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# **EFFECT OF QUALITY SUPERVISION ON REWORK IN THE INDONESIAN CONTEXT**

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## **Abstract**

The quality of site supervision has a major influence on the overall performance and efficiency of construction projects. Inadequate supervision is believed to be one of the major causes of rework. Therefore, experienced and well-trained supervisors have an important role in minimising the amount of rework due to construction defects.

This paper argues that the quality of site supervision Indonesia is directly related to the supervisor's level of experience gained through formal training. Hence, the paper attempts to explore the relationship between the quality of site supervision, expressed as training cost, and the rework cost borne by contractors in high-rise building construction.

Based on site data collection targeting ten building construction sites in Indonesia, this paper suggests that inadequate site supervision is the principal cause of rework during construction. It also offers insights into the statistical relationship between the cost of supervisors' training and the cost of rework.

This research was carried out in the developing economy of Indonesia. It may be that the issues of site supervision evidence here are typical of other economies in transition.

**Keywords:** Quality supervision; Rework; Rework costs; Training cost; High-rise construction; Indonesia.

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## INTRODUCTION

The Indonesian construction industry is facing a serious labour skill shortage problem. Young people are not keen to join the industry mainly because local construction jobs tend to rely on physical work or hard manual labour and offer relatively poor pay conditions. Even when they do, most of them do not receive proper training before entering the industry, leading to poor productivity.

Due to the improved economy in 1990's, customers in Indonesia are demanding better service and higher productivity. Unfortunately, conventional technologies, which rely heavily on using labour skills, have proven unsuitable to the new context of needs. Therefore, many contractors attempt to develop training programs for upgrading their employees' skills. One of these training programs is usually conducted for supervisors to develop their knowledge and skill in supervising construction site activities.

## REWORK IN CONSTRUCTION

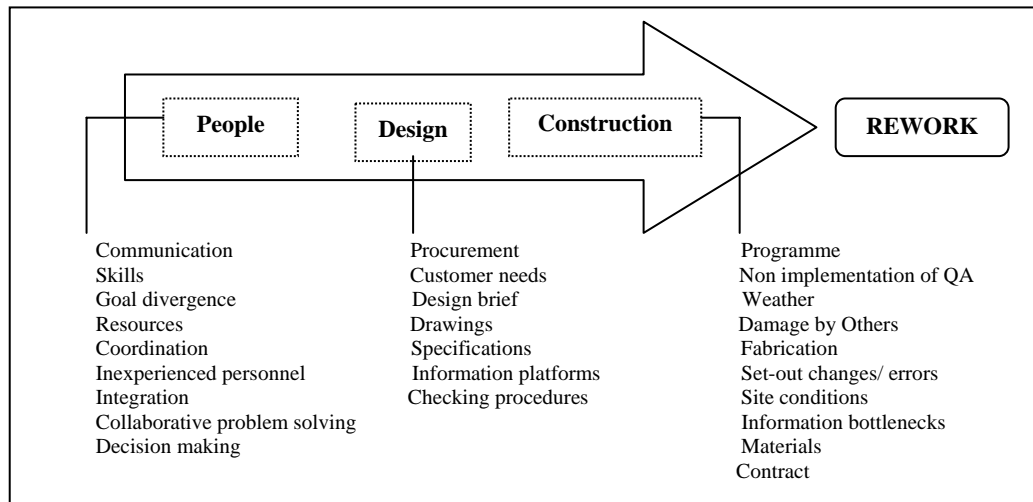
Lack of adequate planning, scheduling, materials management, quality control and quality assurance are chronic problems of construction (The Business Roundtable, 1982b). The effects of these problems are well known and include low productivity, poor safety, inferior working conditions, and inadequate quality (Koskela, 1993).

Serpell et al. (1995) argue that in most cases, construction managers do not know or recognise the factors that produce waste nor do they have measurements of their performance. It can be stated that most of the factors are not easily identifiable. Thus, the measurement of their importance would help management to act, in advance, to reduce their negative effects.

Quality management principles and tools are not strongly embedded in conventional construction management practice. As a result, rework, on many cases, is accepted as an inevitable feature of the construction process increasing the likelihood of project time and cost overruns, and ultimately leading to client dissatisfaction.

Project participants do not realise the extent of rework that actually occurs. According to Taneja (1994), the costs of rework can range from 4% to 12% of the total budget. A significant part of these costs can be traced back to poor quality of material, misunderstanding of drawing and other external factors. A study conducted on nine construction projects concluded that due to poor quality in construction, the costs of rework could be as high as 15% of the total budget (Neese and Ledbetter, 1991).

Love et al. (1997b) conducted a study to ascertain causes and associated costs of rework on two building projects. Rework cost was found to be 2.40% and 3.27% of the total project cost. Causes of rework were classified into three principal groups namely, *People*, *Design* and *Construction* as illustrated in Figure 1. According to this particular study, causes of rework related to *People* could be responsible for up to 60% of the rework costs.



