

## **Factors Affecting Labor Productivity in Menara Sentraya Building Construction at Jakarta Indonesia**

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**Abstract:** The developing countries which face unemployment problems, inflation and resource scarcity seek to utilize resources and in such a way to achieve economic growth and improve citizens lives. Productivity is an issue of particular importance to projects located within the Menara Sentraya Jakarta, as it is considered an oldly developed area. The research objective were to analyze the identify factors and to rank that affect work productivity in building construction project. Work sampling method used to obtain Labor Utilization Rate (LUR) value. It is analysis results factors that affect productivity by calculating Relative Importance Index (RII). The analysis of 49 factors considered in a survey indicates that the main factors negatively affecting labour. Results on factors that negatively affect the productivity are labor, material and tools, manpower, leadership, motivation, time, supervision, project, safety, quality, and the external factor.

**Keywords:** building construction, labor productivity, questionnaire, RII.

### **INTRODUCTION**

An overdue construction project was common to be found caused by the execution which were not in accordance with schedule agreed upon in contract. The delayed project was caused by several factors, such as the productivity level of existing workforce in construction project activities [1].

Labor productivity is one of main element in determining the successful execution of construction project, but the ineffective uses of labor, such as talking, eating, drinking, smoking outside recess were common to be found. Therefore, management should be able to know some ways to measure labor productivity before making an effort to improve productivity [2]. Productivity has been generally defined as the ratio of outputs to inputs [3].

### **RESEARCH METHOD**

#### **Time and Place**

The research was conducted in July 2014 to September 2014, in Menara Sentraya Project, Jakarta.

#### **Materials and Instruments**

This research used tools and materials which are: stop watch, camera, tape recorder, computer, shop drawing, form questionnaire for data sampling and finger time attendance.

### **Procedur and Research Stage**

This research consisted of organize the questionnaires distribution containing questions related to the factors that affect labor productivity in construction as data.

The purpose of questionnaire is to capture data from respondents directly to identify the factors that affect labor productivity, which are the factors that determine LUR value [4, 5]. Questionnaire conducted by giving the simple questionnaire to respondent to be filled by the parties that directly involved in the project such as labor, foremen and supervisors and readmitted after complete answer achieved at the end of the study as shown in Table 1. The survey present 49 productivity factors generated on the basis of related research work on construction productivity [6].

### **RESULTS AND DISCUSSION**

#### **Respondent characteristics**

The questionnaire distributed to the group of workers, foreman and supervisor as respondent. The composition of each respondent group and returned questionnaire can be seen in Table 1.

#### **Number of samples determination**

**Table-1 Respondent group composition and returned questionnaire level**

Respondent	Number of questionnaire		Percentage (%)
	Distributed	Returned	
Labor	30	28	93.33
Foremen	30	29	96.67
Supervisor	30	30	100.00

Minimum number of random samples determined using formula as written below : [13].

$$m = \frac{Z^2 \times P^* \times (1-P^*)}{\epsilon^2}, \quad n = \frac{m}{1 + \frac{m-1}{N}}$$

Where:

m = sample from infinite population

n = sample of limited population

Z = value (e.g. 1.96 to 95% secure level)

P\* = Variation degree between population elements (0.5)

ε = Error tolerance limit (0.05)

N = Number of represented population (23)

$$m = \frac{(1.96)^2 \times 0.5 \times (1-0.5)}{(0.05)^2} = 384 \quad n = \frac{384}{1 + \frac{384-1}{23}} = 21.7 \approx 22$$

**Relative Importance Index Analysis (RII)**

$$Imp. Index = \frac{5n_5+4n_4+3n_3+2n_2+n_1}{5(n_1+n_2+n_3+n_4+n_5)} * 100\%$$

Where:

n1 = number of respondents who answered the “little”

affect

n2 = number of respondents who answered the “some” affect

n3 = number of respondents who answered the “average” affect

n4 = number of respondents who answered the “high” affect

n5 = number of respondents who answered the “very high” affect,

RII values of all factors were calculated using Microsoft Excel 2010 program. These factors were grouped into 10 groups.

