

## SOFTWARE TOOLS FOR PROJECT MANAGEMENT AS A LEAN CONCEPT SUPPORT IN THE PROCESS OF TECHNICAL SYSTEM OVERHAUL

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### ABSTRACT

*The paper presents research results in terms of confirming that the functions in software tools for project management are fully applicable, complete and consistent in relation to the functional requirements of the tools used by the Lean concept. The paper emphasizes the Nagara system in the process of technical system overhaul. The research results were analyzed by matrix diagrams using ORACLE methodology - Model Business System and System Modelling Techniques. The experimental research has been carried out in the process of turbo jet engine repair in a real overhaul-production system. The research has shown that a software project management tool - Microsoft Project completely fulfil the requirements of the Lean concept tool - Nagara system in the process of technical system overhaul.*

**Keywords:** process, overhaul, technical system, lean, Nagara system, project management, software tool.

### 1. INTRODUCTION

Nowadays, a special attention is being given to the issue of increasing effectiveness and efficiency in the process of technical system overhaul. Reasons for this should be sought in the fact that technological progress makes that technical systems become more complex in construction and purpose. Their overhaul is an unnecessary expense both to users and manufacturers. Therefore, we look for ways to reduce costs, i.e. to increase the effectiveness and efficiency of technical system overhaul.

A key element of an organization and overhaul process management regarding effectiveness and efficiency increase of technical system overhaul is organizational problem solving. In the case when it is clear and when the importance of organization in overall productive strength development and production is noticed, most efforts have been made to develop the organization and solve organizational problems.

The complexity of technical system repair process in overhaul systems is especially expressed because of „the technical system overhaul at customer’s requests“. In such an overhaul due to large number of work orders, repair process planning is an ongoing process that takes place every time a request for an overhaul has been received. The complexity of this process also exists due to stochastic changes of process overhaul factors. In other words, work distribution and overhaul cycle are a function of a technical system in an overhaul process, i.e. the overhaul process takes place under conditions of variable work distribution, which results in uneven work position engagement [3]. In

addition, task duration (standard time framework of operation) is changeable. Interoperation time, waiting time, transport time and all other time frameworks that define a process are indeterminate. The availability of recourses (machines, materials, tools and energy) and workers for the execution of specific operations are also undefined. Many repair processes are not managed and all this causes deficit constancy in the performance of technical system repair.

Overhaul-production systems have to obtain a high level of flexibility in the organization and management oriented towards a customer, with quality system constructed, competitive prices in the market and short delivery time. The way to this is harmonic alignment and integration of people, technology and processes – the Lean concept.

Technical system overhauls are in the category of multiple (similar) projects performed at the same location, and that each project accomplished in this way is unique, but also the same kind (type) of such a project is repeated using the same technical systems for work and same human resources [6].

By analysing certain deficiencies in the project management of technical system overhaul, it is required to eliminate the existing problems and to provide:

- achievement of objectives in accordance with plans and work timetable, satisfaction of customers and employed participants (effective overhaul process) and goals at right costs, cost-effectively and profitably (efficient overhaul process);
- overhaul process management with a higher level of flexibility;
- rational resource use;
- timely fulfilment of needs, i.e. shortening time from the moment of order to delivery, which results in satisfied costumers and companies in achieving the ultimate goal.

For these reasons, the subject research has been carried out in terms of verifying whether functions of "standard" software tools for project management fulfil functional requirements of the Lean tool – Nagara system in the process of technical system overhaul.

## **2. LABOUR POTENTIAL MANAGEMENT (Nagara system)**

Problems of planning, management and optimum utilization of available human resources in the implementation of technical system repair deserve special attention because sources of rational business are sought in them. Taking into account that people are seen as participants in a production process, it is increasingly being paid attention to efficient and effective use of them. The approach is based on applying the Lean concept tool – Nagara system, which in human resources imperatively requires greater interdisciplinarity of individuals, i.e. scope of jobs in the interest of overall efficiency, and not only working efficiency (workers are considered as an economical factor of production process). Thus, trained workers are assigned serving more jobs or machines in order to reduce the number of workers in the production process, to balance the workload and achieve more cost-effective production process. This will have a significant impact on increasing effectiveness and efficiency of each overhaul-production system.

