

Tpm Implementation In Small Scale Agriculture Industry: A Case Study

Amit Bajaj¹

Vipan Kumar²,

¹Postgraduate Student

²Assistant Professor

¹G.Z.S.C.E.T. Bhatinda- 151001

²Department of Mechanical Engineering

G.T.B.K.I.E.T. Chappianwali

Malout-152107, Punjab, India

ABSTRACT

The global marketplace has witnessed an increased pressure from customers and competitors in manufacturing .In this age of agile manufacturing the global competition characterized by both technology push and market pull had forced the companies to achieve world-class performance through continuous improvement in their products and processes and improved methodology. The key to increase productivity and is MMM (i.e. Man, Machine and Material). Man is one of the major key to success an industry. With the help of Man, we get a new idea to Improve the way of productivity i.e. production is done by less time, cost and zero defects. And second key is Machine i.e. how to use machines properly and used new technology. In third key, Material is used in good quality with less cost.

The objective of this paper is to increase the productivity and quality of work by implementing the TPM (Total Productive Maintenance) Pillars. (I.e. Setup MMM, Gaining zero defects and find equipment problems). In this paper, we have taken the case study of small scale manufacturing unit. After used TPM Pillars in this industry .We have completed our objective by increasing productivity and Quality of product and also reduced the scrap losses of this industry.

Keywords: -

TPM (Total Productive Maintenance), OEE (Overall equipment effectiveness), Productivity, Maintenance, Skill matrix, Assembly line.

I Introduction:-

Today TPM is the major part of an industry to improve the effectiveness of productivity. The TPM becomes by three words T- Total, P- Productive and M- Maintenance i.e. completely maintaining all the processes of production at all time of working or simply say that careful & intentionally working by employees in the industry. TPM has different types of pillars (details shown below), these pillared describe that how we used TPM in industry. These pillars basically tell about the maintenance of parts of machinery, how to improve the skills of workers, reduce the time, reduce scrap losses, and reduce cost of production, improvement the health & safety of workers and reduce operating time. These are helpful to increase the OEE of the industry.

II Total Productive Maintenance (TPM):-

Total Productive Maintenance is complete solution of all industry to increase the productivity. To describe Total Productive Maintenance it has consists of different types of pillars; these pillars define how to do best work in different section of industry. The name of Total Productive Maintenance pillars are shown below. And also its objectives and benefits are described below.

(i) Eight Pillar of TPM:-

- a) Initial Flow Control Activity
- b) Focused improvement (Kobetsu Kaizen)
- c) Autonomous Maintenance (Jishu Hozen)
- d) Quality Maintenance (Hinshitsu Hozen)
- e) Planned Maintenance
- f) Environment, Health and Safety
- g) Admin TPM
- h) Education and Training

(ii) Objective of TPM:-

- a) Involve people in all level of Organization.
- b) Achieve Zero Brake down, zero defects, Zero Speed loss & Zero Accidents.
- c) Increase Production.
- d) Increase associate morale.

e) Job Satisfaction.

(iii) Benefits of TPM:-

- a) Increases OPE (Overall Plant Efficiency).
- b) Rectify customer complaints.
- c) Reduce the manufacturing cost by 30%.
- d) Satisfy the customer's needs by 100 % (Delivering the right quantity at the right time, in the required quality.)
- e) Follow pollution control measures.
- f) Higher confidence level among the employees.
- g) Keep the work place clean, neat and attractive.
- h) Achieve goals by working as team.
- i) Share knowledge and experience.
- j) The workers get a feeling of owning the machine.
- k) Improving Reliability.
- l) Generate Multi-Skilled employees.

II Literature Review:-

TPM is an innovative Japanese concept. TPM (Total Productive Maintenance) is most important concept for industrial application. It is applicable to every industry i.e. large as well as small or medium scale industry. Every small, medium or large scale industry needs world class performance in their product, processes, work culture and methodology. The level is increased in every industry by two things by increasing production and decreasing cost of production, maintenance etc. and it can be only possible by implementing the TPM.

