

## THE ANALYSIS OF A WORKPLACE FROM AN ERGONOMICALLY CRITERION. CASE STUDY: PRELIMINARY CHARGE

**Adrian VASILIU, Marian BORDEI**

"Dunărea de Jos" University of Galați, 111, Domnească Street, 800201, Galați, Romania  
email: avasilu@email.ro

### ABSTRACT

*This paper presents a practical method of analyzing a workplace from an ergonomically criterion based on an "ergonomic analysis questionnaire", and, also, the conclusions and proposed measures in order to improve the activity of the analyzed workplace.*

KEYWORD: ergonomics, job, worker, ergonomic index

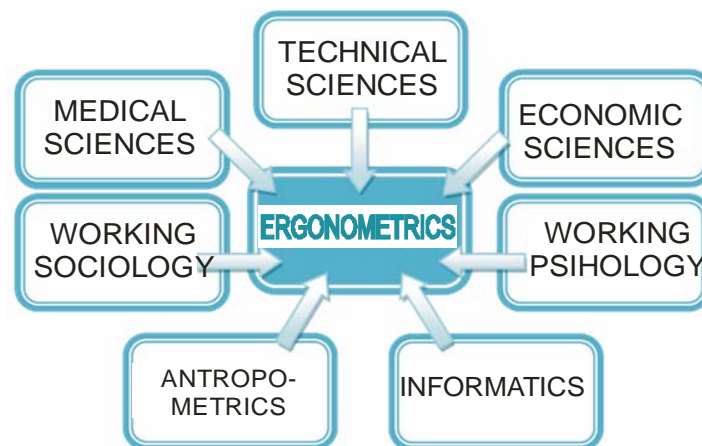
### 1. Introduction

The ergonomics is a branch of multi-disciplinary nature that emerged after The Second World War, having common knowledge with science, biology, medicine, psychology and sociology. Shortly, we can say that ergonomics is the science that studies human behavior in employment, and more often at the workplace. Ergonomics is an approach that allows people to work optimally and efficiently. The basic principle of ergonomics is to adapt the workplace to the worker.

The implementation and application of ergonomics in the workplace starts from the simple worker (individual) to the team (group level).

A solution for the ergonomic research is the research team which consists of specialists from different fields of science.

For a good team cooperation each member must acquire a minimum knowledge from the others domains. This will allow a better flow of information and a good cooperation during the investigation. The ergonomic research is the higher form of scientific research.



*Fig. 1. Ergonomics, interdisciplinary scientific field*

The purpose of applying ergonomic principles in the industry are the following:

- to improve the physical and mental well-being, eliminating the extra work (physical and mental) illness prevention and job satisfaction.
- to improve the social well-being by building relationships and contact with work colleagues,

creating a adequate safe, comfortable and healthy system and working environment.

- to improving the human-machine system and establish a rational balance between technical, economic, and anthropological aspects, in order to increase its effectiveness.



## 2. Objectives

To ensure the effectiveness of the man-work-environment resources and minimize error opportunities under the conditions of reducing stress, at the same time with the increase of job satisfaction, it is necessary, both for the designer and the organizers and work leaders to use appropriate methods that are based on possibilities knowledge and on human requirements during labor process. In these circumstances the analysis, design and ergonomic redesign of the workplace is very useful and a permanent necessity.

The ergonomic analysis of the workplace aims at the constructive design optimization of workplace by improving the work safety and the physical environment factors, the reducing of the negative effects because of work monotony and decrease of physical and mental demands.

## 3. Work method

The process has as starting point the analysis of working conditions or proposed to be achieved in various ways for each workplace, based on evaluation factors and influence criteria. [1]. The research team applies the "ergonomic analysis questionnaire" individually at the workplace where the worker (contractor) develops his professional activity. For the analysis, we will use interview method during the stage of data collection (the questionnaire may be filled with other specific questions or others can be removed from the questionnaire).

The results will be analytically processed by calculating the ergonomic index (1) which reflects the aspects of the ergonomic organization for the job. The bigger the number of workers is the more important the results will be.

After analyzing the questionnaire, critical appreciations will be made regarding the ergonomic aspects of the job, conclusions and suggestions will be presented in order to improve the ergonomic situation at the analyzed workplace and the measures to improve the ergonomic factor will be proposed.

