

Determining the critical factors of unnecessary overtime at manufacturing industries

Amir Hamzah Abdul Rasib¹, Mussyahirah Musazali²

¹Faculty of Mechanical and Manufacturing Engineering Technology, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

*Corresponding e-mail: ¹amir.hamzah@utem.edu.my

Keywords: Overtime; Lean Manufacturing; Operation

ABSTRACT – Overtime is a prevalent scenario in the manufacturing industry. Overtime is used in many parts of the world to accelerate the project schedule and to achieve the daily output. However, if poorly managed, overtime could quickly outstrip financial gains. Motivated by this concern, the purpose of this study is to develop a Non-value Added Overtime (NAO)'s framework and the critical factors of NAO define as an unnecessary activity that needs to be minimized or eliminated. The method used to determine the critical factors of NAO is obtained from the previous case studies and then the factors involved in the concept of input-output manufacturing. Thus, the equation can be created, referring to the framework.

1. INTRODUCTION

The manufacturing industry is dynamic due to the increasing uncertainties in technology, budgets, and development process, which resulted in more and more competition among them. Despite this, one seems to remain is three main criteria, which are cost, quality, and time, have always been the priority in every production undertaken. In this regard, overtime defines as working hours that exceed regular mandatory hours by corresponding to the International Labor Organization (ILO) [1]. Overtime is used to increase production and fulfill the order volume of the customer. However, overtime may somehow increase operating costs and may negatively impact the physiological health of employees.

This paper aims to establish a framework for the critical factors of Non-value added Overtime (NAO) in the method of operational aspect. The crucial factors of NAO are established through the study of the literature on production operations, and the results come out from the framework is the NAO's equation. The NAO's equation then can be used in the industry to know whether the overtime is necessary or not. In this study, a new framework has been developed from the previous framework. Ebrahim et al. [5] presented a framework, however, the research gap is found between the Processing Time, which the previous study did not study in detail on the factors of the unnecessary overtime. Thus this study comes out with the critical factors of NAO from a detailed review of the elements of manufacturing in the elements of operations in manufacturing and a connection with the current manufacturing performance steps.

2. METHODOLOGY

This segment addresses the approach used to clarify the crucial factors of NAO. As stated earlier, the critical factors of NAO were explained by a detailed review of the literature studies on the aspects of production processes. In that respect, a total of 30 papers published in the last five years were reviewed to classify the elements that are likely to contribute to NAO. The literature analysis was used to illustrate the selection of a significant factor, including the explanation of eight Lean Manufacturing (LM) wastes (i.e., Transportation, Motion, Defect, Waiting Overproduction, Inventory, Over-processing, and Unutilized potential) and measurable elements.

In the second level, related phrases or words used in the problems addressed were found by the Microsoft Office Excel application platform. Time is an essential element of resource use in this regard. Nazarian et al. [2] ensured that most work in production processes is based on the time it happened and the time of purely value-added processes. In this study, all elements observed were categorized into the eight wastes of Lean Manufacturing (LM). Ohno [3] identified the eight types of waste in the production process. Then, all time-related elements were divided into two categories: measurable and non-measurable components. By referring to Hair et al. [4], measurable is measuring measurable objects or physical quantities such as mass, temperature, and length. Then, NAO's critical factors were modified through measurable elements. Primarily focused on the principle of the 'Input-Output (IO)' design, there are three pathways in this model: i) Inputs, ii) Operations, and iii) Outputs. Besides, the critical factors of NAO were established through the activity route. Finally, the manufacturing processes were divided into three main stages: i) Pre-process, ii) In-process, and iii) Post-process. The overall methodology is as shown in Figure 1.

