

LABOR PRODUCTIVITY FACTORS AFFECTING THE PROJECTS QUALITY PERFORMANCE IN INDONESIA

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Abstract. Problem of labor productivity has become the focus of many researchers and there has been much research conducted to identify factors that affect labor productivity. Existing studies generally measure the productivity base on time or cost associated with the project. But over time, demand from the users of construction services increased, therefore labor productivity also needs to be associated with the quality they produce.

The aim of this research is to identify factors of labor productivity that affect project quality performance in building construction projects in Indonesia. Data were collected on a survey made on various buildings project in Indonesia. Respondents were required to rank factors of labor productivity that affect project quality performance base on their experience. The analysis of 113 factors grouped in 15 considered in a survey indicates that “*supervision factors*” were found as the most important group with “high effect”, and the subsequent 4 groups: “*execution plan factors*”, “*leadership and coordination factors*”, “*design factors*”, and “*labor factors*” were evaluated as “average effect”. The others group were evaluated as “some effect”. Meanwhile, the main factors negatively affecting the project quality performance are: *low quality of material, unclear instruction to laborer, no supervision method, lack of labor experience, low supervisor’s capability/incompetence supervisors, bad leadership, low skill level of laborer, supervisors absenteeism, poor construction method (e.g. Poor sequencing of work items), and incomplete drawings and design changes.*

The results will become worthwhile information in preparing strategy to improve the project quality performance and also as part of further research in relationship to improve the productivity in Indonesian construction industry. The policy makers and researchers should focus on the identified major factors in order to improve project quality performance.

Keywords: labor productivity, quality performance, construction project, productivity.

1. Introduction

Performance of project completion is often associated with their labor productivity. Similarly, efforts to improve the performance of project completion can not be separated by construction labor productivity. Meanwhile, construction labor productivity problem has become the focus of many researchers in recent years. There have been many researches conducted to identify factors that affect labor productivity. However existing studies generally measure the productivity base on time or cost associated with the project, whereas the performance of project completion in general consists of time, cost, and quality (McKim *et al*, 2000). But over time, demand from the users of construction services increased, in which productivity will not mean anything if the quality of the resulting low. Therefore, labor productivity also needs to be associated with the project quality performance.

Efforts undertaken to improve the construction labor productivity needs to take into account these three factors (time, cost, and quality) in order to get a better picture in understanding productivity problems. Therefore an understanding of factors affecting the quality of this work will be additional information that is useful in determining factors affecting productivity in order to increase the productivity of project completion in the construction industry.

Increasing the productivity of project completion in the construction industry is needed considering of the effect on the national economy of a country (Hillebrandt, 1998; World

Bank, 1984). Similarly, Indonesia as a developing country with projects value continues to increase each year, the company providing construction services in Indonesia is required to improve their productivity performance in order to give maximum contribution to economic growth.

This study will examine the labor productivity factors that affect project quality performance in building construction projects in Indonesia, where the building construction projects have different complexity and demands of qualities with other construction types. Beside that, policy to improve productivity is not necessarily the same in every country. Research by Polat and Arditi (2005) showed that the critical factors in developing countries differs from that in developed countries. This is certainly also true in Indonesia, because Indonesia has the unique conditions that are different from other countries. Indonesia is an archipelagic country with a very wide range of people from different tribes and groups with diverse cultures and beliefs, and demographic characteristics of a typical environment. Given these unique characteristics, it is necessary to understand the existing conditions to be making efforts to improve the project quality performance.

2. Factors affecting labor productivity

The decreased of project completion performance is an indicator of problems associated with productivity and productivity problems are usually associated with labor performance (Lowe, 1987; Handa and Abdalla, 1989; Olomolaiye and Ogunlana, 1989; Emsley *et al*, 1990). For that reason many efforts have been made in order to improve project completion productivity and problems of increasing productivity has long been a concern of many researchers and several researches have been carried out and many factors influencing labor productivity have been investigated by Oglesby *et al* (1989); Olomolaiye *et al* (1989); Sanders and Thomas (1991); Thomas (1992); Langford *et al* (1995); Motwani *et al* (1995); Lim *et al* (1995); Baba (1995); Zakeri *et al* (1996); Lema (1996); Kaming *et al* (1997); Olomolaiye *et al* (1998); Thomas *et al* (1999); Makulsawatudom and Emsley (2002); Ibbs (2005); Hanna *et al* (2005); Nepal *et al* (2006); Khoramshahi *et al* (2006); Enshassi *et al* (2007); Alinaitwe *et al* (2007); Weng-Tat (2007); Hanna *et al* (2008); and Kazas *et al* (2008).

