

Analysis of Factors Affecting Labor Productivity in Drainage Channel Rehabilitation Project in Ubud District

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ABSTRACT

In managing the use of labor effectively, contractors must understand worker productivity. Labor productivity is an important factor in the efficiency of a construction project and can have a significant impact on project performance. This study aims to assess the effective, ineffective, and contributing working time of the Drainage Rehabilitation Project in Ubud Regency and to identify the factors that affect the productivity of the workforce on this project. The methodology used was productivity ratings, which were categorized into three groups: effective working time, contributory working time, and ineffective working time. The results showed that during the five days of observation, effective working time amounted to 83 hours and 6 minutes, ineffective working time was 22 hours and 20 minutes, and contributory work time was only 5 hours and 36 minutes. Key factors that affect productivity include working hours and labor behavior, such as being late, ineffective time spent smoking, conversing with coworkers, and leaving work zones. In addition, productivity decreased on Fridays due to shorter working hours related to religious observance, resulting in an average project productivity of only 72.58%.

INTRODUCTION

The overall success of a construction project is influenced by the success of each job in it, and one of the key factors is labor productivity. According to (Norjana dan Zulfiati, 2020), labor productivity in construction projects is the main element that determines the success of construction work. The overall success of a project depends largely on the success of each stage involved in it. One of the important aspects that affects this achievement is labor productivity. Productivity in construction projects can be affected by a variety of factors, including the quality of the workforce working directly in the field. To measure productivity, there are several methods, such as Productivity Rating, which groups worker activities into three categories: Essential Contributory Work, Effective Work, and Ineffective Work.

Human resources, especially workers who carry out technical tasks in the field, play a crucial role in the success of construction projects. According to (Damayanti dan Sitompul, 2021), human resources are one of the key factors in determining the success of a project. This study aims to identify the effective time, ineffective time, and contribution time in the Drainage Channel Rehabilitation Project in Ubud District as well as the factors that affect labor productivity. Thus, this study examines "Analysis of Factors Affecting Labor Productivity in Drainage Channel Rehabilitation Project in Ubud District" to be a guide for worker management in construction companies in achieving optimal work productivity.

In the construction industry, labor productivity plays a crucial role in determining the overall success and efficiency of a project. Effective labor management not only ensures timely project completion but also optimizes resource allocation and minimizes unnecessary costs. However, labor productivity is influenced by various internal and external factors, including work habits, site conditions, managerial practices, and socio-cultural elements such as religious observances. In regions with high cultural and religious adherence, such as Bali, these factors can significantly impact daily productivity patterns. Therefore, it becomes essential for contractors and project managers to have an in-depth understanding of labor behavior and working time utilization in order to implement strategies that enhance workforce efficiency. This study focuses on the Drainage Rehabilitation Project in Ubud Regency as a case study to analyze labor productivity, assess time distribution during work hours, and identify the key factors that contribute to inefficiencies on site.

LITERATURE REVIEW

Work Productivity

Productivity is a comparison between the results achieved and the total resources used (inputs), which are related to productive mental attitudes, including: regarding attitude, spirit, motivation, discipline, creativity, innovative, dynamic, and professionalism (Wijaya, 2021). Labor productivity measures the extent to which the work results achieved are proportional to the contribution of labor in a given unit of time. (c) explain that productivity reflects the relationship between output (the amount of goods and/or services produced) and inputs (the amount of labor, capital, land, energy, and other factors) required

to achieve these outputs. Various methods can be used to measure productivity, such as Productivity Rating, where worker activities are categorized into three groups: Essential Contributory Work, Effective Work, and Ineffective Work (Norjana dan Zulfiati, 2020). Efficiency in time, materials, and labor, as well as improvements in work systems, production techniques, and labor skills, can improve productivity. In other words, productivity reflects how effective workers are at producing output; The more output produced by workers, the higher the productivity level.

Factors Affecting Labor Productivity

In an effort to increase worker productivity, a company needs to study and pay attention to things that affect work productivity (Sinungan, 2005). Labor is one of the important things in the implementation of a project because it has a considerable influence on the financing and completion time of a construction project (Hernandi dan Tamtana, 2020). Labor productivity is a comparison between the results of work achieved and the participation of labor unions over time. According to (Daryanto dan Rahardjo, 2012), productivity is a concept that describes the relationship between output (the number of goods and or services produced) and the inputs (the amount of labor, capital, land, energy, and other factors) used to achieve these results. There are many methods that can be used to measure productivity, such as Productivity Rating, where worker activities are grouped into three, namely Essential Contributory Work, Effective Work, and Ineffective Work (Norjana dan Zulfiati, 2020). If this increase in productivity is only possible by an increase in efficiency (time-materials-labor) and work systems, production techniques and an increase in the skills of the workforce. So, productivity itself is a picture of the ability of workers to produce output. The higher the output produced by a worker, the higher the productivity level of that worker. Maximum results, such as getting good quality work, low project costs, short time and guaranteed safety can be obtained if the project is implemented effectively and efficiently (Ricson, 2013).

