EMPIRICAL STUDY OF TPM FOR FLY ASH MANUFACTURING INDUSTRY USING SWOT ANALYSIS

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ABSTRACT

In this world of globalization, development is necessary for every Fly Ash (FA) Brick manufacturing industry. For the development of FA brick industry, maintenance is considered as an important function and becoming increasingly difficult to ignore it. The impact of effective and efficient maintenance is important to increase the productivity and maximize the effectiveness of the OEE of brick industry. TPM is a function/approach to understand the relationship of the machines with product and its quality. TPM focuses on improvement in equipment availability, performance and quality with assuring health and safety of employees and protection of environment. This study is conducted in a FA brick industry which is engaged in Fly Ash based Brick production. This research will provide new data and findings on the implementation of TPM towards improving the Overall Effective Efficiency level using SWOT Analysis.

Keywords: Fly Ash, Losses, Maintenance, Productivity, Quality

I. INTRODUCTION

Utilization of fly ash is not a new phenomenon. To find out the properties of FA, scientist started research activities in the year 1937, R.E. Davis and his associates at university of California. The research had established that fly ash possessed specific property called as pozzolanic property which was similar to volcanic ash and deserved to be utilized in cement brick works. Now days, FA bricks are extensively used in all building constructional activities similar to that of common burnt clay bricks. For the superior quality and eco friendly nature of FA bricks, its demand has increased considerably.

The main factor for achieving business success of FA brick industry is quality. Quality is the key strategic factor for competing in today's Global market place. TPM is a systematic approach to understand the equipments function, the equipments relationship to the product quality and the likely cause of failure of the critical equipment conditions. The target of TPM is to achieve Zero defect, Zero equipment unplanned failure and Zero accidents.

SWOT analysis is a strategic planning method used to evaluate the Strengths, Weaknesses, Opportunities and Threats involved with FA brick industry. . It estimates the risks for the FA brick industry by identifying the internal and external factors that are important to achieve the objectives.

This paper will be helping to analyse the SWOT of the FA brick manufacturing industry and implement of TPM for achieving the desired results.

1.1 Literature review:

Organizations adopt TPM as a significant process improvement and problem solving approach for enhancing organization's responsiveness for catering to customer needs and affecting cost optimization as part of maintenance strategy to increase market share and maximize profits (*Ahuja and Khamba, 2008*).

According to Swanson (2001), the aggressive way to improve the function of the production equipment is obtained by implementing TPM. Nakajima (1989) stated that the Top management's primary responsibility is to establish a favorable environment where the work environment can support autonomous activities.

TPM embraces empowerment to production operators establishing a sense of ownership in their daily operating equipment (Tsang & Chan, 2000). This sense of ownership is an important factor that underpins TPM to its continual success with every operator being responsible to ensure that his own machine is clean and maintained.

There are many types of losses or waste that occur in any FA brick manufacturing industry. Through this research, improvement can be recommended to the selected company/mentioned company.

II. CASE STUDY

XYZ Fly Ash brick manufacturing industry runs either in one shift or in two shifts depending upon the work load. Usually the shifts are of 8 - 10 hours which includes a 30 minutes break for lunch or dinner and between shifting change, there is 1hour gap.

The company mainly faces losses due to machine breakdown and labour absenteeism. The existing maintenance department is struggling to cope with the present problems.

In this situation implementation of TPM will lead to increase the efficiency of the whole manufacturing system of FA brick industry.

III. RESEARCH OBJECTIVES

This paper/project aims to implement TPM effectively in FA brick industry. The main objectives are:-

1. To analyse the present maintenance system of FA brick industry after evaluating its SWOT.
2. To propose a solution in the implementation of TPM to overcome the current problems.

3.1 Scope of the Research

1. Identify the problem of FA brick manufacturing industry.
2. Identify the SWOT of FA brick industry.
3. Identify the areas of improvement.
4. Create new improvement method.

This paper is done to assist the company by finding the causes of the problems and subsequently to work out the solutions to the problems.

