



Analysis of the productivity value of hebel couple's work using work study method in building construction project pilot scale product development facility

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ABSTRACT

Construction is a field in the world of property in the part of planning and construction involving architects and civil engineering. Project is a complex activity and has a nature that cannot occur repeatedly, has a limited time using certain resources with the aim of producing a product. One aspect of a successful construction project is resources. This study uses the work study method, namely taking direct observation data in the field by comparing the work group that has been created with the 2008 SNI rules for working on 1 m² of hebel installation work. The result of this study is that the group that has the highest productivity value is work group 3 because the average volume produced is large compared to other groups. The most efficient working group is group 2 because with not too high costs it can produce an average volume of 15.6875 m² per day. The total wage paid for hebel wall installation work per 1 m² of work group 1 amounted to Rp 126,329.00. Group 3 (productive) amounted to Rp 183,166.00. Wages for work group 2 (efficient) amounted to Rp 166,467.00. Working group 2 is the most optimal working group. The volume of work that can be produced by the working group is 15.6875 m² hebel pairs in 1 working day.

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INTRODUCTION

Construction is a field in the world of property in the part of planning and construction involving architects and civil engineering. Project is a complex activity and has a nature that cannot occur repeatedly, has a limited time using certain resources with the aim of producing a product. One aspect of a successful construction project is resources. The resources in the project consist of man, materials, money, machine, and method.

In every construction project, project management is needed to manage all resources in the project so that the three predetermined constraints (*triple constraints*: cost, schedule, and quality) can be met. One of the determining factors of resources in the success of a project is the productivity of

its labor. Labor productivity largely determines success in a project implementation. The workforce is required to work well and efficiently, which is to work effectively in accordance with the number of working hours and can produce a volume of work.

The wall is a building structure that functions to separate and form a room. The wall also serves to protect people inside from all weather and wild animal attacks that may occur (Handayani, 2010)

The work of the hebel couple is one of the jobs in construction projects that have a large volume of work and a large number of workers. Labor productivity must be maximized to minimize the cost and time budget of the work. To get a high value of labor productivity, it is very necessary to avoid some activities that can hinder worker productivity. Examples of obstacles that can hinder worker productivity are chatting, breaks carried out during working hours, difficult access to materials, and not ready work areas. In addition, there are also several other inhibiting factors, including age, work experience, relationships between workers, and work group composition.

One method that can be used to calculate worker productivity is the *work study method*. This research itself was carried out in the Pilot Scale Product Development Facility Building Construction Project (Building No.34) - PT Biofarma (Persero).

Human resources are the most strategic element in a project organization. Increasing productivity can only be done by human resources. Conversely, human resources can also cause waste and inefficiency in various forms (Siagian, 2002). Given that in general projects take place with different conditions, then in planning the workforce should be equipped with productivity analysis and indications of influencing variables (Suharto, 1995).

In addition, the work carried out lazily or corruption of working hours than it should be, does not support development, but hinders the progress that has been planned. Conversely, effective work according to the number of working hours that should be and work in accordance with the work description of each worker, will be able to support progress and encourage smooth business both individually and as a whole (Muchdarsyah, 2003).

According to Ravianto (2006) the determination or measurement of productivity is divided into two forms as follows:

1. Simple form
Comparison between the number of work results with the length of work time becomes a productivity measurement tool.
Comparison between output or results with input or input, which is against hours / people becomes a measure of productivity.
2. Compound form
The comparison between the number of units that can be produced with the total number of sources used can be a measure of productivity

RESEARCH METHOD

In this study, the author uses the work study method as a research method, namely research by collecting data directly from observations in the field. The study was conducted by collecting primary data that was observed directly in the field and literature that was directly related to the research conducted.

Location and Time of Research

The research was carried out on the Pilot Scale Product Development Facility Building Construction project (Building 34) - PT Biofarma (Persero).

Data collection and monitoring of hebel pair work by each working group is carried out every one square meter on 1 working day for 4 days. Field monitoring is carried out every 08.00 WIB and 16.00 WIB.