The term "Total Productive Maintenance" was first used in the late 1960's by Nipponese, a supplier of electrical parts to Toyota. At the Time it was a slogan for their plant improvement theme "Productivity Maintenance with total employee's participation. In 1971, Nipponese received the Distinguished Plant Award (The PM Prize) from Japan Institute of Plant Maintenance (JIPM). Eventually, Seiichi Nakajima, a vice chairman of JIOPM, became known as the father of TPM, since he provided implementation support to hundreds of plants, mostly in Japan.

In global manufacturing industries, drastic changes have taken place in the last three decades reflected in management approaches, product and process technologies, customer expectations, supplier relationships as well as competitive behaviour (Ahuja et al. 2006). Despite implementation of advanced manufacturing technologies and development of lean production, benefits from these programs have often been restricted due to unreliable or inflexible equipments and methods (Tajiri and Gotoh, 1992). TPM can be defined as a systematic work method aiming to develop disturbance free processes at lowest possible cost through the commitment of all co-workers. OEE is calculated by obtaining the availability of the equipment, performance efficiency of the process and rate of quality products (Dal et al. 2000). According to Kennedy (2005), it should be acknowledged that a TPM implementation is not a short-term fix program. It is a continuous journey based on changing the work-area, then the equipment so as to achieve a clean, neat, safe workplace through a "PULL" as opposed to a "PUSH" culture.

III Case Study:-

The Industry Gill Agricultural Implements Private Limited selected for case study, located in Malout, Punjab in India. This company established in 1998 by Mr. Sukhmander Singh Gill. He has installed a unit of Agriculture Equipment. The main Product of this Industry are Multi Crop Thresher, Grading Machine (Orange, Apple & Lemon etc.), Self propelled combine harvester, Tractor mounted harvester, Front tractor mounted reaper, Tractor mounted spray pump. The total cost of unit is 20 Crore (INR). It is a small scale industry. In this organization various kind of agriculture machinery manufactured. We have done our case study on Multi Crop Thresher assembly line. The daily production of Multi Crop Thresher on line is 10 machines/ day. The work is divided for assembly of multi crop thresher on (12) Twelve Stations.

(i) Process Flow Diagram:-

IV Methodology:-

The study has been carried out in Gill Agro Industry to do this job. At study time we find the causes of wastages of time and losses in industry. And we use some equations to know that how this wastages of time and losses affect the industry by calculate OEE. The necessary variables and equations that are used to calculate OEE are listed below:

Total shift time: 8hrs = 480min

Production Break: Lunch Break (60min) + 2 X Tea Break (15min) = 90min

Machine down Time: It refers to periods when a system is unavailable.

Total Machine Manufacturing: Machine manufacturing per day

Total Machine Rejection: Machine Rejected per day

Total Planned Production Time: Total shift time - Production Break

Total Operating Time: Total Planned Production Time - Machine down Time

Final Goods = Total Machine Manufacturing - Total Machine Rejection

Cycle Time (Time taken to produce one unit): Total Operating Time/ Total Machine Manufacturing

Valuable Operating Time per unit: Total Planned Production Time /Total Machine Manufacturing

Availability = Total Operating Time/ Total Planned Production Time

Performance Rate = Cycle Time/Valuable Operating Time per unit

Quality Rate = $\frac{\text{Total Machine Manufacturing} - \text{Total Machine Rejection}}{\text{Total Machine Manufacturing}}$

OEE = Availability X Performance X Quality Rate

V Production Data:-

Using above mentioned variables and equation we calculate the OEE of this industry of the three month from 15 July 2012 to 15 Oct 2012 that shown below in table. After calculating the OEE of this industry we find that the OEE of this industry is very less and the industry profit is not up to the mark. So we concluded that there is need of implementation of TPM Pillars in this industry.

