

## LOGISTICS ACTIVITIES OF MAINTENANCE PROCESSES

PÉTER TELEK<sup>1</sup>

**Abstract:** The maintenance process, as a part of the operation of manufacturing systems, is also developing, following the changes in the production area. In many cases, the maintenance appears as an independent service element of the production process. It results that the maintenance logistics also has to be changed, which requires new elements, relations and approaches. For the manufacturing companies it is important to uncover the relations among the efficiency of the maintenance processes and the material handling parameters. This paper summarises the development of the maintenance logistics and gives an overview about the actual handling and other logistics tasks required by the maintenance processes.

**Key words:** *Maintenance logistics, logistics activities, maintenance logistics solutions.*

### 1. INTRODUCTION

Nowadays, the maintenance process, as a part of the operation of manufacturing systems, is also developing, following the changes in the production area. One of the most important characterization of this changing is that the maintenance appears as an independent service element of the production process. Because of this tendency maintenance logistics also has to be changed, which requires new elements, relations and approaches.

The main objective of this research is to uncover the relations among the efficiency of the maintenance processes and the material handling parameters. In this paper I summarise the development of the maintenance logistics and give an overview about the actual handling tasks, which must be solved.

### 2. THE MAINTENANCE PROCESS

Wear-and-tear of technical equipment is a natural procedure, which causes different negative changings. To avoid the consequences, we must apply a suitable maintenance process, which involves the control, maintain and repair activities related to the given equipment (machines, devices, vehicles, etc.) [1].

Some decades ago, maintenance was a simple, internal task within the production hall, which was realized by special teams, settled close to the manufacturing machines. Size and location of the maintenance facilities were depending on the parameters of the activities and the production area. An important characterisation of the maintenance processes was the direct link to the production process, which significantly influenced its operation.

In the last quarter of the twentieth century, diagnostic methods appeared in the maintenance processes, which opened new directions in the control of the machines. Next step of the development was the Reliability Centred Maintenance (RCM), which is based on the reliability of the machines and their elements, and means a new point-of-view, at first mainly in the aircraft production. The last concept is the Total Productive Maintenance (TPM), which - similarly to the Total Quality Management (TQM) systems - tries to give

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<sup>1</sup> PhD, University of Miskolc, Institute of Logistics, Hungary  
peter.telek@uni-miskolc.hu

the responsibility for certain tasks of the maintenance (keeping, observing, etc.) to the handling operators and introduces a general system concept for the maintenance to avoid malfunctions and crashes [2].

The new efficiency requirements of the economy and the industry significantly deformed the structure of the production and service processes. It is also true for the maintenance systems, where one of the most important changes is that the maintenance activities often made by service companies and the owners of the machines has less control on the maintenance processes. In many times, mainly at large, high productive equipment, the producers offer the maintenance for their machines as an additional service. Beside it, in many cases, the maintenance is much more effective, as a service, because of the specialization and the experience of the operators in numerous similar tasks. Another important changing is the developing of maintenance networks, which control special tasks (e. g. elevator maintenance) in large areas [3].

We can say, that the tasks and objectives of the maintenance is the same as in the last century, but the realization and organization of the tasks are significantly changed, which have important effects on the handling processes.

### 3. LOGISTICS OF MAINTENANCE PROCESSES

As many other service processes, maintenance also requires handling activities, so the task of maintenance logistics is to take care about the materials, elements, devices and operators required by the maintenance processes (Fig. 1), with the next activities [4]:

- element supply,
- element and device storing,
- allocation of the operators,
- transport of elements, devices and operators,
- handling of the wastes related to the maintenance, etc.

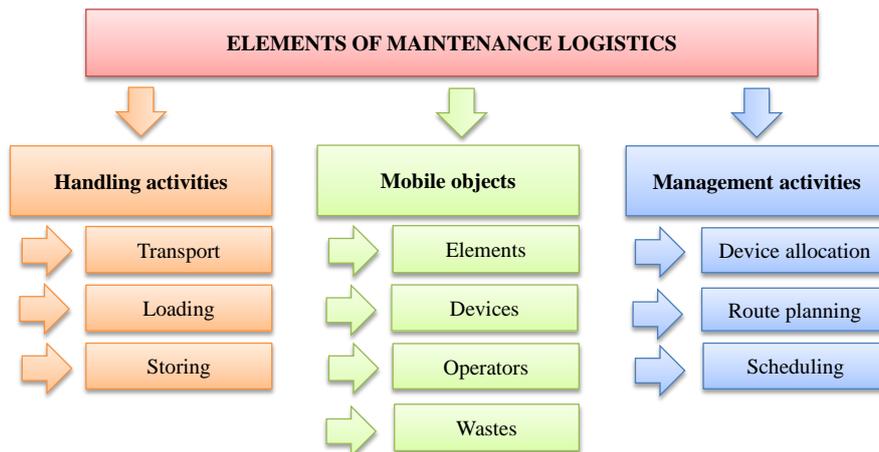


Figure 1. Logistics aspects of maintenance processes

Changes in the maintenance processes result new ideas and advanced solutions within the logistic processes [5] and the maintenance service companies require more and better