IV. TOTAL PRODUCTIVE MAINTENANCE (TPM)

According to Seiichi Nakajima (Founder of TPM), TPM is a plan improvement methodology which enables continuous and rapid improvement of the manufacturing process through the use of employee involvement, employer empowerment & closed looped measurement of results.

Total Productive Maintenance or TPM is a philosophy to enhance an organization's productivity and produce high quality goods by minimizing waste thereby reducing costs.TPM implementation takes time and the top management should be willing to show patience in achieving the desired results.

Total productive maintenance is a practical technique aimed at maximizing the effectiveness of facility that we use within an organization. It is not only necessary for the organizational point of view, but also beneficial for individual. Directly or indirectly it leads to a better work life to an individual. An organization can succeed, enjoy profits and stay ahead of the competition only by providing faultless service and defect-free high quality products which are easily understood by and useful to customers for a reasonable price.

Here, it aims to use the equipments of FA brick industry in most efficient way by involving every employee from the Management to the Workers. For FA based brick, quality is the first priority. There are so many new FA based brick industries which are coming in operation but company with quality products and services will only survive. TPM will help the FA brick industry to take care of every day's problems. In initial stage, management may think TPM as an unnecessary investment. But gradually TPM not only change the system of the FA brick industry but also motivate all level of employees.

4.1 Pillars of TPM

TPM involves everyone from the organization and is structured through the 8Pillars. Each pillar will have own unique role in improving the FA brick manufacturing industry.

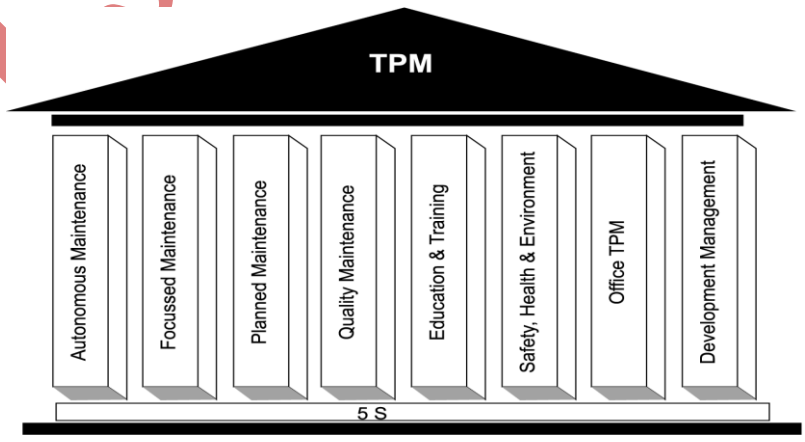

Fig. 1 TPM Pillars

4.1.1 Autonomous Maintenance (AM) is most important in TPM implementation as it is the back bone of TPM. In FA brick industry, operator needs to maintain their equipments by performing daily checking.

If there is no machine maintenance, deterioration is rapid. Early detection of machine problem is most important. FA brick industry can perform AM by taking simple initiatives like-

- Initial cleaning.
- Creating a check list for cleaning.
- General inspection.
- Full implementation continuity that understands the relationship between machine/equipment condition and product quality.

4.1.2 Focussed Maintenance analyses the different losses affecting the FA brick industry. It develops the skill and motivates workforce to eliminate the losses from their own process.

4.1.3 Planned Maintenance aims to achieve zero break-down in FA brick industry and also reduces the cost and increases machine efficiency.

4.1.4 Quality Maintenance aims to assure zero defects condition. It controls the process interaction between man, machine, material and method within the FA brick industry.

4.1.5 A company's workforce is a priceless asset and so FA brick industry should provide systematic Training and Education (T&E) for them.

4.1.6 Safety, Health and Environment is a drive towards the achievement of zero accidents. It is not just safety related but covers zero accidents.

4.1.7 Office TPM concentrates on all areas that provide administration and support functions in the industry. The pillar applies the key TPM principles in eliminating waste and losses from the FA brick industry. It ensures that all processes support the optimisation of manufacturing processes and that they are completed at optimal cost.