Relative Importance Index (RII) was used to analysis various factors that affect labor productivity in the construction that associated with the project implementation. The scores for each factor were obtained through the sum score of labor, foremen and supervisors respondents. The results of this analysis calculation indicate rank of all factors and then the influence of each factor can be determined. RII was calculated by the following above equation: [7] and [8]

**Table-2: Overall ranking of factors negatively affecting labor productivity**

No.	Group	Factors	Imp. Index (%)	Rank
1	Material and tools	Material availability	54.67	8
		Tools availability	54.00	9
		Tools received as demanded	53.33	10
		Material received as demanded	52.00	13
		Tools as needed	51.33	14
		Warehouse near to work site	48.00	18
2	Labor	Disloyalty	58.00	3
		Work experience	56.67	5
		Dissatisfaction	56.00	6
		Old age	55.33	7
		Rivalry	54.67	8
		Labor absenteeism	54.00	9
		Misunderstanding among labor	52.67	12
3	Leadership	Lack of labor supervision	56.67	5
		Brief with labor rarely	56.00	6
		Misunderstanding between labor and supervisor	54.67	8

4	Motivation	Late payments	58.67	2
		Less socialization on program	58.67	2
		Weak financial system	57.33	4
		No training session	57.33	4
		No briefing before work	56.00	6
		No transport money	52.00	13
		No place for eating and resting	48.00	18
5	Time	Mistakenly using work hour	60.00	1
		Direct work system	60.00	1
		Work overtime	58.67	2
		Work time reduction	58.00	3
		7 days no days off	46.00	19
6	Supervision	Rework	56.67	5
		Absence of supervisor	55.33	7
		Late in checking	51.33	14
		Changing drawing and specification	49.33	16
7	Project	Same work type	60.00	1
		Work method	58.00	3
		Activity type in project	51.33	14
		Project's fence	49.33	16
8	Safety	Work at high place	58.00	3
		Less-lighting	56.67	5
		Safety briefing	56.67	5
		Safety violation	53.33	10
		No safety officer in site	53.33	10
		Bad ventilation	53.10	11
		Accident	52.00	13
		Noise	48.67	17
9	Quality	High quality work requirement	50.00	15
		Low quality material	46.00	19
		Inefficiency tools	38.67	20
10	External	Government regulation violation	54.00	9
		Climate change	52.00	13

### Material and tools group

The results in Table 3 demonstrate 6 factors in the materials and tools group; these were ranked according to their importance in affecting labor productivity as follows: material availability, tools availability, tools received as demanded, material received as demanded, tools as needed and warehouse near to work site. These findings show that a material availability is the most important of all factors negatively affecting labor productivity. Material availability was ranked in the 8 position of all 49 factors negatively affecting labor productivity, which is understandable, as work cannot be accomplished without necessary materials. Material availability rated in the 8 position among factors affecting labor productivity in the Indonesia [9]. This result is justified in the Menara Sentraya, as most materials used in construction projects are got from local market

around the Menara Sentraya construction projects.

Results also show that tools availability has a high effect on labor productivity and ranked in position 9 of all factors negatively affecting labor productivity. This result might be justified, as labor needs a minimum number of tools to work effectively. If there is lack of tools, productivity will decrease. Results also illustrate that unsuitability of warehouse materials storage location has an average effect on labor productivity and is ranked in position 18 of all factors negatively affecting labor productivity. This result was supported by [10], who stated that size and organization of materials warehouse location have a significant impact on labor productivity. This result is justified as labor needs more time to fetch required materials from unsuitable warehouse locations, which negatively affects productivity.

**Table-3: Ranking factors material and tools group**

Factors	Imp. Index	Rank
Material availability	54.67	1
Tools availability	54.00	2
Tools received as demanded	53.33	3
Material received as demanded	52.00	4
Tools as needed	51.33	5
Warehouse near to work site	48.00	6

**Labor group**

Table 4 illustrates the ranking of the 7 factors in the group related to labor. The result show that the most important factor negatively affecting the productivity is disloyalty, followed by work experience, dissatisfaction, old age, rivalry, absenteeism, mis understanding among labor. The surveyed contractors ranked disloyalty in the first position in the group labor with an importance index 58.00. This factor also rangked it the 3 position all 49 factors negativelly affecting labour productivity has high effect on productivity (Table 3). This result is justified, as disloyalty improves both resign and exsoduce to other project which consequently decreases labor productivity. Hence, result indicated that work experience result indicated that mis understanding among labor has an average effect on labor productivity, it this factor was ranked at position 12 of all 49 factor negatively affecting labor productivity. This result is is justified, as mis understanding among labor creates disagreement among labor about responsibilities and work bound of each laborer, which lead to a lot of mistakes in work and consequently decreases labor productivity.