## **3. EXPERIMENTAL RESEARCH**

The experimental research (check) of Microsoft Project software tool support to functional requirements of the Lean concept tool – Nagara system in the process of turbo jet engine repair has been conducted in a real overhaul-production system.

### **3.1 Experimental research results**

Input data for verification of Microsoft Project software tools are functional overhaul process requirements shown in Table 1. The part of input data is shown in Figure 1, and the part of output data is shown in Figure 2. Output software data (screen display) are treated as "matrix diagram" using ORACLE methodology:

- Model Business System and
- System Modelling Techniques.

Matrix diagram is shown in Figure 3.

Table 1: Functional requirements of the Lean concept tool– Nagara system

REQUIREMENTS OF THE LEAN TOOL - NAGARA SYSTEM	SOFTWARE INPUT	SOFTWARE OUTPUT
DEVELOPMENT OF A "HUMAN RESOURCES" DATABASE	- workplace ID - name and surname of workers	- human resources with a set of qualifications
HUMAN RESOURCE PLANNING	- work diversity - price, number of hours per worker	- labour resource availability
INTERDISCIPLINARITY OF INDIVIDUALS	- working time calendar of work positions - workers' working time calendar	- allocated resources for a specific scope of work - assigned work amount to resources
PAIRING OF QUALIFICATION SETS	- planned expenditures of time - work order ID - overhaul time framework	- resource costs - identified excessive resource allocations - eliminated excessive resource allocations
REPAIR PROCESS WORKLOAD BALANCING	- number of work order operations - standard operation time - work order execution deadline	- replaced allocated resources with resources that are available to work (that have the same set of qualifications)
COST-EFFECTIVE OVERHAUL PROCESS	- priorities - priority rules - actual time when a process starts - actual time when a process ends - actual work - recorded "unplanned" events	- replaced allocated resources with resources that have a certain set of qualifications - analyses - reports