4.1.8 Development Management aims to implement new products with new process.

V. FINDINGS

As mentioned earlier, the main problem faced by FA brick industries are machine breakdown problem and the problem of the labour. Like other manufacturing industries, their other problems are:

- ✓ Poor supply of material/ unavailability of material.
- ✓ Quality defects.
- ✓ Power cut.
- ✓ Minor break down.
- ✓ Production adjustment.

- ✓ Local area problem.
- ✓ Rework time.

These problems are faced by the XYZ Company frequently. Production adjustment is not mentioned in the chart because management managed the production by overtime. In case of power cut, if the company cannot arrange for alternative option then production will be interrupted minimum for 1hr daily.

Table1. Types of Losses per month

Types of losses	Time in Minutes
Machine breakdown.	2880
Unavailability of material	1440
Labour problem.	10080
Quality defects	1440
Power cut	180
Local area problem	2880
Rework time.	30
Minor break down.	1440

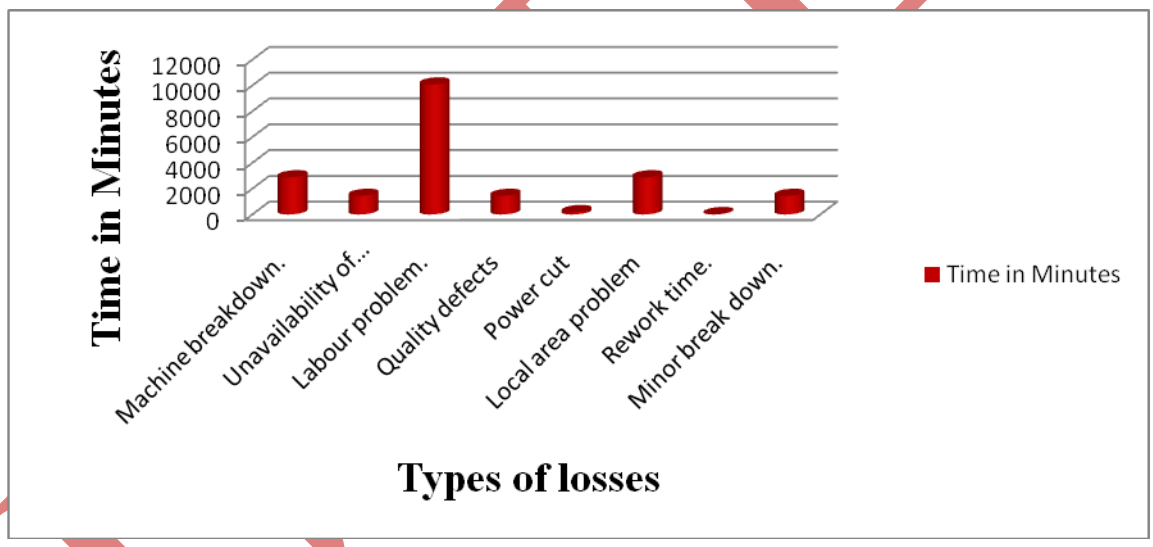

Fig. 2 Losses faced by the FA brick industry per month

VI. METHODOLOGY

The selected company wants to implement TPM after eliminating the problems and increase OEE of the company. Before implementing TPM in the FA brick industry, we collected the information through

1. Direct Observation: all the data including all process time, loss time and problems are noted down.
2. Discussion with workers and managers help to gather information about daily problems faced by the FA brick manufacturing industry.
3. Data regarding Product Operation and engineering are also collected.

All the collected data from FA brick industry were analyzed thoroughly. Implementation of TPM was proposed to the FA brick industry to improve the current system. Through TPM, employees skill can be upgraded and participation of all sectors will increase efficiency and strengthen the team work motives.

