

Analysis Factors Affecting The Labor Productivity Based On Line Of Balance in High Rise Building Projects

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ABSTRACT: In the world of construction services, labor productivity is one of the critical success factors of a development project. The magnitude of the level of labor productivity is influenced by many factors, including Material and equipment, leadership, communication, motivation, and work competence.

This study aims to determine the effect of the application of Line of Balance scheduling method to the level of labor productivity, analyze the dominant factors affecting labor productivity, and measure labor productivity by Labor Utilization Rate (LUR) and Relative Importance Index (RII) method development of X Apartment in Batam City. From the results of data collection, both observational data and questionnaires performed data processing with the help of computer program SPSS (Statistical Package for Social Science) version 23.0.

From the research that has been done the implementation of Line of Balance (LoB) scheduling method on project X is effective to increase labor productivity with value equal to 74.4%. Based on the reality in the field of scheduling LoB that has been applied can increase the acceleration of completion of construction from 454 days to 432 days. The result of analysis of total labor productivity (LUR) level for work component of formwork, iron force and casting is 46.23% (labor productivity in project X is still relatively high). Result of analysis Hypothesis percentage effect of material and equipment variable, leadership, communication, motivation, and work competence to variable productivity of labor equal to 47.1% and the rest 52.9% influenced by other variable not included in this research. Relative Importance Index (RII) analysis on the indicator of variables affecting labor productivity in this project sequentially is the upward communication indicator on the communication variable with the value 89.40%, the motive indicator on the work competence variable with the value 89.20%, the availability indicator on the variable of material and equipment with value 89.00%, physiology indicator on motivation variable with value 88.80% and indicator Direction on leadership variable with value 87.80%.

KEYWORDS: Line of Balance, Labor Productivity, LUR, RII, Materials and Equipment, Leadership, Communication, Motivation, Work Competence.

I. INTRODUCTION

The potential of Indonesia's national construction services business currently occupies a very strategic position in the Indonesian economy. With the potential of a large construction service business will provide a great opportunity for the absorption of workers who have expertise in the field of construction services industry, with the availability of employment will create income for the workforce and reduce the unemployment rate. Prospective existence of small, medium and large scale construction service industry has strategic value for Indonesia, considering the proportion of its role is quite large and involves the number of manpower involved in project implementation and development activities. The number of activities on construction projects has an effect on the amount of resources used. These resources include manpower or workers, materials / materials, and tools. Material is one of the most important resources. According Ervianto (2004), the use of materials is the most important part that has a large percentage of 50-70% of the

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total project cost. The success or failure of construction service providers in working on construction projects depends on the effectiveness of resource management (Wulfram, 2005).

The construction of the High Rise Building is part of a construction project. According to Dipohusodo (1996), the project is essentially a process of transforming certain resources and funds in an organized manner into a solid development outcome based on the original goals and expectations using the budget and resources available for a certain period of time.

The construction project has a specific purpose where in its achievement there are limits to be met, ie project budget, schedule and quality that must be met. According to Soeharto (1995), these three are often associated as project targets as Cost, Quality and Time. Project management is said to be good if the goal is achieved.

Line of Balance (LOB) is a simple diagram to show out put standardization of various work items according to the location and time at which the tool / labor will work optimally. LOBs can also be used as productivity indicators generated by workers. On the other hand, the LOB method is performed to prevent extremely unstable fluctuations in resource histograms, which can lead to uneven resource management (Arditi and Albulak 1986). The use of LOBs is expected to be an early detection of project performance to determine factors affecting productivity.

II. LITERATURE REVIEW

Basic Concept of Productivity

Gaspersz (1985) in his book states that productivity is not the same as production, but production, quality performance, results, is a component of productivity effort. Thus productivity is a combination of effectiveness and efficiency, so productivity can be measured based on the following measurements.

$$\text{Productivity} = \frac{\text{The resulting output}}{\text{Input used}} = \frac{\text{Achievement of objectives}}{\text{Use of resources}}$$

When the workforce or tool works individually then the productivity measured is individual productivity. When labor or tools work in groups then the productivity measured is group productivity.