Finding also show that contractors respondent rated rivalry as having an average effect on labor productivity, this factor ranked at position 8 of all 49 factors negatively affecting productivity. Findings also show respondents rated ‘increases of old age’ as having an average effect on labor productivity, with this factor being ranked at number 7 of all factors negatively affecting labor productivity (Tabel 3) [14] support this result, citing that the age of the workforce affect job site productivity. This result as justified, as labor speed, agility and strengthn decline over time and contributes to a reduced productivity.

‘Labor absenteeism’ in particular had a low effect on labor productivity, ranking at position 9 of all factors negatively affecting productivity. This result might be justified, given the transient nature of the local workforce and the ease with which construction contractors could hire additional labor to cover absenteeism from other foreman. Mis understanding among labor are not considered to be as instrumental as other factors, and ranked as position 12 of all factors negatively affecting labor productivity.

**Table-4: Ranking factors under labor group**

Factors	Imp. Index	Rank
Disloyalty	58.00	1
Work experience	56.67	2
Dissatisfaction	56.00	3
Old age	55.33	4
Rivalry	54.67	5
Labor absenteeism	54.00	6
Misunderstanding among labor	52.67	7

**Leadership group**

The results in tabel 5 illustrate the ranking of the 3 factors under leadership group. Lack of labor supervision was ranked first, bbrief with labor rarely was ranked second and mis understanding between labor and supervisor labor was ranked third. Lack of labor supervision has a high effect on labor productivity (imp. Index 56.67) and ranked on position 5 of all 49 factors negatively affecting labor productivity (Tabel 3). This result is justified, as lack of labor supervision

increases labor mistakes at work, as well as delaying corrective action for these mistakes.

Misunderstanding between labor and supervisor has a high effect on labor productivity (Imp. Index 54.67) , and ranked in position 8 of all factors negatively affecting labor productivity. This result as justified, as misunderstanding between labor and supervisor creates bad relations between them. Such misunderstandings have adverse effect on labor mood and consequently decrease productivity.

**Table-5: Rank factors under leadership group**

Factors	Imp. Index	Rank
Lack of labor supervision	56.67	1
Brief with labor rarely	56.00	2
Misunderstanding between labor and supervisor	54.67	3

**Motivation group**

Table 6 indicates the ranking of 7 factors under the group related to motivation. These factors were placed in descending order according to their importance late payment, less socialization on program, weak financial system, no training session, no briefing before work, no transport money and no place for eating and resting. Results demonstrate that

late payment has a high effect on labor productivity (Imp. index = 58.67) and ranked in position 2 of all 49 factors negatively affecting labor productivity. This result is justified, as payment late has a very bad effect on labor mood, and consequently decreases its productivity. Motivation is essential to labor, as it gives site labor satisfaction such as achievement, sense of responsibility and pleasure of the work itself.

**Table-6 Rank factors under motivation group**

Factors	Imp. Index	Rank
Late payments	58.67	1
Less socialization on program	58.67	2
Weak financial system	57.33	3
No training session	57.33	4
No briefing before work	56.00	5
No transport money	52.00	6
No place for eating and resting	48.00	7

Non-provision of transport money and places for eating and resting is not considered to be as instrumental as other factors on labor productivity, and ranked in positions 18 and 49 respectively among all factors negatively affecting productivity. This result is supported by [11], who mentioned that nonfinancial benefits such as transport money, meals, and uniforms have a high effect on labour productivity. These results might be justified within the Menara Sentraya because its small area means transportation to any place within the Menara Sentraya can be made available easily. Furthermore, findings illustrate that a lack of training sessions is not considered to be as instrumental as other factors on labour productivity, and was ranked 4 of all

negative factors. Surveyed contractors illustrate there is no need for training sessions, and labour can be trained more effectively on site by working closely with experienced labor

**Time group**

Table 7 shows the 5 factors in the group related to time; these were ranked according to their importance in affecting labour productivity as follows: mistakenly using work hour and direct work system were ranked first, work overtime was ranked second; work time reduction was ranked fourth, 7 days no days off was ranked fifth.