VII. ANALYSIS

TPM will fail if Autonomous Maintenance (AM) practice is left out. If the operator knows how to determine the machine condition, then it will be easier to service the machine before its breakdown. FA brick industry facing the machine problem frequently because workers do not have proper training by experienced trainer. Sometimes high demand in production is also indentified as a reason why the operator was burdened. Lack of relationship problem among organization may be a problem. In spite of all these, machine problem of FA brick industry must be redressed first because there is no use in solving other problem if the main problem is left unsolved.

During this study, lack of training and education was found as a root cause. The proper training is not provided to the employees of the FA brick manufacturing industry and it would enhance the efficiency of the organization if looked into the same.

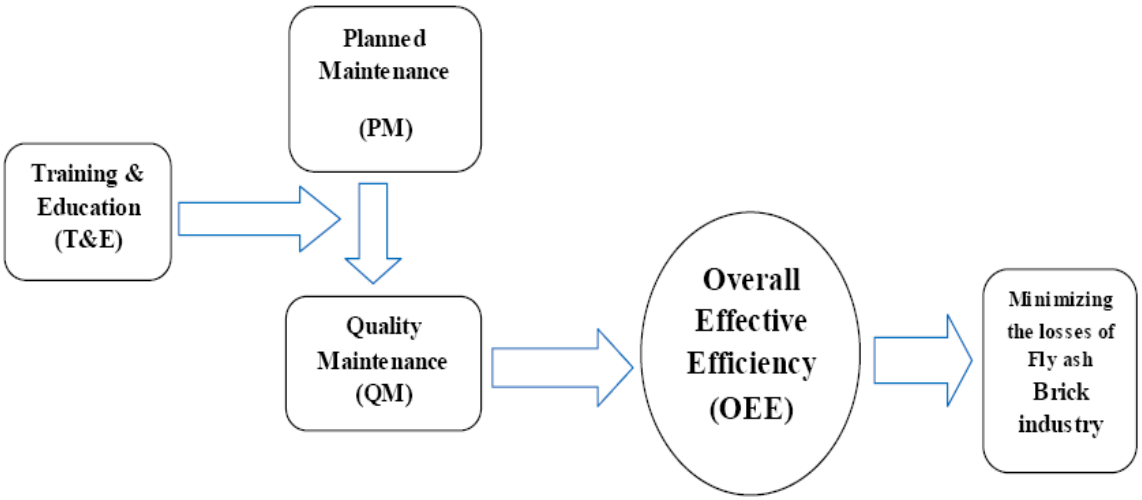

Fig.3 Effect of 3 pillars of TPM with OEE

VIII. IMPLEMENTATION OF TPM

Before implementation of TPM in FA brick Company, it is very much necessary to evaluate the Strengths, weaknesses, opportunities and threats of FA brick industry. By scanning the internal environment of the FA brick industry we list find out its strength and weaknesses and that of external environment we identify its opportunities and threats. This analysis gives an idea about the company's success in the market as well as its proximity to the customers need. Strength are the strong hold about the product and where the opportunity penetration the product by identifying the weakness as well as the threats to the product.

8.1 Hurdles for Implementing TPM in Fly Ash based Brick industry

- Lack of top management commitment: TPM programs for FA brick industry can be effective if only the top management is totally involved in it. It is the responsibility of the management to explain the necessity of TPM to the members.

- Organizational resistance to change**:** In the cut throat competition among FA brick industries, it is important to innovate the new approach.

- Unwillingness to commit resources**:** TPM implementation requires investment in terms of resources (man, machine, material). Management thinks TPM as unnecessary investment.

- Work culture**:** Distance/Gap between Management and non-management staff is a common factor in every industry. If Management of FA brick industry involves all the members in decision making process then it will not only increase the confidence levels of the employees but also it would be easy to implement new concept.

- Resistance by employees**:** Narrow sense of vision hinders the growth of the industry. In FA brick industry it is observed that one employee / worker is not ready to do the job of another one. It is the task of the employer to overcome this hindrance by including proper knowledge and wisdom in the hearts of workman.

