Vol. 10, No. 2, 2024, pp. 332-336
DOI: https://doi.org/10.29210/020242665

Contents lists available at Journal IICET

JPPI (Jurnal Penelitian Pendidikan Indonesia)
ISSN: 2502-8103 (Print) ISSN: 2477-8524 (Electronic)

Journal homepage: https://jurnal.iicet.org/index.php/jppi

The effect of line balancing on the efficiency and effectiveness of shoe production at PT Wangta Agung

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Article Info

Article history:

Received Feb 21st, 2023
Revised Jan 22nd, 2024
Accepted May 03rd, 2024

Keyword:

Line balancing,
Efficiency,
Effectiveness,
PT wangta agung,

ABSTRACT

Business competition is increasing, companies must reorganize their business strategies and tactics every day in the era of globalization. The purpose of this study was to determine the effect of Line Balencing on the efficiency and effectiveness of shoe production at PT Wangta Agung. The research method used is descriptive research. Descriptive research is a type of research conducted with the main purpose of providing an objective description or description of the situation. The results of the research on the actual shoe production workstation configuration consisted of 15 work stations with a cycle time of 16 seconds. Analysis of sewing activity work time takes about 23.75 minutes for one additional operator to assist the two main operators in meeting the set targets. The increased capacity of the shoe-making production workstation consists of 7 stations that have a balance of 16 seconds of delay time with production efficiency with a yield of 87.5%.

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Introduction

Business competition is increasing, companies must reorganize their business strategies and tactics every day in the era of globalization. The essence of competition lies in how companies implement processes to produce products or services better, cheaper and faster than their competitors ((Rosita et al., 2020); (Sutanji & Sutandi, 2021); (Suliantoro & Nugrahani, 2015)). The nature of competition lies in how companies must reorganize strategies to be able to produce better, cheaper, faster products or services compared to other competitors. One of the things that affects production is the design of production activities. This design greatly affects the activities in the company. Production effectiveness is a term used to describe the circumstances or levels at which a company produces the largest units until it uses as few resources as possible. Area utilization in facility layout arrangements is the main thing in industrial layout design manufacturing ((Sofyan & Syarifuddin, 2018); (Ekoanindiyo & Wedana, 2012)).

PT Wangta Agung is one of the companies in Indonesia engaged in manufacturing, the main production produced is the manufacture of ardiles shoes. From the observations made, there is a waste of material handling in the production process, this is due to the layout of the facility that does not match the distance between one work station and another. Factory layout has a significant impact on company performance such as cost, material handling, work in process, inventory, lead time, productivity, and delivery performance ((Sakkung & Sinuraya, 2012); (Rosita et al., 2020); (Indrawati, 2020)). The genre of material that is not neatly organized causes congestion in the stream, which is what makes production activities between work stations

ineffective and efficient.In most manufacturing companies, workstation assignments must be programmed in the planning and scheduling of available capacity to achieve a level output file in meeting capacity planning objectives that maximize capacity utilization and maximize share of the market(Prabowo, 2016). The schedule ofwork or tasks in the factory shows the schedule for carrying out activities using resources or allocating facilities (Purwanto, 2021)The scheduling process is to sort the master production schedule (MPS) into the time-frame activities period required in the production process in fulfilling customer orders. The demand for the company's products comes largely from product orders, which are an attached function of marketing from various periods and are often received in unevenly fluctuating quantities (Meredith, J & Shafer, 2013).

The production line must organize individual processing or assembly tasks at the workstation in a way that facilitates the flow of materials or parts from the workstation to other workstations(Putra Pertiwi, 2019). So, an assembly line is a flow-oriented production system consisting of a set of linearly arranged work stations, a station is considered to be any point on the assembly line where a task is performed on the part. The time it takes to complete a task on each operation is known as runtime. The cycle time of the assembly line is predetermined by the desired level of production. This rate of production is regulated in such a way that the desired amount of the final product can be produced in a certain period of time ((Hsinchu, 2015); (Nur & Suyuti, 2017)).

Line balancing is a method of assigning a number of jobs to work stations that are interconnected in a track or production line so that each work station has a time that does not exceed the cycle time of the work station ((Ahyadi & Prahara, 2016); (Permadi, 2013); (Hilmi, 2015)). The balancing method is very important to make the production flow smoother. Line balancing is a tool that can be used to optimize workstations or production line throughput(Fudianto & Munir, 2017). This tool will help in reducing production time and maximizing output or minimizing imbalances between stations to achieve the run rate needed to maximize production flow. This can be done by equalizing the amount of work at each station (Zupan & Herakovic, 2015).(Assauri, 2018)defines this balancing as a group of otang or machines that perform sequential tasks in assembling a product given to each resource evenly in every production line, thus resulting in high work efficiency at each workstation. Effective and efficient production is a term to describe the state or rate, at which the company produces the largest number of units using as few resources as possible. The idea is as an effort to achieve a balance of task assignments at workstations so as not to overload the load of fish-fed stations (Tessalonika et al., 2021).Research conducted by (Agustira, 2019) states that the achievement of production targets is influenced by process time that exceeds the standard by 44.5%. The results of the hypothesis test calculation show that the process time that exceeds the standard has a significant effect on achieving production targets because t count 4.196 is greater than t table 1.96. With the application of using the line balancing method starting from 6 workstations to 3 work stations in the production process. The proposed layout using line balancing is more efficient at DS Collection because the results of the method are greater efficiency of 96% and optimal. The main purpose offtrack balancing is to reduce unproductive time on that trajectory as determined by the slowest operation Background-based (Sakiman et al., 2022)which has been explained above, this research will explain the effect of line balancing on the effectiveness and efficiency of shoe production at PT Wangta Agung.

