, labor, capital and time. Lean production reduces and tries to eliminate costs, increases productivity efficiency and output and productions reduces and try to eliminate costs, increases productivity efficiency and output and improves mental satisfaction & motivation. Lean production involves using a various practices designed to eliminate waste and increasing productivity and quality. Lean Production includes - Introduction "Lean" was first introduced in Japanese manufacturers. The Toyota production system is optimum admired as a very successful play on lean methodology. In another quote, lean methodology refers to production processes that improve upon mass production techniques to reduce cost, reduce time to produce, improve quality, and better respond to market demands. The benefits of lean production techniques have been documented in several studies, including a worldwide study of automotive industry.

PROPOSED METHODOLOGY

In this Methodology we have implemented three new and improved techniques of modern science which is kaizen, lean manufacturing and total productive maintenance. Industries are increasingly paying attention to maintenance efficiency optimizing the level in reliability and availability of assets. Many of the improvements could be obtained using new technologies and strategies to maximize service level and to reduce the maintenance costs, as long as it is possible to identify the business areas where a leap in technology could render and optimize the maintenance processes. Performance improvements in the maintenance and conservation activities of assets are measured by availability and operational reliability. They should be obtained preserving maximum quality and safety levels and minimizing the costs.

In the current scenario of competitiveness, improvement efforts are essential to reach high levels of effectiveness and efficiency in every company's production or operational department. The purpose is to achieve competitive advantage (in products or offered services) based on different hard-to-copy aspects, i.e. know-how.

- To obtain maximum performance, the organizations must be prepared for changes and there are three interconnected areas in the change concept:

- Processes, work fluxes to achieve the improvements (e.g. doing more preventive work instead of corrective work, etc.). Kaizen guide to implement the following points.

The workplace should have the environment including discipline support to work nature. Customer orientation at each single stage it should be came to about the choice and interact of customer this thinking guide for more value. Zero defect practically it is not possible to achieve the target of zero defect but it can be tending to achieve the target of zero defects, such attention leads the organization to reduce and eliminate defects

As we know that the defects are barrier for any industry defect cause, the work which is not profitable for company but result to be loss. The effect includes the following terms of losses.

- 1) Raw material loss used in product.
- 2) Machines parts and power consumption.
- 3) Labor work effort
- 4) Labor and machine time used to produce the particular product.
- 5) Labor & machine time and energy consumed to produce again a product unit similar specification confirming the quality of the place of defected place.

So it is conclusion that types of losses mentioned above can be encounter by view of Kaizen.

TPM Support:

As above entailed the defects are major causes and losses.

Basic defect resources:

- 1) Human Error
- 2) Material not confirming the required specification.
- 3) Machine errors

Above three mentioned root cause can be reducing or finished by the basic concept of TPM. Total Productive Maintenance matches all the dimensions regarding improvements of productivity and quality it reduces and elimination and defects. One of the most returning features of kaizen is that big results come from many small changes which are not even costly and may be accumulated over time, it doesn't require suddenly big expenditures. In general, this has been misunderstood to that kaizen means small changes. In fact, kaizen means everyone at every stage involved in making improvements. While the majority of changes may be small at number of stages. The greatest impact may be created by kaizen that are led by senior management as transformational projects, or by cross-functional and checking teams. In this Methodology it is suggested to implement three new and improved techniques of modern science which is kaizen, lean manufacturing and total productive maintenance. Industries must be paying attention to maintenance efficiency optimizing the level in reliability and availability of assets.

Implementation should in the way that reduces the maintenance costs, as long as it is possible to identify the business areas where a leap in technology could render and optimize the maintenance processes. Performance improvements in the maintenance and conservation activities of assets should be measured availability and operational reliability.

During the implementation of methodology following care should be taken-

- To obtain maximum performance, the organizations must be prepared for changes.
- Processes, work fluxes to achieve the improvements (e.g. doing more preventive work instead of corrective work, etc.).
- Technologies to facilitate or enable advanced and improved processes.

For implementation proper & regular implementation of proposed methodology following steps should be followed

- 1 Firstly, the problem occurring in implementation of methodology should be identify.
2. The identified problem should be analyzed appropriately.
3. After analysis the required solution or development can be found.
4. Implement new development. Evaluate the results coming from the implementation of new development.

