

SELECTED ORGANIZATIONAL ASPECTS OF MAINTENANCE ORGANIZATION MODELLING

WYBRANE ORGANIZACYJNE ASPEKTY MODELOWANIA ORGANIZACJI UTRZYMANIA RUCHU

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Abstract:

In the article there was made the review and evaluation of modeling selected methods of the maintenance organization parts. Based on the main objectives of this organization, there was specified the set of structural and system connections into maintenance organization. The set was extracted from the model called Business Centered Maintenance. Then there presented and discussed the possibility of modeling of the maintenance organization using two- and three-dimensional models.

Key words: *maintenance, exploitation, maintenance management, modelling, maintenance organization*

Słowa kluczowe: *utrzymanie ruchu, eksploatacja, zarządzanie utrzymaniem ruchu, modelowanie, organizacja utrzymania ruchu*

INTRODUCTION

The task of any technical organization is to establish principles and rules by which you can achieve the order. These rules should have a reasonable range of detail as well as flexibility, because the company's organization must be constantly adapted to changing operating conditions. This also applies to the Maintenance Organization as a special extracted department in the enterprise. Tasks performed in such an organization in most production companies rely on to solve various problems arising from the production process. In particular, by improving the efficiency of maintenance, which in practice translates into extension of functioning time, reduce breakdowns and downtime of equipment and the proper organization and execution of maintenance work, it is possible to maintain continuity of production, increase productivity and improve the quality of manufactured products and thus reduce equipment maintenance costs and costs of production and product.

THE BASIC OBJECTIVES AND TASKS OF THE PATTERN MAINTENANCE ORGANIZATION

The main objective of the Maintenance Organization is to achieve maximum of production capacity in the enterprise in terms of productivity, efficiency and quality at the minimum total cost.

Detailed objectives of the Maintenance Organization result directly from the main objective and are focused on technical facilities and economic and organizational factors.

These objectives are aimed at an optimal adjustment of resources (personnel, spare parts, tools and information) to the exploitation processes. So the specific objectives of the Maintenance can be divided into three parts [1]:

- a) objectives for technical objects,
- b) objectives for exploitation tasks (exploitation process),
- c) objectives of the other "participants" of the exploitation area (technical and non-technical environment of facilities, information).

The most commonly formulated detailed objectives of the Maintenance Organization, include [1]:

- time increasing of the effective work of technical facilities,
- reducing the operating time of restore of technical facilities (maintenance and repairs tasks), while improving the quality of restoration,
- increasing the reliability of technical facilities, by identifying and eliminating causes of failure, and during data collection for the needs of reliability characteristics estimation,
- reducing the use of consumables (fuel, oil, grease and other energy carriers, etc.),
- optimization of spare parts management, rationalization of supply and storage system, rationalization of the transport infrastructure,
- optimization of information flow in the technical system, modernization of acquisition systems, implementation supporting systems (CMMs, EAM, ERP),
- training the personnel for operation and maintenance,
- improving the conditions of use of technical facilities (improving the safety of workers, elimination of environmental hazards caused by the use of technical facilities).

A set of principles that characterize pattern maintenance organization includes [5]:

1. The principle of expediency - the maintenance organization must be consistent with the overall objective of the company.
2. The principle of economic efficiency - a priority is profitability of the company as a whole, not the maintenance department.
3. The principle of balance - too much regulation reduces organizational flexibility, their deficiency leads to a lack of determination of responsibility for decisions and tasks performed; ideally, maintenance organization should be as much as you need, as little as possible.
4. The principle of coordination - the tasks of maintenance must be reasonably divided into most and less important, including the proper prioritization.

- administrative structure - often called the organizational structure, which is the image of the responsibilities and relationships between different positions/people.
2. Systems - which are a description of the implementation of specific functions within the maintenance organization, in the form:
 - planning system - including the a way and scope of development of the short and long term plan for activities into maintenance organization,
 - control system - including the methods and tools to track implementation of the maintenance tasks.