Basically the concept of productivity cycle consists of four main stages:

1. Measurement of productivity
2. Evaluation of productivity
3. Productivity planning

Measurement of Productivity

Lim Chye (1994) suggests that productivity measures need to be done because they are essentially an important and useful thing because:

1. Measurement of productivity can be used by management as a way to direct and control the productivity of the company.
2. Measurement of productivity can be used as feedback to workers to improve their productive performance.
3. In an effort to develop a system of utilization of productivity improvement, both for the construction industry as a whole and for each company.

In productivity measurement, more productivity is emphasized on:

1. The efficiency level of the actual work result, which is usually reflected by the output ratio rather than the input.
2. The level of physical efficiency, ie the size of a physical work required to accomplish a particular task.

Work Sampling Method / Labour Utilization Rate (LUR)

Work sampling in general can be regarded as a technique where many quick observations are made within a certain period of time from a working group, machine or process (Olomolaiye and Kaming 1996). In this study the focus is on workers. Work sampling can be divided into three approaches (Oglesby 1989), Olomolaiye and Jayawardane 1998, Dozzi and AbouRizk 1993):

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1. Field rating is the easiest method by logging randomly the worker is doing the job or not. The field rating is defined as (Dozzi and AbouRizk 1993).

$$\text{field rating} = \frac{\text{number of workers at work}}{\text{total number of workers}} \times 100\%$$

2. Five minute rating is by observing an activity with a short time, this technique is not suitable for observation in large groups. (Dozzi and AbouRizk 1993).
3. Productivity ratings are grouped into three types of activities (Boy 1986) and Dozzi and AbouRizk 1993) are:
 - a. Effective work (productive) is a work in which the activities of workers directly related to the construction process that contribute to the final result.
 - b. Essential contributory work (semi productive) is an activity that does not directly affect the outcome but is generally required in running an operation.
 - c. Ineffective work (non productive) is the activity of workers who are unemployed or doing something that is not directly related to the work done.

The technique to calculate how much the level of effectiveness (productivity) of workers used approach called Labor Utilization Rate (LUR). According to (Oglesby 1989) calculation of LUR value obtained by the following formula:

$$\text{LUR} = \frac{\text{effective} + \frac{1}{4}\text{essential contributory}}{\text{total observation}}$$

Where effective and essential contributory is the number of workers who perform effective work and essential contributory work in a row and the total number of observations is the total number of workers of the three types of activities (effective + essential contributory + ineffective work). The reason for using the sampling work (productivity rating) method because this method is considered most easily implemented by direct observation of the field without disturbing workers who are working and suitable for work that is a group. Observations are made at a certain time every time workers are working.

Relative Importance Index (RII) Method Analysis

Relative Importance Index (RII) is used to perform analysis of various factors affecting worker productivity in construction related to project implementation. Score of each factor is obtained by summation of respondent score of worker, supervisor, and supervisor. The result of the analysis calculation shows the rank of the whole factor and then determined the influence of the strength of each factor.

The calculation method using RII, then used the formula as follows:

$$\text{RII} = \frac{\sum W}{(A \times N)}$$

Where:

W = the weight given for the dominant causal factor with (range 1-5)

A = the highest weight (in this case 5)

N = total number of respondents

Line of Balance (LoB) Method

Line of balance method (LoB) is a scheduling method that is generally used for projects that have repetitive activities. LoB schedules are presented by grafik as in the making of the X-Y plan of the line production series, which from each presentation of the LoB activity introduces the control point into a new concept to occupy a sequence of production lines that may or may separate from each other or meet depending on the relative slope. LoB also introduced a row of activity controllers that became a new concept for the factors that determine the length of the project. This sequence includes activities between the control points in the sequence of the line production unit and extends from the start of the project until the project is completed. This method is able to show the utilization of resources, either in the form of labor, equipment and materials without interruption (Wiranata, 2009).

Advantages of Line of Balance Method

1. Have a visual form that is easy to understand
2. Can directly detect activities that have disruption on project scheduling

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3. Able to demonstrate the utilization of resources, whether in the form of labor, equipment and materials without interruption

Disadvantages Line of Balance Method

1. Scheduling is very risky to changes in work items
2. Cannot indicate specifically the relational logical relationship between the activities and the critical path of the project
3. Prone to conflict between activities

Factors Affecting Labor Productivity

Materials and Equipment

The use of materials in the construction process effectively depends on the desired design of a building. Material savings can be made at the stage of supply, handling and processing during construction time. Selection of the right tool will affect the speed of construction poses, transfer or distribution of material quickly, either horizontally or vertically.

