

A STUDY REGARDING THE USE OF THE FUNCTIONAL MAINTENANCE MODEL USING A SYSTEMIC APPROACH

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ABSTRACT: *The management strategy of industrial enterprises should consider implementing a certain type of maintenance that would ensure not only the rapid completion of maintenance tasks but also the prevention of losses caused by potential shutdown of equipment involved in the main operations. The concept of functional maintenance is based on the elements that ensure a correlation between the technical and the economical aspects of equipment maintenance. In this context, the main objective of the maintenance department consists in ensuring the correct functioning of technological equipment.*

KEY WORDS: *functional maintenance, systemic approach, operational safety.*

JEL CLASSIFICATION: *M11, D2.*

1. INTRODUCTION

The functional maintenance model considers that the maintenance of technological equipment is an integrated function of an enterprise's production activity. Thus, to accomplish the tasks of a production unit with focus on quality, cost and deadlines implies an analysis of the following factors (Pavel, 1980):

- **Personnel training**, both for employees working directly on the equipments as well as for those that assure maintenance and reparations. In the system, coordination, organization and monitoring of activities is tightly connected to professional competence (Pc), due to the following demands:
 - knowledge of the specifics of the activity, of imposed norms and solving problems for equipments, all these being part of the elements that describe personnel professionalism (P);
 - aptitudes regarding the correct fulfillment of tasks and the capacity to integrate the complete set of duties, that are part of *personnel aptitudes* (Ap);

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- aptitudes regarding the technical and economic liability for the current activities (At).

Thus the functional model of the professional training level can be represented as $P_c = f(P, A_p, A_t)$.

- **The technology being used**; technological analysis targets two major groups:

- product manufacturing technology;
- maintenance and repair technologies associated with each equipment.

Inconsistency between the two groups of technologies may lead to disorders such as losses in production quantities of quality, increased expenditure, reduction of economic efficiency. Through this model, a correlation between the two groups is established so that any upgrade of manufacturing technologies is immediately followed by a similar upgrade for maintenance and repair technologies.

- **Production organization**, in relation to maintenance and repair implies the design, development and implementation of methods and techniques that would ensure the realization of the enterprise's fundamental objective (Ceașu, 1990). Such methods may be:

- performing statistical tests related to the functioning quality of technological equipments;
- using new equipment monitoring techniques such as vibration measurement, temperature recording, oil analysis.

- Design and development of the **informational sub-system**. This represents the synthesis tool that offers the possibility to monitor the main activities and assess the potential risk of a situation and thus allow decision-making that would ensure maximum efficiency. This sub-system must keep the maintenance coordinator's dashboard updated as follows:

- groups all significant informations regarding scheduled activities;
- presents in a systematic manner the information need for technical – economic analysis;
- contains the information that present phenomena through their evolution over time;
- presents warnings in regard to the possibilities of undesired phenomena;
- provides necessary information for presented situations to decision makers.

2. SYSTEMIC APPROACH FOR THE MANAGEMENT OF THE FUNCTIONAL MAINTENANCE MODEL

The functioning of technological equipment, especially base ones, in conditions of safety implies: a technological preparation of repairs based on the correct and complete knowledge of their wear, the scheduled monitoring of the evolution of safety through periodic technical inspections, economic analysis of maintenance costs, equipment upgrade, personnel training etc.

The desire to implement advanced techniques and methods in the management of the maintenance and repair activities may be left to the stage of intent, if it is not followed by the financial, material and human effort needed to develop the technological and informational base. In this context, the functional maintenance

model represents a new approach of maintenance and repair management, based on the interdependence between the elements of the system and on the critical analysis of these elements.

The fundamental components of the functional maintenance model include:

- ✘ management of the maintenance and repair activities;
- ✘ the technological process of maintenance and repair, reunited with the terotechnic system of activities;
- ✘ the existence of an informational subsystem, based on a database, that ensures the connection between the company's management and the maintenance department, by ensuring a feedback connection needed to adjust decisions and finding the most efficient decisions;
- ✘ economic analysis of maintenance costs and ways to recover such expenses.