TWO AND THREE-DIMENSIONAL MAINTENANCE ORGANIZATION MODELS

Two-dimensional models describe different aspects of the maintenance organization separately for structures and systems. It is also difficult to clearly include resources and information flow between the elements.

In order to complete the mapping of the maintenance organization, there seems necessary to take into account the relationships between elements resulting from different aspects. For this purpose, there may be helpful three-dimensional models that allow you to extend the method of modeling, as well as possibilities of analysis. When creating such models, we must take into account the principle of synergy, which says that all maintenance organization is greater than the sum of its parts.

An interesting and useful three-dimensional model of the maintenance organization is a pyramid showing the structure of human resources in conjunction with an administrative structure including performed functions (duties, responsibilities and other relationships) Personnel pyramid was shown on fig. 2 and fig. 3.

BUSINESS CENTERED MAINTENANCE COMPONENTS

One of the most important ways to describe maintenance organization is to present its components and aspects with using appropriate models. The basis for optimization of maintenance tasks is the set of structural and system connections into maintenance organization. The set can be extracted from the model called Business Centered Maintenance [2]. Diagram in fig. 1 shows the relationships between the major components of the typical maintenance organization.

In this perspective, the model of the maintenance organization consists of two main elements, which are closely related to the decision-making process and the objectives set out earlier. These are:

1. The structures - which are structured description of "content" of the maintenance organization, in the form:
 - structure of the resources - including the location, size, scope, functions and logistics of resources, most of the workload,

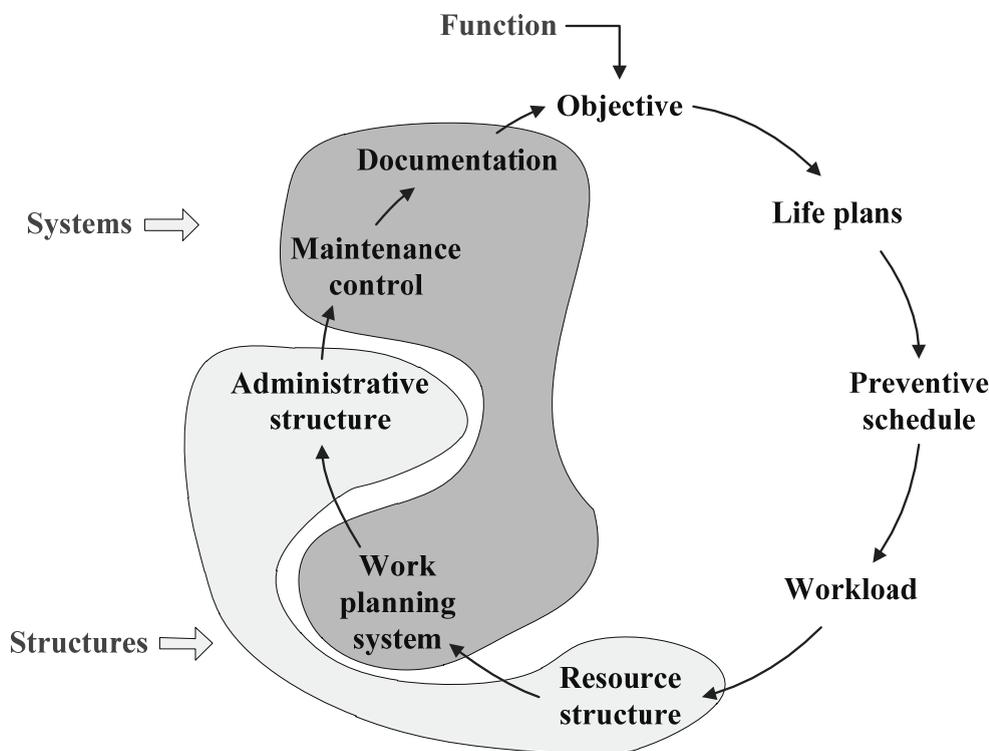


Fig. 1. The major components of the typical maintenance organization [2]
 Rys. 1. Główne elementy typowej organizacji utrzymania ruchu

