

## The Rank of Factors Affecting Labor Productivity on Construction Projects

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### ABSTRACT

Human resources or labor is one of the factors that influence the success of a construction project. Based on this statement, it is necessary to analyze labor productivity. Many factors can affect labor productivity. This research aims to determine the ranking of factors that affect labor productivity in high-rise building construction projects in Jabodetabek. These factors are divided into 2 parts, namely internal factors, and external factors. Internal factors are factors derived from within labor control and external factors are factors derived from outside labor control. The method used in this research is a quantitative research method using a questionnaire. Furthermore, this research is analyzed using IBM SPSS software for validity and reliability testing and analyzed using the Relative Importance Index (RII) to determine the ranking of these factors. Based on the results of the validity and reliability tests, 18 variables were declared valid and reliable. The highest ranking of the factors that affect labor productivity when viewed as a whole is work skills which is a variable from internal factors with an RII value of 0,906, while the highest ranking of external factors is equipment quality with an RII value of 0,883.

Keywords: labor productivity, internal factor, external factor, Relative Importance Index

### INTRODUCTION

Nowadays construction projects are increasing. It can be seen that wherever we go there are various kinds of construction projects such as building construction projects, water structures, bridge buildings, and others. The construction of the construction project can be achieved if it has adequate resources. According to Ervianto [1], these resources are divided into 5 types or can be called 5M, consisting of man, money, methods, machine, and materials. The success of a project can be achieved with the presence of adequate resources. A project is said to be successful if the project is on time, at the right cost, and with the right quality [1,2].

Human resources or labor is one of the factors that influence the success of construction projects from these 5 kinds of resources. This is because, in various countries, labor costs comprise 30 to 50% of the total cost of a construction project, so it can affect the success of a project [3]. These human resources affect construction projects also because construction projects are labor-intensive work or jobs that require a lot of human labor and labor is a productive resource, so the productivity of construction projects depends on human effort and performance [4,5].

Based on this statement, it is necessary to analyze labor productivity. Productivity is the ratio between output, which is the result of production, and input, namely the total resources used [1,6]. In this study, the productivity that is analyzed is labor productivity, so the production result in question is the result of the work done by the workforce and the resource in question is labor. In this explanation, it can be said that productivity is directly proportional to the results done by

the workforce [7].

Many factors affect labor productivity. These factors can be grouped into various groups, namely internal factors, and external factors. Internal factors are factors that come from within the control of the workforce, such as experience, work discipline, work motivation, adaptability, work skills, and others. External factors are factors that come from outside the control of the workforce such as weather, image changes, material availability, material location, and others [2,7].

Based on the introduction above, the research objectives in this study are to determine the 3 highest rankings from overall factors that affect labor productivity (internal factors and external factors) and to determine the 3 highest rankings of each internal factor and external factors that affect labor productivity.

### **LABOR PRODUCTIVITY**

Definition of labor productivity according to Hernandi and Tamtana [8] is the amount of work that can be produced by a worker or a group of workers within a certain time.

#### **Internal and External Factor**

Understanding internal and external factors in the context of labor productivity according to Oktavio et al. [7] namely, internal factors are factors that come from within the workers' control, while external factors are factors that come from outside the workers' control.

### **RESEARCH METHODOLOGY**

The method used in this study is a quantitative research method using a questionnaire. This research was conducted to determine the highest ranking of factors that affect labor productivity on construction projects. The construction projects analyzed are high-rise building construction projects that have reached the final stage or have been completed and large-scale projects with a minimum budget limit of Rp250,000,000,000 (two hundred and fifty billion rupiahs). This research is located in the Jabodetabek area.