OEE Calculation for July to Sep. month (before TPM) in tabular form

Factors/Month	15July-14Aug	16Aug-15Sep	16Sep-15Oct
Total shift time	12480min	12000min	12000min
Production Break	2340min	2250min	2250min
Machine Down Time	1040min	875min	1125min
Total Machine Manufacturing	182	174	168
Total Machine Rejection	52	48	50
Final Goods	130	126	118
Total Planned Production Time	10140min	9750min	9750min
Total Operating Time	9100min	8875	8625min
Cycle Time	50	51	52
Valuable Operating Time per unit	56	56	58
Availability	89.74%	91.03%	88.46%
Performance Rate	89.28%	91.07%	89.65%
Quality Rate	71.42%	72.41%	70.23%
OEE	57.22%	60.03%	55.68%

VI Suggestions and Implementation of TPM:-

In case study of Gill Agro Industry we calculate the OEE of the Industry; the OEE of the Industry is not good for the Industry future. We see that there are many problems and weakness in this Industry at time of Production and Assembly Line operations. After three month study of this Industry, find the problems and weakness of Industry and we gives the some suggestion to this Industry. After given the suggestion to Industry, employee of this Industry Implementation this suggestion and find the result that industry reduce weakness and improved assembly line operation. The some suggestion and its implementation are shown below:

a) At time of Assembly of threshers there is no sequence of work and these cause to Waste of time. After gives the suggestions Assembly of threshers working in line and this cause reduce the time of operation. The Assembly line of this Industry shown below:



Figure 1: Assembly Line

b) In these Industry workers has not well skilled in every work. Employee do only one type of work in Industry. This situation create problem at time of working. To solve this problem we create the skilled matrix generation method to improved skill of workers in Industry. The skilled matrix generation table shown below:

Skilled Matrix Generation (After TPM) Table

Employee Code/Process	Drum fitting on frame	Balancing of main shaft	Flywheel fitting	Pulley fitting	Shaking sieve fitting	Covering	Testing of M/c
A	✓	✓	✗	✗	✗	✗	✗
B	✗	✗	✓	✓	✗	✗	✗
C	✓	✗	✗	✗	✗	✗	✗
D	✗	✗	✗	✗	✗	✓	✗
E	✗	✗	✗	✗	✓	✗	✗
F	✗	✗	✗	✗	✗	✗	✓
G	✗	✗	✗	✗	✗	✓	✗

Skilled Matrix Generation (Before TPM) Table

Employee Code/Process	Drum fitting on frame	Balancing of main shaft	Flywheel fitting	Pulley fitting	Shaking sieve fitting	Covering	Testing of M/c
A	✓	✓	✓	✓	✓	✓	✓
B	✓	✓	✓	✓	✓	✓	✓
C	✓	✓	✓	✓	✓	✓	✓
D	✓	✓	✓	✓	✓	✓	✓
E	✓	✓	✓	✓	✓	✓	✓
F	✓	✓	✓	✓	✓	✓	✓
G	✓	✓	✓	✓	✓	✓	✓

c) Before implementation TPM industry used shearing machine (manually operated), that consume lot of time and wastage of raw material. After suggestion industry has purchased plasma cutting CNC machine that has increase the quality and quantity of work and less man power required. The data and figure shown below:

Scrap losses before & after implementaton TPM Table

Sr. No.	Sheets(G.I.)	Scrap Losses
1.	10 Gauge	8 kg
2.	14 Gauge	7 kg
3.	16 Gauge	6 kg
4.	18 Gauge	6 kg
5.	20 Gauge	5 kg
6.	22 Gauge	4 kg
7.	10 mm plate	7 kg

Sr. No.	Sheets(G.I.)	Scrap Losses
1.	10 Gauge	3 kg
2.	14 Gauge	2 kg
3.	16 Gauge	3 kg
4.	18 Gauge	3 kg
5.	20 Gauge	2 kg
6.	22 Gauge	1 kg
7.	10 mm plate	3 kg