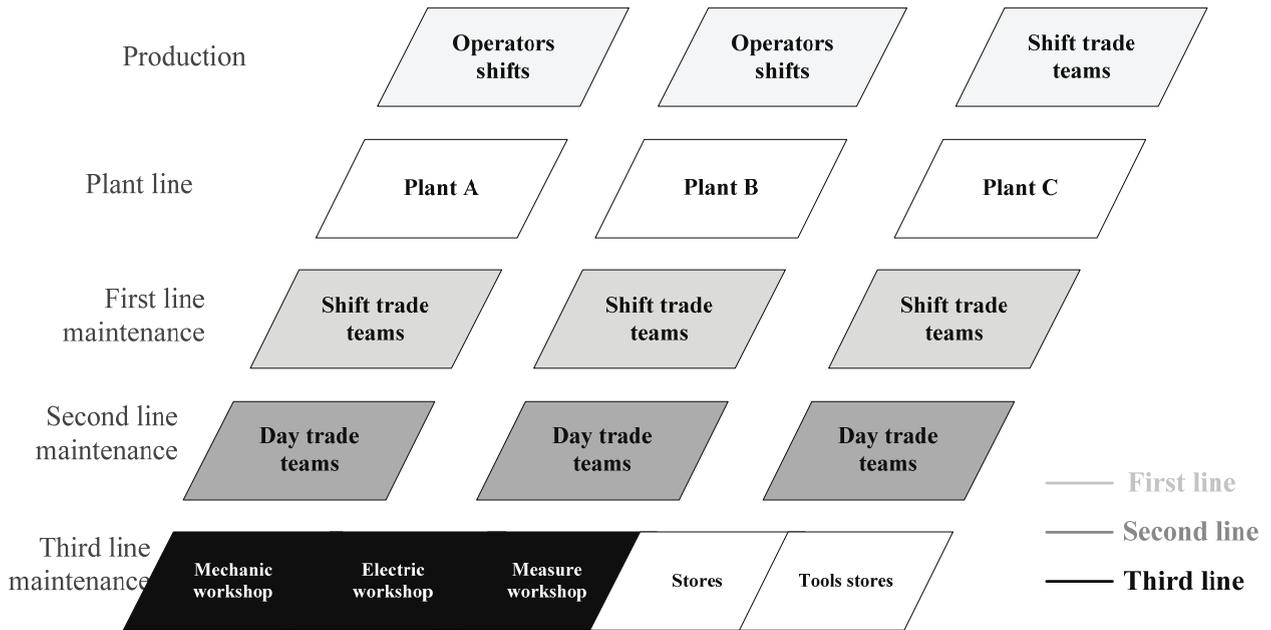


Fig. 2. Two-dimensional model of maintenance organization [3]
 Rys. 2. Model dwuwymiarowy organizacji utrzymania ruchu

