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Comparison of Time Standardization Methods on the Basis of Real Experiment

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Abstract

The paper focuses on mutual comparison of currently most common methods for time standardization. For comparison of selected methods an experimental research in conditions of automotive assembly production was performed. Compared methods were direct measurement according to REFA methodology and two predetermined time systems MTM-1 and BasicMOST. Mutual comparison of results obtained by means of those 3 methods was performed. The experiment was performed on 21 assembly workplaces where time span of analyzed operations oscillated between 4 to 29 seconds. The main goal of the research was to demonstrate reliability, mutual accuracy and deviations of selected methods. A hypothesis needed for verification was stated, that individual methods should have maximal accuracy deviation ± 10%. Findings about time demands for performing the analysis according to selected method was a partial goal of our research.

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1. Introduction

Production represents the heart of each industrial company. Its effective control and planning is the key factor for whole company success and prosperity. Main resources appearing in production are material, human and financial. These resources are closely connected and in time they undergo transformation, which makes the time consumption during production one of the most observed parameters. There are different methods for observing and

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measuring time demands. Basically we can divide these into measuring methods and calculating methods [1]. Measuring methods have some limitations and their usage is possible only in production that already exists. In this case we can measure time directly with stopwatches, indirectly from video, or statistically from frequency of observed activities.

The direct measurement method used in our experiment is called REFA. The REFA (Reichsausschuss für Arbeitszeitermittlung) is an abbreviation for the name of a German organization which is involved in organization and work improvement in industrial companies. Although the organization's portfolio of services is great, it is most commonly known for time studies. This method describes concrete methodological approach to direct time measurement with stopwatch. Differences of the REFA method from the others are in specific time division, calculation of total time, determination of performance level or in special time units called hunderte minutes [2].

Predetermined time systems can be considered as calculating methods. One of the main benefits of these methods is the possibility of using them already during preproduction phases, when the workplace still does not physically exist. Furthermore these methods are very useful as a tool for optimization and rationalization.

There are quite a lot of predetermined time systems existing these days. The reason is historical. Since 1948, when the MTM system was officially introduced, many variations that ease the analysis have been developed. For example UAS system was specifically developed for serial assembly production or batch production and in these days is very common in automotive industry [3]. On the other hand the MEK system is more suitable for piece production [4]. Also many of these predetermined time systems have been modified in order to respect ergonomic parameters of the job like ErgoMOST or ErgoSAM [5, 6]. The predetermined time systems are typical for automotive industry as mentioned before but also many other applications can be found in other types of industry e.g. textile [7], wood processing, furniture production etc. In this paper we will focus on the possibility of using the two probably most frequently used predetermined time systems (MTM-Method Time Measurement and MOST-Maynard Operation Sequence Technique) for production planning and their mutual comparison.

The MTM method was developed by Maynard in the United States in 1948. One reason why the MTM system became the most widespread is probably due to the fact that it was made publicly available with no economic or judicial claims on behalf of the inventor. The MTM Association for Standards and Research was founded in the United States in 1951. The managing director of the Volvo Car Corporation took the responsibility of introducing MTM in Sweden, and the first installation of MTM was made at the Volvo engine factory in Skövde in 1950. The work led to the foundation of the Swedish MTM Society in 1955 [8]. The strong interest in the MTM system may be explained by the potential it holds in the rationalization of work. Nowadays, the MTM system and its modern versions are widely used in many companies to calculate production times for line balancing, line pace setting and in calculation of business tenders.

An analysis using the basic level of MTM, MTM-1, is a very time-consuming task. This led already during the 1950s to initiatives to combine MTM data in order to simplify and thus decrease time needed for analysis. The Swedish MTM society took the initiative to a task that led to the development of MTM-2 that in 1965 was accepted by the International MTM Federation as an international standard [9]. Similar systems, one of which is MOST, have been developed for much the same reason.

The MOST method was developed by K. B. Zandin from Maynard Corporation company in 1980. The main idea of this method is that we can define the same motion sequences for the majority of all operations. Individual motion sequences are described by basic equations which occur during manipulation of objects. Within these motion sequences single motion activities have their firm place in the sequence. [10]

MOST has similarly like MTM different levels of complexity. Maxi MOST is characterized by the highest level of operation analysis complexity. It is suitable for operations which are performed less than 150 times per week. Recommended duration of operation ranges from 2 minutes to hours. BasicMOST is the most common level of analysis which is used by the majority of operations. These operations are of a middle level of complexity which means that they are performed more than 150 times but less than 1500 times per week. Operations in this category usually last from several seconds to 10 minutes. Mini MOST is the lowest and most detailed level of analysis. This form of analysis is suitable for operations performed more than 1500 times per week and their average durations are shorter than 1.6 minutes, usually from 2 to 10 seconds [10]. The sequences of BasicMOST represent the two basic activities necessary to measure manual work: General Move and Controlled Move. The two remaining sequence models include in BasicMOST were added to simplify the measurement of hand tool use and activities with mental process and the movement of objects by manual crane.