Graphical Representation of Scarp Losses Before & After Implementation TPM

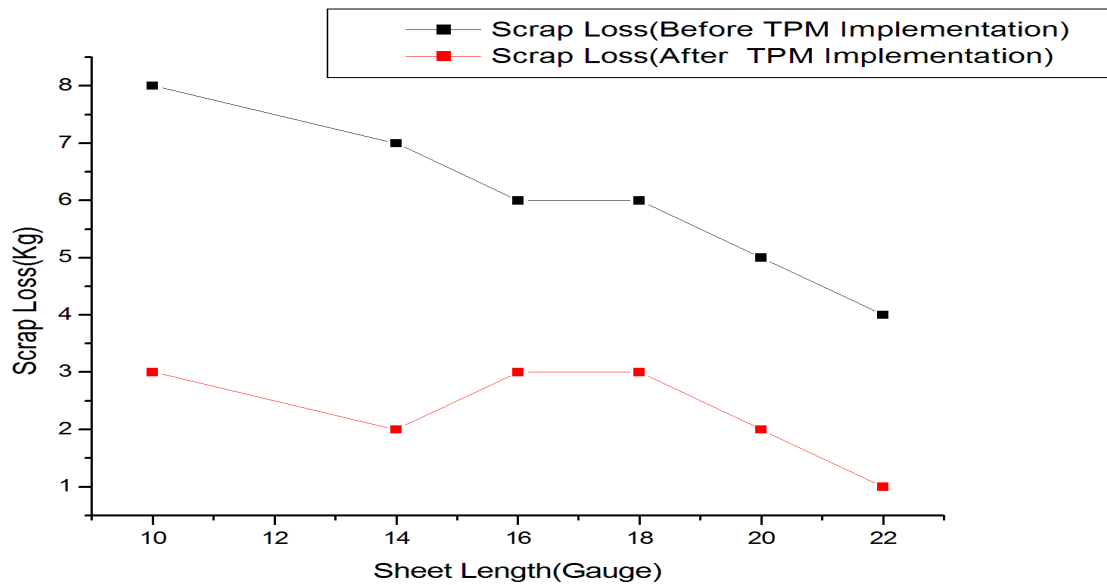


Figure No. 2

Figure no 2:- shows the scrap losses before and after implementation. It shows that when the implementation of TPM is carried out properly the scrap losses decreased and increases the proper utilization of material. So it is clear from graph before the TPM Implementation scrap losses is more and after Implementation scrap losses is reduced. To avoid such kind of scrap losses there is proper management of the work. It may be seen from the plot that 1kg of scrap loss per sheet is appropriate to reduce the scrap losses.

- a) In the duration of lunch time (60 min) maintenance personnel must do preventive maintenance of the plant.
- b) We have also suggested implementing cleaning of machine and shop floor area before starting the work so that rejection of rework reduces.
- c) Before implementation of TPM there is no proper working condition of workers. And after implementation TPM improved the working condition of workers by gives healthy food and purify ground water.
- d) Before implementation of TPM there is unplanned stoppages and high down time due to lack of non availability of spare parts as per requirement. After implementation of TPM spare parts always available in industry stock.
- e) After TPM implementation the organization is ready to meet the market requirements.
- f) At the initial phase of our study many employees consider it is an additional or burden but after implementation they feel that it is a win win situation for industry and employees.

g) During the study period we have found that there is lot of wastage of time due to unplanned or unframed work.

h) During the study period we have found that, the syndicate hundred bolt should tightened manually with the help of spanner and that process take (20) minutes approximately .We have rectify that by suggesting and implementing pneumatic spanner to tightened the bolts on syndicate and approximate (05) minutes required to complete the work.

After given the suggestion and implementation of TPM we calculate the OEE from 15Nov 2012 to 15Feb 2013 that shown below in table:

OEE Calculation for July to Sep. month (after TPM) in tabular form

Factors/Month	15Nov-14Dec	15Dec-14Jan	16Jan-15Feb
Total shift time	12480min	12000min	12000min
Production Break	2340min	2250min	2250min
Machine Down Time	390min	300min	450min
Total Machine Manufacturing	234	220	240
Total Machine Rejection	26	21	25
Final Goods	208	109	215
Total Planned Production Time	10140min	9750min	9750min
Total Operating Time	9750min	9450min	9300min
Cycle Time	42	43	39
Valuable Operating Time per unit	44	45	40.5
Availability	96.15%	96.92%	95.38%
Performance Rate	95.45%	95.55%	96.29%
Quality Rate	88.89%	90.45%	89.58%
OEE	81.58%	83.77%	82.27%