material handling devices and more effective design methods for the external transport and organization tasks [6]. Important characterisation of the service companies is the application of parallel processes, which much more effective, but highly increases the complexity of the logistic system [7].

There are different solutions to manage the logistic tasks of maintenance processes which depend on many parameters of the maintenance system [8.]. Fig. 2 presents the general and logistic management variations of the maintenance processes.

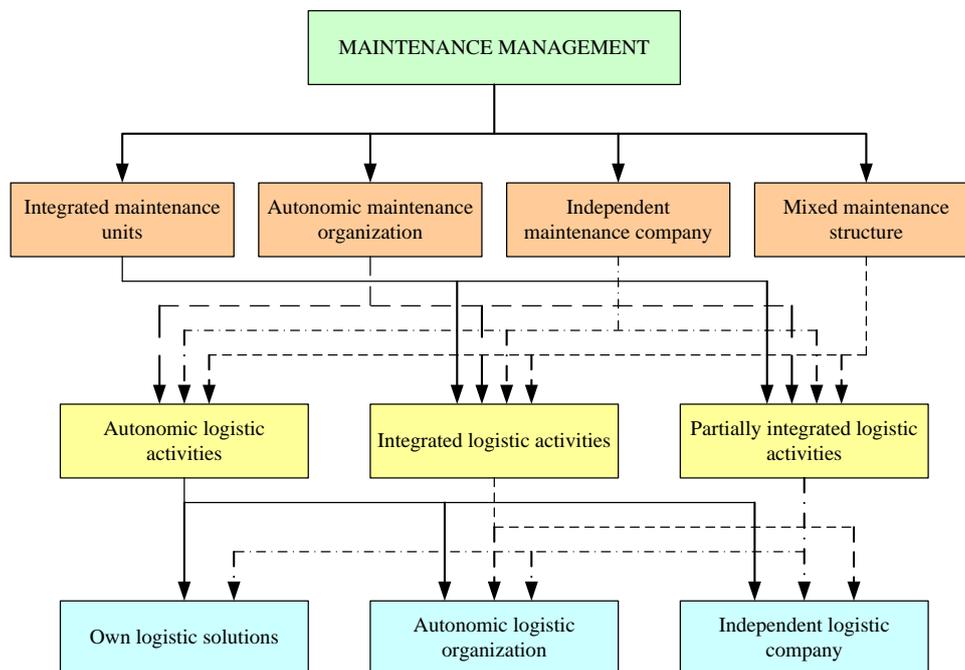


Figure 2. Management possibilities for the maintenance processes

In the aspect of the autonomy of maintenance organizations next solutions can be applied in the practice:

- integrate the maintenance activities into the production or service units of the company,
- organize autonomic maintenance unit within the production or service company,
- apply independent maintenance companies,
- using mixed maintenance structure.

The logistic activities required by the maintenance processes can be realized in three different forms:

- as independent solutions for the maintenance system,
- together with other logistic processes as integrated activities (Fig. 3),
- as partially integrated activities (some of them are independent, the others are integrated).

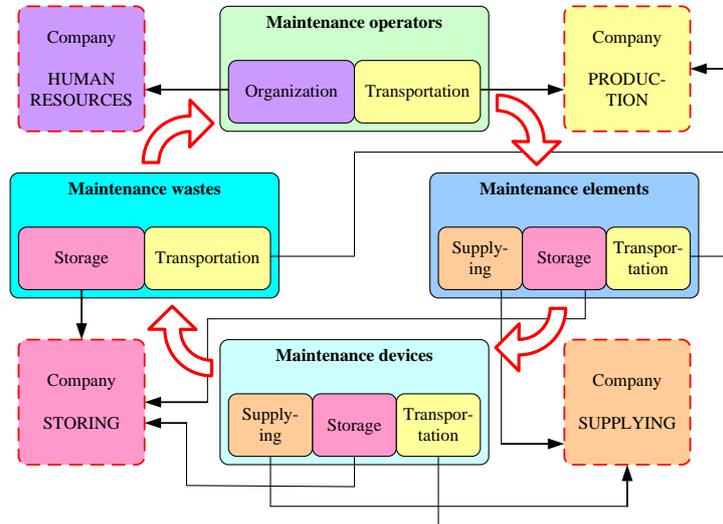


Figure 3. Relations of maintenance logistic tasks integrated into company logistics

Management of maintenance logistics can be organized

- individually within an autonomic maintenance organization,
- by an autonomic logistic organization of the company,
- by an independent logistic company.