The ergonomic index calculation of a workplace (station) is made by the relation:

$$I_e = (\Sigma P + \Sigma N) / N_i \quad (1)$$

where:

P = YES answers favorable (positive) - marked with 1;

N = NO answers unfavorable (negative) - marked with 1;

\*\*\* DO NOT KNOW Answers - marked with 0;

$N_i$  = number of questions

*Processing results*

The ergonomic index will be calculated: the ergonomic index can take values between -1 and 1 resulting:

1. - the principles and ergonomic requirements, maximum satisfaction at work and therefore efficient activity;

0. - non-compliance of all ergonomics requirements, work is carried out in satisfactory conditions.

-1. - non-compliance of ergonomic requirements, minimal satisfaction, inefficient activity.

*Data collection and processing*

The questionnaire was applied to a sample of 12 employees from the Agglomeration Department and to six employees from the Furnaces Stockade Sector Department of AMG. The samples included people working in shifts serving various specific installations, of different ages and sexes.

**Table 1. Ergonomic analysis questionnaire for batch preparatory work [2]**

No.	QUESTIONS	YES	DO NOT KNOW	NO
<b>A. Questions related to specific activity</b>				
1.	Do you know the main function in the workplace?	1		
2.	But secondary function?		0	
3.	Do you know the basic requirements of the job?	1		
4.	Know the risk factors in your work?	1		
5.	When distributing the functions to take account of personal skills?			-1
6.	There are conditions permit exercise properly?			-1
7.	There are elements that disturb the activity (lack of space, lighting, noise, temperature, risk)?			-1
8.	There is a functional link between employees?	1		
9.	The links are appropriate?	1		



10.	Been taken into account in the preparation and distribution functions prior specialization?		0	
	<b>Ie=(5-3)/10=0.2</b>			
	<b>B. Questions about the physical demands and posture during work</b>			
11.	Physical efforts can be supported without danger of overload or impairment of work capacity?			-1
12.	Is the space enough?	1		
13.	But free space?	1		
14.	Where are prompted for an orthostatic position have taken measures to support and balance?			-1
15.	Doorways in height are provided with guard rails?	1		
16.	Area reserved knee and leg clearance satisfactory?			-1
17.	Motor vehicles are utilized?	1		
18.	Additional steps can be taken to ease the physical exertion of various materials handling?	1		
19.	The pace of work is appropriate?		0	
	<b>Ie=(5-3)/9=0.2</b>			
	<b>C. Questions about applications perception, attention, skills</b>			
20.	Is distracted attention by noise or other acoustic stimuli?	1		
21.	Routine activities and skill is running under visual control?	1		
22.	Education and training are dynamic and appealing?			-1
	<b>Ie=(2-1)/3=0.33</b>			
	<b>D. Questions on adapting to ambient conditions, light, color, noise, dust</b>			
23.	Sufficient illumination to be fulfilled her duties?	1		
24.	Light sources are installed?			-1
25.	There area each compartment lighting adequate?		0	
26.	There are contrasts of light on the most common directions?	1		
27.	There are contrasts of light on the most common directions?	1		
28.	Intensity artificial lighting is sufficient and steady?			-1
29.	Chromatic interior helps to improve lighting?		0	
30.	Wall color is pleasant and soothing?			-1
31.	The temperature at which the work is best?			-1
32.	We have taken steps to limit the effect of thermal radiation?			-1
33.	Warming winter appropriate?			-1
34.	The temperature of the surrounding surfaces is the same as that of air?	1		
35.	Working at high temperature in summer is accompanied by measures to prevent heat stroke?			-1
36.	Air exchange with the outside is appropriate?		0	
37.	We have taken measures to limit dust in your workspace?		0	
38.	Relative humidity corresponding physiological requirements?		0	
39.	Attention staff is disturbed by noise?	1		
40.	Perception and decision-making capacity are negatively influenced by noise?	1		
41.	They made arrangements for isolating noise producing?			-1
42.	We have taken steps to soundproof workspaces?			-1
	<b>Ie=(7-8)/20= - 0.5</b>			
	<b>E. Questions about clothing and protective equipment</b>			
43.	The equipment used in the movements of the performers creates difficulties?	1		
44.	There are protective equipment against microorganisms and dust?	1		