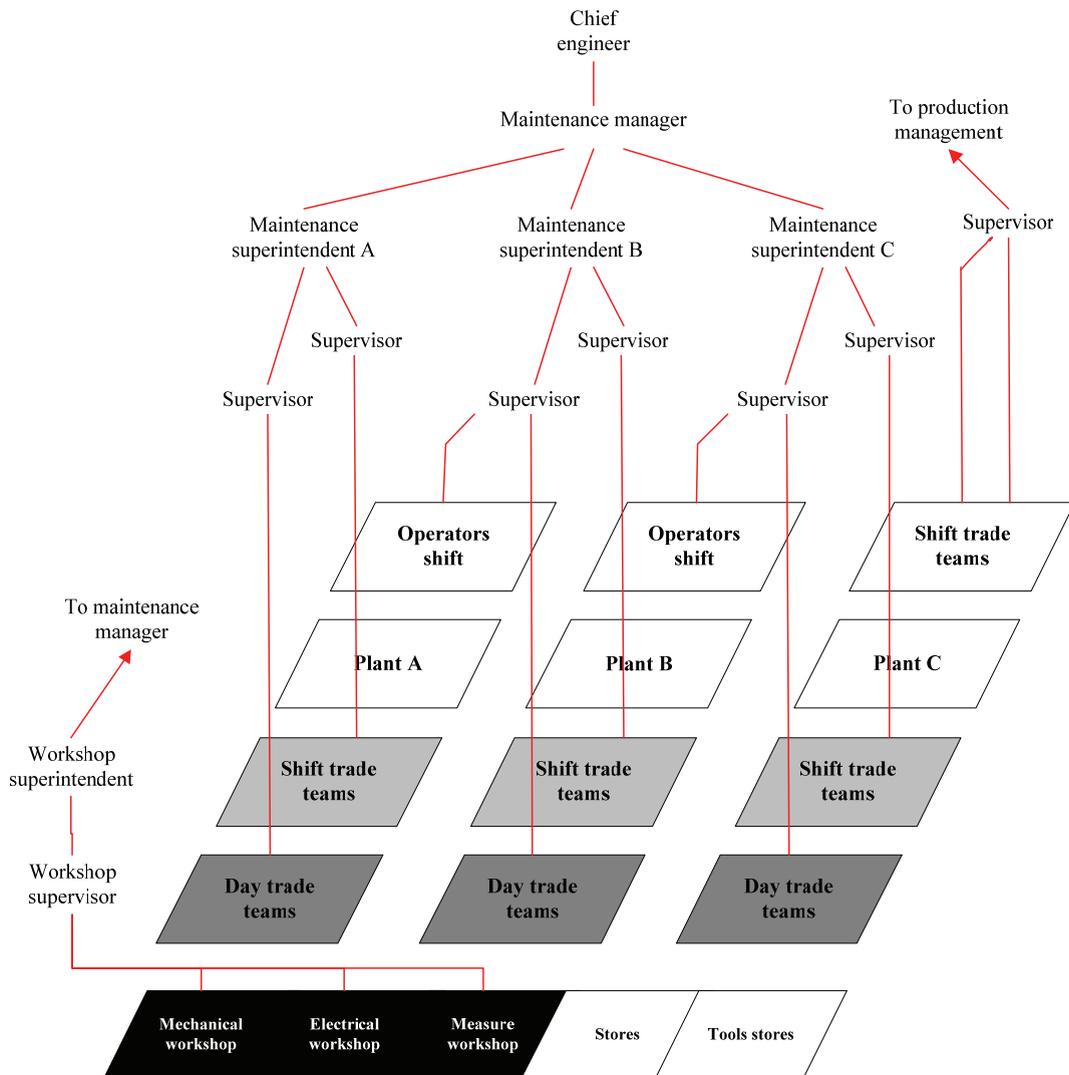


Fig. 3. Three-dimensional model of maintenance organization [3]
 Rys. 3. Model trójwymiarowy typowej organizacji utrzymania ruchu

Fig. 2 shows the two-dimensional plane, which is the basis for a three-dimensional model of the maintenance organization, which includes:

- part of an administrative tasks for maintenance, in the form of physical and logical set of the execution of particular work (division of the factory, maintenance teams and workshops),
- part of the organizational arrangement in the form of personnel and assignment of particular teams to specific places.

For purposes of this model, there have been listed production teams and maintenance teams, which were arranged in three groups:

- 1st line maintenance - essential maintenance, which aim to maintain the technical efficiency of production lines,
- 2nd line maintenance - planned and corrective work performed to date,

- 3-line maintenance work carried out by a large master plan.

Figure 3 shows three-dimensional model, which complements the two-dimensional plane of Figure 2 with the elements and relationships within the organizational structure. Such a model may be used to optimize the flow of information within the maintenance organization with direct regard to the responsibilities and competences of the personnel in charge of various units.

Another example of this type of model is three-dimensional model of the planning system, which includes the flow of information and the way and scope of decision-making process, taking into account the above structures (fig. 4). Such a model was created by a logical separation of part of the two-dimensional plane and the assignment of elements of organizational structure and elements of information system (documents and commands).

