PREVENTIVE MAINTENANCE AS A PRODUCTIVITY IMPROVEMENT STRATEGY

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ABSTRACT

This paper reports the production improvement strategy for the fast moving consumer goods industry (FMCG’s). It suggests that the machine breakdowns and other related problems within the plant are due to lack of preventive maintenance in the machine shop resulting in very poor production performance of the plant.

INTRODUCTION

Organisational system used in the production of goods are subject to deterioration with usage and date. Systems deterioration results in increased breakdowns leading to higher production costs and lower production quantity. A well-planned Preventive maintenance (PM) programme can reduce costly breakdowns. Tasks such as replacing filters, lubricating and adjusting setting are examples of PM. Deciding what PM tasks to do, and when, constitute a critical resource allocation and scheduling problem1.

PM attempts to anticipate future problems and reduces/removes the impact of such problems. PM is a maintenance activity that aims at retaining a part of a technical system in the operational state as compared with corrective maintenance, which aims at restoring a part of the system to operational state2.

In general, maintenance may be considered to be of two categories. One is failure maintenance (FM), where the maintenance is undertaken only after the equipment has failed. The other is preventive maintenance that is undertaken while the equipment is still in operating condition, so as to prevent or reduce the probability of a failure.

As production systems move towards advanced, and hence more expensive technologies, proper maintenance planning becomes more important. Direct maintenance costs are increasing because of high costs of components and technical support that are needed for the advanced technologies. In addition, downtime due to system breakdown also has become expensive. Hence, a sound maintenance planning becomes imperative in a modern production system2.

PM literature is rich with studies concerning the development and implementation of mathematical models for maintenance planning in deteriorating systems. Surveys conducted by different researchers4, 5, and in-dept mathematical analysis6 carried out comprehensively documented the various approaches to modelling preventive maintenance. Many researchers have developed models to address systems that operate continuously, as well as system that operates intermittently. The latter case assumes the system to age or deteriorates only during the operating periods7. Most of the maintenance activities in this situation could be performed during non-operational times.

A number of research reports available in the literature deal with the preventive maintenance from a narrow perspective of improving the reliability of the facilities. However, only few articles treat PM as a strategy to improve productivity. Also, there is a lack of research based on the case studies to demonstrate the claim of PM as a strategy. Realising the importance of PM in improving productivity, an attempt has been made in this paper to study the scope of PM with the help of a case study.

BACKGROUND OF THE COMPANY

Cussons (UK) Limited is a medium-sized manufacturing company producing household cleansing

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products and toiletries, a company probably best known for Imperial Leather Soap, with an annual turnover of around 90m. At Cussons, it was recognised that despite adequate production capacity the Nottingham based soap-making (SM) plant failed to meet customers' demand, so a review of the SM process at Nottingham was initiated in order to find out where the problems were.

Soap is produced by the chemical reaction of sodium hydroxide on vegetable oils and animal fats. The raw material which are used in the manufacture of the soap is a white animal fat called tallow, Coconut oil (CNO) and sodium hydroxide. Tallow is obtained when beef or mutton is rendered. Coconut oil is produced by pressing the white flesh of the coconut namely copra or palm kernel. Sodium hydroxide is produced electrolytically from sodium chloride generally known as common salt. Glycerine is obtained as a by-product of the process. Cussons acquires tallow from internal and external suppliers, whereas, Coconut oil is imported from the Far East on the basis of demand forecasting. These raw materials are going through various processes until they finally finish up as soap.

This process begins with the arrival of raw material and can be divided into component processes. Figure 1 depicts the soap process from the arrival of raw material to final product.

For the purpose of this review an in-depth study of each process was necessary so that direct observation was followed up by interviews with management staff, shift manager, technicians, and all other personnel involved in the SM process, thus facilitating the subsequent research into the nature of the problems within the Process. Figure 2 reports the production constraints and theoretical capacity of each process.

Discussion with various company managers and personnel revealed and there was general consensus of opinion that the bottlenecks stemmed from the 'Drier'. Laval capacity utilisation is negatively effected by the capacity of the drier. Presently, Laval just meets the dryer's capacity of 8 tons per hour against a demand of 11 ton per hour wet soap. But when the Drier I commonly known as Mazzoni 1 with a capacity of 3.5 ton wet soap per hour is replaced with a Drier of higher capacity this may not be the case. At this stage, drying capacity will increase by 2-3 tonnes per hour but there is a danger that bottlenecks may stem from other departments namely Laval and bleaching even though theoretically this should not happen.

**HISTORY OF MACHINE BREAKDOWNS /SHUTDOWNS**

Given the importance of maintenance in any plant and the concerns voiced about the maintenance department in the SM Plant, the logical step was to focus attention on the maintenance department in this paper. Discussions took place with maintenance staff both in the SM process and SFR in addition the manager's logbooks were studied.

It became apparent that there is no policy of preventive maintenance but the company's maintenance policy amounts to little more than a run to breakdown policy. This has evolved because of the high demand on the soap manufacturing (SM) plant.

The maintenance department had a maintenance scheduling programme but again because of the need for the machine to be in constant use, the scheduling was put aside or deferred to a later date. Previously, the servicing and maintenance had been carried out during holiday periods. However, it was decided to stop this procedure on the grounds that it was not cost-effective.

