ANALYSIS OF NORMS METHODS IN THE GARMENT INDUSTRY

Professional paper
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ABSTRACT: *Several norms methods are used in production today, and garment manufacturers are often at a loss as to which method to use. That is why in this paper we have analyzed 3 different methods - Method with coefficients, REFA and MTM-2.*

Keywords: *garment industy, Method with coefficients, REFA, MTM-2.*

ANALIZA METODA NORMIRANJA U INDUSTRIJI ODEĆE

APSTRAKT: *Danas se u proizvodnji koristi nekoliko metoda normiranja i često su proizvođači odeće u nedoumici koju metodu da koriste. Zato smo u ovom radu analizirali 3 različite metode normiranja - Metodu sa koeficijentima, REFA i MTM-2.*

Ključne reči: *odevna industrija, Metoda sa koeficijentima, REFA, MTM-2.*

1. INTRODUCTION

Companies of the production sector are exposed to drivers like globalisation, which lead to a high amount of challenges, such as customisation of products as well as a reduction of the time-to-market. [1] According de Almeida and Ferreira with the continuous growth of competitiveness among companies, the increase in productivity has become an important requirement for many of those companies.
Garment production deals with norm working. Norm is the time the average skilful worker of appropriate expertise needs to perform a specific technological operation with normal effort and fatigue, at normal environmental action and under normal conditions of work. This definition suggests the following three conditions [3]:
1. Qualified and well trained worker;

2. Working at a normal pace with which a trained worker performs the task under normal conditions with a normal level of consumption of his own energy. Normal human consumption of energy is the one at which the employee can withstand the pace of work - neither too fast nor too slow. Carrying out of time norm that most of the skilled workers can perform is 100%.
3. Performing a specified task which has a certain prescribed method of work, materials specification, specification of tools, accessories and the equipment used, position of intermediate storage before and after performing the task, displaying additional requirements related to safety, quality, workplace regulations and activities to ensure the carrying out of the task.

2. METHODS

In order to calculate the time norm methods can be used, such as: Method is with three coefficients, Michelin methods, The method of average value, The method of maximum frequency, REFA and MTM.
A time method with stopwatch timer is most widely used in our garment industry. This method is with three coefficients: the fatigue coefficient, the coefficient of environmental influence and the supplementary coefficient.
The fatigue coefficient is required because of the reduction of performance due to physical and mental fatigue of workers during working time caused by monotony, hard work, body position, etc. With physical fatigue, as a consequence of dynamic muscle strain, exhaustion and fatigue may occur (if the work is limited to some constant movements and muscle groups), and as a result of static muscle strain (if the limbs are immobile and if there is a permanent contraction of muscle groups). Muscle fatigue is a lack of oxygen, and occurs whenever a bigger impact within a unit of time is required than it corresponds to the amount of oxygen that is available. [3] For determining of supplementary coefficient about 15% are taken , including [3]:
- 5% for personal needs,
- 4% for interruptions caused by personal fatigue,
- 2% for a very unfavourable position of the body
- 2% for insufficient light,
- 2% for precise work.

Methods-Time-Measurement system (MTM) is a system of predetermined times and is used for the design of working processes. Therefore, manual tasks are analysed, described, structured and planned by means of defined process modules. These are systematically structured and arranged, in order to visualise influence factors and to design working systems already in the planning phase. [4] MTM is the most famous one in the world and it is mostly used in garment industry. It is used for the rationalization of existing work procedures and for providing objective data to design new work processes. This system is a time system which divides every manual technological operation into basic movements (Reach, Grasp, Move, Position, and Release) which are given certain time values

depending on the nature of movements and the conditions in which they are carried out. [3].

The MTM methodology is in continuous development and **t**oday in use are: MTM-1, MTM-2, MTM-3, MTM-UAS, MTM-MEK, MTM-EAWS, MTM-SAM, MTM-SD and MTM-VI.

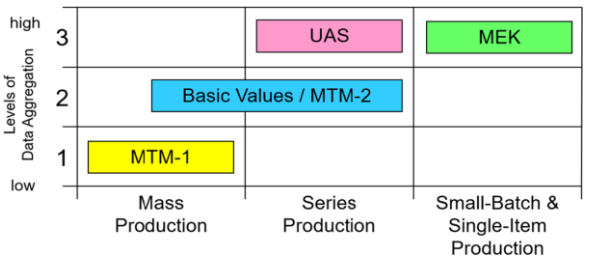

Figure 1: Application fields for different MTM standards [5]

REFA is m ethod for the systematic observation, capture and measurement of work processes. [6] The REFA method works with a so-called performance level which is used for correction of measured time so that different intensities of work by individual employees can be taken into account. If a man is aware that he is being measured he can consciously or unconsciously perform his work at a different speed. [7] According Buresa and Pivodova REFA performance level enables the observer to adjust and recalculate the measured time to so-called normal performance level with value 100%. Under the normal performance level we understand performing harmonious, natural and balanced motions and their coordination. It can be performed during the whole shift permanently by every worker who is experienced, educated and trained and is following safety instructions.

2. ANALYSIS OF NORMS METHODS

For better optimization and standardization of workplaces, the production of men's denim shirts was analyzed. In order to determine the required norming method, several workplaces were analyzed with 3 different methods: Method is with three coefficients, REFA and MTM-2. In this paper, we will show you the analysis of the production of the collar, where the worker has 3 phases of work:

- Sewing stand collar on collar (Ordinary sewing machine).
- Cutting and turning the stand collar (Hand makes).
- Topstitch the stand collar (Ordinary sewing machine).