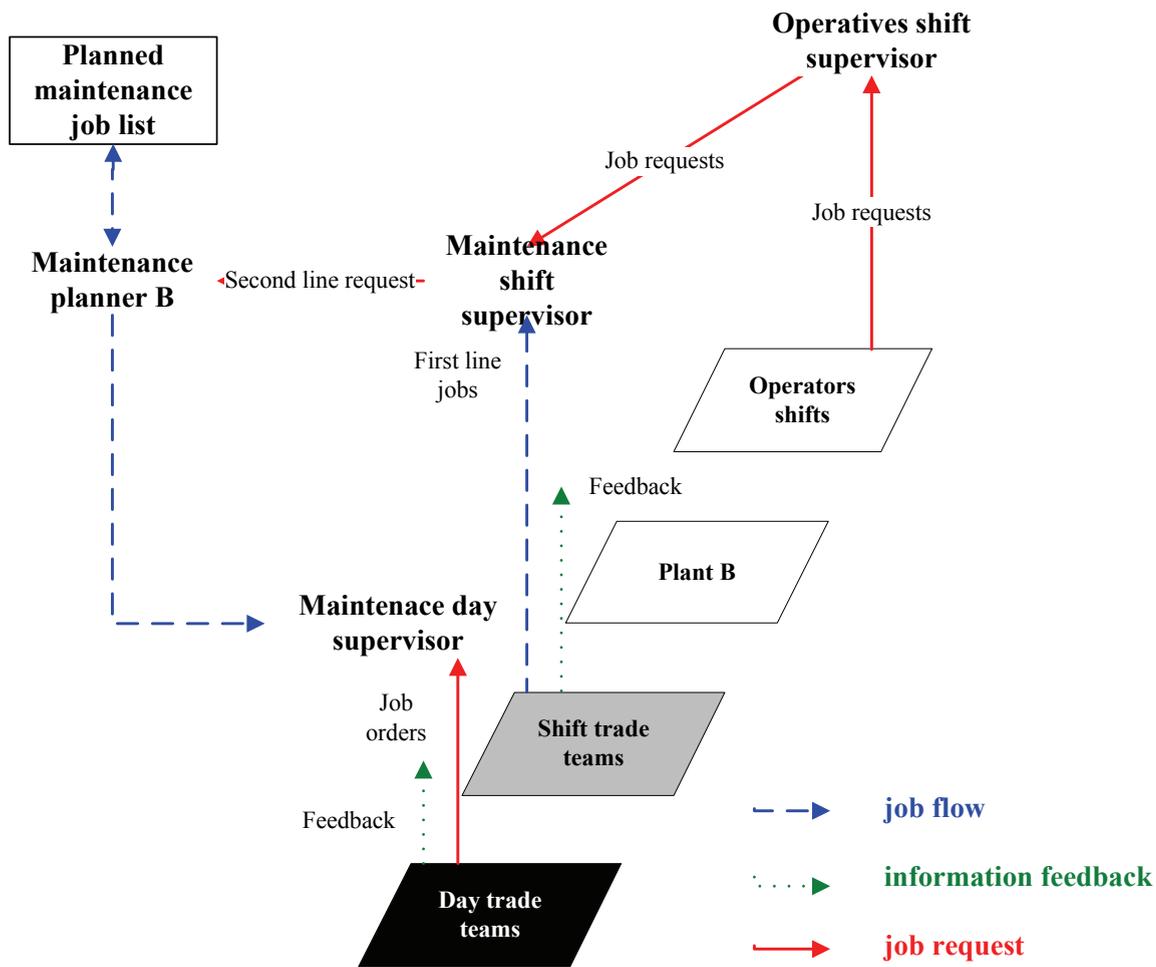


Fig. 4. Three-dimensional model of planning system [3]
Rys. 4. Model trójwymiarowy systemu planowania

EXAMPLES OF MAINTENANCE CYCLES AS A RESULT OF MODELING MAINTENANCE ORGANIZATION

The above models correspond to the so-called pattern or standard maintenance organization. In practice, each maintenance organization is characterized by the individual features, which differentiate the elements presented models. This is particularly evident, when we compare compa-

nies with different exploitation and production specifics, where the differences are mainly due to the workload of particular teams. Below, there are three examples of companies that have a different way of planning and execution of maintenance work, and thus they have a different set of models describing the maintenance organization.