The identified key factors were used by stakeholders in each country to formulate their strategies to improve the performance of the construction industry. Nevertheless, although much research has been done and produce the factors that affect productivity, but there are still many things still unknown (Makulsawatudom and Emsley, 2002), and there are many determinants of productivity have not been well understood, in addition productivity data are still contradictory (Lim and Price, 1995) for that further research needs to be done.

Based on past researches above, 113 factors affecting construction labor productivity have been identified. The factors were grouped into 15 groups base on their characteristic: 1. Design (5 factors, included factors relating to completeness of design); 2. Execution plan (5 factors, included factors relating to completeness of execution plan); 3. Material (8 factors, included factors relating to availability of material); 4. Equipment (6 factors, included factors relating on using equipment); 5. Labour (18 factors, included factors relating to labor condition); 6. Health and safety (4 factors, included factors relating to implementation of health and safety work); 7. Supervisor (6 factors, included factors relating to supervision method); 8. Working time (6 factors, included factors relating to time and scheduling); 9. Project factor (15 factors, included factors relating to condition and complexity of the project); 10. Quality (3 factors, included factors relating to quality performance); 11. Financial (6 factors, included factors relating to financial support); 12. Leaderships and coordination (5 factors, included factors relating to coordination and communication); 13. Organization (12 factors, included factors relating to manajerial); 14. Owner/consultant (4 factors, included factors relating to owner/consultant's involvement); 15. External factor (10 factors, included factors relating to weather, rules, and politic). Those factors generally were identified base on time or cost associated with the project. In according to get better understanding in

productivity problems those factors need to be assess against quality performance of works generated. For that, those indicators will be used as a basis for preparing a questionnaire to determine its effect on the project quality performance.

3. Methods

3.1. Research method

Survey was made through questioner distributed to respondents who involve in managing building projects in wide area in Indonesia. The respondents are people who work as: operational director, project manager, project coordinator, construction manager, site manager, site engineer, superintendent, estimator, supervisor, etc. They work at contractor companies in Indonesia both private and government, in addition there are some of respondents who work as public works official in various areas in Indonesia and was involved with various building projects as a representative of the owner (the government).

In this study, an ordinal measurement scale 1 to 5 was used to determine the effect level. Respondents were asked to rank factors affecting quality performance according to the degree of importance (1 = affects with little degree; 2 = affects something; 3 = affects with average degree; 4 = affects with large degree; 5 = affects with very large degree). For analyzing data by ordinal scale, an importance index (I) was used by following equation (Lim *et al*, 1995a):

$$\text{Importance index} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{5(n_1 + n_2 + n_3 + n_4 + n_5)} \times 100$$

Where:

- n_1 = number of respondents who answered "little effect";
- n_2 = number of respondents who answered "some effect";
- n_3 = number of respondents who answered "average effect";
- n_4 = number of respondents who answered "high effect";
- n_5 = number of respondents who answered "very high effect".

The Importance index (I) for all factors was calculated. Meanwhile, the group index was calculated by taking the average of factors in each group. The maximum value of the index is 100 when all respondents answered "very high effect" and the minimum value of the index is 20 when all respondents answered "affects with little degree". Since the results are obtained as decimal numbers instead of integer numbers, a specific scale should be established. Thus, 5 expressions are defined by the intervals of 20 to classify the effect of level (see Figure 1).

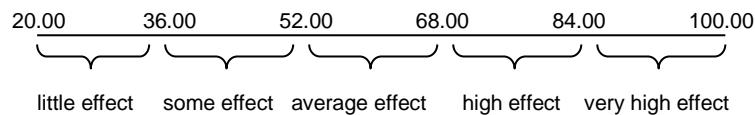


Figure 1
Evaluation scale

3.2. Survey response

As a result of surveying, mailing, and following up, a total of 51 questionnaires were completed and return from various district in Indonesia (see Table 1).