Inspection of the logbooks revealed that the SFR logbooks contained records of maintenance, training etc., for each of the ten production lines. However, going through the manager logbooks for the soap-making plant, it became apparent that this was not the case with these records and there were apparently no records for individual plant. So to build up an accurate picture of shutdowns within the soap-making plant, shift managers' logbooks were studied in detail, shift by shift, for the period 10-4-96 to 7-9-96. All the shutdowns in that period were noted and are reported in the Figs. 3-5.

These frequent breakdowns/shutdowns greatly effect the production performance which resulting in lost production. This weekly-lost production is reported in Fig.6.
Fig. 1 - Cusson's Nottingham soap processes.

Fig. 2 - Cusson's production process constraints.
Fig. 3- Weekly shutdown of Laval process in hours.

Fig. 4- Weekly shutdown of drying process in hours.

Fig. 5- Weekly shutdown of Mazzoni Evaporator in hours.
COMPARISON BETWEEN ACTUAL AND POTENTIAL SOAP PRODUCTION

Figure 7 depicts the actual soap production against potential soap production on a weekly basis for the 26 weeks provided by the soap finishing room. The output shown in this graph is much less than the plant capacity. There may be other reasons for this shortfall in production but discussion with various company managers and personnel revealed and there was general consensus of opinion that due to heavy demand for soap by Cusson’s customers, the plant is running 24 hours a day, seven days a week without any break. In this situation, the plant lacks proper maintenance which resulting in frequent break and shut-downs.

Keeping in view the performance of the plant, Cusson’s management adjusted the potential production target levels for every week by reducing the production shut-down and breakdown periods in a hope to achieve that production level to meet customer’s demand. Unlikely Cusson’s soap plant failed to achieve the adjusted level as well, the same is reported in Fig.8.

The comparison of potential and adjusted production reveals that by adjusting the production the shortfall level did not change too much. Because the adjusted production, which is approximately 93% of the potential production with a difference of 7%, interestingly the shortfall difference is 10%, which reveals even more decrease in production and makes
too much difference between the adjusted and potential production. This overall situation is the result of improper maintenance, which can be improved significantly by introducing the preventive maintenance schedule for each machine rather than to wait for it's failure.

FRAMEWORK FOR THE DEVELOPMENT OF PM SYSTEM

It is evident from the company's performance that Cuison's is loosing too much production due to lack of proper implementation of maintenance policy which resulting in frequent breakdowns. Cuison's has a maintenance policy but it is not properly implemented merely because it is not cost-effective. Looking to all the aspects of the company it is suggested that Cuison's should formulate the comprehensive PM schedule, though is Cuison's opinion it is not cost-effective but the breakdowns are even more costly which directly affect the production performance.

Key to any manufacturing operation is the 'care and feeding' of its production equipment. In theory, an effective preventive program will preclude any major problems with the equipment and will allow producers to maximise output, minimise cost, and assure on-going quality of the parts being produced'. Table 1 presents such an illustrative scenario for improving the efficiency of the plant.

Table 1: Strategic scenario of Cuison's PM process for production improvement.

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<thead>
<tr>
<th>Problem areas identified</th>
<th>Strategies/Methods of PM</th>
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<td>Machine breakdowns</td>
<td>Special care and regular monitoring of the plant is essential to reduce the costly breakdowns. In this way, PM tasks such as timely oil or lubrication should be provided to all the machines to run satisfactorily.</td>
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<td>Work force</td>
<td>Special work force should be prepared within the company to look after the machines during working hours and should be allowed to take PM tasks on their own to remove the minor defects in the machines, if needed.</td>
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<td>Uncertainty</td>
<td>It is necessary to create the healthy environment within the plant. At the moment, the plant is only running at 50-60% of the capacity. The plant efficiency can be improved and uncertainty can be reduced by taking such PM measures.</td>
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<td>Productivity improvement</td>
<td>To improve the productivity is the foremost task for every company. This task can be achieved through the efficiency of the plant. To keep the plant running is only way to improve the productivity. This can be achieved through the PM strategies reported earlier in this table.</td>
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Maintenance, like any other operations man-
Management entity, requires its decisions to be made in a multi-criteria environment. It needs co-ordination between various functional groups like production and maintenance, as it is a support function of production activity. In this paper, which follows a case study at a fast moving consumer goods industry, such an illustrative scenario is presented. Clearly showing the need for co-operation between production and maintenance.

CONCLUSIONS

- Looking all the aspects of company’s performance vis-a-vis machines breakdowns and shutdowns, it is Cusson’s interest to formulate the comprehensive PM policy to reduce the shutdown periods and to increase the productivity. Because preventive maintenance is an excellent measure of management excellence. It requires a long term commitment; continuous monitoring of PM technology; a constant assessment of the financial and organisational trade-offs in contracting out, versus in-house maintenance. Elements such as employee moral, efficiency, effectiveness and costs all have to be considered.

- By implementing PM schedule and making full use of employees in this production improvement process, Cussons can improve their manufacturing processes, resulting in significant improvement in productivity.

REFERENCES