- Long term commitment of management and employees**:** Remuneration and benefit are great motivators for employees.

- Attitude towards manufacturing / production process: Positive attitude towards FA brick industry makes the organization competitive. Right attitude helps the management for implementation of TPM successfully.

- Maintenance management process: To implement TPM in FA brick industry, management and employees should go jointly. Management should apply correct maintenance program for the industry.

8.2 SWOT analysis

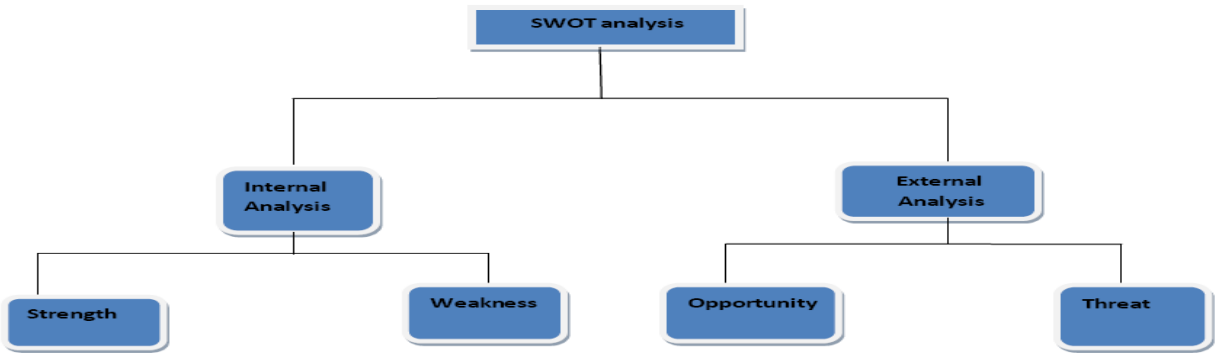

Fig. 4 SWOT Analysis

Table 2 SWOT Analysis of Fly Ash Brick manufacturing industry

Strengths	**Weaknesses**
▪ Availability of the raw material. ▪ Durability of FA bricks. ▪ FA bricks are eco friendly product. ▪ Required less time in production compared to clay burnt brick. ▪ Can be produced in every season. ▪ Utilization of waste material in FA brick manufacturing is possible. ▪ No top soil erosion for brick production. ▪ Coal is not required in this manufacturing process.	▪ Storage of raw material for longer period may destroy its quality. ▪ Transportation cost of Fly Ash is high if the Thermal Power Plant is not in the vicinity of the FA brick factory. ▪ Market penetration is weak/slow. ▪ FA bricks are not popular among common man till today. ▪ Negative perception about the FA brick. ▪ Tax imposition. ▪ Electricity/diesel consumption. ▪ Availability / supply hindrance of raw material.
Opportunities	**Threats**
▪ Project- now a day's FA bricks are used in diff. projects. ▪ Loan- banks are helping to arrange finance for starting a project. ▪ Market share- possibility to increase the market share of FA brick if it gets the proper patronage from the government. ▪ Better working conditions- due to the better working condition than traditional brick plant, more people want to join this field.	▪ No support from government. ▪ Tax payment- Unorganized traditional bricks plants are exempted from tax. ▪ Fuel charge/ power-cut- In case of power cut plant will run with diesel, so with the increase in the price of fuel there will be the threat to decrease the production. ▪ Loose disposal of Fly Ash is a threat to the top soil.

8.2.1 Strength

The main ingredients used in FA brick production are Fly Ash (FA), Sand, Cement, Lime, Gypsum etc. The benefit of using FA as the main ingredients is that they are widely available in the form of waste from industry. FA brick is an eco-friendly product, not creating any environmental hazards. The production of FA brick is possible during monsoon season also is basically a diversification from traditional clay burnt brick in order to stop the use of valuable top soil.

8.2.2 Weakness

When EA brick industry is located at a far off distance from thermal power plant , then the transportation cost of FA is normally increased which is a negative point. Despite of more advantages of FA brick over clay burnt one, it is difficult to change the settled practice of common people to switch over from clay burnt to FA brick.

