

## USE OF VALUE ANALYSIS TO INCREASING THE VALUE OF ERGONOMIC DESIGN OF WORKPLACE

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**Abstract:** Nowadays, when the market is saturated and supply dominates over demand, companies are under pressure to produce at lower costs and higher quality. The human factor is also starting to become a priority. Therefore it is necessary to ensure a good quality working environment for employees. This is an ergonomics task. However, the problem remains how to increase the value of the ergonomic effects at the lowest possible financial cost. One of the tools is value analysis. This article concentrates on the possibilities of the application of value analysis to ergonomic workplace design.

**Key words:** ergonomics, value analysis, product, process

### 1. INTRODUCTION

In order to be able to describe the reason for the application of value analysis and ergonomics in workplace design, it is first necessary to define some terms.

*Ergonomics:*

- is an interdisciplinary scientific discipline system, which comprehensively addresses the human activity and its link with technology and environment, in order to optimize the psychophysical burden and ensuring the development of his personality (Chundela, 2005).
- is the scientific discipline to optimize interaction between humans and other elements of the system, using the theory, knowledge, principles, methods and data to optimize well-being and human performance system (IEA, 2001).

*Value Analysis(VA):*

- is an organized and creative approach, that concentrates on finding the non-contributing costs. The non-contributing costs are costs that do not increase quality, durability, appearance and other characteristics desired by the customer (Miles, 1971).
- is an organized and creative process using the process of economic and functional design, the purpose is to increase the value of the subject of value analysis.(ČSN EN 1325-1, 1997).

In this paper we start from the definition of ergonomics according to IEA and of VA by Miles.

### 2. ERGONOMIC DESIGN OF WORKPLACE

The classical approach of the ergonomic industrial engineer to designing a workplace can be divided into two basic procedures:

- design of a new workplace,
- evaluation of an existing workplace.

When designing a workplace compliance to legislative and safety regulations must be adhered to. Then the following operations must be performed:

- determine specification of ergonomic task,
- identify the population group,
- analyze the labor act (the act of distribution of elements)
- provide required ergonomic data (as will be examined),
- provide the required accompanying documentation,

- establish training requirements and training service,
- choose the method of evaluation (according to observed phenomena),
- assess the development of the project (if specified ergonomic data has been achieved),
- evaluate the results of the analysis (comparing the technical and ergonomic requirements),
- evaluate project manned (practical test),
- evaluate the test results with the service and make changes (assessed by testing the service and adjusting in real life), (ČSN EN 614-1, 1997).

When evaluating an existing workplace, the ergonomist is limited by many factors:

- technical characteristics of the production system,,
- environment,
- technology
- material flow - arrangement of the layout of production,
- financial resources and so on.

If the arrangement of production and individual links between workplace are not respected, this can lead to errors. A localized modification to the design of a workplace may only shift the problem to another site. It is therefore necessary to understand the whole system as a process with inputs and outputs.

### 3. VALUE ANALYSIS

VA primarily concentrates on value of product – the output of the process. Ergonomic design can be seen as the process. The output of this process is the product – a new workplace.

The main purpose of VA is to obtain the same functions of a product at reduced costs. (Miles, 1971)

First the concept of value must be explained. In use in ergonomics is customer (owner of process – company), producer (ergonomist – workplace creator) and consumer (worker). For all of them the same product can have different values depending on the time, place and use.

The value of product is understood (Dostál et al., 2009) as:

$$V = \frac{F}{C} \quad (1)$$

F - degree of fulfillment of the required functions

C - costs required to achieve these functions

Function is the effect of product or one of its components. (ČSN EN1325-1, 1997)

The main purpose of VA is to obtain the same functions of the product at reduced costs. (Miles, 1971) It can be used for reducing the financial costs of ergonomic workplace adjustments. Costs have a relation to functions.

The basic steps of VA are (Miles, 1971):

- finding the functions,
- function evaluating by comparing,

- defending the need to develop alternatives.  
VA approach concentrates on finding the answers to the following five questions (Miles, 1971):

- What is the item or service?
- What does it cost?
- What does it do?
- What else would do the job?
- What would that alternative cost?

Answering the questions above leads to the job plan of VA.

The steps of the plan follow (Miles, 1971):

- Orientation (what is needed to be achieved)
- Information (basic information – for example: technology)
- Creative thinking (searching for alternatives)
- Analysis (evaluating by effects, costs assignment)
- Planning (plan for the development of most promising proposals)
- Realization (realization of plans)
- Summary (creating of VA suggestion sheet for managers).

#### 4. COMPARISON OF APPROACHES

According to the Tab. 1, there are some points of VA contained in an ergonomic design and vice versa. It is essential to consider and to correctly interpret the following:

- the population group cannot be neglected,
- respect the labor act,
- identification of training requirements may be to ensure good working practices,
- evaluation of project with manned workplaces can reveal hidden problems.

The absence of an equivalent approach to working with VA for ergonomic design, including creative thinking is also apparent.

Value Analysis	Ergonomic design	
Step of VA	Equivalent step of ergonomic design	
1 Orientation	1	Identify specification ergonomic task
2 Information	●	Identify the population group
3 Creative Thinking	●	Analysis of the work task
4 Analysis	1	Determination of the desired ergonomic data
5 Planning	2	Provide the required documentation
6 Realization	●	Establish training requirements
7 Summary	5	Select evaluation method
	4	Evaluate the project
	5	Review the results of the analysis
	●	Evaluate the project with the worker
	6,7	Evaluate the test results with the worker - change

Tab. 1. Comparison of approaches

#### 5. RESULTS – NEW APPLICATIONS

When applying VA to ergonomic design it is appropriate to include the VA process and to provide answers to 5 basic questions. This part can be described as the value phase.

Phase	The job plan of ergonomic design	
Preparatory	1	Identify specification ergonomic task
	2	Determination of the desired ergonomic data
	3	Identify the population group
	4	Analysis of the work task
	5	Provide the required documentation
Value	6	Determine the answers to 5 questions
Project	7	Select evaluation method
	8	Evaluate the project
	9	Review the results of the analysis
Test	10	Evaluate the project with the worker
	11	Evaluate the project with the worker - changes
Final	12	Establish training requirements
	13	Realization
	14	Summary and conclusions

Tab. 2. New job plan of ergonomic design

This approach is included in the modification of the procedure of ergonomic design, in terms of the job plan of VA. The result is a new job plan – Tab. 2.

#### 6. CONCLUSION

The main benefits of merging what, at first glance are two different approaches, is the creation of a comprehensive tool for enhancing the value of ergonomics projects. The approach should generate more possible solutions. Furthermore, it should contribute to evaluation and lower financial demands of ergonomic projects. In the future it will be necessary to develop further the influence of the extent of fulfillment of the ergonomic and technical requirements on the value of the workplace and the links between them. The next task should be to establish the importance of individual (technical and ergonomic) requirements. In the future, we would like to develop this approach to production system design in more detail and to try to apply it in practice

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