Leadership

Siagian (1999) formulates leadership as an activity to influence the behavior of people to work together toward a particular goal they want together. In other words, leadership is the ability to influence groups to achieve the group's goals.

Communication

Communication is one of the important elements in organizational life. Management functions ranging from planning, organizing, and direction to supervision all involve communication. Communication helps project organizations to achieve individual goals as well as project organizational goals.

Motivation

Motivation is a fundamental psychological process and is one of the elements that can explain a person's behavior. Motivation comes from the word "movere" in Latin meaning "to move" or "to move". According to some experts, motivation is defined as follows:

Hamzah B. Uno (2007) says that motivation is a basic motivation that drives a person's behaviour. This impulse lies in a person who moves to do something that suits his inner drive. Therefore, the actions of a person based on a particular motivation contain a theme in accordance with the underlying motivation.

Work Competence

According to Patricia Marshall in the book *People and Competencies* (2007: 107) competence is a basic characteristic of a person who allows it to deliver superior performance in a particular job, role or situation.

Work Productivity (Performance)

Performance is the work of a worker in a certain period of time compared with various possibilities such as predefined standards, target goals or criteria that have been determined in advance and mutually agreed. Performance is basically what employees do or do not do. Performance is what affects how much they contribute to the organization.

III. RESEARCH METHODS

Types and Data Sources

In the implementation of this research required some types of data consisting of primary data and secondary data.

Primary Data:

Primary Data is the main data needed in this research. The data required for this research is the time schedule data obtained from the contractor and supervisor of this project, the direct observation data of the field and the data taken through the questionnaire.

Secondary Data:

Secondary data is the supporting data needed in this study which is the data obtained from the literature such as references and journals.

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IV. RESULTS AND DISCUSSION

Data Analysis of Research Results

Analysis procedures

The procedures adopted in the analysis of research data are:

1. Editing
2. Scoring
3. Tabulation
4. Analysis

Research Hypothesis Testing Plan

In the design of hypothesis testing, the influences of research variables are presented in the form of diagrams as follows:

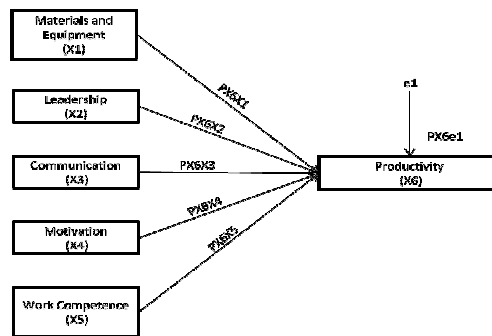


Figure 1. Diagram of Research Structure I

Source: Writer, 2017

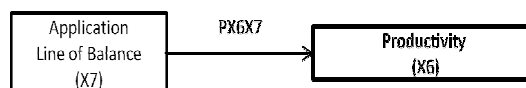


Figure 2. Diagram of Research Structure II

Source: Writer, 2017

Equation structure formula:

Structure I (Linkert Scale): $X_6 = PX_{6X1} + PX_{6X2} + PX_{6X3} + PX_{6X4} + PX_{6X5} + PX_{6e1}$

Structure II (Guttman Scale): $X_6 = PX_{6X7}$

Remark:

X_1, X_2, X_3, X_4, X_5 are independent variables, X_6 is dependent variable, X_1 (Materials and Equipment), X_2 (Leadership), X_3 (Communication), X_4 (Motivation), X_5 (Work Competence), X_6 (Productivity), X_7 (Line Of Balance Application)

PX_{6X1} = The effect of X_1 directly on X_6 , the X_1 Regression coeffer Against X_6

PX_{6X2} = The effect of X_2 directly on X_6 , the X_2 Regression coeffer Against X_6

PX_{6X3} = The effect of X_3 directly on X_6 , the X_3 Regression coeffer Against X_6

PX_{6X4} = The effect of X_4 directly on X_6 , the X_4 Regression coeffer Against X_6

PX_{6X5} = The effect of X_5 directly on X_6 , the X_5 Regression coeffer Against X_6

PX_{6X7} = The effect of X_7 directly on X_6 , the X_7 Regression coeffer Against X_6

a. Project Scheduling Line of Balance (LoB) Method

In general the steps of preparing the project scheduling with LoB are as follows:

