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Research Article

Analyzing a Furniture Assembly Process Using Maynard Operation Sequence Technique (MOST)

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Abstract – Productivity enables a business to meet demands faster and get its products to market in less time. Accurate determination of production time is important for continuity in productivity. Predetermined time systems (PTS), one of the work measurement methods, is an evaluation system based on operator motion analysis. Maynard Operation Sequence Technique (MOST), one of the most popular PTS methods, is based on the idea that identical movement sequences can be defined for most operations. As in many other fields, increasing competition in the furniture industry has led to the need to improve manufacturing processes and increase their efficiency. Methods used to improve manufacturing processes such as MOST are also critical in furniture manufacturing. In this study, a furniture assembly process was analyzed using the MOST method for time management and productivity improvement strategies, and assembly time was determined. The related process was analyzed using basic MOST, and the results were compared with the stopwatch method. As a result of the comparison, a difference of 3% was found between the two methods.

Keywords – Standard time, Productivity, PTS, MOST, Furniture

I. INTRODUCTION

High productivity is vital in meeting customer demand. Productivity enables a business to meet demands faster and get its products to market in less time. Production time is essential to ensure continuity in productivity. Work study approaches are utilized in determining standard production time [1]. Work study is a discipline that provides more economical working conditions, creates systematic solutions to problems, and improves the process.

Predetermined time systems (PTS), one of the work measurement methods, is an evaluation system based on operator motion analysis. The PTS aims to establish the standard required for a worker to complete a task in a given time frame [2], [3]. MTM (Methods Time Measurement) and MOST (Maynard Operation Sequence Technique) are the two most popular PTS methods widely used in work processes. MOST was developed by K. B. Zandin in 1980, based on the idea that the same sequence of actions can be defined for most operations [3]. MOST is generally applied to improving or creating a process, especially in the manufacturing industry. Kumar et al. (2020) utilized lean manufacturing and the MOST method to reduce cycle time and improve workforce utilization. As a result of the study, an 11.23%

increase in productivity was determined [4]. Another study used the MOST method to analyze manual work operations and evaluate work efficiency [5]. Viharos and Bán (2020) compared the widely used predetermined movement time systems MTM and Basic MOST methods [6]. Bures and Pivodova (2015) compared the most widely used methods for time standardization in automotive assembly conditions. Direct measurement (REFA), MTM-1, and Basic MOST methods were selected for comparison [7]. PTS methods also have an important application area in the textile industry. Demirci and Gündüz (2020) used value stream mapping and MTM-UAS methods in their textile industry study. As a result of the study, it was reported that the lead time was reduced by 56% [8]. Kalkancı et al. (2018) analyzed an activity that may cause a bottleneck in the textile sector with stopwatch and MTM methods [9]. In another sector, Çolak et al. (2016) utilized the MTM method to improve production time in the white goods industry [10].

The furniture sector is an important field of activity for the whole world. As in many areas, increasing competition in the furniture industry has led to the need to improve manufacturing processes and increase productivity. Methods used to improve manufacturing processes such as MOST are also critical in furniture manufacturing. In this study, a furniture assembly process was analyzed using the MOST method for time management and productivity improvement strategies, and assembly time was determined.

II. METHODOLOGY

Synthetic Time Systems (PTS) are one of the methods used for work measurement. PTSs are advanced techniques used to calculate the time required to complete various tasks using predetermined time standards for various actions without relying on direct observation and measurement. Fundamental human body movements are categorized based on their structural characteristics and performance in various contexts. The relevant timings are determined within the parameters of these classes. The amount of time needed for a worker to finish a task at a specific level of productivity is then determined using these timeframes [11].

One of the PTS techniques, MOST, determines the time required for an operator to perform a task. For this, an activity is broken down into movement elements, and time values, known as TMUs, are calculated [12]. This study analyzed sofa base frame assembly using the MOST method. The related process was analyzed using basic MOST, and the standard time was compared with the stopwatch method. Three categories of movement: “general move, controlled move, and tool use” are the main focus of basic MOST. MOST is widely used in industry to estimate the time required for an operator to complete a task. Each action is broken down into elements, and motion analysis is performed using MOST. The TMUs for each operation are summed, and the total is multiplied by 10. 1 TMU is equivalent to 0.036 seconds. The standard time is calculated by adding allowance values to the total time. Basic MOST sequence models are given in Table 1.

Table 1. Basic MOST sequence models

Activity	**Sequence model**	**Notations**
General Move	ABG ABP A	A-Action distance B-Body motion G-Gain control P-Placement
Controlled Move	ABG MXI A	M-Move control X-Process time I-Alignment
Tool Use	ABG ABP * ABPA	*F-Fasten *L-Loosen *C-Cut *S-Surface treat *M-Measure *R-Record *T-Think

III. RESULTS AND DISCUSSION

Table 2 shows the operations and the TMUs calculated according to the sequence models. As a result of the analysis of each operation of the sofa base frame assembly work, the type of sequence models of general move, controlled move, and tool use were observed. Normal time was calculated by multiplying TMUs by 0.036. Standard time was determined by adding a 12% allowance to the normal time. As a result of the MOST analysis, the standard time required to complete the assembly process was determined to be 379 seconds.