Figure 1. Location map

Research Steps

The research steps are carried out sequentially and gradually. These steps are made so that data retrieval can run well. The steps taken include:

1. Preparatory stage
2. Field observations
3. Data retrieval
4. Data processing
5. Discussion

Data Collection Techniques

In the collection of primary and secondary data that serve as guidelines for determining the value of productivity obtained from the workforce during field observations. In this case use 2 ways, namely:

1. Direct observation and recording in the field. By observing and recording the productivity of each work group every day, data will be obtained which will later be a comparison of the effectiveness of the number of workers needed in the work of the hebel couple.
2. Literature Study. Done by reading lecture materials, final project books, journals, reference books related to making research.

In the author's observations in the field about the installation of hebel walls in buildings that have a simple area of 100 m² completed in approximately 5 working days by 8 people. So in determining the amount of simple retrieval time, the author uses the slovin method and gets the amount of simple retrieval time as much as 4 working days. The stages of research can be sorted as follows:

1. Define a workgroup
2. Record work time of 1m² hebel pairs per work group
3. Model the effective time of each workgroup
4. Determine the most productive and effective work groups
5. Calculates the volume of work that can be produced per day by each workgroup
6. Calculate the cost required for hebel pair work by each work group
7. Summing up the most optimal working group.

Variable Measurement

In practice, by setting standards for all variables in order to obtain accurate data. The limitations of variable measurement are as follows:

1. Business Hours. Observed through recording working hours by taking into account the same rest hours between one group and another.
2. Material quality. Checking work materials and tools so that differences in circumstances do not occur because they can affect worker productivity.
3. Time and location. Determine the same time and location to obtain accurate observation data.

RESULTS AND DISCUSSIONS

In this research study, data was used as a guideline to determine the productivity of each work group. Productivity figures are obtained from the comparison of the volume of work of hebel pairs with processing time. While work efficiency is the ability of the work group to utilize time as efficiently as possible to work.

Figures for worker efficiency and productivity are obtained from data during field observations but there are also some data ignored. This is done so that the data taken becomes valid without any factors being eliminated (lost). Neglected or unrecorded work that can affect productivity figures is preparatory work such as preparation of tools, marking the position of hebel pairs.

Metode Work Study

The first step before taking field data is the depiction of the work site, the determination of the sequence of steps of the hebel installation work, and the determination of the movement of workers, materials, and tools in the field. The steps of the work are made into a *job chart* which is then drawn a *flow diagram* of the *job chart*. From this *flow diagram* can be known the actual movement of workers in the field which will help in taking field data. The actual picture of the steps of workers in the field will be a reference for the movement of materials or materials. The movement of materials and these materials are called *String Diagrams*.