#### **Analysis Procedure and Data Collection**

This research stage begins with conducting a literature study, problem identification, and previous research. Then proceed with the determination of the data collection method, namely the questionnaire. Furthermore, the preparation of questionnaires and modifications from previous studies were carried out. After the questionnaire was compiled, data collection was carried out by distributing the questionnaire. The distribution of this questionnaire is done online through the google form application. The distribution of this questionnaire is carried out to 30 respondents with the criteria, namely, construction actors and preferably having the positions of Project Manager and Site Manager. Furthermore, the data that has been obtained is tested for data feasibility, namely validity and reliability tests, then the ranking of factors that affect labor productivity is determined using the Relative Importance Index (RII). After that, it ends with conclusions.

### Identification of Factors Affecting Labor Productivity

This identification is done by grouping factors from more than 1 journal to determine the factors that will be used in this study. The tabulation of factor grouping is divided into 2, namely internal factors and external factors. The tabulation results can be seen in **TABLE 1** for internal factors and **TABLE 2** for external factors.

**TABLE 1.** Internal Factors Draft

No	Variable	Sources
1	Work discipline	[2,7,9]
2	Work motivation	[2,4,7,9-11]
3	Age	[7-9,12]
4	Education level	[7,9,12]
5	Absenteeism	[7,10,13]
6	Work skill	[2,4,7,9-12]
7	Work experience	[4,7-12]
8	Misunderstanding between labors	[7,8,11]
9	Lack of periodical meetings	[4,7,8]
10	Level of labor empowerment (training and resourcing)	[7,10,13]

**TABLE 2.** External Factors Draft

No	Variable	Sources
1	Weather conditions	[2,7-10,12]
2	Site conditions	[7,9,10]
3	Overtime work	[4,7,12]
4	Late payment	[4,7,10,11]
5	Incentive programs / labor financial motivation system	[4,7,12,13]
6	Work at heights	[7,8,11,12]
7	Limited movement/work area	[4,7,8]
8	Availability of materials and effectiveness/ease of handling	[2,4,8,10-13]
9	Material storage location	[2,4,9]
10	Poor quality or damaged equipment	[7-9,13]

The questionnaire in this study was prepared using a value measurement scale with a Likert scale. The Likert scale used is a 6-point Likert scale where the score number 1 strongly disagrees to score number 6 strongly agrees. The use of a 6-point Likert scale is done because it can minimize deviations or reduce the risks that occur due to personal decision-making when compared to a 5-point Likert scale [14]. The description of the Likert scale in this study can be seen as follows, 1 = strongly disagree, 2 = disagree, 3 = less agree, 4 = quite agree, 5 = agree, and 6 = strongly agree.

### Relative Importance Index (RII)

Data analysis in this study used the Relative Importance Index (RII) method. In this study, this method aims to determine the ranking of the factors that affect labor productivity. The formula for determining the ranking with the RII method can be seen in Equation 1.

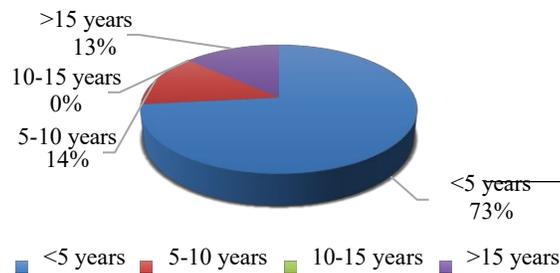
$$RII = \frac{6(n_6)+5(n_5)+4(n_4)+3(n_3)+2(n_2)+n_1}{W \times (n_6+n_5+n_4+n_3+n_2+n_1)}$$

(1)where RII = Relative Importance Index of each factor; n6 = number of respondents who chose scale 6; n5 = number of respondents who chose scale 5; n4 = number of respondents who chose scale 4; n3 = number of respondents who chose scale 3; n2 = number of respondents which is a scale of 2; n1 = the number of respondents who choose a scale of 1; W = chooses the largest scale on a Likert scale.

## RESULT AND DISCUSSION

### Respondent Data

The questionnaire in this study was filled out by 30 respondents. The respondents of this research are parties who have been involved in the construction of high-rise buildings in the Jabodetabek area. Characteristics of Respondents based on work experience in construction from 30 respondents can be seen in **FIGURE 1**. The results of the questionnaire tabulation data can be seen in **TABLE 3** for internal factors and **TABLE 4** for external factors.



