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Impact of Maintenance on Profitability: A Case Study of Power Loom Textile

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Abstract:
This Paper examines the role of maintenance in power loom textile of Solapur, Maharashtra, India and its impact on profitability. The case study approach is adopted to find out the agreement and importance of maintenance practices and gap analysis of these two through interview techniques. If a cost effective maintenance is selected then it leads to increase in overall equipment effectiveness and improved cost effectiveness in terms of time, money and utilization of resources. The profitability is directly proportional to cost effective maintenance. If maintenance practices are good then the Company can earn more profit. In power loom textiles the maintenance is very frequent because of old machines. Management often looks at maintenance as a necessary evil, not as a mean to reduce costs. Maintenance should be viewed as a value-adding activity. From theoretical point of view this study therefore demonstrates that maintenance should be treated as a profit generating function.

Keywords*: Gap analysis, Maintenance practices, Power loom, Case study, India*

1. Introduction

The case study is conducted in a power loom which is having eight weaving machines and Company exports the product (Napkin) abroad. One machine is selected for the case study. Maletic et al. (2013) model (Figure 1) is applied in a case study which describes the interaction between maintenance, production and company's profitability. The model illustrates how an effective and efficient maintenance policy could affect the production process by improving Overall Equipment Effectiveness (OEE) and cost-effectiveness. Effective and efficient maintenance policy as that which reduces failures and utilizes as long as possible of the component/equipment life before replacement (Al-Najjar, 1997). Thus, considering these elements company could benefit in higher productivity and nevertheless in higher profit margin. The most important tangible asset which influences the performance of power loom textiles is maintenance. The cost per piece is increases due to the high cost of maintenance. The down time is also high which lead to failure in delivery date. A survey performed by Alsyouf (2004), showed that seventy per cent of the respondents considered maintenance as a cost centre. However, in many studies (Al-Najjar, 2000; Mitchell et al., 2002; Waeyenbergh and Pintelon, 2002) authors have emphasized the role of maintenance in improving performance and profitability of manufacturing processes. This suggests that maintenance is no longer a cost centre, but could be profit-generating. In general, improvements in the performance of a maintenance policy aim to reduce production cost and increase Company's profit and competitiveness through enhancing process availability, performance efficiency and quality rate (Al-Najjar, 2007).

2. Literature Review

Overall Equipment Effectiveness (OEE) is a way to monitor and improve the efficiency of manufacturing process. Developed in the mid 1990's, OEE has become an accepted management tool to measure and evaluate plant floor productivity. OEE is broken down into three measuring metrics of Availability, Performance, and Quality. These metrics help gauge plant's efficiency and effectiveness and categorize these key productivity losses that occur within the manufacturing process. OEE empowers manufacturing companies to improve their processes and in turn ensure quality, consistency, and productivity measured at the bottom line.

The utilization of resources is very important in achieving high productivity and quality. The shop floor of any manufacturing firms consists of number of machines. If these machines are used effectively then the rate of production will be high. The machines may not be operating with its designed speed, which is an ideal speed of the machine then the efficiency will fall down.

So, the concept of OEE is emerged. Overall equipment effectiveness or efficiency OEE is a metric that has been accepted completely in the industries.

2.1. Improving equipment effectiveness (OEE)

Equipment effectiveness is a measure of the value added to production through equipment. This goal is to increase equipment effectiveness so each part of equipment can be operated to its full potential and maintained at that level. Nakajima (1988) describes that TPM maximizes equipment effectiveness though two types of activity to insure that the equipment performs to design specifications which is the true focus of TPM.

Quantitative: increasing the equipment's total availability & improving its productivity within a given period of operating time.

Qualitative: reducing the number of defective products, stabilizing & improving quality. Although the equipment must operate at its design speed, produce at the design rate, and produce a quality product at these speeds and rates, there are factors which might obscure efficient utilization of the equipment. Examining, identifying and eliminating all losses which obscure the efficiency of the equipment will increase the efficiency of the equipment. The concept of zero breakdowns and zero defects are inevitable to maximize equipment effectiveness. These equipment losses include: equipment downtime loss, performance loss, and defect loss.

2.2. Loss categories of simple OEE

- 100% Availability = No Down Time Losses
  Machine has been running without any recordable stops
- 100% Performance = No Speed Losses
  Machine has been running at the maximum speed (target counter)
- 100% Quality = No Quality Losses
  Machine has not produced any bad parts (bad/reject/rework)

3. Gap analysis

This study is based on gap analysis, i.e. to measure both importance and agreement of different maintenance practices. By identifying the gaps in a case company, it is possible to discover areas where company needs to put more attention in terms of improvement efforts. The idea behind this gap analysis is to ask the respondents both about agreement (A) and importance (I) of different maintenance practices. Generally the importance measurements can be understood as indications of the respondents' needs and the agreement measurements as indications of the company's performance. By doing so, it is possible to identify the potential areas for improvements in accordance with the respondents' importance perceptions (Dahlgaard-Park and Dahlgaard, 2010). Then the difference between importance and agreement was found out. The most important areas are where the difference between agreement and importance is highest. The items used in this study were selected for the reason that they have been most commonly used in the empirical studies (Swanson, 2001; Alsyouf, 2009) conducted so far.