Suited to the actual logistic tendencies, it can be observed that the physical and the related logistic activities are organizationally separated also in the maintenance processes. It means that in many cases, different companies realize the tasks belong to the maintenance processes. Usually there are three companies in the process: one owns the production, another one performs the maintenance and a third one solves the logistic tasks (individually the maintenance logistics or together with other company logistics).

An example for this case, when the applying company buys the maintenance of a given machine, as an additional service from the producer company. In mixed management structure it can be a solution that in the above mentioned case the applier company stores the elements and devices for the maintenance process, which are used by the maintenance company.

#### 4. ACTUAL MAINTENANCE LOGISTICS ACTIVITIES

Based on the above mentioned aspects, there are three areas of the maintenance logistics activities (Fig. 4):

- handling and management of internal maintenance processes,
- logistics activities of maintenance companies,
- logistics solutions of maintenance networks.

Traditional handling and logistics management activities are in all three cases and can be solved by similar methods and equipment. The most important tasks are the followings:

- handling activities related to the maintenance activities:

- transport of operators, devices and elements into the maintenance locations,
- handling the repaired elements (at the maintenance locations, at the repairing station, transport among the locations, etc.),
- handling of the devices, elements and wastes after the maintenance activities,
- storing activities (elements, devices, wastes),
- element and device supplying activities,
- recycling activities,
- scheduling and allocation activities of the logistic equipment and human resources, etc.

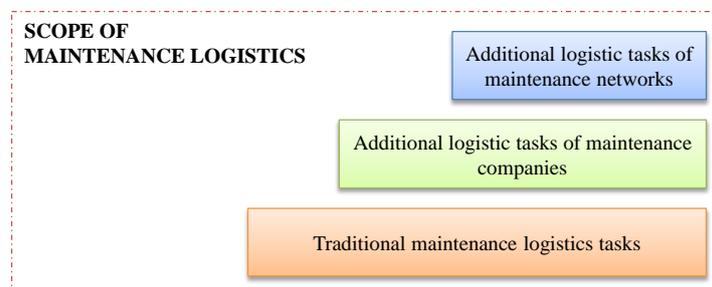


Figure 4. Levels of the maintenance logistics activities

The logistics activities of maintenance companies are a little bit different from an internal organization, because they serve different companies and cover larger geographic area. Beyond the traditional logistics activities they can solve additional logistics tasks:

- external transport activities (operators, elements, devices, wastes),
- controlling of different and far located maintenance tasks,
- harmonizing numerous, different logistics activities,
- applying additional handling devices (transporters, loaders, etc.),
- using special solutions (e. g. mobile repairing stations), etc.

In certain cases, the maintenance activities can be realized in similar, but far located objects, which require usual control and maintenance activities. In this cases, maintenance networks are applied which cover large geographic areas, huge amount of objects and several experts (e. g. personal elevator maintenance service). The additional logistics tasks of this maintenance networks are

- supplying the required resources (experts, devices, elements, etc.) for the verification and maintenance activities,
- allocation of the human experts and the maintaining objects,
- purchasing and storing of the required elements and materials, etc.

The realization of the maintenance logistics tasks are depend on the structure and characterization of the given production or service process, however in many of the cases requires advanced logistics solutions and methods which determines the efficiency of the general and logistics processes [9, 10].

## 5. SUMMARY

Maintenance processes, as a part of the operation of manufacturing systems, is also developing, following the changes in the production area. Due to this fact, maintenance logistics also has to be changed, which requires new elements, relations and new approaches.

In this paper the author summarised the development of the maintenance logistics and give an overview about the actual handling tasks, which must be solved. Nowadays there are three areas of the maintenance logistics, which are the handling and management of internal maintenance processes, the logistics activities of maintenance companies and the logistics solutions of maintenance networks.

The realization of the maintenance logistics tasks depends on the structure and characterization of the given production or service process, however in many of the cases requires advanced logistics solutions and methods which determines the efficiency of the general and logistics processes.

If we can find exact methods to determine the relations among the efficiency of the maintenance processes and the logistics solutions, better and more effective maintenance systems can be realized.

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