

THE CONCEPTION AND THE UTILISATION OF MAINTENANCE MANAGEMENT'S SCOREBOARD BY DEPENDABILITY BREAKEVEN POINTS

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Abstract. A competent manager wishes to have available in every moment the necessary information on the state of the system he or she is managing. The manager's efficiency emerges from the rightness of his/her decisions taken in an optimum time range, and from the efficient allocation of the available resources. Tracking the efficiency indices' evolution leads to the best solutions to everyday problems. A useful instrument at the foundation of modern management is the scoreboard. The paper presents the conception method and the utilization algorithm of the maintenance management's scoreboard by dependability breakeven points.

Key words: scoreboard, dependability, reliability, maintainability, security, availability, breakeven points

1. Definition and Objectives of the Maintenance Management's Scoreboard

As a general definition, maintenance management's scoreboard represents an ensemble of information processed and presented so that it characterizes the state and evolution of the managed system at a certain moment [1]. It is to be realized for every hierarchical level, in order to provide the managers with the necessary data for making sound decisions.

For the maintenance department, the scoreboard has a specific structure, due to its unique and specific activities. It will include data regarding the evolution of its own activities [2], but also will track the evolution of the entire company [3]. Because of the strategic role of the maintenance department, an efficient scoreboard is a must in all enterprises, regardless of size or operation domain.

The objectives of the maintenance management's scoreboard are the following:

- measures and forecasts the volume of activity of different teams, departments, individuals;
- tracks the interactions between different work departments;
- measures and foresees results;
- controls and forecasts the resources utilization;
- Tracks and forecasts the attainment dates of specific activities.

2. The Usefulness and Advantages of a Scoreboard

The utility of the scoreboard in the maintenance department's activity is proven by the following advantages [4]:

- It defines the objectives and the means of their achievement. Due to its realism, the scoreboard is a promoter of objectives elaboration;
 - It facilitates the coherence of objectives. Being an efficient instrument for tracing the entire activity, it shows the influences above and below the department;
 - It leads to time saving. Having the relationships with the main partners already formalized, the necessary information can be easily found. It is an effective instrument for identifying and tracing the essential information for the maintenance management.
 - It anticipates and diminishes the reaction times. By its own structure, the scoreboard constitutes a continuous diagnosis instrument of the maintenance activity;
 - It is of interest to the medium-term maintenance activity. By showing the current reality in an accurate way, it favors reflections upon the management of the medium term activity of the compartment.
- The usual time ranges are one year long, with possibility of extension up to 3 years. Furthermore, the following are also important aspects of the scoreboard:
- It is not "caught" in the events, situations or current maneuvers. The certain individual – otherwise said, it is objective.
 - It presents qualitative aspects and animates the activity. Its conception shows a clear picture of the reality, no further calculus being necessary;
 - It provides an adequate allocation of responsibilities. Acting as an instrument of tracking the reality, it can easily emphasize the parallel tasks or sub-functions.

- It formalizes and simplifies the dialogue between the involved parties. The scoreboard represents a real basis for discussion between different hierarchical levels or departments (manager - subordinate, provider - buyer, acquisition - production etc.).

3. The Conception and Utilization of the Scoreboard

In order to obtain the advantages previously analyzed, it is necessary that the scoreboard is created with considerable care to the adequacy and correspondence with reality. Each manager wishes that the scoreboard he or she uses to be efficient and contain all the data needed. Its creation will be based upon answering the following questions [3]:

- Who will use the scoreboard, why and when?
- Where will he/she find the information, how will it be presented?
- How much information will be necessary for an effective management?

To all these problems we will try to answer in the following paragraphs [4].

Who? The information is usually distributed among the enterprises' departments. Most times an inclination appears towards monopolizing certain information, leading to lowered responsibility on certain managers and operators. And as the information volume is substantial, the one having access to it will waste a lot of time analyzing it and will lose the contact with the reality.

The information must be adapted to the responsibility. Each hierarchical level needs a certain observation rhythm and a certain segmentation of data. If frequent and "fine" information is needed to a hierarchical level, this will lead to the situation that the superior will have to solve the problem for the subordinate. This causes the breaking of responsibility delegation.

Why? It is necessary to understand that a given position needs certain scoreboard elements. The following shall be kept into mind:

- Listing all the interaction partners and departments;
- Defining the responsibilities of the involved personnel;
- Emphasizing the types of decisions that need to be taken.

When? It is important the date to which the information needs to be provided, the frequency, and the time needed to obtain it. The frequency refers to the responsiveness of a certain hierarchical level as compared to the input stimuli.