The adjustment of the functioning of the new model should be based on cause-system-effect elements. In the case of phenomena outside the scope of technological equipment operations, adjustment in regard to the cause of the phenomena implies adopting a positive reaction, ie monitoring the parameters' evolution considering the limits in which they should operate (Hamelin, 1980).

The system's evolution in a specific direction under the influence of positive restrictions can be adjusted based on control actions such as:

- ✘ periodic systemic technical inspections that should aim to uncover weaknesses in the monitored equipment;
- ✘ operative monitoring of repair activities for which a network-graph based on a critical route has been designed;
- ✘ operative monitoring of loading capacities used in manufacturing spare components for equipments in use;
- ✘ monitoring the evolution of spare components consumption;
- ✘ economic analysis of maintenance and repair costs for each technological equipment.

Adjustment of phenomena evolution compared to the registered output of the system is based on information regarding system output, that may adjust the equipment's functioning as mentioned, based on a feed-back connection. Thus, any disturbance, ie. deviation of output values from predefined parameters' values, should be used in the correction of the system's evolution.

The systemic approach to maintenance and repair management emphasizes the existence of successive levels of objectives, in accordance with management levels. Thus, each level sets its objectives and resources needs and the monitoring of accomplishing objectives is performed in reverse through the feed-back connection, starting from the final results towards the management of the operations department.

The purpose of the informational system in enterprise management consists in allowing a permanent overview of resources and objectives, of the model of operations and of all factors that may influence in any manner the maintenance and repair activities (Aramă, 1976).

The functional maintenance model should also adapt to the structures of other functional sub-systems of the enterprise such as supply or personnel training.

By further approaching the terotechnic system of specific maintenance and repair activities, it should be mentioned that terotechnics is in charge of *looking after*, ie. terotechnics is much more extensive than maintenance engineering since it includes the whole process of assembly, maintenance, repair, replacement, organization, technological norms for personnel training, information processing model, various analysis (Maxer, 1988) as well as the increase in equipment reliability.

The economic concept of functional maintenance proceeds from the fact that making decisions regarding operations should be based on the following criteria:

- ✗ safety in functioning, a criteria for which there are no restrictions regarding implementation time or costs;
- ✗ predefined budget for maintenance expenditures as well as the operational costs must fit in the budget approved by the management;
- ✗ the duration of maintenance and repair activities varies; there may be tasks that have to be performed as emergencies while ensuring work safety. In such cases, the volume of funds are not predefined. Optimization requests are dependent on the criteria of duration for the needed operations.

The model implies in most cases decision making in maintenance and repair of technological equipment, that implies a correlation of the three criteria mentioned above. From an economic point of view, maintenance costs (M_c) depend functionally on: the duration of the equipment's functioning in conditions of safety (T_s); the moment of replacement for an used equipment (M); evaluation of the necessary funds for equipment maintenance for its complete period of use (F_e). Thus the functional relation for maintenance costs is: $M_c = f(T_s, M, F_e)$.

3. CONCLUSIONS

The theoretical and practical base for the necessity of this system is given by the following aspects:

- ✗ functional maintenance of technological equipment represents a component of the production function, but with independent tasks and responsibilities;
- ✗ the necessity of a correspondence between manufacturing technologies and maintenance of the equipments that correspond to these technologies, economic efficiency of maintenance and repair correlated with the real productivity of each equipment as well as with products quality;
- ✗ the development of a model using the experience of specialists in industrial enterprises, research institutions and so on.

REFERENCES:

- [1]. **Aramă, C.** (1976) *Terotehnica*, Editura Tehnică, București
- [2]. **Ceașu, I.** (1990) *Organizarea și conducerea activității de întreținere și reparații*, Editura Tehnică
- [3]. **Hamelin, B.** (1980) *Entretien et maintenance*, Editura Eyrolles, Paris
- [4]. **Maxer, P.** (1988) *La charte de la Maintenance Industrielle*, Paris AFNOR
- [5]. **Pavel, N.** (1980) *Conducerea activității de întreținere funcțională*, Revista Economică, București, nr. 19