8.2.3 Opportunity

There is a recent notification of the Government which bans banning the use of top soil for brick production. The annual demand for bricks is near about 400 crores, of which demand of 200 crores is supplied by FA industry. Old or upcoming new big builders are also using FA brick slowly. FA bricks projects help the

entrepreneur to get the bank loan at a faster rate. Due to better working conditions than traditional brick plant, more people want to join this field.

8.2.4 Threats

Though Government declared to stop the use of top soil for brick making but no proper initiatives have been taken yet to promote the FA brick industries.

IX. PROPOSED MODEL

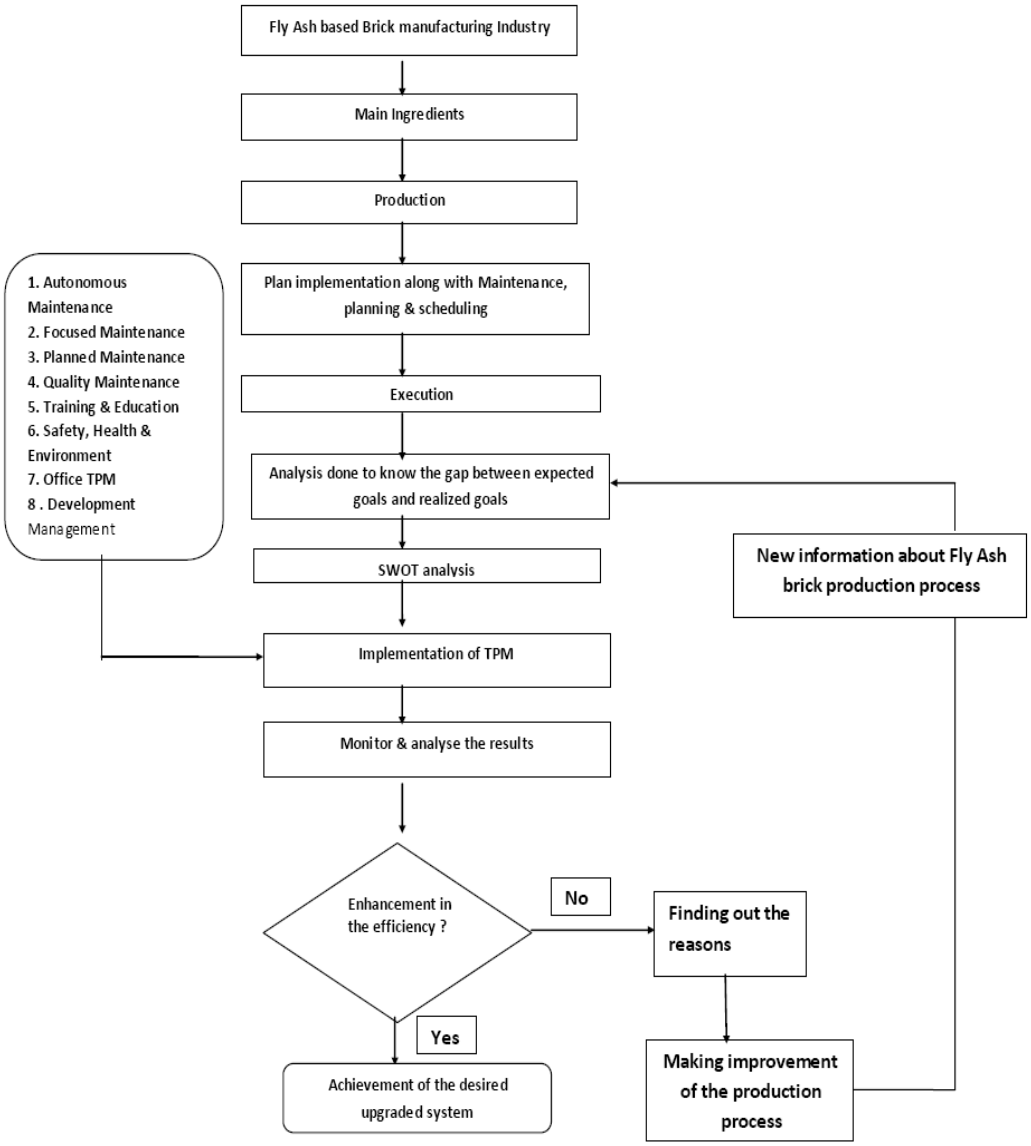

Fig. 5 Proposed Model of TPM Implementation for the enhancement of the Fly ash based Brick industry

X. CONCLUSION

The fly ash brick manufacturing industry is growing today since the tradition al bricks is being replaced to a large extent by fly ash one because of their certain remarkable good features as that of the normal clay bricks. The fly ash brick manufacturing industry is growing but there is a lack of technical and management acumen in

handling the day to day problems. The TPM has now become the essential means to be applied by putting more emphasis on autonomous maintenance along with other maintenance to reduce the waste, upliftment in the machine efficiency has a positive thrust upon productivity and the quality of the fly ash bricks being manufactured at the industry. The TPM is to be done in the perspective of SWOT analysis by capitalizing the strength areas, reducing the weaknesses while exploring the opportunities and tracing out threats which should be guarded by a convenient safety measure.

This is going to lead the FA industry in the positive direction with optimum utilization of resources as well as inculcating positive attitude in the work environment that would definitely accelerate the system efficiency and effectiveness of the concerned organization leading to a prosperous better future

REFERENCES