Power station

Sample power station has three generators of 500 MW each. Traditionally, each generator has a defined maintenance plan, based on three annual overhauls lasting eight (fig. 5).

The specificity of the object, in this case imposes the need to take account of workers and firms contracted to major overhauls. Work in progress are carried out by internal staff with regard to shift patterns and prioritization.

Fig. 5 shows the cyclic and large load maintenance resources, in terms of value, but little in terms of time (3rd line maintenance). Current tasks (1st and 2nd line) bind in this case, fewer resources, but of a time-continuous.

Food processing plant

Sample food processing plant operates at 15 changes per week (three shifts per day from Monday to Friday), 50 weeks a year, due to the needs and requirements of production.

Maintenance plan is built as follows (fig. 6):

- for current and planned corrective work - based on off working days (weekend),
- for major repair work - based on an annual stop.

From the management point of view it is necessary to ensure:

- weekly maintenance teams - to carry out emergency work and the correction of high-priority,
- weekend maintenance teams - to carry out work on the technological break weekend,
- repair teams including staff and external companies - to achieve the annual big overhaul.

Sugar refinery

Sample sugar refinery working continuously for 6 months, due to the necessity of effective use of time of harvesting sugar cane/beet. The next 6 months and equipment are turned off and the sugar factory is not working (fig. 7).

The main corrective and preventive actions are planned for a period of production interruptions in order to maintain maximum availability and efficiency of machinery and equipment during a 6-month period of work.

The specificity of production dictates how to ensure the workforce, particularly:

- shift maintenance service - to the work in progress within a 6-month period of production,
- planned group of employees - for overhaul within a 6-month downtime.