**Table-7: Rank factors under time**

Factors	Imp. Index	Rank
Mistakenly using work hour	60.00	1
Direct work system	60.00	2
Work overtime	58.67	3
Work time reduction	58.00	4
7 days no days off	46.00	5

Working 7 days per week without holiday has a high effect on labour productivity, while working additional hours during the working day has an average effect [12]. supported these results, stating that working additional days and hours has a negative impact on labor productivity. These results are not surprising, because

working additional days and hours creates an adverse effect on the motivation and physical strength of labour, thus decreasing their productivity. However, the impact of working additional hours for a short period may be not notice able, or nonexistent.

Results also demonstrate that mistakenly using work hour has a high negative impact on labor productivity. This result is acceptable, as good use of time schedule leads to many advantages such as continuous flow of work, reduced volume of rework, minimisation of confusion and misunderstanding. Using a daily work system instead of a unit rate system has an average negative effect on labour productivity and ranked in position 1 of all 49 factors negatively affecting labor productivity (Table 3). This result is justified, as the labor desire to work by unit rate system to earn more money. Therefore labour works too hard to finish the greatest volume of work when working by the unit rate system.

Work time reduction on the construction site has a moderate effect on labour productivity, and is ranked in position 3 of all factors negatively affecting labour productivity. This result was also supported by [12], who mentioned that work time reduction on a construction site has an adverse impact on labour

productivity. This result is justified, as work time reduction on a construction site causes overcrowding of labor which consequently reduces labour productivity.

**Supervision group**

All supervision factors have a high impact on productivity and were ranked according to their importance as follows: rework, absence of supervisor, late checking. Changing drawings and specification during execution is the most important (Table 8) factor in supervision factors group, and is ranked within the 16 most important factors negatively affecting productivity, with an importance index value of 49.33. This result is supported by [10], who stated there is a 30 % loss of efficiency when work changes are being performed. This result can be interpreted as changes of specifications and drawings that require additional time for adjustments of resources and manpower so the change can be met. Labour morale is also affected by extensive numbers of changes.

**Table-8: Rank factors under supervision group**

Factors	Imp. Index	Rank
Rework	56.67	1
Absence of supervisor	55.33	2
Late in checking	51.33	3
Changing drawing and specification	49.33	4

Late in checking is the third important factor in supervision factors group, and is also ranked within the 14 most important factors negatively affecting productivity. Late in checking also has a high impact in the Indonesia [9]. This result is justified, as work inspection by a supervisor is an essential process to proceed in work, for example, as contractors cannot cast concrete before inspection of formwork and steel work, late in checking contributes to delays in work activities.

Absence of supervisor, the second factor in the supervision factors group, is ranked in position 7 of all factors negatively affecting labour productivity. This is not surprising in Menara Sentraya. supervisors can

stops work totally in activities that require attendance of supervisors,

**Group project**

The most important factor in this group was working within same work type, work method, activity type in project, project fence (Table 9). Working within same work type was ranked in position 1 of 49 factors negatively affecting labour productivity. This result is supported by [10], in which it was reported that one of the common reasons for low productivity is working within a same work type. This result might be justified, as same work type reduce of labour and consequently reduce their productivity.

**Table-9: Rank factors under project group**

Factors	Imp. Index	Rank
Same work type	60.00	1
Work method	58.00	2
Activity type in project	51.33	3
Project's fence	49.33	4

Work method has an average impact on labor productivity and was ranked in position 3 of all factors. Work method also has a significant impact on labour productivity in Indonesia [9].