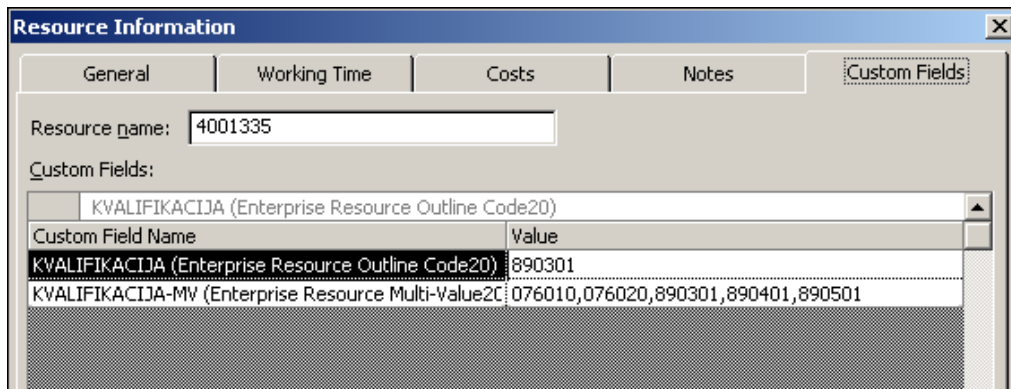


Figure 1: Screen display of workers' work diversity input

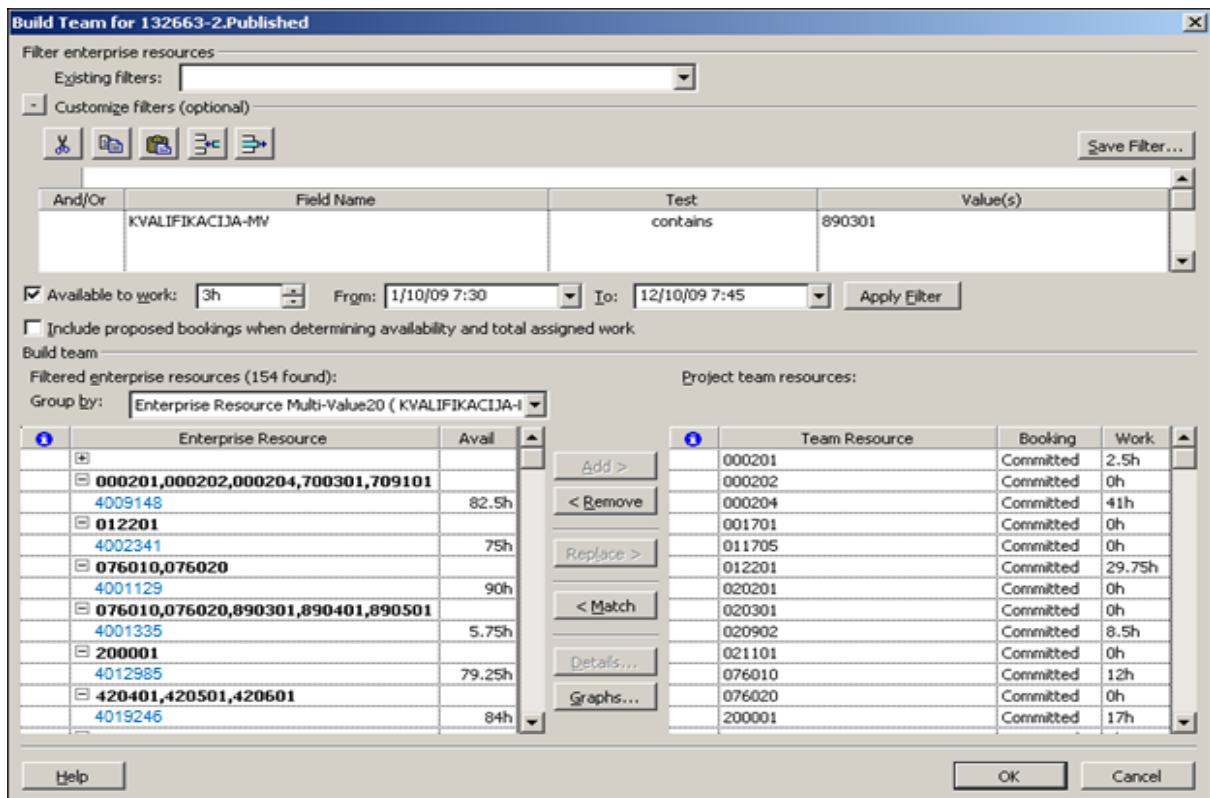


Figure 2: Screen display of interdisciplinary work potential management

FUNCTIONS \ ATTRIBUTES	WORKER'S ID	NAME AND SURNAME	WORKING TIME	"SET" OF QUALIFICATIONS	PRICE number of hours
DEVELOPMENT OF A "HUMAN RESOURCE" DATABASE	IRUA	IRUA	IRUAN	IRUA	IRUA
HUMAN RESOURCE ADDING	IRUA	IRUA	IRUAN	IRUA	IRUA
HUMAN RESOURCE REMOVAL	IA	IA	IA	IA	IA
INTERDISCIPLINARITY OF INDIVIDUALS	R	R	R	R	R
QUALIFICATION SET MANAGEMENT	R	R	R	R	R
HUMAN RESOURCE REPLACEMENT	R	R	R	R	R
GRAPHS	R	R	R	R	R
I = Insert      R = Retrieve      U = Update      N = Nullify      A = Archive					

Figure 3: Matrix diagram of Nagara system requirements– attributes (worker)

#### 4. CONCLUSION

The process of verification that the functions of integrated software tool are fully correct, complete and consistent in relation to the systematic specifications and process requirements of technical system overhaul is in terms of evaluating the software tool so that it:

- satisfies the required developmental standards,
- fulfils all requirements,
- works as it is intended for target environment.

On the basis of the screen display of functional requirement fulfilment and "matrix diagram", it can be concluded that: *Microsoft Project software tools entirely fulfil the requirements of the Lean tool - Nagara System.*

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