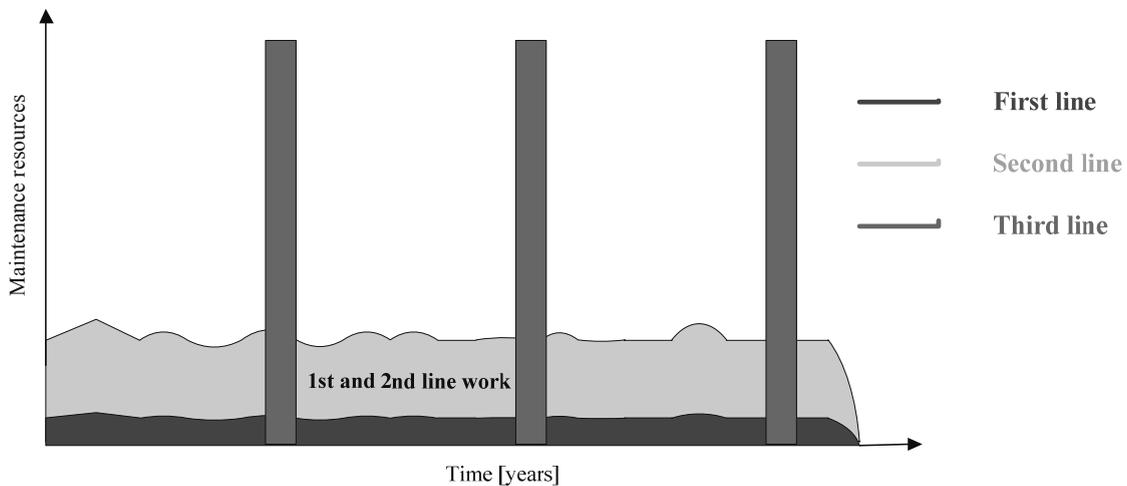


Fig. 5. Power station workload [2]
Rys. 5. Obciążenie pracą w elektrowni

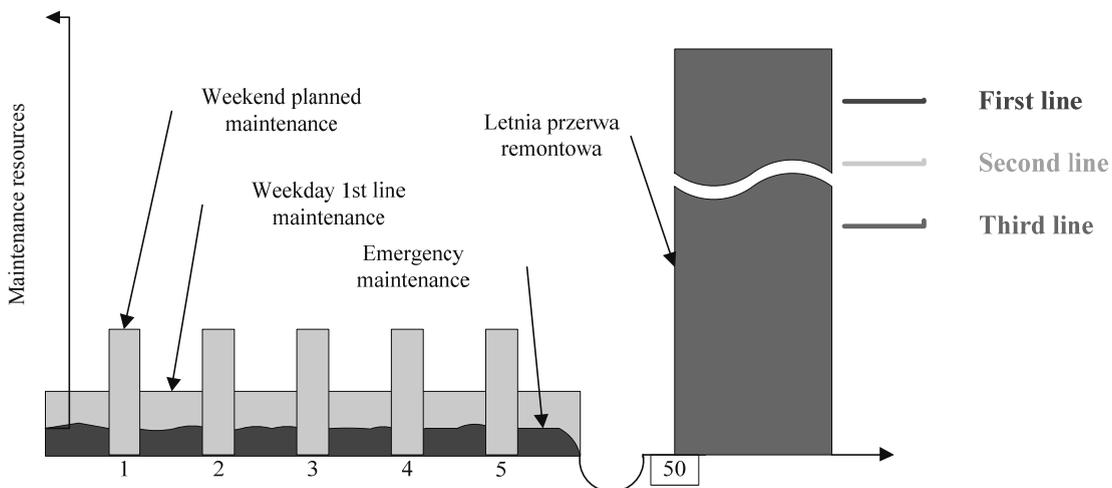


Fig. 6. Foot Processing Plant workload [2]
Rys. 6. Obciążenie pracą w fabryce produktów spożywczych

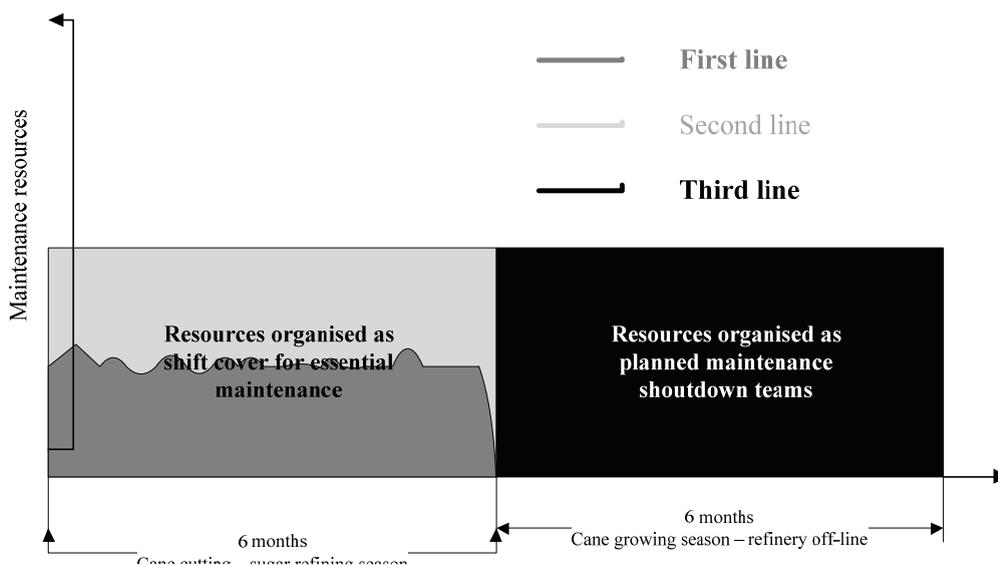


Fig. 7. Sugar refinery workload [2]
Rys. 7. Obciążenie pracą w cukrowni

CONCLUSIONS

For most practical applications are made visualization of maintenance organization as a set of two-dimensional models. However, full representation and use of potential, there allow models that consider jointly the most important aspects, namely three-dimensional models.

There are a number of factors, which influence on modeling of maintenance organization. Consideration of these factors determines the specificity of the enterprise. There are:

- internal factors - a set of conditions that result from the operation of the maintenance organization,
- external factors - a set of conditions resulting from the operation of other units into enterprise, which affect the operation of the maintenance organization.

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