1. Create WBS and logic dependency of project work

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Data of all activities in the time schedule of the X Apartment project there are 4 types of work for each floor (36 floors). Before creating a Line of Balance diagram (LoB), it should initially establish the relationship or sequence of activities of each work component. Job descriptions result in 122 activity components with duration corresponding to Time Schedule

2. Conflict Analysis, Buffer Time Delivery, and create a Barchart

Conflict occurs because the time schedule data provided by the project is inefficient so that in this research project scheduling will be made as efficient as possible. Given the conflicts that occur due to the incorporation of several types of activities it is necessary to provide buffers for some activities. The existence of time buffer (buffer time) due to the work that experienced a conflict that is impossible to happen. For example, the work of plate and beam for the floor above is not possible if the predecessor work is the work of the column for the floor below has not been done. Then made a bar chart (barchart) following the time schedule.

3. Analyze the LoB

After creating the block diagram then transfer to the LoB graph by drawing a linear line of each activity component based on the duration of activities that existed in the time schedule. If no conflicts occur and with no faster termination of resources and time to 432 days than using a project time schedule that will take as much as 454 days

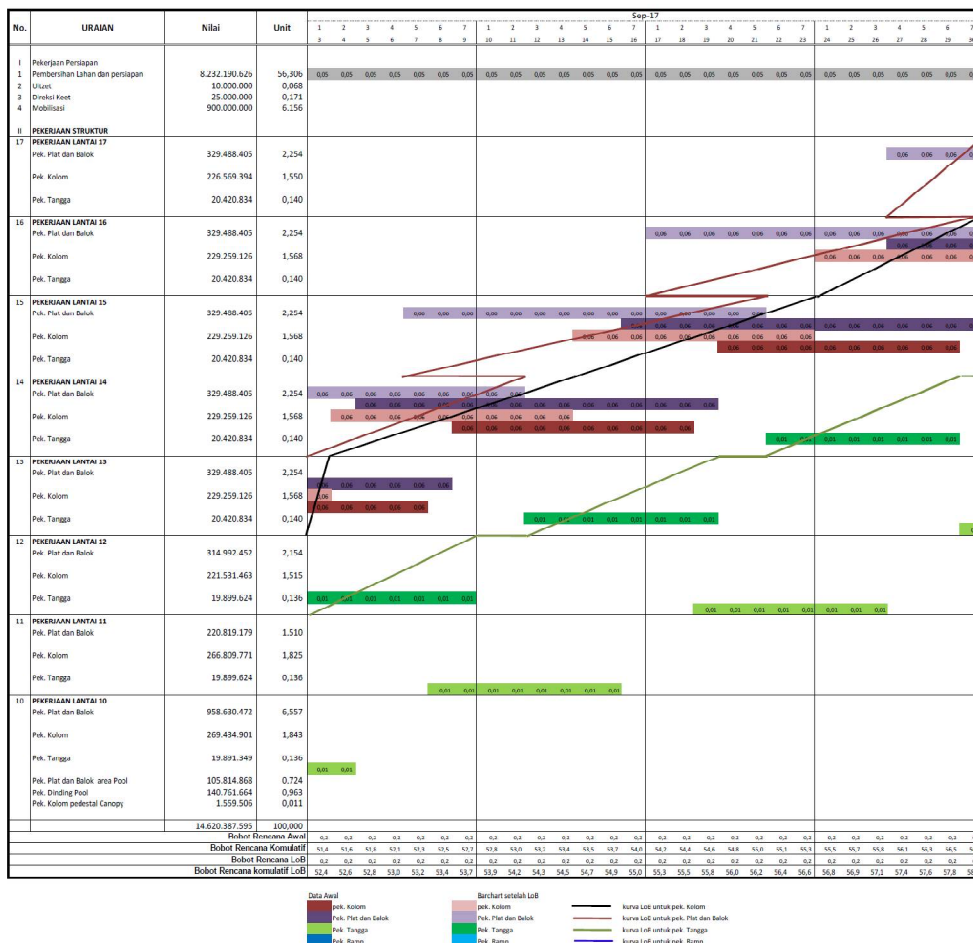


Figure 3. LoB Diagram X Apartement in Batam City

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b. Analysis of Influential Factors in Labor Productivity

Observations made according to business hours on the project that is starting at 08.00 am until 17:00 pm. To observe the normal activity of the worker, the calculation is recommended not to start at least 30 minutes after the worker starts work in the morning or returns to work after the afternoon break, or 30 minutes to the break (lunch) or dispersion (Oglesby et al., 1989). In this study, observation in normal hours is divided into three periods, ie morning (08.30 - 11.30), noon (13.30 - 15.00), and afternoon (15.00 - 16.30). The observation day is Monday to Saturday.

