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ALGORITHM FOR PRODUCTION PROCESS MANAGEMENT IN OVERHAUL-PRODUCTION SYSTEM

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Summary: *This paper shows the development of algorithm for production management in companies which are engaged in overhaul of technical systems.*

First phase indicates the need to develop an algorithm for production management which involves overhaul of technical systems.

Second phase points out the problems of companies which are engaged in overhaul of technical systems.

Third phase defines a model of production management, as well as conditions and restrictions that govern the process.

Fourth phase develops the algorithm, based on the defined model, for solving the problem of process management in companies which are engaged in overhaul of technical systems. Research has shown that the algorithm can be defined and used for process management in overhaul-production system, with the aim of increasing effectiveness and efficiency of the production system.

Keywords: *model, production process, overhaul-production system, overhaul, technical system.*

1. INTRODUCTION

Nowadays, the problem of production management has attracted much attention, both from the practical and from research standpoint. The reasons may be found in the fact that modern production is marked with a rapid development of science and technology, new technologies, flexible systems, modern management methods and management techniques supported by computer.

Modern management of production process is set as an imperative today because the efficient and effective production of complex technical systems can only be done in modern equipped and organized production. Therefore, the problem of development and implementation of modern methods in modern production

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management is dealt by many scientists now, organized within the framework of certain institutions or independently.

The need for efficient production management, with computer support, is conditioned by following factors:

- without production, the human society could not survive,
- requirements for product quality are booming because a wide range of products is available from different manufacturers,
- high requirements in terms of price,
- exceeding the delivery time is not allowed,
- technical systems are becoming more and more complex,
- limited financial and human resources and
- demands for greater efficiency and effectiveness of production systems [7].

For these reasons, the problem of production management should be approached in a systematic way. This means that the production should be considered as a whole consisting of elements (i.e. the basic elements of production) and the relation between them and their features integrated in order to achieve a certain goal, i.e. the system state change (Figure 1).

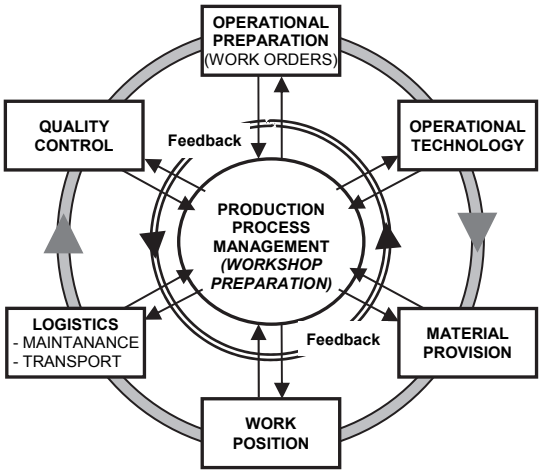

Fig. 1 *Systemic approach to production process management [5]*

Management as a process of system control, so as to achieve the objective function, consists of editing a whole of procedures, which are necessary to perform on scientific principles and in a particular order. Namely, if there is any procedure that is not performed according to scientific principles and in a particular order, the system cannot achieve a particular objective function, if it is objectively determined. Therefore, for management we can say that it is a regulated whole of procedures in an algorithmic form which in certain time and under certain environmental conditions leads to the realization of the particular objective function.

The above mentioned setting for control of real systems can be applied to production, too. Therefore, the production management as a system includes a regulated whole of procedures, which are required to be performed in the production

process in order to implement the project (s) or plan within a certain period of time and under certain conditions.

In practice, otherwise, there is a tendency to organize control effects on the basis of predetermined rules. A system of predetermined rules, which are the base for processing information into control effects, is called a control algorithm.

A particular problem in production management is an overhaul of technical systems. In fact, that is the reason why today there is, in order to increase the efficiency and effectiveness of the production, a tendency to define an algorithm for overhaul of technical systems, which is the subject of this paper.

2. ALGORITHM OF PROPOSED MODEL FUNCTIONING

As noted, the effective planning and monitoring the implementation of overhaul, i.e. work orders, can be discussed only with the introduction of proper information system in this area of work. Starting from D. Heany's [3] definition of information system, which states that the information system is *„...a set of clearly defined rules, practical experience and work methods in which people, groups (or both) should work on entering the data into a computer, which will process the information so that it can provide all the information that will allow individuals to make decisions in certain business situations...*", an algorithm of planning and production process management is established based on the proposed model, shown in Figure 2.