Table 2. Most analysis of the base frame assembly

No.	Operation	Sequence Model	TMU	Normal time (seconds)	Allowance (%12)	Standard time (seconds)
1	Bring side frames and support parts	A6B0G5A6B0P1A0	180	6.48		
2	Place in assembly order	A6B0G3M3X0I18	300	10.8		
3	Assemble side frames	A3B0G1A3B0P48F96A3B0P1A0	1550	55.8		
4	Fixing the center support to the side frames	A3B0G1A3B0P24F48A3B0P1A0	830	29.88		
5	Rotation of the base frame	A1B3G3A1B3P1A0	120	4.32		
6	Bringing and fixing the support platform	A6B0G1M3X0I10A0	200	7.2		
7	Fixing with staples	A3B0G1A3B0P48F144A3B0P1A0	2030	73.08		
8	Bringing wooden furniture leg supports and feet	A6B0G10A6B0P15A0	370	13.32		
9	Screwing the leg supports	A3B0G1A3B0P60F120A3B0P1A0	1910	68.76		
10	Screwing the furniture feet	A3B0G1A3B0P60F120A3B0P1A0	1910	68.76		
		Total	9400	338.4	40.6	379

Table 3 compares the basic MOST results and the standard time determined by the stopwatch method. As a result of the comparison, a difference of 3% was found between the two methods. Standard time measurement by stopwatch method refers to the practically measured time to complete a specific task. This method considers the actual working conditions and the worker's rhythm. Basic MOST is a motion-based analysis method and refers to the estimated time. This method analyzes operations and includes more details than the stopwatch method. Such differences in the working environment may be due to rhythm variations, task pressure, or experience factors.

Table 3. Comparison of basic MOST time and standard time

Standard time (seconds)	Basic MOST time (seconds)
367	379

IV. CONCLUSION

This study analyzed the sofa base frame assembly process with the MOST method for time management and productivity improvement strategies. The related process was analyzed using basic MOST, and the standard time was compared with the stopwatch method. The standard time required to complete the assembly process was determined as 379 seconds in the MOST method and 367 seconds in the stopwatch method. The difference is about 3%. This difference indicates a high degree of compatibility between the two methods. This difference between MOST and the stopwatch method is acceptable and indicates that the process was generally planned correctly. The related assembly work determined that values very close to the stopwatch method can be reached with basic MOST analysis. Accordingly, using time systems such

as basic MOST in the furniture industry will provide significant advantages in identifying improvement opportunities in the process, time management, and productivity analysis. This research is limited to the process analyzed. It can be applied to each operation to analyze different processes. The standard time calculated with the MOST technique can provide a basis for identifying opportunities for improvement in the process. Estimating the appropriate standard time for each activity is important for effective process planning. The research can be extended to other production systems in the same or different sectors.

REFERENCES

[1] C. Ünal and K. Narin, "a Case Study on the Investigation of Knitted Fabric Garment Production With Pre-Determined Time Systems," *Tekst. ve Muhendis*, vol. 30, no. 132, pp. 289–296, 2023.

[2] R. O. Schmid, "An analysis of predetermined time systems," 1957.

[3] K. B. Zandin, MOST work measurement systems. *CRC press*, 2002.

[4] R. Kumar, P. Kalra, and S. Kant, "Productivity enhancement of assembly line by using Maynard operation sequence technique after identification of lean wastages," *Int. J. Product. Qual. Manag.*, vol. 29, no. 4, pp. 463–482, 2020.

[5] L. Ma et al., "A framework for interactive work design based on motion tracking, simulation, and analysis," *Hum. Factors Ergon. Manuf.*, vol. 20, no. 4, pp. 339–352, 2010.

[6] Z. J. Viharos and B. Bán, "Comprehensive comparison of MTM and BasicMOST, as the most widely applied PMTS analysis methods," *17th IMEKO TC 10 EUROLAB Virtual Conf. "Global Trends Testing, Diagnostics Insp. 2030,"* pp. 393–401, 2020.

[7] M. Bures and P. Pivodova, "Comparison of time standardization methods on the basis of real experiment," *Procedia Eng.*, vol. 100, no. January, pp. 466–474, 2015.

[8] Ö. Demirci and T. Gündüz, "Combined Application Proposal of Value Stream Mapping (Vsm) and Methods Time Measurement Universal Analysis System (Mtm-Uas) Methods in Textile Industry," *Endüstri Mühendisliği*, vol. 31, no. 2, pp. 234–250, 2020.

[9] M. Kalkanci, "Bornoz Üretiminde Bir Operasyon İçin MTM Metodu (Metot Zamanlarının Ölçümü) İle Kronometre Yönteminin Karşılaştırılması," *Avrupa Bilim ve Teknol. Derg.*, vol. 13, pp. 77–83, 2018.

[10] M. Çolak, G. Aydın Keskin, B. Çelik, and S. Avcı, "Metot Zaman Ölçümü (MZÖ) Yöntemi İle Üretim Süresinin İyileştirilmesi: Beyaz Eşya Yan Sanayisinde Bir Uygulama," *SAÜ Fen Bilim. Enstitüsü Derg.*, vol. 20, no. 3, pp. 417–424, 2016.

[11] M. Kurt and M. Dağdeviren, İş Etüdü. *Dünya Tıp Kitabevi*, 2020.

[12] M. Wani and R. Pant, "Implementation of Single minute exchange of die in motor manufacturing unit," *Int. Res. J. Eng. Technol.*, vol. 04, no. 11, pp. 1300–1310, 2017.