**FIGURE 1.** Pie Chart Characteristics of Respondents Based on Work Experience in Construction

**TABLE 3.** Tabulation of Questionnaire Data Internal Factors

Variabl	Internal Factors Affecting Labor Productivity	Scale					
		1	2	3	4	5	6
X1	Lack of work discipline affects labor productivity on construction projects	1	0	0	1	1	1
X2	Lack of work motivation affects labor productivity on construction projects	1	0	0	6	1	1
X3	Age of the labor affects labor productivity in construction projects	2	1	0	7	9	3
X4	The education level of the workforce affects labor productivity on construction projects	1	3	0	1	1	2
X5	Labor absenteeism affects labor productivity on construction projects	1	1	0	3	1	1
X6	The skills of the workforce affect labor productivity on construction projects	1	0	0	1	1	1
X7	Lack of work experience affects labor productivity on construction projects	0	1	0	4	1	1
X8	Misunderstanding between laborers affects labor productivity in construction projects	0	1	0	4	6	1
X9	Lack of regular meetings between laborers affects labor productivity on construction projects	0	1	0	7	1	5

X10	Lack of empowerment and training affects labor productivity on construction projects	0	1	2	3	4	5	6	7	8	9	10
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**TABLE 4.** Tabulation of Questionnaire Data External Factors

Variabl	External Factors Affecting Labor Productivity	Scale										
		1	2	3	4	5	6					
X11	Weather conditions (wind, temperature, rain) affect labor productivity on construction projects	0	1	2	3	4	5	6	7	8	9	10
X12	Poor field conditions affect the labor on construction projects	0	1	2	3	4	5	6	7	8	9	10
X13	Overtime work affects labor productivity on construction projects	0	1	2	3	4	5	6	7	8	9	10
X14	Late payments to workers affect labor productivity on construction projects	0	0	1	2	3	4	5	6	7	8	9
X15	Incentive programs (bonuses or rewards to workers) affect labor productivity on construction projects	0	1	2	3	4	5	6	7	8	9	10
X16	Work at heights affects labor productivity on construction projects	1	2	3	4	5	6	7	8	9	10	
X17	Limited movement and work area affect labor productivity on construction projects	0	1	2	3	4	5	6	7	8	9	10
X18	Availability of materials and ease of handling affect labor productivity on construction projects	0	1	2	3	4	5	6	7	8	9	10
X19	The remote location of material storage affects labor productivity on construction projects	0	2	3	4	5	6	7	8	9	10	
X20	Damaged equipment affects labor productivity in construction projects	0	0	1	2	3	4	5	6	7	8	9

**Validity Test**

The validity test in this study used IBM SPSS software. The measurement of this validity test uses Corrected item- total correlation. The number of samples is 30 (N = 30) and the significance level used is 5%, so the value of the r table used is 0.361. The data is declared valid if the calculated r value is greater than 0.361. Based on the results of validity testing using Corrected item-total correlation, there are 2 invalid variables, namely X3 and X4 variables, so from validity testing 18 valid variables are obtained. The results of the validity test can be seen in **TABLE 5** with the Corrected item-total correlation method.

**TABLE 5.** Validity Test Result Based on Item-Total Statistic Output

Variable	Corrected Item-Total Correlation (r count)	r	Result
X1	0.799	0.36	Valid
X2	0.698	0.36	Valid
X5	0.720	0.36	Valid
X6	0.690	0.36	Valid
X7	0.741	0.36	Valid
X8	0.595	0.36	Valid
X9	0.452	0.36	Valid
X10	0.780	0.36	Valid
X11	0.785	0.36	Valid
X12	0.866	0.36	Valid

X13	0.751	0.36	Vali
X14	0.618	0.36	Vali
X15	0.551	0.36	Vali
X16	0.571	0.36	Vali
X17	0.789	0.36	Vali
X18	0.752	0.36	Vali
X19	0.842	0.36	Vali
X20	0.730	0.36	Vali