For instance, the operator observes that the equipment is not working properly and needs to be repaired. If the department manager will receive this information each time, and he/she will react to this, he/she will walk away from the specifics of the managerial activity.

The inferior levels must have the information before the superior levels. If this condition is not fulfilled, then all defection will become a subject of inquiry, divergence, conflict, turning the work place into a court trial. The frequency of obtaining the information must be adapted to the respective promptitude and speed of response.

Where? The analytical accountability represents a data bank that is particularly useful for management. But it also generates results that are difficult to use. For creating the scoreboard, there will be extracted only the most available data that is necessary for the activity. The accountability service is not focused on running all activities based on costs; this is why all the departments must have their own instruments. What has to be noted here is the possible emergence of a situation when there is a double or even triple account keeping, due to the interest of having data from "before" and "behind" the department. In conclusion it is very necessary to correlate the scoreboards of different hierarchical levels.

How? The display mode is essential for scoreboard's use. The recommended display modes are simple ones, easily accessible to the persons who use it, based on graphs, histograms, level variations etc. The display will be made according to the department's objectives, distinguishing the essential from the secondary aspects. As the objectives are being achieved, the scoreboard will be modified to reflect the new objectives.

How much? The problem here is the one of the costs involved in processing the data and presenting the information. The experience shows that the information needed for an effective scoreboard represents 1-20% of the total information available at a certain hierarchical level. The scoreboard will usually contain information on maximum 10-20 indicators. The supplementary information will be either stocked up, or used by the lower hierarchical levels. In choosing the information to be included in the scoreboard, proves very useful the rule of 80/20 (PARETO), which in this case will show that 80% of the activities can be traced using 20% of the total indicators. This way, solving this problem becomes very easy.

4. Maintenance Indicators Traced by the Scoreboard

The scoreboard has to be essential and useful to a maintenance manager. For this reason, the dependability breakeven indicators have to be treated, both technically and economically.

This paper proposes a scoreboard adapted to the dependability management by breakeven points which was conceived, described and presented by the references [5, 6, 7].

We can define the dependability management by breakeven points as a management method with the objective of technically and economically validate the functioning of equipment in dependability/ safety conditions based on the following breakeven points: Reliability, Maintainability, Availability and Security.

The intercession to be used is presented in the following logical scheme (Figure 1):

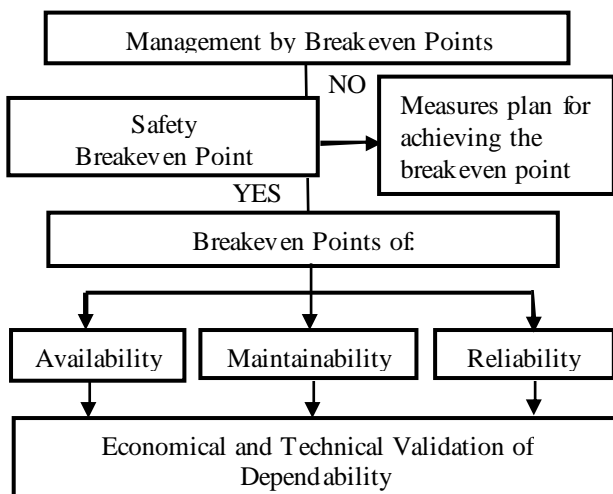


Figure 1. The Logical Scheme of dependability Management by Breakeven Points

In the logical scheme from Figure 1 the following concepts are used:

- Security Breakeven Point, representing the minimum admitted level for the security of people, goods and environment, which ensures the company's activity in profit conditions.
- Availability Breakeven Point, the minimum availability of the equipment starting from which the company can gain profit.
- Maintainability Breakeven Point, representing the minimum maintainability of a technical system, necessary to cover the costs of functioning; beginning with it, the company/equipment gains profit.
- The Reliability Breakeven Point, considered as

the minimum reliability of a technical system necessary to cover the costs of functioning and starting with what the company/ equipment gains profit.

Every time an activity raises security problems, the other actions will be blocked until it is solved. Only after solving a security problem, the other components of the dependability can be analyzed.

The technical and economic validation of the analyzed system is obtained when all breakeven points are met, according to a procedure described as follows.

5. Example and Interpretation of Dependability Management by Breakeven Points Scoreboard

Analyzing a real example of a knitting machine with large diameter from a small size Romanian textile firm having a relatively low technological level, Figure 2 presents the scoreboard for each dependability element previously described.

