

## APPLICATION OF SELECTED METHODS OF WORK RATIONALIZATION

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**Abstract.** *Work rationalization represents the approach to the simplification of production process, and the analysis of the process with the goal to reach its purposeful arrangement. The paper introduces the possibilities of applying certain rationalizing arrangements with which it is possible to reach the increase of production volume, and thus work productivity.*

**Key Words:** *Work rationalization, methods of operational measuring, MTM methods.*

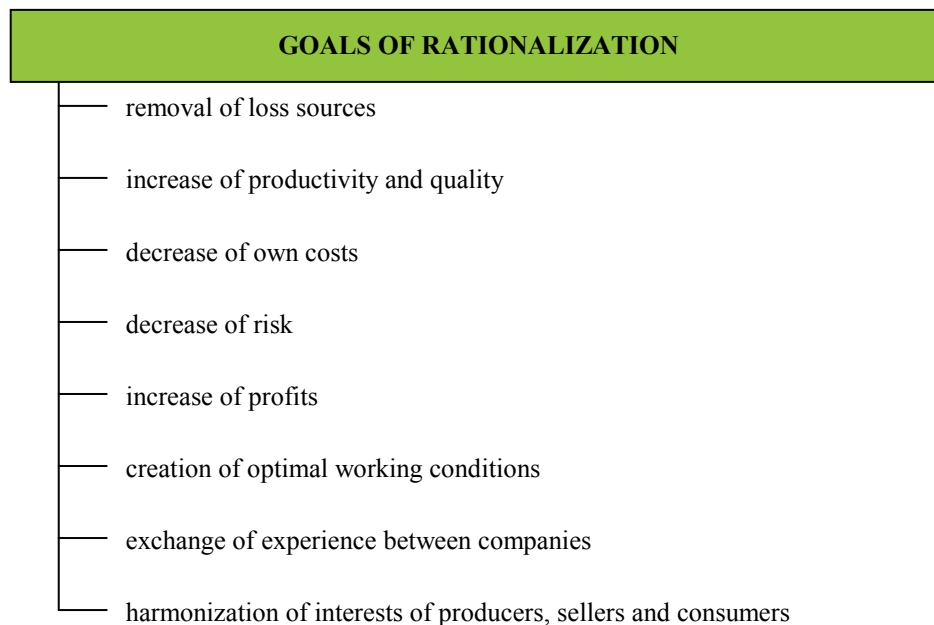
### 1. WORK RATIONALIZATION

According to the Wikipedia encyclopedia, rationalization means the increase of work process effectiveness on the basis of introducing (rationalizing) arrangements in partial steps of the given activity.

At the rationalizing process it is the improvement of the human activity, increase of its effectiveness; increase of economic efficiency; summary of arrangements for the most effective utilization of work force and technology on the basis of the most modern knowledge of science and technology.

Thus, rationalization means the selection of the right way to the simplification of the production process and process analysis with the goal to reach its purposeful arrangement.

Goals and contributions that are possible to be reached through rationalizing processes are shown in Scheme 1. [2]



Scheme 1. Goals of rationalization

### 1.1. Methods used in work rationalization

There are a lot of methods that are used at work rationalization. They differ in accuracy and severity. Methods, by which information necessary for work rationalization itself is collected, are for example:

- *methods of continuous measuring*, for example *image of the working day* (recording of working process actions), *chrono-measuring* (measuring of partial elements of the working operation with the goal to discover duration of single working operations), *bilateral observation* (chronological recording of occurrence of working and technological actions),
- *methods of selected measuring* - these are methods of multi-moment measuring and their modification,
- *complex measuring methods* – methods of operational measuring, that are laborious, but capable of collecting information for the analysis of the working process,
- *special methods* – used for the study of special aspects of the working process, for example even for psychology and physiology of work.

The character of the used method depends on the character of the examined object.

At the selection of the method it is necessary to respect mainly the following:

- essence and meaning of the solved problem,
- availability of input data,
- costs for solving the problem by using the given method,
- disposable time for solving the given problem,
- contribution gained with the solution and others.

## 2. EXAMPLES OF APPLYING RATIONALIZATION METHODS IN PRACTICE

### 2.1. Work rationalization by using the method of operating measuring

For the purposes of solving the project a workplace was selected where car components are manufactured, more specifically, the part of the installation line that is a workplace for manual installation. One worker works at the workplace and the time of one installation cycle is 6 minutes and 26 seconds. The working activity requires high skills of the worker, who performs several manual operations - screwing, folding and fastening.

At the analysis of the working activity the following facts were discovered:

- the working activity is monotonous, performed only when standing,
- movements of the worker between the installation workplace and the place where the components and mechanism are, necessary for the installation, represent about 10% of the overall time of installation,
- journal for recording parts is situated incorrectly – outside the workplace,
- working tool, used at finishing operation is situated incorrectly – considering the height and side of its position.