The functioning of the model by the established algorithm will be presented through:

- the procedure using computers and
- the procedure managing production process using work orders.

2.1. Procedure using computers

Processing network diagrams of the overhaul of technical systems, i.e. work orders, depends on the available hardware configuration and corresponding software tools. This procedure in planning and implementation of the overhaul of technical systems, i.e. in planning and production process management using work orders, takes place as follows:

First, in a computer, we properly enter work orders with the requirements of order, all data relating to individual operations of work orders for their duration, resource requirements and, possibly, information about the planned costs of implementation. Based on these data, the first time analysis is performed. The computer calculates the earliest and latest times of certain activities, and time reserves and determines the critical path of realization of work orders/overhaul.

That is followed by scheduling a network diagram and calculated times are converted into calendar dates. If provided, we distribute capacity and define the network plan in accordance with executed capacity distribution and, possibly, define the costs of activities and implementation of technical system overhaul as a whole.

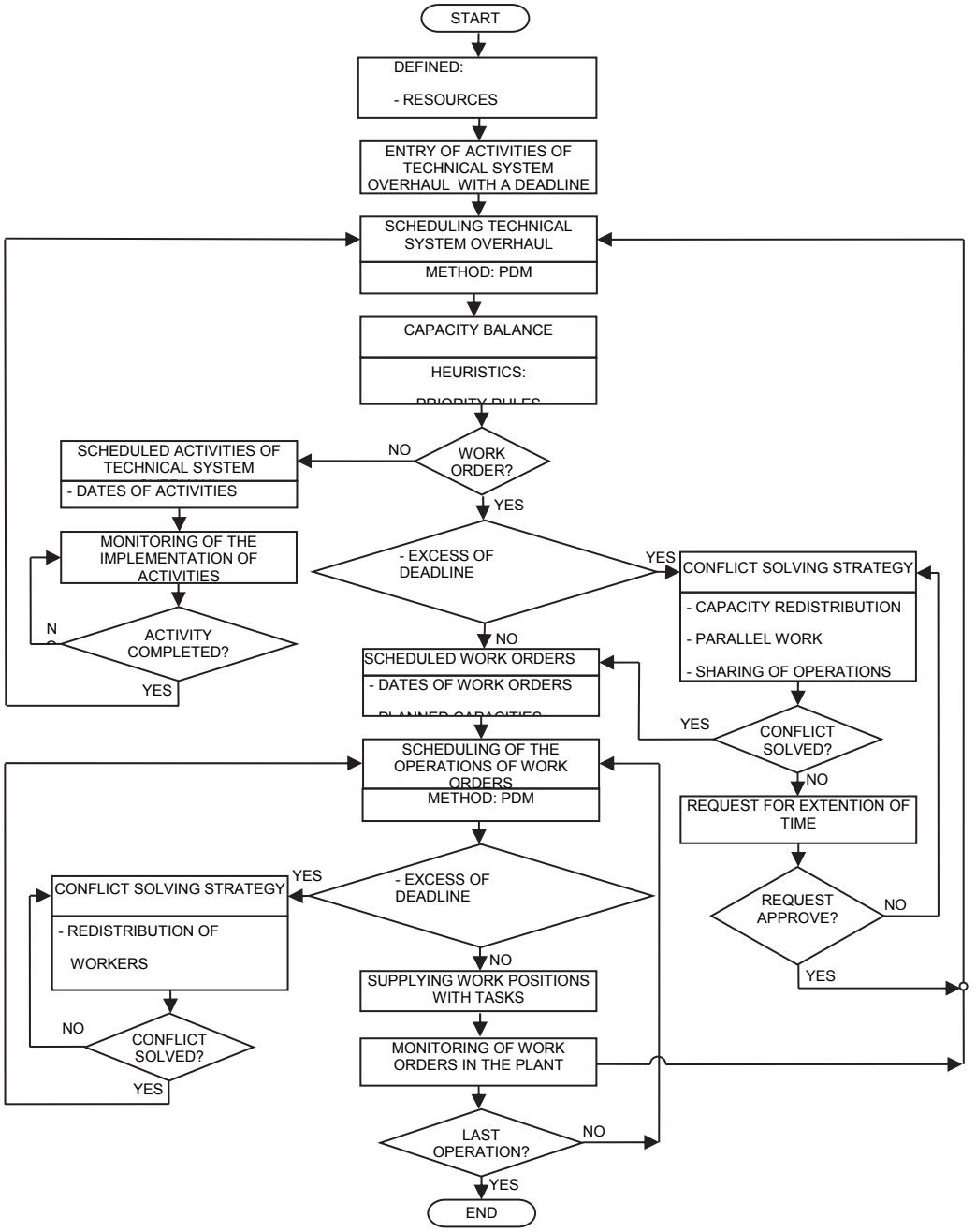

Fig. 2 *Algorithm of proposed model functioning [5]*

Since the process of monitoring and control of the implementation of technical system overhaul leads to changes and delays, primarily in the duration of individual activities, which are usually caused by a number of difficulties and delays in the execution of work orders (lack of certain types of resources and equipment, etc.), it is necessary to perform a new analysis of overhaul plan based on actual data obtained from overhaul-production system by monitoring the execution of work orders.

As noted, in order to make a good control of the execution of work orders/overhaul, it is necessary to form and organize an effective reporting system that will provide timely and real information about their actual state in the execution. Comparing the information provided by the reporting system on the real state in the execution of the work order/overhaul and planned values, we obtain basic elements for managing the execution of work orders/overhaul, i.e. for taking appropriate control actions that enable the actual implementation of the overhaul-production system to take place in accordance with predetermined plans. These reports mainly rely on computer processing and a set of reports provided by a software tool that is used. However, they are formed in a specific way and adapted for use at the appropriate organizational level, depending on the needs and competencies of certain functions and individuals in the management process of the execution of work order/technical system overhaul.

2.2. The procedure of production process management using work orders

The process of planning begins with requests submitted by sale sector and they refer to the technical system overhaul (or making spare parts), made under the contract or customer's demand. The request is submitted to the operational preparation sector, as an implementer of technical system overhaul.