Table 1. Results Work Sampling Analysis

| Works | Types of Activity | | Number of Observations | Proportion (%) | Total (%) | LUR (%) |
|---|-------------------|------------------------------|------------------------|----------------|-----------|---------|
| Formwork | Effective | Direct Work | 278 | 35,82 | 35,82 | 45,88 |
| | Contributory | Bringing materials and tools | 245 | 31,57 | | |
| | | Instruction | 67 | 8,63 | | |
| | Ineffective | Walking empty-handed | 89 | 11,47 | 23,97 | |
| | | Stand Idle | 75 | 9,66 | | |
| | | Personal Time | 22 | 2,84 | | |
| Total Framework | | | 776 | 100,00 | 100,00 | |
| Iron Work | Effective | Direct Work | 315 | 37,41 | 37,41 | 46,97 |
| | Contributory | Bringing materials and tools | 274 | 32,54 | | |
| | | Instruction | 48 | 5,70 | | |
| | Ineffective | Walking empty-handed | 90 | 10,69 | 24,35 | |
| | | Stand Idle | 55 | 6,53 | | |
| | | Personal Time | 60 | 7,13 | | |
| Total Iron work | | | 842 | 100,00 | 100,00 | |
| Casting | Effective | Direct Work | 140 | 37,63 | 37,63 | 45,30 |
| | Contributory | Bringing materials and tools | 86 | 23,12 | | |
| | | Instruction | 28 | 7,53 | | |
| | Ineffective | Walking empty-handed | 30 | 8,06 | 31,72 | |
| | | Stand Idle | 62 | 16,67 | | |
| | | Personal Time | 26 | 6,99 | | |
| Total Casting | | | 372 | 100,00 | 100,00 | |
| Total: Formwork, Iron work, and Casting Works | Effective | Direct Work | 733 | 36,83 | 36,83 | 46,23 |
| | Contributory | Bringing materials and tools | 605 | 30,40 | | |
| | | Instruction | 143 | 7,19 | | |
| | Ineffective | Walking empty-handed | 209 | 10,50 | 25,58 | |
| | | Stand Idle | 192 | 9,65 | | |
| | | Personal Time | 108 | 5,43 | | |
| Total All Works | | | 1990 | 100,00 | 100,00 | |

Based on Table 1. it can be calculated that the LUR value on the work Formwork, iron work, and casting work is 45.88%; 46.97%; 45.30% respectively. From the calculation can be seen that the most high-value work LUR is the most productive. The normal limit of LUR values for construction project work is 40% - 60% (Oglesby et al., 1989).

c. Instrument Test (Validity and Reliability Test)

The program used to test the validity and reliability of the instrument is the Statistical Program for Social Science (SPSS) version 23.0. r_{table} for data $n = 100$ is 0.195. Each test in the statistics has a basis in decision-making as a reference for making conclusions. In this Validity test, the basis of the reference is as follows:

- a. If the value of $r_{count} > r_{table}$, then the data stated valid
- b. If the value of $r_{count} < r_{table}$, then the data stated invalid

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Table 2. Validity Test Result of Research Instrument of Material and Equipment Variables (X1), Leadership (X2), Communication (X3), Motivation (X4), and Work Competency (X5)

| | Material and Equipment | Leadership | Communication | Motivation | Work Competency | | |
|-----------|---|------------|---------------|------------|-----------------|-------------|----------|
| Statement | Corrected item total Correlation (r_{hitung}) | | | | | R_{tabel} | Validity |
| Item 1 | 0,371 | 0,239 | 0,736 | 0,383 | 0,454 | >0,195 | Valid |
| Item 2 | 0,618 | 0,443 | 0,565 | 0,543 | 0,631 | >0,195 | Valid |
| Item 3 | 0,236 | 0,434 | 0,694 | 0,46 | 0,512 | >0,195 | Valid |
| Item 4 | 0,358 | 0,432 | 0,595 | 0,331 | 0,607 | >0,195 | Valid |
| Item 5 | 0,614 | 0,572 | 0,723 | 0,398 | 0,412 | >0,195 | Valid |
| Item 6 | 0,372 | 0,579 | 0,613 | 0,295 | 0,391 | >0,195 | Valid |
| Item 7 | 0,519 | 0,524 | 0,432 | 0,403 | 0,725 | >0,195 | Valid |
| Item 8 | 0,37 | 0,638 | 0,516 | 0,363 | 0,505 | >0,195 | Valid |
| Item 9 | 0,32 | 0,656 | 0,632 | 0,343 | 0,526 | >0,195 | Valid |
| Item 10 | 0,209 | | | 0,227 | 0,352 | >0,195 | Valid |