Table 1
Survey area and number of responded

No	Area of survey	Number of respondent
1	North Sumatera	1
2	West Sumatera	5
3	Riau Island	1
4	Jakarta and surrounding	13
5	West Java	28
6	East Java	1
7	South Sulawesi	1
8	Middle Sulawesi	1
		51

The respondents come from large contractor (41.18%), small-medium contractors (47.06%), and some are public officer from public work minister and their associates (11.76%). A close personal contact with contractors is needed due to a lot of item in questionnaire to be filled. Meanwhile, the majority of respondents (94.12%) have working experience more than 5 years, more over 43.14% have working experience more than 10 years. The experiences of the respondents include various building construction projects from low-rise to high-rise buildings (see Table 2).

Table 2
Type of project

Type of building			Number of respondent
< 3 floors	3 – 10 floors	> 10 floors	
25	14	12	51

4. Results and discussion

In this study, 113 factors negatively affecting project quality performance in building construction project in Indonesia have been ranked according to their importance index (I). These factors have been classified into 15 groups: *supervision*; *execution plan*; *leadership and coordination*; *design*; *labor*; *material*; *organizational*; *equipment*; *owner/consultant*; *working time*; *quality*; *external factors*; *financial*; *health and safety*; and *project factors*. The 15 groups was rank base on the group index calculated by taking the average of factors in each group (see Table 3).

Among 15 groups considered in this study, there are one group having “high effect” (*supervision group*), 4 groups having “average effect” (*execution plan group*, *leadership and coordination group*, *design group*, and *labor group*), and 10 others groups with “some effect”. Meanwhile *project factor group*, *health and safety group*, and *financial group* are the bottom 3 ranking of groups negatively affecting project quality performance. Nevertheless even it only have “some effect”, *health and safety factors* need to be take care cause it will effect to quality of work life (QWL). The QWL will increase work motivation and finally will improve labor productivity (Soekiman, 2009).

Meanwhile among 113 factors considered in this study, there are total 10 factors with importance index 68.00 – 80.00 (high effect) and spread into the top 6 groups; 43 factors with importance index 52.00 – 68.00 (average effect), 49 factors with importance index 36.00 – 52.00 (some effect), and 11 factors with importance index 20.00 – 36.00 (little effect).

The top 20 ranking of factors negatively affecting project quality performance can be seen as a whole in Table 4. The first 10 factors are evaluated as “high effect” and the subsequent 10 factors are evaluated as “average effect”.

Table 3
Ranking factors negatively affecting project quality performance among groups

Factors groups	Importance index	Effect level	Rank
Supervision group	68.6920	High	1
Execution plan group	64.1560	Average	2
Leadership and coordination group	62.7460	Average	3
Design group	59.3720	Average	4
Labour group	55.1420	Average	5
Material group	51.2260	Some	6
Organizational group	51.1760	Some	7
Equipment group	49.8040	Some	8
Owner/Consultant group	48.5300	Some	9
Working time group	47.3860	Some	10
Quality group	44.4440	Some	11
External factor group	43.6080	Some	12
Financial group	43.3980	Some	13
Health and safety group	43.7260	Some	14
Project factor group	41.0980	Some	15

Table 4
Top 20 ranking of factors negatively affecting project quality performance

Factors	Imp index	Effect level	Rank
Low quality of material	74.9020	High	1
Unclear instruction to laborer	72.9412	High	2
No supervision method	71.3725	High	3
Lack of labor experience	71.3725	High	4
Low supervisor's capability/Incompetence supervisors	70.5882	High	5
Bad leadership	70.5882	High	6
Low skill level of laborer	70.1961	High	7
Supervisors absenteeism	69.8039	High	8
Poor construction method (e.g. Poor sequencing of work items)	68.6275	High	9
Incomplete drawings and design changes	68.2353	High	10
Inappropriate work method	67.8431	Average	11
Bad site management	67.8431	Average	12
Miscommunication between labor and supervisor	66.6667	Average	13
Inspection delay	66.2745	Average	14
Poor communication (e.g. inaccurate instructions, inaccurate drawings)	66.2745	Average	15
Lag of skill laborer	66.2745	Average	16
Indiscipline labor	65.4902	Average	17
Bad material management	64.3137	Average	18
Bad resource management	63.9216	Average	19
Incomplete design	63.5294	Average	20

Result indicated that the top 10 ranking of factors negatively affecting project quality performance was spread into the top 6 groups having “average effect” to “high effect”.