5. If the results coming from evaluation are satisfactory then the process should be maintaining in correct format.

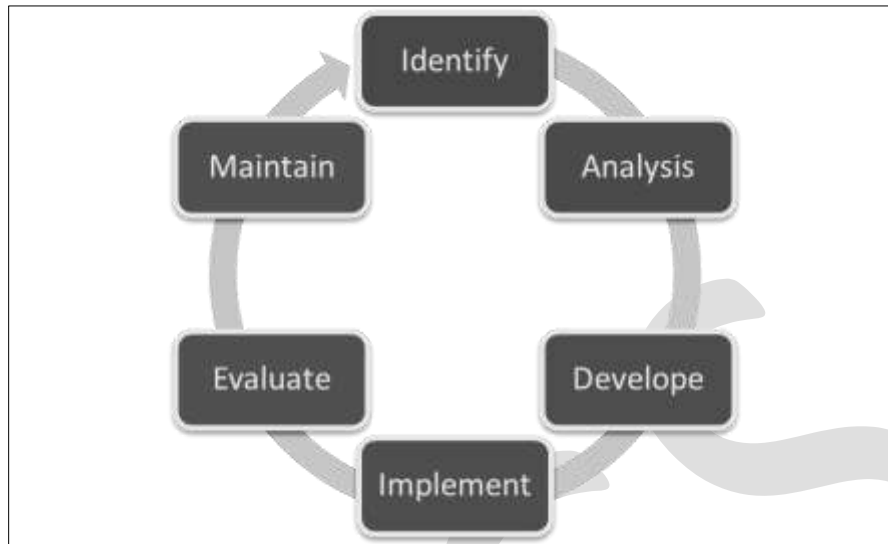


Figure 3- Process to Execute

RESULTS & DISCUSSIONS

As the proposed methodology is an interlinked methodology for rapid and better production, Quality and efficiency in various fields of plant improved by using TQM, Kaizen and lean manufacturing. Following are the points which can be improved by implementation of this methodology. No Breakdowns or comparatively lesser than before. No Small Stops or Slow Running. No Defects or reduction in percentage of defects. The interlinked system provides values to a safe working environment. No Accidents is target and can be achieved by a regular practice. Improvements in operational efficiency. The overall reliability of company enhances.

Regular improvements in qualities Become easy & possible. Better trained mechanics and higher levels of expertise. After practice Lower operating cost is possible. Provide better planning and preventative maintenance. Increased all machines, equipment and technical devices life span. Improved job satisfaction and job security. Help to sustain in competition. Increase departmental relation sheep like Maintenance partnership with production. Improve maintenance role in organization. Less capital tied up. Assures better quality performance in every sphere of activity. Helps in checking non-productive activities and waste. Improved service, delivering. Improvements in value per employ of organization. Lean help to reductions in defects and rework. Kaizen reduces waste in areas such as inventory. Reduced waiting times. Reduction in transportation. Efficient worker motion. Regular improving employee skills. Control over production. Remove use less quality operation from and in processes. Improved space utilization. Improved product quality. Efficient use of capital, communications, production capacity and employee retention.

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CONCLUSION

All of the above points have good effects on the related organization-financial impacts, business development, as well as helping to become a business that can better react, and meet exact customer's needs. The methodology is the combination of three very important system TPM, Kaizen and Lean so it covers a wide range of profitability of an industry or organization. As the interlinked working system ensure the efficient use of resources like as capital, Employees, machines and fix assets it all supports at last the organization financially.

The lower or zero break down enhance the system reliability in eternal organization as well in market. Improved maintenance system and active employees will be give regular growth to the quality of product indirectly which responsible for customer satisfaction.

The lean & kaizen based production system gives the higher efficiency of overall plant and reduce the product or service production cost which help to face the competition and also increase the profit. Regular thinking process system and awareness gives the new product development and improvement concepts which become stronger day by day when each employee is participating in this

methodology and working better at his or her level.