Insufficiencies, discovered by measuring and observation of the installation process, are possible to be removed by the following arrangements:

- *Adjustment of the installation workplace considering spatial arrangement of objects.* A fixed place is created at the working field for each object, tool, components etc. and is situated according to the frequency of their usage.
- *Adjustment of the installation workplace from dimensional point of view.* By using ergonomic principles, the workplace is adjusted in such a way as to contribute to the feeling of worker's comfort, to the using of his performance capacity and to decrease negative effect of technical part of the system man – machine environment.
- *Proposal in the field of material movement.* Using of the movable cart with tanks that, except for the decrease of time-loss, contributes even to the decrease of physical loading of the worker.

By execution of these arrangements, the minimization of non-productive time occurs. Time of one installation cycle is shortened by 35 seconds, and that results increases the cycle numbers during the working shift by seven.

The shortening of continuous time of installation cycle, among other things, shows:

- a) in the increase of work productivity of workers as a consequence of the decrease of labor consumption,
- b) in better utilization of machine and equipment capacity,
- c) in the increase of production field capacity,
- d) in the decrease of capital bound. [3]

### 2.2. Work rationalization by applying MTM methods

For the purposes of solving this task, as in the previous example, a workplace of manual installation was selected.

The working activity comprises the installation of screws with  $\varnothing$  10 mm and length 50 mm to 30 openings with  $\varnothing$  10 mm, the openings are situated on the fixture with dimensions 200 × 150 mm. The tank with screws is situated in 40 cm distance from the fixture.

The work is performed only with the right hand, while the left hand only holds the fixture. The analysis of the recent state presented in symbols and time units MTM is in table 1.

Table 1. Analysis of the initial method of manual installation

Left hand	TMU	Right hand	Motion
	16,8	R40C	Rash
	7,3	G4A	Grasp
	18,5	M40C	Move
	–	G2	Grasp
	–	T90S	Turn
	16,2	P2AP	Position
	2,0	RL1	Release
$\Sigma$	60,8		

The time for situating one screw is 60,8 TMU, time of the whole operation is 1824 TMU. Movements taking the most time are reach (R) and displace (M).

It is possible to remove insufficiencies, discovered by measuring and observation of the installation process by the following arrangements:

- replacement of tanks with screws closer to the fixture – shortening of the distance to  $\frac{1}{2}$ , that means for 20 cm,
- fixing of the fixture in such way as to perform the installation with both hands,
- increase of opening tolerance at the place of the screw in order to make placement to the opening more easier,
- arrangement of the tank shape in such a way as to enable easy grabbing of screws with both hands at the same time.

By continuous calculations and introducing these rationalization arrangements, it is possible to reach total operation timesavings by 76 % compared to the original state. This fact directly affects the increase in work productivity of each worker performing identical working operations, which consequently enables the increase of the whole working system productivity.

In the simple process of workplace rationalization with the emphasis on the possibility of work productivity increase by using MTM methods, it is possible to mention the following steps:

- *analysis of the recent situation* = analysis of work movements and their time duration. The analysis is executed on the basis of external impulses – dissatisfaction of workers with working activity, working place, dissatisfaction of the management with reached work productivity etc.
- *calculation of work productivity by a direct method*:  $PP = Q / p$ , as share of production volume and number of workers,
- *proposal and execution of the change of arranging the workplace* and working activity with respect to ergonomic principles (anthropometry, perimeter, optimally reached spaces etc.),
- *analysis of working movements and calculation of times of their duration* after the application of proposals,
- *repeating calculation of work productivity* for single working operations.

By application of this method at the solution of a concrete project within the grant, the task was to reach substantial increase of work productivity at manual installation of mechanical product. Production volume, depending on the character and complexity of installation operation increased by 3,2 – 12%.

Both examples point out some possibilities of simple problem solving in the work system human – machine.

The realization of rationalization steps brings mainly total work time saving, work performance increase and also work productivity increase.

#### CONCLUSION

Rationalization, as one of the tools of making production more effective, means rational actions, using initiatives of workers and professional execution of the rationalizing activity. For effective application of rationalization it is of crucial importance to understand rationalizing intentions and changes correctly and to create conditions and presumption for their execution.

The economic essence of rationalization reflects in reaching higher performance, higher efficiency and assumes knowledge and the application of newer and more modern systems, concepts and methods of work.

The contribution is part of solving grand task VEGA 1/0679/08 Integrated System for innovative projection, planning and organization of production and the grand task VEGA 1/0052/8 System approach to rationalization of work processes at production companies.

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## PRIMENA ODABRANIH METODA RACIONALIZACIJE RADA

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*Racionalizacija rada predstavlja pristup pojednostavljenju proizvodnog procesa i analiza procesa sa ciljem da se ostvari svrsishodno rešenje. Članak uvodi mogućnost primene određenih rešenja racionalizacije sa kojim je moguće ostvariti povećanje proizvodnog obima, i tako radne produktivnosti.*

Ključne reči: *racionalizacija rada, metode operativnog merenja, MTM metod.*