Supervision group

Among 15 groups of labor productivity factors affecting project quality performance, “*supervision factors*” were found as the most important group with importance index 68.6920 (high effect), as can be seen in Table 3. Six factors were investigated in this group, and “*unclear instruction to laborer*” (high effect; Imp. index 72.9412), “*no supervision method*” (high effect; Imp. index 71.3725), “*low supervisor’s capability/incompetence supervisors*” (high effect; Imp. index 70.5882), and “*supervisors’ absenteeism*” (high effect; Imp. index 69.8039) were ranked by the respondents as the 4 most effective factors. The 4 factors exist among the top 10 factors when 113 factors are considered and the supervision group becomes the most important group that affects project quality performance. Consequently this group needs a special attention when considering in improving project quality performance.

Execution plan group

The second most importance group is “*execution plan factors*” with importance index 64.1560 (average effect). Five factors were investigated in this group and “*poor construction method e.g. poor sequencing of work items*” (high effect; Imp. index 68.6275) was ranked by the respondents as the most effective factors. The factor exists among the top 10 factors when 113 factors are considered.

Leadership and coordination group

The third most importance group is “*leadership and coordination factors*” with importance index 62.7460 (average effect). Five factors were investigated in this group and “*bad leadership*” (high effect; Imp. index 70.5882) was ranked by the respondents as the most effective factors. The factor exists among the top 10 factors when 113 factors are considered.

Design group

The fourth most importance group is “*design factors*” with importance index 59.3720 (average effect). Five factors were investigated in this group and “*incomplete drawings and design changes*” (high effect; Imp. index 68.2353) was ranked by the respondents as the most effective factors. The factor exists among the top 10 factors when 113 factors are considered.

Labor group

The fifth most importance group is “*labor factors*” with importance index 55.1420 (average effect). Eighteen factors were investigated in this group and “*lack of labor experience*” (high effect; Imp. index 71.3725) and “*low skill level of laborer*” (high effect; Imp. index 70.1961) were ranked by the respondents as the most effective factors. The factors exist among the top 10 factors when 113 factors are considered.

Material group

The sixth most importance group is “*material factors*” with importance index 51.2260 (average effect). Eight factors were investigated in this group and “*low quality of material*” (high effect; Imp. index 74.9020) was ranked by the respondents as the most effective factors. The factor exists among the top 10 factors when 113 factors are considered.

5. Conclusion

A total of 113 factors were identified in this study, with identification of factors influencing construction productivity being based on careful review of literature. These factors have been classified into 15 groups.

The results indicated that the main 20 factors negatively affecting project quality performance are: (1) low quality of material; (2) unclear instruction to laborer; (3) no supervision method; (4) lack of labor experience; (5) low supervisor's capability/Incompetence supervisors; (6) bad leadership; (7) low skill level of laborer; (8) supervisors absenteeism; (9) poor construction method (e.g. Poor sequencing of work items); (10) incomplete drawings and design changes; (11) inappropriate work method; (12) bad site management; (13) miscommunication between labor and supervisor; (14) inspection delay; (15) poor communication (e.g. inaccurate instructions, inaccurate drawings); (16) lag of skill laborer; (17) indiscipline labor; (18) bad material management; (19) bad resource management; and (20) incomplete design.

Meanwhile among 15 groups of labor productivity factors affecting project quality performance, "*supervision*" were found as the most important group with "high effect", and the subsequent 4 groups: "*execution plan*", "*leadership and coordination*", "*design*", and "*labor*" were evaluated as "average effect". The others group were evaluated as "some effect"

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