REFERENCES:

- [1] Womack, J., Jones, D. and Roos, D. (1990), *The Machine That Changed the World*, Rawson Associates, New York.
- [2] Hongyi Sun Richard Yam Ng Wai- Keung Thevimplementation and evaluation of TotalvProductive Maintenance (TPM)—an action case study in Hong Kong manufacturing company. *International Journal Advance in manufacturing Technology* (2003)Vol22: pp224- 228.
- [3] I.P.S. Ahuja and J.S. KhambaAn evaluation of TPM implementation initiatives in an Indian manufacturing enterprise. *Journal of Quality in Maintenance Engineering* (2007) Vol.13 No.4 pp338-352.
- [4] Marcelo Rodrigues, Kazuo Hatakeyama, Analysis of fall of TPM in companies, *Journal of Material Processing Technology* (2006) 276-279.
- [5] Alok Kumar A Uplap, Dr.R.S.Dalu, RavikantV.Paropate ,P.S.GhawadeS.R.Kewate, *Implementation Strategy of Total productive Maintenance in Indian Industries*
- [6] Womack, J. and Jones, D. (1996), *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, NY.
- [7] Hines, P., Holweg, M. and Rich, N. (2004), *Learning to evolve: A review of contemporary lean thinking*, *Int. Journal of Operations & Production Management*, Vol. 24, No. 10, pp. 994-1011.
- [8] Holweg, M. (2007), "The genealogy of lean production", *Journal of Operations Management*, Vol. 25, No. 2, pp. 420-437.
- [9] Verma, A., Bao, H., Ghadmode, A. and Dhayagude, S. (2005), "Physical Simulations in Classroom as a Pedagogical Tool for Enhancing Manufacturing Instruction in Engineering Technology Programs" in *Proceedings of the 2005 American Society for Engineering Education Annual Conference & Exposition*, Paper No. 2005-220, 12pp.
- [10] MacDuffie, J. and Pil, F. (1997), "Changes in Auto Industry Employment Practices: An International Overview" in Kochan, T., Lansbury, R. and MacDuffie, J. (Eds.) *After Lean Production: Evolving Employment Practices in the World Auto Industry*, Cornell University Press, New York.
- [11] Ozelkan, E. and Galambosi, A. (2009), "Lampshade Game for lean manufacturing", *Production Planning &Control*, Vol. 20, No. 5, pp.385-402.
- [12] Okkola, T. and Kässi, T. (2012), "Designing an Industrial Management Curriculum, Overcoming Obstacles", *Int. Journal of Industrial Engineering and Management*, Vol. 3, No. 2, pp. 67-74.
- [13] Bonwell, C. and Eison, J. (1991), *Active Learning: Creating Excitement in the Classroom*, ASHE-ERIC Higher Education Reports, Washington.
- [14] Jorge L.Perez-Lafont, B.S.I.E., 'Installation of T.P.M. program in a Caribbean plant. *International conference on Computers and Industrial Engineering*' 33.1.2 315-318. (1997) .
- [15] F.T.S. Chan, H.C.W. LAU, R.W.L. Ip, H.K. Chan, S. Kong 'Implementation of Total Productive maintenance : A case study' *International journal of Production Economics* 95 .71-94. (2005)
- [16] F.-K. Wang, W. Lee 'Learning curve analysis in total productive maintenance' *International Journal of Management Science* 29 ,491–499, (2001)
- [17] Kathleen E. McKone a, Roger G. Schroeder b, Kristy O. Cuab 'The impact of total productive maintenance practices on manufacturing performance' *Journal of Operations Management* ,19, 39–58, (2001).
- [18] M.C. Eti a, S.O.T. Ogaji b, S.D. Probert b., 'Implementing total productive maintenance in Nigerian manu
- [19] Miles, M., Melton, D., Ridges, M. and Harrell, C. (2005), "The Benefits of Experiential Learning in Manufacturing Education", *Journal of Engineering Technology*, Vol. 22, No. 1, pp. 24-28.
- [20] Holweg, M. and Bicheno, J. (2002), "Supply chain simulation – a tool for education, enhancement and endeavour", *International Journal of Production Economics*, Vol. 78, No. 2, pp. 163-175.
- [21] Billington, P. (2004), "A Classroom Exercise to Illustrate Lean Manufacturing Pull Concepts", *Decision Sciences Journal of Innovative Education*, Vol. 2, No. 1, pp. 71-76.
- [22] Prusak, K. (2004), "Problem Definition and Problem Solving in Lean Manufacturing Environment", in *Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition*, pp. 195-206.