Method

The type of research conducted, using descriptive research. Descriptive research is a type of research that is carried out with the main objective of providing a description or description of the situation. The research design used explains the situation faced today (Sugiyono, 2017). The location of the study is limited to the title variable, namely at PT Wangta Agung. Primary sumber obtained by researchers comes from books, articles, scientific journals as a comparison with the facts contained in PT Wangta Agung, while secondary sources come from request / order data for one year and output data for one year. Data processing in this study goes through the following stagesPerform a data adequacy test, data uniformity test conducted using bka and bkb, calculating raw time, calculates the cycle time of the work station required, and calculates the minimum amount of work, and calculating balance and efficiency.

Results and Discussions

Assembly Line Balancing or simply Line Balancing (LB) is a matter of assigning operations to workstations along assembly lines in such a way that the assignment becomes optimal in a sense. (Manaye, 2019)Since the introduction of the assembly line by Henry Ford, line balancing has been an optimization of production line issues to improve efficiency. The difference between optimal and suboptimal assignments can result in savings (or wastage) of up to millions of dollars per year (Falkenauer, unkown). The main purpose of line balancing is

to evenly distribute tasks across workstations so that machine-man idle time can be minimized. Line balance aims to group facilities or workers in an efficient pattern for; obtaining the optimal or most efficient balance of production or assembly process capacity and flow (Kumar & Mahto, 2013).

According to the findings, the actual raw materials for some parts of the shoe are cheaper than expected. This is due to several factors, including the following: the distance between the imagery in the estimation process is less consistent and precise compared to punching on the production floor. Analysis of the time and cost of sewing shoe upper is carried out by evaluating the performance of the sharing parties who have worked on the tailoring upper. Below will be written a table containing the difference in the cost and time of small shoe upper (31-34) and large shoe upper (35-38).

Table 1. Cost And Time Of Sewing Upper Shoes Small Size (31-34)

No	Criterion	Sewing divisions
1	Total upper-done shoes	12,750 pairs (100%)
2	Processing time	39 days
3	Price per unit	IDR 41,980.5

Table 2. Cost and time of sewing upper shoes Large size (35-38)

No	Criterion	Sewing divisions
1	Total upper-done shoes	26400 pairs (100%)
2	Processing time	94 working days
3	Price per unit	IDR 43,604.8

The data can give an idea that the workmanship of small-size and large-sized shoes has significant differences. From the data taken from the research site, data was obtained that for small size shoes produced 12,750 pairs of shoes with a processing time of 39 days. Sewing divisions of small sizes are able to work on orders in a shorter time and at a lower price per unit. The difference between the work on shoes.

The process of working on shoes, among them consists of the process of overwriting. Shoe overlocks is done by sewing around the bottom of the shoe upper using thread, which will be used to pull the top of the shoe so that it is positioned correctly on the shoe mold in the injection machine with the next process being the process of injecting the bottom sole of the shoe. In this PT, there are four machines contained in the manufacture of shoes and there are 2 employees who are given the main task of inspecting the existing parts. The main responsibility given is to inspect the top, then sew and it is expected that this process can complete a minimum of about 700 pairs of shoes within 7 jobs. Both operators received assistance from other operators who were given duties from the owner to be double employees. The task of this employee is to help in order to be able to complete daily tasks in accordance with daily targets in accordance with the direction of the operator. After the sewing process is the packing process, belowwill be explained about components in theworking element inthe packing process are:

Table 3. Components in The Working Element In The Packing Process

No	Work elements
1	Inject results
2	Cutting used inject
3	Carrying out the insole screen printing process
4	Installation of the insole stage
5	Installation of tescon on insole
6	Front strap mounting
7	Installation of suumpel paper
8	Full installation of the strap
9	Price tag installation
10	Cleaning of the bottom using SBP liquid
11	Get rid of small lint threads
12	Inner box assembly process
13	Installation for sticker box
14	Inner box closing process
15	Shoe wrapping

Table 4. Of Division Of Labor Elements

No	Workstations	Work elements	Station working time(seconds)
1	1	1,2	16
2	2	3,4,5	15
3	3	6	13
4	4	7,8	15
5	5	9,10,11	14
6	6	12, 13, 14	16
7	7	15	9

Efficient calculation

Efficiency =Total Product Turnaround Time

Number of work stations x cycle time

LE = 16+15+13+15+14+16+9

7 X 16

= 98

112

= 0,875 X 100% = 87, 5 %

The data and calculations above can be concluded that the efficiency results for shoe production produce high efficiency, which produces a value of 87.5%. The use of raw materials for the molding process is based on taking into account the standard use of raw materials in each part of the shoe. Specifically, the estimated amount of material required is compared with the existing factual conditions. Analysis of processing time for sewing activities takes about 23.75 minutes for one additional operator to assist the two main operators in meeting the set targets. This increase in the capacity of the shoemaking production workstation consists of 7 stations that have a balance of 16 seconds of delay time with production efficiency with a yield of 87.5%. So that in line with research conducted by (Agustira, 2019) states that process time that exceeds the standard has a significant effect on achieving production targets, with the application of using the line balancing method starting from 6 work stations to 3 work stations in the production process. The proposed layout using line balancing is more efficient at DS Collection because the results of the method are greater efficiency of 96% and optimal.

Conclusions

The research studies that have been carried out can be concluded that the actual configuration of work stations for shoe production consists of 15 work stations with a cycle time of 16 seconds. Analysis of the processing time of sewing activities takes about 23.75 minutes for an additional operator to help the two main operators to meet the targets that have been set. The increased capacity of the shoemaking production work station consists of 7 stations having a balance delay of 16 seconds with production efficiency with a yield of 87.5%.

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