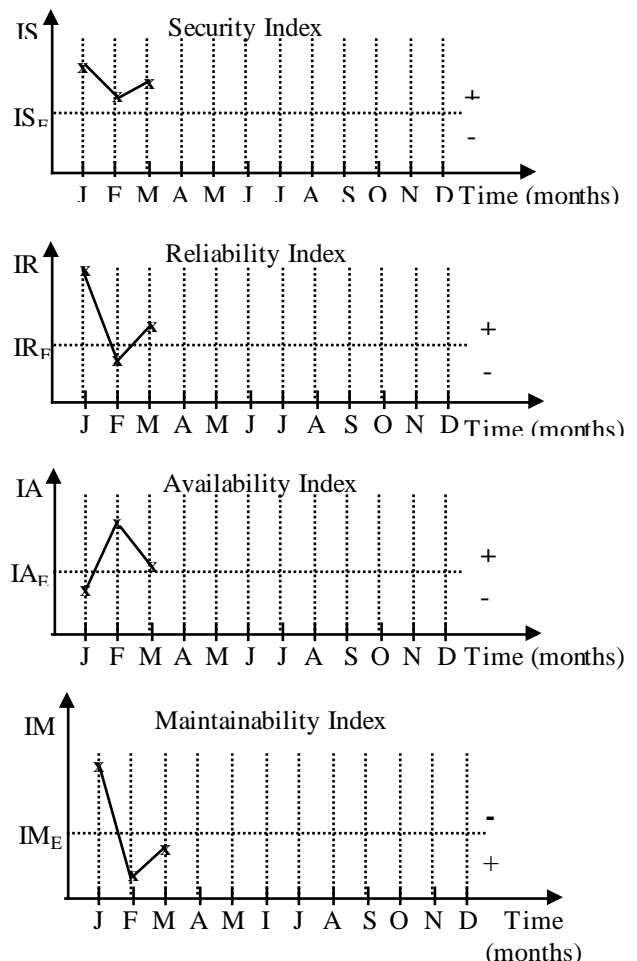


Figure 2: The Dependability Management by Breakeven Points Scoreboard

The interpretation of the dependability management by breakeven points scoreboard is presented in subsequent paragraphs.

January: we can observe an overdraft in the security breakeven point IS_E (positive aspect), which shows that the security aspects are respected in the company. As a result, we can move to analyzing the other breakeven points. There can be noted an overdraft of the reliability breakeven point IR_E (positive aspect), demonstrating the implementation of a strategy mainly oriented towards products quality. The Maintainability Index IM is found much over the breakeven point IM_E (negative aspect), as result of a large volume of preventive maintenance performed on the equipment. There is a too large amount of time allocated to these interventions. We can see the value of the availability index below the breakeven point IA_E (negative aspect). As a result of the "quality type" strategy, the large number of maintenance interventions, although increased equipment's intrinsic reliability, also affected its availability.

All this information has been translated into practice by obtaining a batch of products that meet the requirements, but also by not achieving the production plan.

February: the security index is decreasing, not exceeding the limit – a positive aspect, but it needs further monitoring. The equipments' reliability is below the breakeven point, a negative aspect caused by the functioning of the machine in lack of a spare part, causing dysfunctions. The maintainability index is below the breakeven point (positive aspect), caused by a small number of preventive and corrective interventions. The availability index is much over the breakeven point (positive aspect), which shows the focus of the productive sector towards a physical production-type policy. In other words, in this month the production was high as volume, but low as quality.

March (forecast): it is foreseen a slight correction of the security index, by improving equipment's reliability. The volume of maintenance intervention will be slightly increased, bringing IM closer to the breakeven point. As a consequence, the reliability index will be improved, without surpassing IF_E . The availability index will continue to position slightly above the breakeven point value.

As a result, the joint policy of production and maintenance will concentrate on a production volume slightly reduced from the one in February,

with slight quality amelioration as compared to the previous months; a reasonable compromise for a real given situation.

6. Conclusions

A maintenance manager has to permanently keep under control the evolution of his/her own results. The efficiency results from the rightness of the decisions taken, in the optimal time range and through efficient allocation of available resources.

The present paper defined a new management instrument for improving maintenance managers' activities. The proposed dependability management by breakeven points scoreboard represents a strategic instrument intended for maintenance managers and production and quality managers. By presenting the scoreboard and the relationships between the dependability components, is demonstrated the importance of using this instrument for improving the collaboration between different company's departments, in the way of implementing unitary strategies intended for achieving the functional objectives.

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