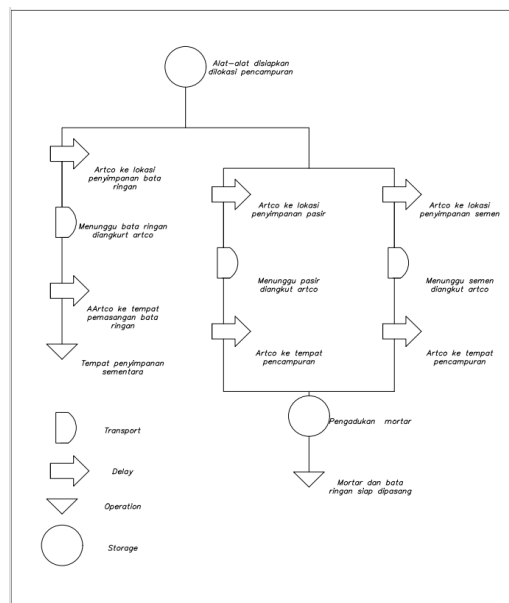


Figure 2. Job diagram chart

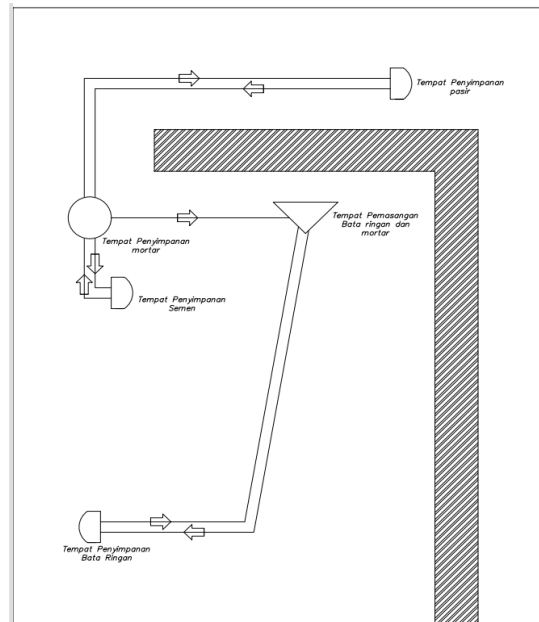


Figure 3. Flow diagram

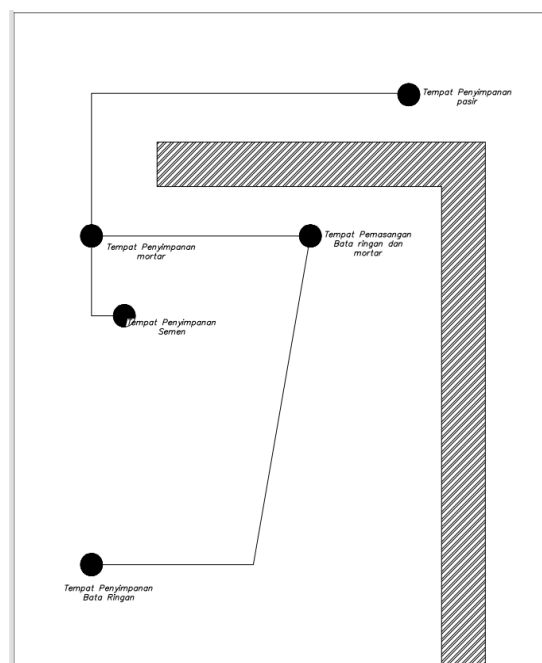


Figure 4. Chart strings

In this study, the diagram above is used as a guideline for taking time data in the field. Time data retrieval is carried out in the following steps:

1. The handyman moves the hebel from storage to a predetermined location.
2. Remove and add sand to the mix.
3. Remove and add cement to the stir.
4. Add water and mix mix.
5. Bring mortar mortar to hebel installation site.

6. Disassemble mortar at the hebel installation site.
7. Installing hebel pairs
8. Return artco to the place of stirring the mortar.

Data Retrieval

In collecting data for each working group, the author did it 2 times a day with a duration of observation for 4 working days. Then from the data obtained, the average results and duration of work for 4 days of observation were taken according to each working group per 1 m² of hebel wall installation. The working hours used in data retrieval are as follows:

1. Working group 1 (1 worker and 1 handyman): 08.00 and 16.00 WIB
2. Working group 2 (1 worker and 2 handymen): 08.00 and 16.00 WIB
3. Working group 3 (2 workers and 2 handymen): 08.00 and 16.00 WIB



Figure 5. Data retrieval

Work Model with Study Method

A work model is a chart that illustrates the effectiveness of a particular group by comparing the effectiveness of one group's time with another. The model is created based on time data recorded according to the sequence of jobs on the job diagram. While the *Multiple Activity Chart* is a model for recording the activity of more than one subject, where each subject is recorded on the same time scale so that it can show the relationship of one subject to another.

The work model is classified into 3 parts, namely *Work*, *Task*, and *Activity*. The work referred to here is the work of the hebel couple. Task is a type / type of work that consists of lifting materials, stirring PCs / cement, and installing hebel. While the *activity* itself is a classification of work or division of *tasks*.

Calculation of Work Productivity and Efficiency

Worker productivity is calculated based on the reference time of a group in completing a job. Days or hours are units commonly used in productivity values. In productivity analysis using the formula:

$$\text{Produktivitas} = \text{Output} / \text{Jam kerja}$$

The productivity of each work group in one day is as follows:

1. The 1:1 combination obtained an average of 9.1825 m²/day.
2. The 2:1 combination obtained an average of 15.6875 m²/day.
3. The combination of 2:2 obtained an average of 19,125 m² / day.