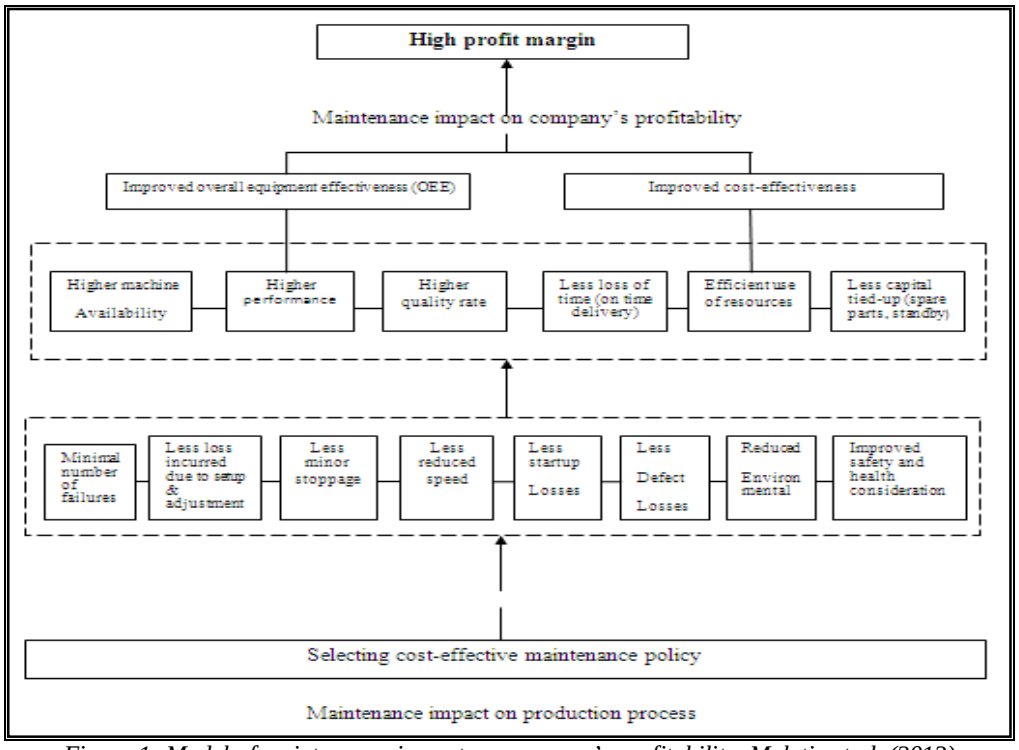

Figure 1: Model of maintenance impact on company's profitability, Maletic et al. (2013)

4. Data collection

To find the gap five respondents (employees) were selected and interviewed based on agreement and importance of different maintenance practices. The researcher has taken a note of the same and responses are converted in the likert scale ranging from 1 to 5. Similarly the data is collected from the production department bad quality products, planned stoppage time, unplanned stoppage time, short stoppage time, planned stoppage time and economic data, such as fixed cost and selling price. There were also data collected for assessment of current state of maintenance function in the observed company.

Total production	5500 pieces per month
Good quality products	5280 pieces per month
Production lost due to unavailability	88 pieces per month
Selling price	Rs 20.60 per piece
Production cost	Rs 14.55 per piece

Table 1: Production data

5. Data analysis

The aim of the first phase is to explore in which areas in the field of maintenance, company has effectively deployed its resources and those areas that need more attention. As can be seen from Table 2 the biggest gaps correspond to practices, such as monitoring the production equipment status, investing in improving the skills and competence of maintenance staff and analyzing equipment failure causes and effects. These gaps represent the signals from the respondent's viewpoint about where to improve first. Based on these observations it can be assumed that company lacks an efficient Condition Based Maintenance (CBM). Therefore, the gap between importance and agreement reflects the potential improvement priority.