[1] Ahuja and Khamba, Strategies and Success Factors For Overcoming Challenges In TPMI implementation In Indian Manufacturing Industry, Journal of Quality in Maintenance Engineering, Vol 14, pp 123-147, 2008

[2]Tsang, A. H. C. & Chan, P. K. (2000). TPM Implementation in China: A Case Study, *International Journal of Quality & Reliability Management*, 17(2), 144-157.

[3] Ananth,G. and Vinayagam,K.B., "*Implementation and fall of TPM in Micro Manufacturing Industries Using SWOT Analysis-A Review*", International Journal of Engineering and Innovative Technology (IJEIT) Volume 1, Issue 4, April 2012, ISSN: 2277-3754 .

[4] Gupta,S.N., and Valarmathi,B.," *Total Quality Management*", 2nd Edition.

[5] Larson, H.F.G, "*An analysis of maintenance strategies and development of a model for strategy formulation – A case study",* Department of Production and Production Development, Chalmers University of Technology, Goteborg,Sweden,2012.

[6] Nakajima S., "Introduction to TPM (Total Productive Maintenace), Productivity Press, Cambridge, MA. pp. 1-121(1988).

[7] Owen,C.,"*Total Productive Maintenance",* industry Forum.

[8] Pasupuleti,P.,"*Factors contributing to the proliferationof a native technologyof a developing nation contributing towards the sustainable development: A case study",* Master Thesis, Aalborg Universitet,2010.

[9] Shahanaghi,K. and Yazdian,A.S.*," Analyzing the effects of implementation of Total Productive Maintenance (TPM) in the manufacturing companies: a system dynamics approach",* World Journal of Modelling and Simulation, ISSN 1 746-7233, England, UK Vol. 5 (2009) No. 2, pp. 120-129.

[10] Shah,Y.M.B," *Total Productive Maintenance: A Study of Malaysian Automotive SMEs",* Proceedings of the World Congress on Engineering 2012 Vol III, WCE 2012, July 4 - 6, 2012, London, U.K.

[11] Sharma,K., et al*," An Empirical Study Approach on TPM Implementation in Manufacturing Industry",* International Journal on Emerging Technologies,Jan,2012.

[12] Suresh,P.K.," *TPM Implementation in a Food Industry-A PDCA Approach* **",**International Journal of Scientific and Research Publications, Volume 2, Issue 11, November 2012 1 ISSN 2250-3153.