Tabel 3. Validity Test Result of Research Instrument of Line of Balance (X7)

| Statements | Corrected item total Correlation (r_{count}) | R_{tabel} | Validity |
|------------|--|-------------|----------|
| Item 1 | 0,515 | >0,395 | Valid |
| Item 2 | 0,831 | >0,395 | Valid |
| Item 3 | 0,739 | >0,395 | Valid |
| Item 4 | 0,879 | >0,395 | Valid |
| Item 5 | 0,854 | >0,395 | Valid |
| Item 6 | 0,775 | >0,395 | Valid |
| Item 7 | 0,714 | >0,395 | Valid |
| Item 8 | 0,837 | >0,395 | Valid |
| Item 9 | 0,742 | >0,395 | Valid |
| Item 10 | 0,633 | >0,395 | Valid |

For the results of validity for 1 statement variable obtained all items have correlation probability scorer $r_{count} > r_{table} = r_{count} > 0.396$. (r_{table} for 25 people questionnaires = 0.396), so that the instrument for Line of Balance effectiveness to worker productivity meet the validity test.

Table 4. Reliability Test Results

| Variables | r_{count} | R_{tabel} | Remark |
|-------------------------|-------------|-------------|----------|
| Materials and Equipment | 0,650 | >0,6 | Reliable |
| Leadership | 0,716 | >0,6 | Reliable |
| Communication | 0,750 | >0,6 | Reliable |
| Motivation | 0,630 | >0,6 | Reliable |
| Job competence | 0,719 | >0,6 | Reliable |
| Performance | 0,720 | >0,6 | Reliable |

According Ghozali and Rumengan (2013: 217) Cronbach's Alpha results > 0.60 then the value obtained reliabel.

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d. Hypothesis testing

Hypothesis test aims to see whether the partial or each independent variable affect the independent variables by using the number t. The distribution table t is sought at $\alpha = 5\% \ 2 = 2.5\%$ (2-sided test with degrees of freedom (df) $n-k-1$. (N = number of respondents, k = number of independent or dependent variables)

Criteria for Ho testing is accepted if $t_{table} \leq t_{count}$ or $t_{count} > t_{table}$

Ho is rejected if $t_{count} < t_{table}$ or $t_{table} > t_{count}$ and magnitude influence of each independent variable to dependent variable can be seen at Beta value. SPSS data processing results are as follows:

Based on the above table obtained Rsquare number of 0.471 or (47.1%). This shows that the percentage of contribution of independent variables (material and equipment, leadership, communication, motivation, and work competence) to the dependent variable (Performance / Labor Productivity) of 47.1%. Or the variation of independent variables used in the model is able to explain as much as 47.1% variation of the dependent variable. While the rest of 52.9% influenced or explained by other variables not included in this research model.

Furthermore, the path model above path model is tested. from the test result and the above calculation is made the equation of structure as follows:

Structure I: Influence of Material and Equipment, Leadership, Communication, Motivation and Work Competence on Performance or Labor Productivity.

$$X_6 = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \epsilon_1; \text{Rsquare}$$

$$X_6 = 0.376X_1 + 0.132X_2 + 0.408X_3 + 0.286X_4 + 0.394X_5; \text{Rsquare} = 0.442$$

$$\epsilon_1 = \sqrt{(1 - R^2)} = \sqrt{(1 - 0.442)} = \sqrt{0.558} = 0.747$$

Where obtained standard Beta is the value of significant coefficient and relationship between variables according to the analysis path and correlation value X1, X2, X3, X4 and X5 from the test results above

