A COMPUTERIZED MODEL FOR ASSESSING THE RETURN ON INVESTMENT IN MAINTENANCE; FOLLOWING UP MAINTENANCE CONTRIBUTION IN COMPANY PROFIT

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In order to reduce as much as possible the economic losses that are generated due to lack or inefficient maintenance, it is necessary to map, analyse and judge maintenance performance and act on deviations before it is too late. It is always necessary for a company to act for increasing profit and consequently enhance its competitiveness. In this paper, a software model (MainSave) has been developed for mapping, monitoring, analysis, following up and assessing the cost-effectiveness of maintenance (and maintenance investments). MainSave can be used for assessing savings and profit/losses due to maintenance performance, identify problem areas and primarily plan for new beneficial investments in maintenance. The module has been tested at Fiat/CRF in Italy. The major conclusion is; applying MainSave it would be possible to identify, assess and follow up maintenance contribution in company business.

Keywords: Maintenance Savings, Maintenance Profit, Maintenance Risk Capital Investment, Return on Investment in Maintenance

1 INTRODUCTION

Manufacturing industries realize the importance of monitoring and following up the performance of production and maintenance processes by simultaneously using economic and technical key performance indicators (KPIs). These indicators establish a bridge between the operational level in terms of, e.g. productivity, performance efficiency, quality rate, availability and production cost, and the strategic level expressed by company profit and competitiveness. Also, these key indicators are important to follow up the maintenance role in a sustainable manufacturing, [1]. In the past, the survival of manufacturing companies was mainly connected to how much a company was able to push into the market. This situation has changed and today's strategies imply cost minimization and differentiation and the ability to use available resources in a cost-effective way with reduced pollution to the surroundings. The focus on customer needs puts great demands on the production and maintenance systems to meet the goals of high product quality, production safety and delivery on time at a competitive price, [2,3].

Properly identified KPIs are required for following up the work done to achieve company strategic objectives and daily competition survival. Also, integration of the KPIs with the knowledge and database can provide a manager the required information, knowledge and ability to monitor and interpret the performance measures for making cost effective decisions, [4]. Furthermore, such KPIs can be utilised for benchmarking, which is one of the tools for never-ending improvements, [1,5].

2 THEORETICAL BACKGROUND

Traditionally and faulty maintenance costs are divided into direct and indirect costs. Direct cost, i.e. the costs that can easy be related directly to maintenance, consists of direct maintenance labor, consumable maintenance material, outsourcing in maintenance and overheads to cover the expenses of, for example such as tools, instruments, training, administration and other maintenance related expenses. Indirect-costs, i.e. the costs that can be related indirectly to maintenance inefficiency, cannot all be easily related to maintenance as the losses in the production due to machine failures can be related. For example, indirect-cost/profit that is related to losing/gaining of customers and shares of market are not that easy related to maintenance inefficiency/efficiency, respectively. Also, it would not be easy (or sometimes impossible) to find these costs in the current accountancy systems without being confused with other costs, [6]. In order to assess the economic importance of an investment in maintenance, it is often necessary to find the Life Cycle Income (LCI) of a machine/equipment, which is usually not an easy
task either. It is easier to assess the savings that have been achieved by more efficient maintenance, such as reduced downtime, number of rejected items, capital tied in inventories and operating costs [4,6].

To be able to monitor, assess and improve the outcome of different maintenance actions it is necessary to use a model for identifying and localizing/retrieving both technical and economic data from company databases. In order to make the process of data gathering and analyzing even easier and more cost-effective, the model should be computerized, [7,8]. Using MIMOSA database reduces technical difficulties and disturbance that may be induced in the current IT-systems of a company, [9]. This would allow following up maintenance KPIs more frequently and easily, thereby be able to react quicker on disturbances and avoid unnecessary costs. It will also be easier to identify and trace the causes behind deviations. The model should also help in interpreting the measurements of relevant basic variables and KPIs in order to achieve cost-effective decisions in planning and executing maintenance actions and to identify where an investment in maintenance may have the best financial payoff, [1,6,10].

In order to evaluate the economic importance of maintenance activities and consequently the Return on Investment in Maintenance (ROIM), it is necessary to assess the savings achieved by a more efficient maintenance policy. It can be done by analyzing the life cycle cost (LCC) and the transactions between maintenance and other disciplines within the plant, such as production/operation, quality and inventories expenses using system theory. Analysis and assessment of the transactions between maintenance and other working areas can be used to highlight the real maintenance role in the internal effectiveness of a producing company. Maintenance savings are usually achieved through reducing; downtime, number of rejected items, operating/production costs, expenses of different fees/penalties, such as those due to failure-related accidents or failure-related-environment violation and cost of tied up capital, i.e. less unnecessary components and equipment in inventories, [2,4]. Assessment of the savings achieved by more efficient maintenance is less influenced by irrelevant factors compared with the assessment of LCI when company profit is generally considered for assessment, [4]. In this case, several external factors, such as the amount of the product sold, currency course, wars, crises and product price that are irrelevant to the maintenance role but have an appreciable effect on the assessment of the company’s LCI.

Discussing solely direct and indirect maintenance costs imply that maintenance is a cost-centre. Therefore, during recessions, companies generally reduce maintenance budget/costs regardless of the benefits that maintenance activities may generate. While the investments in maintenance during these periods can be one of the best investments in the company, see [6]. The economic benefits that could be gained by more efficient maintenance can be found as enhancements in the results of other working areas, such as production, quality and investments, through reducing losses of profit happened due to;

- a) Losing production time (and production),
- b) More tied up capital and expenses
- c) Losses of customers,
- d) Loss of reputation and consequently
- e) Loss of market share.

These losses are usually generated mainly due to lack of (or inefficient) maintenance. In general, the majority of the indirect costs listed above are due to failures and short stoppages resulting from maintenance performance deficiencies, as discussed in [11]. In this paper, maintenance-related economic factors considered when evaluating the economic role of maintenance are;

1. Maintenance direct cost,
2. Economic losses (which can be considered as Potential Savings or Maintenance Income when using more efficient maintenance)
3. Maintenance savings,
4. Risk capital investments in maintenance for enhancing its performance and achieving better accuracy in maintenance decisions, and
5. Maintenance results (maintenance profit/losses)

Part of the economic losses (potential savings), those are due to unavailability and expenses of delivery delay, that a manufacturing company may encounter can be recovered by implementing more efficient maintenance policy, [4,6,12]. This is why we label the economic losses as potential savings or maintenance income. The latter represents the resource for savings and consequently maintenance profit that can be generated by more efficient maintenance.

3 MODELING COST-EFFECTIVENESS WITH RESPECT TO MAINTENANCE

A maintenance policy is considered cost-effective if and only if its return on investment is greater than the capital invested in maintenance. But, the benefits of the improvements in maintenance are usually collected in other working areas but hardly