45.	Protective equipment bothers accomplishing tasks?	1		
46.	When purchasing or making clothing and protective equipment to take into account the proposals of the employees?			-1
	<b>Ie=(3-1)/4=0.5</b>			
	<b>F. Questions regarding working hours and psychological environment</b>			
47.	Perception, attention and dexterity is required in the normal range?	1		
48.	Working time is appropriate?	1		
49.	Function is sufficient motivation for the work efficiency and good humor?			-1
50.	Service members were able to form collective team spirit?	1		
51.	In making teams take account of options and affinity component members?			-1
52.	There is an atmosphere of collaboration, consultation and participation in enforcement activities?	1		
53.	Head customary to close with each subaltern speak?	1		
54.	The reward system is stimulating?			-1
55.	Known or particular staff tries knowledge unrest?			-1
	<b>Ie=(5-4)/9=0.11</b>			
	<b>TOTAL</b>	<b>26</b>	<b>0</b>	<b>-21</b>
	<b>Ie=(26-21)/55=0.12</b> <b>Ie= 0.12</b>			

Based on the results and the ergonomic index calculation the value 0.12 resulted, value which falls to the limit, to fully respect the ergonomic requirements; the activity of the worker at the analyzed workplace runs in satisfactory conditions.

#### 4. Conclusions

Unsurprisingly, ergonomic index was positive but close to zero for all persons interviewed, which demonstrates clearly the need for more intense concerns from managers in this unit to ergonomics. Certainly there are negative aspects in this regard, aspects that can be improved by applying a set of appropriate measures.

Based on the questionnaire were determined following conclusions, and have proposed the following measures:

**Specific activity (Ie = 0.2):** It finds a good knowledge of the requirements of function (job) of the basic requirements of the job, the risks specific to the job by the employee. Some shortcomings are found in functional connections between employees, but the work is in satisfactory condition.

As recommended measures improving functional link between employees and better sharing of staff working on functions taking into account personal skills.

**Physical demands and body position (Ie = 0.22):** From the point of view of application and

physical posture during work finds that space is sufficient and space and have taken the necessary steps to support and balance as and providing sufficient transport.

As recommended improving working conditions so as to minimize the danger of overloading.

**Requests perception, attention, skills (Ie = 0.33):** With regards to perception, attention, skills finds that the work is under major influence of acoustic stimuli (noise) and that the trainings are dynamic and appealing. Ergonomics index shows that the activity is conducted in a more than satisfactory.

As recommended measures are personal protective equipment against noise (ear) where the noise level is exceeded or limited and staff training in addition to training SMART.

**Environmental conditions (Ie = -0.05):** Regarding the ambient conditions is found that insufficient lighting at work, often appear large temperature contrasts and the work is near sources of noise insulated. Ie = -0.05 - shows that the overall activity is conducted in poor conditions.

As recommended improvement measures both natural and artificial lighting, equipping staff with appropriate equipment (summer - winter) and isolating noise and where it is not possible equipping staff with PPE against noise (earplugs).

**Clothing and protective equipment (Ie = 0.5):** Regarding the protective clothing and equipment are



clearly noted concern management to ensure the necessary equipment for the smooth running of the production process. As observed for management: when making supply protective equipment should be consulted and the staff uses to avoid difficulties in the use of and increase the range of appropriate protective equipment against temperature.

**The work program and psychological environment ( $I_e = 0.11$ )** on the program of work and psychological atmosphere is found (in terms of the employee) that: salary is insufficient in relation to the work performed; not take into account the composition of the collective choices of team members; reward system is not stimulating.

**Final conclusions:**

- job description was a constant concern, so the organizational structure is reasonable and appropriate in the circumstances, but not stimulating.

- report preparation and content of the posts did not work as a lever of efficiency and job satisfaction.

- management of documentation structures was powerless to counteract the wage provided humiliating and incompatible with the volume of work and the terms of existing work, which effectively reduced the authority of managers and staff motivation.

## References

- [1]. **Burloiu, P.** - *Managementul resurselor umane*. București: Lumina Lex, (1997), p. 1272.
- [2]. \*\*\* - *Les profils de postes*. Paris. Ed. Masson, (1976), p. 20-40
- [3]. **Grandjean, E.** - *Principiile ergonomiei*. București: Editura Științifică, (1972).
- [4]. **Mathis, R. Nica, P.** - *Managementul resurselor umane*. Ed. Economică, (1997).
- [5]. **Nicolescu, O.; Verboncu, I.** - *Management*. București, Editura Economică, (1997).