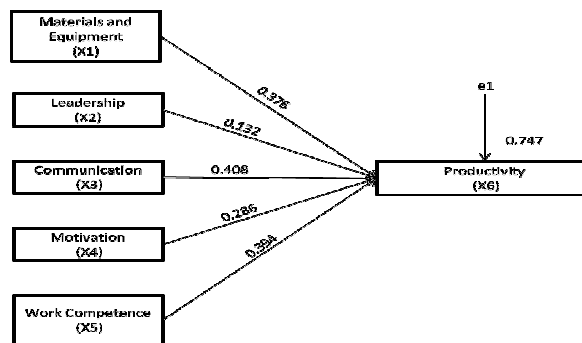


Figure 4. Causal Relationship Structures X1, X2, X3, X4, X5 and X6

Table 10. Summary of Hypothesis Test Results Structure I

| No | Hypothesis | T Value | Conclusion |
|----|--|---------|---|
| 1 | H0: There is no direct effect of Material and Equipment on Productivity H1: There is a direct influence of Material and Equipment on Productivity | 4,940 | $T_{count} > t_{table} = 4,940 > 1,661$ H0 rejected H1 accepted, Material and Equipment effect on Productivity |
| 2 | H0: There is no direct influence of Leadership on Productivity H1: There is a direct influence of Leadership on Productivity | 1,746 | $t_{count} > t_{table} = 1,746 > 1,661$ H0 rejected H1 accepted, Leadership influence on Productivity |

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| | | | |
|---|--|-------|---|
| 3 | H0: There is no direct influence of Communication on Productivity H1: There is a direct influence of Communication on Productivity | 5,373 | $t_{count} > t_{table} = 5,373 > 1,661$ H0 rejected H1 accepted, Communications effect on Productivity |
| 4 | H0: There is no direct influence of Motivation on Productivity H1: There is a direct influence of Motivation on Productivity | 3,734 | $t_{count} > t_{table} = 3,734 > 1,661$ H0 rejected H1 accepted, Motivation effect on Productivity |
| 5 | H0: There is no direct influence of Work Competence on Productivity H1: There is a direct influence of Work Competence on Productivity | 5,109 | $t_{count} > t_{table} = 5,109 > 1,661$ H0 rejected H1 accepted, Work Competence effect on Productivity |

Structure II (Guttman scale): Testing Line-Balance Effectiveness on productivity, respondents from managerial level consisting of Project Manager, Side Engineers, supervisor, Estimator, Cost Control, Quality Control consisting of 25 people. Then everything is taken into the respondent.

X6 = PX6X7

Guttman Scale Testing the Effectiveness of the Line of Balance on Productivity

The Guttman Scale Assessment is a research if you want to get a firm answer to a question asked, and always made in a multiple choice of "yes" and "no". For answering the answer eg for the answer "yes" is given a score of 1 while the answer "no" given a score of 0 when converted in percentage then logically can be translated to answer "yes" $1 = 1 \times 100\% = 100\%$, and "no" scores $0 = 0 \times 100\% = 0\%$.

Table 11. Percentage of Line of Balance Effectiveness on Labor Productivity.

| Statement Items | (%) ANSWER "YES" | (%) ANSWER "NO" |
|-----------------|---------------------|--------------------|
| P1 | 17 | 8 |
| P2 | 17 | 8 |
| P3 | 19 | 6 |
| P4 | 18 | 7 |
| P5 | 19 | 6 |
| P6 | 20 | 5 |
| P7 | 20 | 5 |
| P8 | 20 | 5 |
| P9 | 18 | 7 |
| P10 | 18 | 7 |
| TOTAL | 186 | 64 |
| AVARAGE | 18,6 | 6,4 |

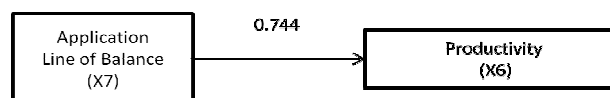


Figure 6. The Structure of Causal Relationships X7 and X6

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e. Analysis of *Relative Importance Index (RII)*