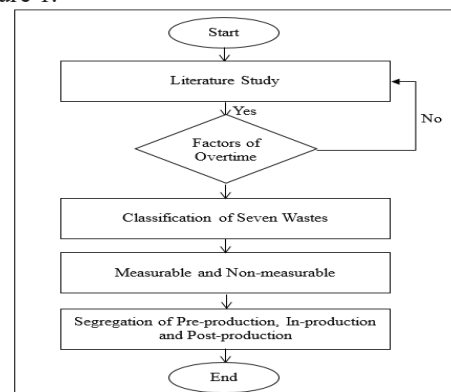


Figure 1: Process Flow of Studies

3. RESULTS AND DISCUSSION

Figure 2 outlines the conceptual NAO Factor Model built through the fundamental theory of 'Input-Output (IO)' manufacturing, which focuses on operations. NAO's critical factors have been established by visual elements in the three phases of manufacturing operations.; i) Pre-process, ii) In-process, and iii) Post-process. Changeover time, Processing Time, and Non-conformance Time were clarified as the main elements in the Hidden Time Loss (HTL) components due to previous studies [5].

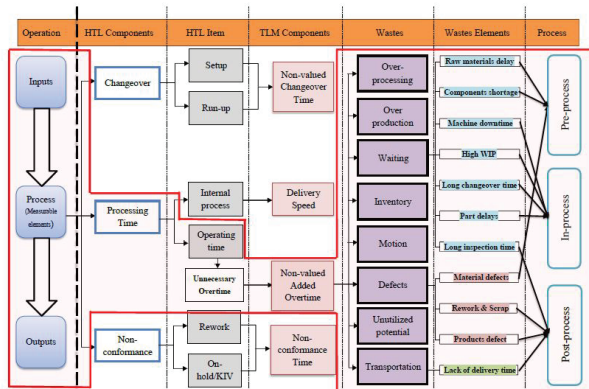


Figure 1 Proposed model of NAO's factors

From Figure 1, the overall framework is obtained from the previous framework. However, for the wastes and waste elements, the studies are collected from various past case studies. Thus, from the framework indicated, the study comes out with an equation on how the NAO's factors will contribute to the organization's profit and profit loss. The NAO's calculation will be measured in terms of time because the factors related to the NAO are calculated on how long does it works, whether in seconds or minutes. The equation involved is stated below:

$$NAO(s) = \alpha(s) + \beta(s) + \gamma(s) \quad (1)$$

Where,

NAO : Non-value Added Overtime in seconds,

α : Pre-process in seconds,

β : In-process in seconds,

γ : Post-process in seconds

4. CONCLUSION

The crucial factors of NAO have been explained by referring to a detailed review of the literature studies in the background of the method in operations of manufacturing and a model of NAO factors is proposed. As the time-based strategy is one of the most discussed issues in studying the manufacturing elements found in the three pathways of operations in manufacturing; i) Pre-production, ii) In-production, and iii) Post-production. Therefore, the development of an equation of NAO will be the next stage of this research.

ACKNOWLEDGEMENT

The author would like to extend special thanks to FRGS-RACER/2019/FTKMP-COSSID/F00412 grant, Fakulti Teknologi Kejuruteraan Mekanikal dan Pembuatan and Fakulti Kejuruteraan Pembuatan, Universiti Teknikal Malaysia Melaka (UTeM), for the use of the facilities and useful data in order to complete this study.

REFERENCES

- [1] J.-W. Seo, Better Work Discussion Paper No. 2 Excessive Overtime, Workers, and Productivity: Evidence and Implications for Better Work, no. 2. 2011.
- [2] E. Nazarian, J. Ko, and H. Wang, "Design of multi product manufacturing lines with the consideration of product change dependent inter-task times, reduced changeover and machine flexibility," *J. Manuf. Syst.*, vol. 29, no. 1, pp. 35–46, 2010.
- [3] T. Ohno, *Toyota production system: beyond large-scale production*. 1988.
- [4] J. F. Hair, M. L. D. S. Gabriel, and D. Silva, "Development and validation of attitudes measurement scales: fundamental and practical aspects," *RAUSP Manag. J.*, vol. 54, no. 4, pp. 490–507, 2019.
- [5] Z. Ebrahim, A. H. Abdul Rasib, and M. R. Muhamad, "Understanding Time Loss in Manufacturing Operations," *Appl. Mech. Mater.*, vol. 761, no. May, pp. 619–623, 2015.
- [6] Z. Ebrahim, A. Hamzah, A. Rasib, and M. R. Muhamad, Unnecessary overtime as a component of time loss overtime unnecessary overtime as a component, *J. Adv. Manuf. Technol.*, vol. 11, no. January-June, 2017.