Results also indicate that the work method and type of activities in the project are not considered to be as instrumental as other factors, and were ranked in positions 3 and 14 of all 49 factors negatively affecting labour productivity. This result is supported by [10], who found that work method and activity type project have a high impact on labour productivity. This result might be justified, because building projects within the Menara Sentraya are complex and are big in size. Therefore activities in

different projects largely have the same work type and there is any major difference between work methods used in construction.

**Group safety**

The result in Table 10 depicts that the 8 factors under the safety group have been placed in descending order as follows: work at high place, less lighting, safety briefing, and safety violation, no safety officer in site, bad ventilation, accident and noise.

**Table-10: Rank factors under safety group**

Factors	Imp. Index	Rank
Work at high place	58.00	1
Less-lighting	56.67	2
Safety briefing	56.67	3
Safety violation	53.33	4
No safety officer in site	53.33	5
Bad ventilation	53.10	6
Accident	52.00	7
Noise	48.67	8

Accidents have a high impact on labour productivity, and ranked in position 13 of 49 factors negatively affecting labour productivity. These results were supported by [10], who stated that accidents have a significant impact on labour productivity.

Insufficient lighting has an average impact on labour productivity and ranked in position 5 of all 49 factors negatively affecting labour productivity (Table 3). This result is justified, as labour needs sufficient lighting to work effectively and consequently insufficient lighting has a negative impact on labour productivity. Bad ventilation and working at high places are not considered to be as instrumental as other factors, and ranked in positions 11 and 3 of all factors negatively affecting labour productivity.

The results also indicate that unemployment of the safety officer on construction site is not considered to be as instrumental as other factors on labour productivity. This result is justified within the Menara Sentraya, as contractors seldom employ safety officers in building projects; therefore they are not aware of the importance of employing a safety officer on construction sites. It should be noted that employment of a safety officer on construction sites helps the labour to understand the required safety regulations and then to

follow them. This prevents, or at least reduces, the number of accidents which consequently improves labour productivity. Noise also is not considered to be as instrumental as other factors on labour productivity, and ranked 17 in the last position of all factors affecting productivity. This result is justified, as equipment and tools used in building projects within the Menara Sentraya cause little noise.

**Quality group**

The results in Table 11 depict the 3 factors under the quality factors group; these are placed in descending order as follows: High quality work requirement, low quality material, inefficiency tools or equipment, poor quality of raw materials, and high quality of required work. The surveyed companies have more tendencies to place inefficiency of equipment as the most important factor within this group, with an importance index value of 38.67. This result might be justified, as the productivity rate of inefficient tools is low and this consequently has an adverse impact on labour productivity depending on this equipment. The type of equipment also affects labour productivity for example new and modern equipment has a high productivity rate, while old equipment has a low one and is subject to large number of breakdowns.

**Table-11: Rank factors under quality group**

Factors	Imp. Index	Rank
High quality work requirement	50.00	1
Low quality material	46.00	2
Inefficiency tools	38.67	3

The surveyed companies ranked poor quality of raw materials at position 19 of all factors affecting labour productivity, with an importance index value of 46.00. This result might be justified, as the time needed to build with materials of poor quality is greater than the time needed to build with high quality materials. Additionally, wastage of materials of poor quality is high, particularly during handling. Furthermore, using materials of poor quality leads to poor quality work, which is consequently rejected by the supervisor. Quality of required work has an average impact on labour productivity and ranked in position 15 of all 49 factors negatively affecting labour productivity. This result is acceptable, as time required to finish work depends greatly on allowed tolerance of required work i.e. when the tolerance of required work is very low, labour work slowly in order to avoid unacceptable mistakes.

**External group**

The results in Table 12 demonstrate that 2 factors of the external factors group have been ranked according to their importance as follows government regulation violation and climate related to the construction sector. Climate changes have an average impact on labour productivity and ranked in position 13 of all factors affecting the productivity. Government regulations related to the construction sector is not considered to be as instrumental as other factors and ranked in position 9 of all factors negatively affecting labour productivity. This result might be justified within the Menara Sentraya where government regulation of construction projects has been subjected to minor changes only during finishing work.