Table 12. Rank all factors affecting worker productivity

| No. | Group | Faktor | RII | Rank all Factors | Ranking per Factor |
|--|-----------------------------|--|--------------------|------------------|--------------------|
| 1 | Material and Equipment (X1) | Availability of Material | 0,872 | 6 | 2 |
| | | Availability of equipment | 0,890 | 3 | 1 |
| | | Accuracy of material specifications | 0,868 | 7 | 3 |
| | | Compatibility of equipment with work field | 0,838 | 15 | 8 |
| | | Timeliness of material delivery | 0,850 | 11 | 7 |
| | | Timeliness of equipment mobilization | 0,864 | 8 | 4 |
| | | Material storage conditions | 0,834 | 17 | 9 |
| | | Equipment condition | 0,860 | 9 | 5 |
| | | Availability of replacement material | 0,854 | 10 | 6 |
| | | Availability of spare parts of equipment | 0,756 | 34 | 10 |
| 2 | Leadership (X2) | Supervising employees | 0,878 | 5 | 1 |
| | | Provide direction | 0,832 | 18 | 3 |
| | | Listen to employees opinions | 0,814 | 20 | 4 |
| | | Communication is well established | 0,844 | 12 | 2 |
| | | Engaging employees | 0,790 | 28 | 7 |
| | | Giving ideas | 0,810 | 21 | 5 |
| | | Evaluate the work | 0,792 | 27 | 6 |
| | | Describes a new task | 0,776 | 32 | 8 |
| | | To be responsible | 0,748 | 35 | 9 |
| | | 3 | Communication (X3) | | |
| Communicating information | 0,832 | | | | |
| Communicating the work | 0,804 | | | 23 | 5 |
| Easy to communicate | 0,822 | | | 19 | 3 |
| Communication every constraint | 0,894 | | | 1 | 1 |
| Trust of fellow employees | 0,788 | | | 29 | 7 |
| Coordination and cooperation are easy to set up | 0,800 | | | 25 | 6 |
| There is no difference in obtaining information | 0,810 | | | 21 | 4 |
| Division differences do not preclude information | 0,804 | | | 23 | 5 |
| Receive information from various sources | 0,810 | | | 21 | 4 |
| 4 | Motivation (X4) | The company provides facilities and infrastructure | 0,880 | 4 | 1 |
| | | The provision of adequate rest hours | 0,774 | 33 | 7 |
| | | Feel safe | 0,806 | 22 | 2 |
| | | Sanctions when employees make mistakes | 0,746 | 36 | 8 |
| | | Have lots of friends at work | 0,786 | 30 | 5 |
| | | Help each other co-workers | 0,802 | 24 | 3 |
| | | Companies always give rewards for the achievers | 0,744 | 37 | 9 |
| | | Respect employees opinions suggestions and criticism given by the leadership | 0,800 | 25 | 4 |
| | | | 0,784 | 31 | 6 |
| | | Motivation given by the leadership | 0,738 | 38 | 10 |

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|---|-----------------|--|-------|----|---|
| 5 | Competence (X5) | Results-oriented | 0,892 | 2 | 1 |
| | | Responsible for achieving goals | 0,840 | 14 | 3 |
| | | Knowing how to control yourself | 0,842 | 13 | 2 |
| | | Attract interest | 0,836 | 16 | 4 |
| | | Belief in yourself | 0,840 | 14 | 3 |
| | | Ability to control emotions | 0,800 | 25 | 6 |
| | | Have great extra effort in finding information | 0,792 | 27 | 8 |
| | | Knowledge of work | 0,834 | 17 | 5 |
| | | Analytical thinking | 0,794 | 26 | 7 |
| | | Conceptual thinking | 0,776 | 32 | 9 |

V. CONCLUSION

From the analysis and discussion described above can be concluded that:

1. From the research that has been done the implementation of Line of Balance (LoB) scheduling method on project X is effective to increase labor productivity with value equal to 74.4%. Based on the reality in the field of scheduling LoB that has been applied can increase the acceleration of completion of construction from 454 days to 432 days.
2. The result of analysis of total labor productivity (LUR) level for work component of formwork, iron force and casting is 46.23% (labor productivity in project X is still relatively high).
3. Result of analysis Hypothesis percentage effect of material and equipment variable, leadership, communication, motivation, and work competence to variable productivity of labor equal to 47.1% and the rest 52.9% influenced by other variable not included in this research.
4. Relative Importance Index (RII) analysis on the indicator of variables affecting labor productivity in this project sequentially is the upward communication indicator on the communication variable with the value 89.40%, the motive indicator on the work competence variable with the value 89.20%, the availability indicator on the variable of material and equipment with value 89.00%, physiology indicator on motivation variable with value 88.80% and indicator Direction on leadership variable with value 87.80%.

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