### Reliability Test

The reliability test was carried out after obtaining data that had been declared valid through a validity test. This reliability test was conducted to determine whether the data in this study were reliable (consistent) or not. The reliability test in this study used IBM SPSS software. The measurement of this reliability test uses Cronbach's Alpha. According to Ghozali cited in Felixius and Waty [15], the data is said to be reliable if the Cronbach's Alpha value is greater than 0.6. Reliability testing with Cronbach's Alpha is divided into 2 groups of factors, namely internal factors, and external factors. The following is in **TABLE 6** the results of the internal factor reliability test and in **TABLE 7** the results of the external factor reliability test.

**TABLE 6. Reliability Statistics Output Internal Factor**

Cronbach's Alpha	N of Items
0.892	8

**TABLE 7. Reliability Statistics Output External Factor**

Cronbach's Alpha	N of Items
0.925	10

Based on **TABLE 6** and **TABLE 7**, the results of the reliability test with Cronbach's Alpha of 0.892 for internal factors and 0.925 for external factors were obtained. It can be said that the data is reliable because the value of Cronbach's Alpha is greater than 0.6.

### Ranking with the Relative Importance Index (RII)

Based on the feasibility test of the data, namely the validity and reliability test, the variables that can be used next are 18 variables. From these 18 variables, the ranking is then carried out using the RII method. This ranking aims to determine the level of importance of these variables.

Determination of this ranking is carried out in 3 stages, namely the overall ranking of factors, internal factors, and external factors that affect labor productivity. The ranking is done using Equation 1 with RII results in **TABLE 8**, **TABLE 9**, and **TABLE 10**.

**TABLE 8. Overall Factor Rating Results (Internal and External Factors)**

Variable	Factor	RII	Rank
X1	Lack of work discipline affects labor productivity on construction projects	0.9	2
X2	Lack of work motivation affects labor productivity on construction projects	0.833	7
X5	Labor absenteeism affects labor productivity on construction projects	0.861	6
X6	The skills of the workforce affect labor productivity on construction projects	0.906	1
X7	Lack of work experience affects labor productivity on construction projects	0.828	8
X8	Misunderstanding between laborers affects labor productivity in construction projects	0.783	11
X9	Lack of regular meetings between laborers affects labor productivity on construction projects	0.728	14
X10	Lack of empowerment and training affects labor productivity on construction projects	0.778	12
X11	Weather conditions (wind, temperature, rain) affect labor productivity on construction projects	0.833	7
X12	Poor field conditions affect the labor on construction projects	0.817	9
X13	Overtime work affects labor productivity on construction projects	0.772	13
X14	Late payments to workers affect labor productivity on construction projects	0.867	5
X15	Incentive programs (bonuses or rewards to workers) labor productivity on construction projects	0.772	13
X16	Work at heights affects labor productivity on construction projects	0.711	15
X17	Limited movement and work area affect labor productivity on construction projects	0.789	10
X18	Availability of materials and ease of handling affect labor productivity on construction projects	0.872	4
X19	The remote location of material storage affects labor productivity on construction projects	0.789	10
X20	Damaged equipment affects labor productivity in construction projects	0.883	3

**TABLE 9. Internal Factors Ranking Results**

Variable	Factor	RII	Ran
X1	Lack of work discipline affects labor productivity on construction projects	0.9	2
X2	Lack of work motivation affects labor productivity on construction projects	0.833	4
X5	Labor absenteeism affects labor productivity on construction projects	0.861	3
X6	The skills of the workforce affect labor productivity on construction projects	0.906	1
X7	Lack of work experience affects labor productivity on construction projects	0.828	5
X8	Misunderstanding between laborers affects labor productivity in construction projects	0.783	6
X9	Lack of regular meetings between laborers affects labor productivity on construction projects	0.728	8
X10	Lack of empowerment and training affects labor productivity on construction projects	0.778	7