The next stage of planning is launching „basic" work orders which are used to determine the operations for work during the technological examination, i.e. defectation of parts and sets of technical system in overhaul process. Therefore, after the technological examination, i.e. defectation, we obtain the work orders which define the scope and structure of the work to repair a particular technical system in overhaul process.

On the basis of such established work orders, we perform scheduling of technical system overhaul, which includes planning dates of work orders (production cycle budget) and dates of activities, such as dates for providing spare parts, raw materials, cooperation and dates of all other activities defined in the overhaul plan.

In the operational preparation, we perform scheduling of the overhaul (dates of activities, work orders and capacity using standard software tools for project management), provide work orders by technological documentation, raw materials, tools, etc. and launch work orders in overhaul-production system, and then we control the implementation of technical system overhaul through the execution of work orders and all defined activities. The proposed model allows Just-In-Time provision of spare parts, parts under construction, raw materials, etc. Thus, the operational preparation is responsible for scheduling overhaul using work orders, supplying work orders with necessary materials, tools, etc. and monitoring of technical system overhaul.

Workshop preparation accepts the launched work orders and based on them performs scheduling of the production process (the dates of work order operations and capacity) and supplies work positions with tasks, and regulates the production process

in order to ensure the realization of the work orders according to determined dates, i.e. deadlines. Hence, workshop preparation is responsible for scheduling and implementation of work orders, i.e. local scheduling.

To enable functioning of production process management, it is necessary to provide timely feedback to the place of origin, i.e. work positions and functions which are interested in it. However, the speed of transmission and timely receiving feedback at the appropriate work positions of operational preparation and other functions in the system depend on the way of its processing and transfer.

The processing and transmission of information in the proposed model is carried out electronically (EDI), using modern information technologies (computer networks, contemporary software tools and modern computers).

By formation, processing and transmission of information in the proposed model, the managing process of technical system overhaul is completed using work orders and allowing continuous circulation of information, which enables the management subject to complete the tasks – production process management as an object of management system.

3. CONCLUSION

The main contributions of this paper are reflected in the following:

1. It is formulated a model which determines the optimal allocation for creating an arbitrary number of components, on arbitrary number of machines, from the standpoint of the particular objective function, under certain conditions, for which solving the proposed algorithm has been developed, which is the main contribution of this paper. Creation of individual parts is carried out with an arbitrary number of operations, where the order of operations on machines is known, as well as the time of individual operations.
2. To enable that the results of the research could be applied in practice, i.e. to get closer to the actual situation, all constraints are included in the model.

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