Labor Productivity Measurement

To evaluate the effectiveness of each employee's performance, it is important to conduct productivity measurements. Typically, these measurements are generally accepted by referring to a physical recording system per individual or per hour worked, as well as using time measurement methods such as hours, days, or years. One way to assess the level of labor productivity is to apply a method that groups worker activities. In this study, observations were made through the productivity rating method, where worker activities are categorized into three groups: Essential Contributory Work (essential work), Effective Work (effective work), and Not Useful (ineffective work).

1. Essential contributory work, which is work that is not direct, but part of the completion of the work. For example, waiting for other handymen to do not work, Transporting equipment that lives with work, Reading project drawings, Receiving job instructions, and Discussing work.

2. Effective work, which is when workers do their work in the work zone. Effective time is the time when workers perform activities that can be qualified as working.
3. Not useful work, which is activities other than the above that do not support the completion of work (not working). Such as leaving the work zone, walking in the work zone with your bare hands and chatting with fellow workers so that you don't work optimally.

According to (Jayananda, I.W.E., Marhaeni, 2023), that simultaneously education levels, health degrees, wage levels, and the use of ICT have a significant effect on the productivity of workers in districts/cities in Bali Province. Partially, the variables of health degree have a positive and significant effect on the productivity of workers in districts/cities of Bali Province, while the variables of education level, wage level and ICT use do not have a significant effect on the productivity of workers in districts/cities of Bali Province.

Utility Factors

The utility factor is a ratio that measures the level of efficiency of the use of labor time in a project (Efrizal, 2019). It is calculated by comparing the total contribution time (the time actually used for productive work) with the total effective time (the total time expected to be used productively). The utility factor provides an idea of how well the workforce makes use of the available time to achieve the desired output. The higher the value of the utility factor, the more efficient the workforce will be in using their working time. Based on the theory (Oglesby, 1989) If the value of the utility factor is above 50%, then it can be considered effective, that the workforce has used its working time efficiently enough.

$$\text{Labor utility factors} = \text{Act works effectively} + \frac{\frac{1}{4} \text{ Contribution Working Time}}{T \text{ (Total observations)}} \times 100\%$$

METHODOLOGY

This study applies the productivity rating method, which is a descriptive approach to analysis with a focus on job analysis. This approach does not involve experiments, but aims to collect primary data on the status of existing symptoms, namely the condition of symptoms as they were during the study. This study process involves collecting literature and secondary data relevant to the research topic, then determining the survey techniques to be applied.

The object to be researched as a data source in this study is labor in paving installation work. In this study, what was observed was the contribution time, effective time and ineffective time of the workers. The implementation of the research was carried out on the Drainage Channel Rehabilitation project in Ubud District. This observation was carried out for 5 days of paving installation work, namely from Tuesday to Sunday. Observation starts from 08.00 WITA to 17.00 WITA.

Table 1. Workforce Profile

Age	%	Experience	%	Education	Sum	%
20-30	33.33%	<5	33.33%	SLTP	1	33.33%
40-50	33.33%	< 20	33.33%	SD	1	33.33%
50	33.33%	20 >	33.33%	SD	1	33.33%
Total	100%		100%		3	100%

RESEARCH RESULT AND DISCUSSION

Analyzing the Labor Productivity Observations of Paving Work

Research on labor using the productivity ratings method for paving installation work was carried out for 5 (five) days. The workforce in the field consists of 2 (two) craftsmen and 1 (one) worker or handyman's assistant. More details on the roles and productivity of each workforce can be seen in the Table below. The data in the table provide an overview of the distribution of tasks and work efficiency during the observation period, which are then analyzed to determine the overall productivity level of the work team.

a. Effective Time Analysis

Table 2. Results of Labor Observation Effective Time Analysis

No	Date	Builder A Effective Time	Builder B Effective Time	Worker Effective Time
1	15 November 2023	6 Hours 9 Minutes	6 Hours 4 Minutes	5 Hours 44 Minutes
2	16 November 2023	5 Hours 48 Minutes	5 Hours 54 Minutes	5 Hours 2 Minutes
3	17 November 2023	5 Hours 45 Minutes	5 Hours 57 Minutes	5 Hours 24 Minutes
4	18 November 2023	5 Hours 3 Minutes	5 Hours 36 Minutes	5 Hours 3 Minutes
5	19 November 2023	5 Hours 6 Minutes	6 Hours 6 Minutes	5 Hours 37 Minutes

Builder A showed a high effective time on November 15 with 6 hours 9 minutes, but there was a gradual decrease to 5 hours and 6 minutes on November 19. Builder B showed a consistently high effective time, reaching its peak on November 19 with 6 hours and 6 minutes. However, there were fluctuations in the effective time in the previous days. Workers had a relatively stable effective time, with a minor decrease from 5 hours 44 minutes on November 15 to 5 hours 37 minutes on November 19.