**TABLE 10. External Factors Ranking Results**

Variable	Factor	RII	Ran
X11	Weather conditions (wind, temperature, rain) affect labor productivity on construction projects	0.833	4
X12	Poor field conditions affect the labor on construction projects	0.817	5
X13	Overtime work affects labor productivity on construction projects	0.772	7
X14	Late payments to workers affect labor productivity on construction projects	0.867	3
X15	Incentive programs (bonuses or rewards to workers) labor productivity on construction projects	0.772	7
X16	Work at heights affects labor productivity on construction projects	0.711	8
X17	Limited movement and work area affect labor productivity on construction projects	0.789	6
X18	Availability of materials and ease of handling affect labor productivity on construction projects	0.872	2
X19	The remote location of material storage affects labor productivity on construction projects	0.789	6
X20	Damaged equipment affects labor productivity in construction projects	0.883	1

Based on the ranking results, the first rank of overall factors has an RII value of 0.906, namely for the X6 variable and the last rank is the X16 variable. If viewed based on the ranking of internal factors, the first rank is the X6 variable and the last rank is the X9 variable. Based on the ranking of external factors, the first rank is the X20 variable and the last rank is the X16 variable.

After getting the overall ranking order and based on categories (internal and external factors), the 3 highest rankings factors that affect overall labor productivity and based on categories as in **TABLE 11**, **TABLE 12**, and **TABLE 13**.

**TABLE 11. Highest Ranking of Overall Factors Affecting Labor Productivity (internal**

Variable	Factor	RII	Ran
X6	The skills of the workforce affect labor productivity on construction projects	0.90	1
X1	Lack of work discipline affects labor productivity on construction projects	0.9	2
X20	Damaged equipment affects labor productivity in construction projects	0.88	3

**TABLE 12. Highest Rank Internal Factors Affecting Labor Productivity**

Variable	Factor	RII	Ran
X6	The skills of the workforce affect labor productivity on construction projects	0.90	1
X1	Lack of work discipline affects labor productivity on construction projects	0.9	2
X5	Labor absenteeism affects labor productivity on construction projects	0.86	3

**TABLE 13. Highest Rank External Factors Affecting Labor Productivity**

Variable	Factor	RII	Ran
X20	Damaged equipment affects labor productivity in construction projects	0.88	1
X18	Availability of materials and ease of handling affect labor productivity on construction projects	0.87	2
X14	Late payments to workers affect labor productivity on construction projects	0.86	3

Based on the results of the ranking above, from the overall factors, the 3 highest rankings are ranks 1 and 2 are variables originating from internal factors, namely variables X6 and X1, and ranking 3 comes from external factors, namely variable X20. If viewed based on the ranking of internal factors, the 3 highest rankings variables are X6, X1, and X5. Based on the ranking of external factors, the 3 highest rankings are the variables X20, X18, and X14.

## CONCLUSION

Based on the results of research and discussion, the following conclusions are obtained.

1. The 3 highest rankings factors that affect overall labor productivity (internal factors and external factors) are as follows.
  - Skills of workers affect labor productivity on construction projects (RII = 0.906).
  - Lack of work discipline affects labor productivity on construction projects (RII = 0.9).
  - Damaged equipment affects labor productivity on construction projects (RII = 0.883).
2. The 3 highest rankings for each internal factor and external factor affecting labor productivity are as follows.
  - Internal factors
    - Skills of the workforce affect labor productivity on construction projects (RII = 0.906).
    - Lack of work discipline affects labor productivity on construction projects (RII = 0.9).
    - Labor absenteeism affects labor productivity on construction projects (RII = 0.861).
  - External factors
    - Damaged equipment affects labor productivity on construction projects (RII = 0.883).
    - Availability of materials and ease of handling affect labor productivity on construction projects (RII = 0.872).
    - Late payments to workers affect labor productivity on construction projects (RII = 0.867).

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