**Table-12: Rank factors under external group**

Factors	Imp. Index	Rank
Government regulation violation	54.00	1
Climate change	52.00	2

**Overall ranks of all factors negatively affecting labour productivity**

The results in Table 3 depict that the most 5 important factors negatively affecting labour productivity are mistakenly using work hour, direct work system and same work type, with important indexes values of 60.00. On the other, results indicate that inefficiency tools, low quality material, no place for eating and resting same with warehouse near to work site were the lowest factors negatively affecting labour productivity, with important index values of 38.67, 46.00, and 48.00.

**Ranking groups negatively affecting labour productivity**

The results in Table 3 demonstrate the ranking of 10 groups that affect labour productivity. It is noted that the materials/tools factors group was ranked first of 10 factor groups negatively affecting labour productivity this result is justified, as any project cannot be executed without availability of materials and tools. The current payment condition within the Menara Sentraya causes frequent closures of crossing points between the Menara Sentraya, which results in of material availability and some tools in the local market, which affects labour productivity too much. On the other hand, the external factors group was ranked last of the 10 groups affecting labour productivity, which can be readily interpreted as that the government shows little concern about safety and that contractor companies have small awareness of the impact of safety factors on labour productivity. Therefore these safety factors were rated as having

only an average or low impact on labour productivity.

**CONCLUSION**

The aim of this research was to identify factors affecting labour productivity in building projects and to rank these according to their relative importance from the contractor’s viewpoint within the Menara Sentraya construction project. A total of 49 factors were identified in this study with identification of factors influencing construction productivity being based on a careful review of literature and suggestions from director and project manager in site building construction.

The results indicated that the main 10 factors negatively affecting labour productivity are 1) Materials and tools 2) Disloyalty 3) Lack of supervision 4) Late payment. 5) Mistakenly using work hour 6) Rework 7) Same work type 8) Work at high place 9) high quality work requirement 10) Government regulation violation. Furthermore, 49 factors considered in the study were divided into 10 groups, which were ranked according to their importance index:1) Materials and tools factors group 2) Labor factors group 3) Leadership factors group 4) Motivation factors group 5) Time factors group 6) Supervision factors group 7) Project factors group 8) Safety factors group 9) Quality factors group 10) External factors group.

It is recommended that contractin companies should provide a materials supply schedule for each project. This schedule should include the time required to supply materials and the availability of



materials on the local market to furnish the required materials in time. Contracting companies should also select a suitable storage location for purchased materials in each project, which should be easily accessible and close to constructed buildings to avoid wastage of labour time for multiple handling materials. Contracting companies have to pay more attention to the quality of construction materials and tools used in their projects, as using appropriate materials and tools reduces both the time taken to finish the work and wastage of materials. Using appropriate materials and tools also has a positive effect on the quality of work, which consequently improves labour productivity. Project management has to assign or recruit the right people to do the job and should also keep a close eye on labour work to make sure they understand site instructions. Furthermore, it ought to maintain friendly relations with labour and let them know they are important to the organisation and involve them in decisions affecting their jobs, such as process improvements.

It is necessary to use project scheduling techniques in each project to optimise the times of related activities and to ensure that works allow continuous task performance, so as to reduce idleness of the labour force to a minimum. It is important for each contracting company to adopt motivational or personnel management measures to boost labor morale. Contracting companies have to conduct productivity studies at the activity operation level, such as studying factors affecting labour productivity and labour productivity measurement to describe the detailed tasks performed for an activity operation by individual or group in order to establish problem areas and propose ways to improve labour productivity. Contracting companies are also encouraged to keep historical data of productivity studies in completed projects to improve the effectiveness and accuracy of cost estimation of future projects.

It is necessary to conduct training courses and seminars in the topics that will improve productivity in construction projects. The training effort should be tailored to improve abilities to use project scheduling techniques such as Microsoft project. The training effort should also be tailored to improve methods of studying productivity and ways of productivity improvement on construction sites. There is a need to increase the number of trade schools that focus on teaching construction trades such as block work, formwork, reinforcement and concreting to improve the abilities and skills of craftsmen working on construction projects. More efforts should be made by contracting companies to benefit from what other developed countries have achieved through technology transfer and best use of benchmarking.

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