Graphical Representation of Case Study

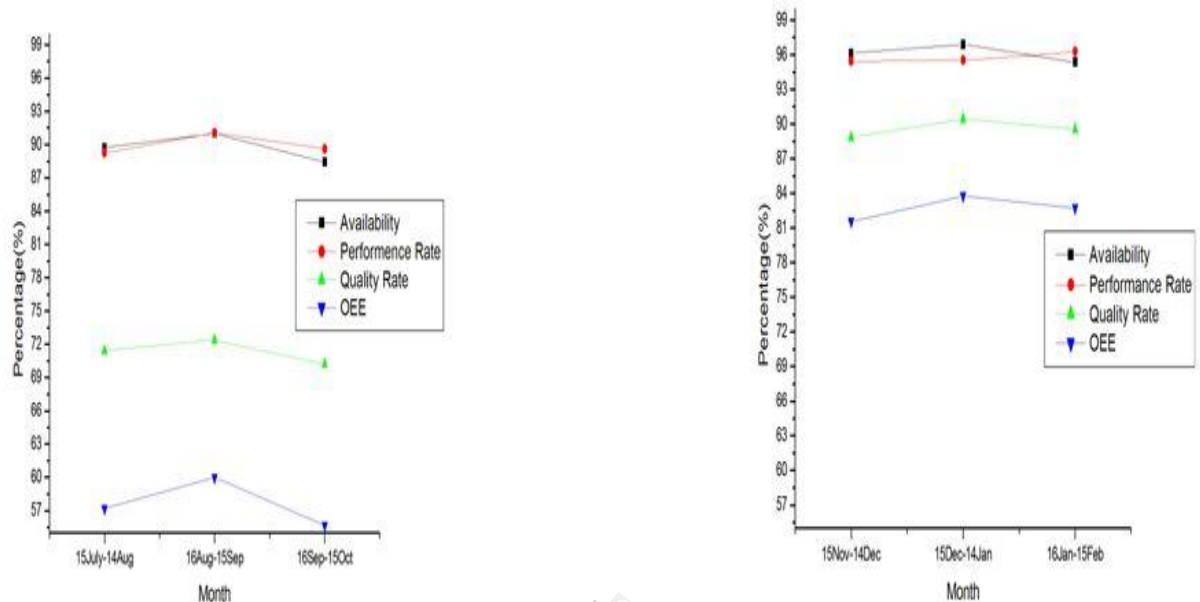


Figure no 3:- shows the comparison of OEE, Performance Rate, Quality Rate and Availability before and after implementation. It shows that when the implementation of TPM is carried out properly the OEE, Performance Rate, Quality Rate and Availability decreased and increases the proper utilization of resources. So it is clear from graph before the TPM Implementation OEE, Performance Rate, Quality Rate and Availability is less and after Implementation OEE, Performance Rate, Quality Rate and Availability are increased. To avoid such kind of losses OEE, Performance Rate, Quality Rate and Availability proper planning and management of the work. It may be seen from the plot that OEE, Performance Rate, Quality Rate and Availability increased after TPM implementation. OEE is increased after three month implementation 22% approximately.

VII Conclusions:-

In Indian history we are first time trying to implement TPM in small scale industry in agricultural field to improve the productivity, production, quality, reduce losses and enrich the working environment and also prepare the organization to meet the market demands without any interruption. During my three month study in Gill Agro Industry we find the

result that OEE value of this Industry is 60% approximately, this value is not good for industry and this cause to less profit. And in this period find the causes of low value of OEE. We found some type of problems and weakness of workers or industry at time of working. So we think that there is need of TPM Implementation in this Industry and after it we give some suggestion by the help of study TPM Pillars. Then we got the result, the working environment of this industry is improved and the OEE of Industry rise to 82% approximately. After the result clears that by the help of TPM, industry improved its OEE. IT directs help to increase productivity and profit of the industry.

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