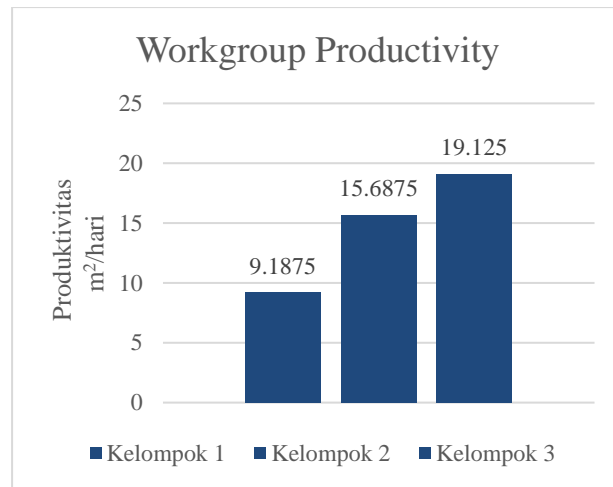


Figure 6. Productivity comparison

Cost Comparison Calculation

The determination of the most optimal work group in the field depends not only on the level of productivity and efficiency but also considers cost factors. Then in determining the cost of every 1m² of hebel wall pair work guided by SNI 2008 then it will be compared between one group with another group

In SNI 2008 for material and worker coefficients have been determined so that it remains only to enter the unit price according to the research location.

The mortar ratio used in this project is PC: PP of 1:4. Before calculating the cost required by the work group, the determination of the wage coefficient is first used as the standard worker in 1 day (OH) for the calculation of the unit price analysis of work. The OH value depends on the productivity of each work group. In this study, the standard working hours used were 8 hours per day. The OH coefficient obtained is used as a calculation of the cost of each hebel installation work per 1 m² by each working group. Comparison of the cost of hebel pairs per 1 m² according to SNI 2008 with one working group with another working group.

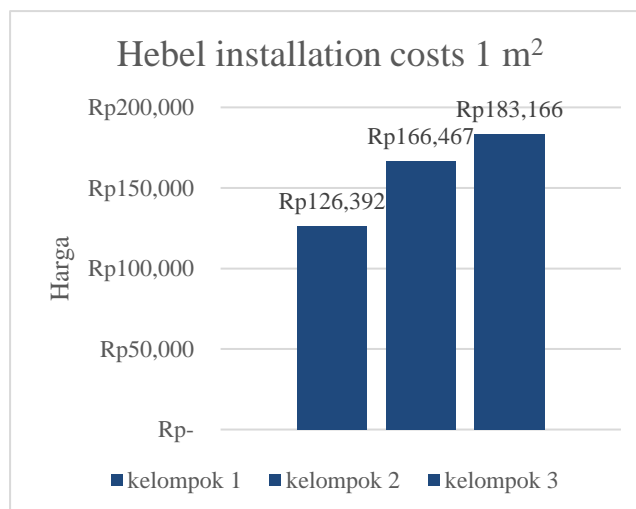


Figure 7. Cost comparison of hebel pairs 1 m²

CONCLUSION

Provide a statement that what is expected, as stated in the "Introduction" chapter can ultimately result in "Results and Discussion" chapter, so there is compatibility. Moreover, it can also be added the prospect of the development of research results and application prospects of further studies into the next (based on result and discussion). The conclusions obtained after making observations and taking data are then analyzed then obtained as follows; In this hebel installation work research, the productivity values of the work group were obtained as follows; Working group 1: 1.15 m²/h, Working group 2:1.96 m²/h, Working group 3:2.39 m²/h. The group that has the highest productivity value is work group 3 because the average volume produced is large compared to other groups. The most efficient working group is group 2 because with not too high costs it can produce an average volume of 15.6875 m² per day. The total wage paid for hebel wall installation work per 1 m² of work group 1 amounted to Rp 126,329.00. Group 3 (productive) amounted to Rp 183,166.00. Wages for work group 2 (efficient) amounted to Rp 166,467.00. Working group 2 is the most optimal working group. The volume of work that can be produced by the working group is 15.6875 m² hebel pairs in 1 working day. The productivity of the hebel pair's work is disrupted due to areas that have not been sterilized from other work remnants and difficult access to materials. If the project wants to accelerate performance then the combination of work group 3 but the costs incurred are high, if productivity performance is to be optimally used a combination of work group 2, and a combination of work group 1 can be used if the project wants cost savings.

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