No.	Maintenance practices	Importance (I)	Agreement (A)	Gap
1	Keeping the level low in spare parts inventory	4	3.8	0.2
2	Decreasing the repair time	3.9	3.6	0.3
3	Helping improve the production process	4.2	3.9	0.3
4	Performing periodic planned replacement	4.1	2.1	2
5	Recording process quality rate	3.6	2.8	0.8
6	Investing in improving the skills and competence of maintenance staff	4.2	2.9	1.3
7	Analysing equipment failure causes and effects	3.4	2	1.4
8	Monitoring the production equipment status	3.3	2.2	1.1

Table 2: Gap analysis

The aim of the second phase of this case study was to find out the benefits that company could gain in terms of productivity and profitability of a weaving process, if more effective maintenance policy would be implemented. First, the data analysis involved the identification and analysis of factors that cause the stoppage time. Based on the received data, the total stoppage time was distributed as short stoppages 50 per cent, unplanned stoppages 25 per cent and regular planned stoppages 10 per cent (Figure 2).The short stoppage constitutes the largest portion of the stoppage time. Some stoppages were planned in order to perform maintenance tasks. It was estimated that 60 per cent of time spent for maintenance effort for this machine is for planning activities. However, according to the results 10 per cent of total stoppage time belongs to planned stoppages. Thus, this represents opportunity for improvement, by implementing more efficient and effective maintenance policy.

The main causes for unplanned stoppages were due to electrical reasons, sewing threads, start-ups and adjustments of machine. Therefore, all these unplanned stoppages affect the productivity and quality, and by minimizing them, company could benefit in higher profit margin., as presented in the model (Figure 1).Hence, in study (Al-Najjar and Alsyouf, 2004) authors found that on average a value of around 3.5 per cent of the actual generated profit could have been gained if, ideally, all the failures, had been avoided using an efficient maintenance policy.

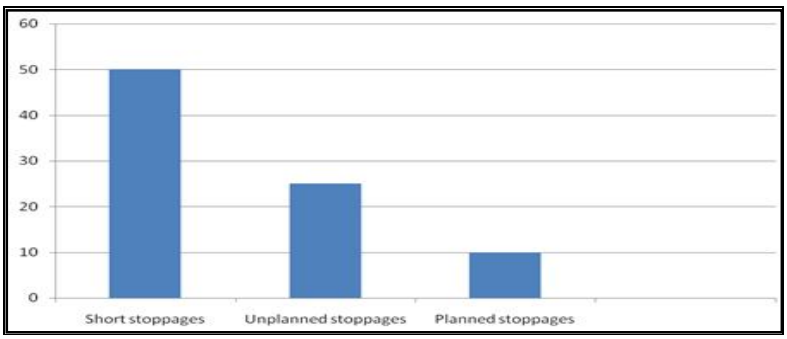

Figure 2: Causes of total time stoppage time at a weaving machine

6. Profit calculation

For calculating company's profit we used economic data and data relating to productivity. Machine's average monthly quantity produced was Q1=5280 pieces and the total production were 5500 pieces per month. The average selling price was about 10.60 per piece. The average TC1, at Q1 was 7.55 per piece. The average quantity of production lost due to all types of unplanned stoppages was estimated about 88 pieces per month. In ideal case, if an effective maintenance policy would eliminate all stoppages, the new quantity produced would be 5368 pieces per month, and TC2 would become 7.50. Thus, the impact on the company profit, considering improved productivity (without the considering any other costs, for instance cost of investment) was calculated by using Equations:

Profit before improvement F1 = Q1 (Price-TC1) = 5280(20.60-14.55) = Rs 31944
Profit after improvement F2= Q2 (Price-TC2) =5368(20.60-14.50) = Rs 32745
Net profit= 32745-31944= Rs 801

7. Findings

It is essential for the companies to implement cost effective maintenance policy in order to enhance their profitability. In addition, Ilangkumaran and Kumanan (2009) stressed the importance of selecting a proper maintenance policy in the textile industry. While empirical findings provide interesting insight in maintenance in relation to company's profitability, this can be also discussed in the view of the current state of the maintenance activities in the company. Maintenance function is organized as a part of production department. Researcher found that time spent for planning does not result in preventing the failures in desired level, in order to reduce the level of unplanned stoppages. Further analysis reveals that company is not using advanced maintenance approaches and that there is still high portion of corrective maintenance. The main tasks conducted considering maintenance are, for instance: restoring equipment to operation, installing new equipment, etc. Company is aware of the role of maintenance, but need to set maintenance strategy in order to be successful. However, this brief observation can be discussed in the view of our empirical results. If company would put more effort in implementation of modern maintenance approaches, such as CBM for properly describing current machine condition and predicting its future status it could prevent and minimize unplanned stoppages, and therefore benefit from higher quality and productivity. Management often looks at maintenance as a necessary evil, not as a mean to reduce costs (Paz and Leigh, 1994), or as a potential profit generating function (Al-Najjar, 2007).However, in today's highly competitive environment manufacturing systems are struggling to operate more effectively (Oke, 2005). This means that it is necessary to implement a proper maintenance policy in order to remain competitive. Thus, by assessing potential benefits company could reveal how cost-effective the investments in maintenance were and whether or not they were relevant (Al-Najjar and Alsyouf, 2004). Maintenance should be viewed as a value-adding activity. From theoretical point of view this study therefore demonstrates that maintenance should be treated as a profit generating function.

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