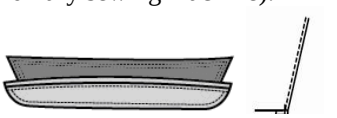

Figure 2: Collar

The size of the observations was 10 for the Method is with three coefficients and REFA and 3 videos for the movement analysis when working with the MTM-2 method. The Table

1. shows the results of measurements by the Method is with three coefficients where is the norm of this technological operation 129,39s. The results have been obtained with SE-ERGO calculator.

Table 1: Results of measurements by SE-ERGO calculator

tn =	**129,395**
coefficients	
Kn =	0,11
Ka =	1,3
ts =	147,8985
Kd =	0,15

Figure 3 shows a part of Z2 the REFA norming methodology form with detailed statistical data processing. The resulting norm amounts to 129.3s.

Zy	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	ΣL / n			
m_z																Σt_i / n	$\bar{t}_i$	$t = \bar{L}/100 * \bar{t}_i$	Vrsta ča
																1040	104	67,8	
L	95	105	95	100	115	95	100	105	115	115						10			
t_i	66	65	66	66	65	66	64	65	64	65						652	65,20		
F																10			
																1040	104	23,5	
L	95	105	95	100	115	95	100	105	115	115						10			
t_i	23	23	23	22	22	22	22	23	23	23						226	22,60		
F																10			
																1040	104	38,0	
L	95	105	95	100	115	95	100	105	115	115						10			
t_i	37	37	37	36	36	37	37	37	36	35						365	36,50		
F																10			

$\bar{t}_c = \Sigma t_c / n = 124$ HM	$\Sigma t_c = 1243$ HM	n = 10	Zbir vremena za ciklus tc	126	125	126	124	123	125	123	125	123	123					
s = 1,3 HM	$v = s / \bar{t}_c = 1\%$	ε = 0,7%	ε' =	n' = #DIV/0!													Σ t =	129,3 HM

Figure 3: Part of Z2 the REFA

The methods MTM-1 and MTM-2 are excellent methods for analyzing clothing production, but we opted for a simpler MTM-2 method. Figure 4. shows a part of MTM-2 form with results. When calculating the norm, because only movements are analyzed, it is necessary to add Performance Rating and Allowance Factor.

Left hand	Symbol	TMU	Symbol	Right hand
takes the top collar	GB 30	14		
takes the stand collar	GB 45	18		
places the parts	PC	26	PC	places the parts
sewing				sewing
release	GW 3	1	GW 3	release
		18	GB	takes the scissors
cutting and turning the stand collar	C	15	C	cutting and turning the stand collar
places the part	R	6	R	places the part
sewing				sewing
release	GW 3	1	GW 3	release
TMU		99		
SMV = Basic Time×Performance Rating×Allowance Factor/100 = **128.8 s** = 2.12 min				

Figure 4: Part of MTM-2 form

The analysis of the application of 3 norms methods on the same technological operation is shown in the Table 2.

Table 2: Analysis of the application of 3 methods

Method	Norm (s)
Method is with three coefficients	129.39
REFA	129.3
MTM-2	128.8

3. CONCLUSION

In this papir we by applying threedifferent norms methods, we obtained similar results, which indicates that we can use all this methods in the production of garments. The Method with three coefficients and REFA are much simpler and faster for workplace analysis than MTM-2. MTM-2 requires more experience in analysis.
In order to increase productivity and efficiency, it is necessary to deal with work analysis and target norms in order to standardize all workplaces in garment production. Targeted standards will shorten production time and reduce production costs. In order to achieve this, regardless of which method we use, it is necessary to perform an analysis of the movements as with the MTM method and thereby reduce or combine the movements, because in the production of clothes we have a lot of manual work.

REFERENCES

[1] Schenk, M., Wirth, S., Müller, E. (2014). *Fabrikplanung und Fabrikbetrieb: Methoden für die wandlungsfähige, vernetzte und ressourceneffiziente Fabrik*, Springer Vieweg, Berlin, Heidelberg

[2]de Almeida, D.L.M., Ferreira, J.C.E. (2009). Analysis of the Methods Time Measurement (MTM) Methodology through its Application in Manufacturing Companies, *Flexible Automation and Intelligent Manufacturing*, FAIM, Middlesbrough

[3] Colovic, G. (2010). *Management of technology systems in the garment industry*, Woodhead Publishing Ltd., Elsevier, Cambridge

[4] Morlocka, F., Kreggenfelda, N., Louwb, L., Kreimeiera, D., Kuhlenkötter, B. (2017), Teaching Methods - Time Measurement (MTM) for Workplace Design in Learning Factories, *Procedia Manufacturing*, 9. pp. 369 – 375, Elsevier

[5] Gorobets, V., Holzwarth., V., Hirt, C., Jufer, N., Kunz, A. (2021). A VR-based approach in conducting MTM for manual workplaces, *The International Journal of Advanced Manufacturing Technology*, 117:2501–2510, Springer

[6] https://refa-international.com/

[7] Buresa, M., Pivodova, P. (2015). Comparison of Time Standardization Methods on the Basis of Real Experiment, *Procedia Engineering*, 100, pp 466 – 474, Elsevier