Overall, the data shows fluctuations in the effective time used by each workforce. Builder B recorded the highest effective time on November 19, while Builder A experienced a consistent decline in effective time. Workers showed a more stable effective time but also experienced a small decline. These fluctuations can be affected by a variety of factors, including fatigue, motivation, or distractions during work.

b. Ineffective Time Analysis

Table 3. Labor Observation Results Ineffective Time Analysis

No	Date	Builder A Ineffective Time	Builder B Ineffective Time	Worker Ineffective Time
1	15 November 2023	1 hour 26 minutes	1 Hour 56 Minutes	1 Hour 5 Minutes
2	16 November 2023	1 hour 26 minutes	1 Hour 41 Minutes	1 hour 11 minutes
3	17 November 2023	2 Hours 2 Minutes	1 Hour 30 Minutes	1 Hour 45 Minutes
4	18 November 2023	1 hour 38 minutes	2 Hours 6 Minutes	1 hour 38 minutes
5	19 November 2023	2 Hours 14 Minutes	1 Hour 45 Minutes	1 hour 39 minutes

Builder A shows fluctuations in ineffective time with the highest time on November 19 (2 hours 14 minutes) and lowest on November 15 (1 hour 26 minutes). In general, there is an increasing trend of ineffective time over time. Builder B also showed an increase in ineffective time from 1 hour 56 minutes on November 15 to 2 hours 6 minutes on November 18, with a slight decrease on November 19 (1 hour 45 minutes). Workers showed varying ineffective hours, with the highest time on November 17 (1 hour 45 minutes) and the lowest on November 15 (1 hour 5 minutes).

c. Analysis of Contribution Time

Table 4. Results of Labor Observation Contribution Time Analysis

No	Date	Builder A Contribution Time	Builder B Contribution Time	Worker Contribution Time
1	15 November 2023	19 Minutes	13 Minutes	1 hour 13 Minutes
2	16 November 2023	10 Minutes	12 Minutes	1 hour 27 Minutes
3	17 November 2023	13 Minutes	13 Minutes	1 hour 55 Minutes
4	18 November 2023	19 Minutes	15 Minutes	1 hour 38 Minutes
5	19 November 2023	15 Minutes	9 Minutes	1 hour 39 Minutes

Builder A shows varying contribution times, with the highest time on November 18 (19 minutes) and the lowest on November 16 (10 minutes). This indicates fluctuations in work efficiency. Builder B also has fluctuations in contribution time, with the highest time on November 18 (15 minutes) and the lowest on November 19 (9 minutes). Workers showed a relatively more stable

contribution time, with the highest time on November 17 (1 hour 55 minutes) and the lowest on November 15 (1 hour 13 minutes).

Identify Factors That Affect Productivity

Hands-on observation in the field identifies several factors that affect labor productivity in a project. The first factor is worker delays, which are often caused by a lack of discipline and responsibility, resulting in decreased productivity. The second factor is the distance between the tool storage and the cement, which results in additional time for material retrieval from distant warehouses. The third factor is the labor's ineffective time, which includes activities such as sitting, smoking, drinking, talking to coworkers, and leaving the work zone before the specified time. In addition, on Fridays, working hours of only seven hours also have an impact on the decrease in output compared to other days.

Table 5. Factors Affecting Productivity

No	Factors Affecting Productivity	Caption and Time
1	Labor delays are coming Location.	In this study, the delay in the 10-20 minutes work.
2	Tool storage distance factor (Warehouse)	The distance between the warehouse and the location is about 10 meters, so it affects the time of the worker in doing his work.
3	Time ineffective	The ineffective time of labor during this study was 22 hours and 40 minutes, and in a day it was about 4 hours 57 minute.
4	Working hours	On Fridays, working hours are only 7 hours due to the worship factor, which only produces a productivity of 73.69%.

CONCLUSIONS AND RECOMMENDATIONS

In this study, during the five days of observation time, the effective time of Builder A was 1695 minutes, Builder B 1720 minutes, and Worker 1618 minutes. Ineffective time Builder A 559 minutes, Builder B 427 minutes, Worker 258 minutes. Contribution time for Builder A 76 minutes, Builder B 62 minutes, Worker 472 minutes. The average utility factor in 5 days is 75.30%, so it can be concluded that the level of work productivity in the Drainage Channel Rehabilitation Project work in Ubud District is quite satisfactory, because the worker utility factor is more than 50%.

ADVANCED RESEARCH

Future advanced research could focus on developing predictive labor productivity models by integrating real-time monitoring technologies, such as wearable devices or IoT-based tracking systems, to capture detailed behavioral and environmental data on construction sites. This data can be analyzed using

machine learning algorithms to identify patterns of inefficiency and optimize workforce allocation dynamically. Moreover, expanding the scope of study to multiple projects across different regions and construction types could help validate the generalizability of the observed productivity trends. Additional variables such as weather conditions, managerial supervision, and cultural or religious practices could also be incorporated to build a more holistic understanding of labor performance. By refining productivity assessment tools and exploring proactive management strategies, future studies could significantly enhance labor efficiency in infrastructure projects.

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