**Figure 1.** The classification of causes of rework

Source: Love et al. 1997b

### TQM IN CONSTRUCTION

Many articles have addressed the adoption of Total Quality Management (TQM) principles in construction (Ahmad and Sein, 1997). Basically, there are two distinct purposes for applying TQM on construction projects (Jaafari, 1996). These are satisfying the customer's requirements through a quality assurance (QA) system and achieving continuous improvement (CI). Jaafari also stresses that the application of TQM in construction will not only reduce failure (rejects or reworks) costs, but also makes efficiencies in the respective construction and management processes.

The International Organisation for Standardisation (ISO) developed the ISO 9000 series in the 80's. ISO 9000 standards are now accepted internationally as an approach to quality system. In general, the standards describe a number of issues on which an external party (a certification institute) can assess the quality system of an organisation. If the quality system conforms to these standards, then a certificate can be issued and formal registration take place, indicating that the implemented quality system meets the requirement of the ISO 9000 series.

In Indonesia, TQM is gaining popularity with many project managers attempting to create a quality documentation as required in the ISO 9000 standards. Construction firms are also anxious to acquire ISO 9000 certificates. This is due to the absence of an accurate systematic approach to measure the efficiency the current documentation process.

### REWORK AS WASTE

According to Love et al. (1997a), rework is defined as an activity that is deemed to be complete, but not to the satisfaction of the customer. As a result, the activity is required to be altered in accordance with customers' requirements. In this case, rework includes defects and may also include variation that can occur at any time in any process. Invariably, these issues (rework and variations) contribute to project overruns in time, cost and naturally client dissatisfaction (Love et al. 1997b).

Koskela (1994) describes that construction process is a combination of value-adding activities and non value-adding activities. He describes the latter as an activity that consumes time, resources or space but does not add value to the final output. Alarcon (1995) argues that construction activities are characterised by high contents of non value-adding activities leading to low productivity. Thus, process improvement, through identifying and eliminating rework, has a significant impact on productivity.

### **SUPERVISION AND REWORK IN INDONESIA**

Construction projects in Indonesia are labour intensive. It is believed that approximately 2.5 million labourers are involved directly employed by the construction industry. However, most of them work as unqualified and unskilled labourers. As a result, extra coordination and supervision needs to be given. In other words, the success in completing site activities, right the first time, relies heavily on the quality of supervision.

Naturally, the quality of supervision is dependent upon the supervisor's skill. A supervisor is usually given authority and responsibility for planning and controlling the work of a group by close contact (Betts, 1989). Eckles et al. (1975) state that supervisors are managers whose major activities focus on leading, coordinating and directing the work of others in order to achieve group goals. In addition, they argue that a successful supervisor has to deal with several skills such as management skills, human relation skills and skills in leadership, motivation, communication and organisation behaviour.

In Indonesia, construction site supervision is a crucial element. The inability of many supervisors to plan work, communicate with workers, and direct activities adequately is fundamentally linked to increasing amount and cost of rework. These abilities can be improved by formal training (The Business Roundtable, 1982a). Most of project managers argue that formal training can improve the supervisor's skills. However, the majority of supervisors learn their job the hard way; that is, making mistakes and then correcting them. Although this system of trial and error is considered to be an essential part of training, practical experience must be supplemented by formal training to form a sound working basis (Betts, 1989).

Performance improvement opportunities could be easily identified if the waste concept is well understood by contractors. However, as mentioned above, due to the poor quality of documentation, most Indonesian contractors do not have reasonably accurate estimates of rework costs. Therefore, research into the rework issue was conducted to identify the following: causes of rework, rework costs, formal training costs, and quality of supervision.

### **CASE STUDY**

To determine the relationship between quality supervision and rework, ten large building constructions in Jakarta, the capital of Indonesia, were targeted with a focus on the quality of supervision. In addition, data regarding the cause and the quantity of rework was collected. This study was limited to inspecting the quality of concrete formwork set-up, steel bars fixing and concrete pouring.

### **Research methodology**

The first stage of this research was to conduct a survey targeting large contracting organisations in Jakarta. The questionnaire form was divided into two sections. The first section was designed to solicit information from contractors regarding the causes and cost of rework. Section two concentrated on supervisors' activities and training. In the second stage, interviews held with ten project managers and supervisors in order to supplement the findings of the questionnaire survey.

## **PRELIMINARY FINDINGS**

### **Supervisor and supervision**

Survey respondents believe that the following activities are common to all supervisory jobs:

- Understanding site-drawings;
- Understanding quality specifications;
- Attending site-meetings;
- Planning, allocating labourers and jobs/ tasks;
- Discussing problems with foremen and labourers;
- Reading and writing reports;
- Talking to other supervisors and managers;
- Controlling and checking each jobs/ tasks being taken in projects;
- Organising site storage.

Therefore, supervisors must have the ability to plan, organise, lead, monitor and control. They also must have basic technical and inter-personal skills, and most importantly, a good knowledge of every operation under their control.

It is interesting to note that although project managers accept that some form of supervisory training is essential, and show initial enthusiasm towards this topic when it is discussed, only few seem prepared to take any practical step. Some managers said that supervisors either cannot be spared or are too busy to make the arrangements. Others ignore the facilities offered, possibly because they think the subject is unimportant.

### **Quality supervision**

Supervisors' jobs are to use available resources effectively and efficiently. All project managers agree that the effectiveness of supervisors' efforts is judged by how well they manage each phase during the construction process, and by the value of the end products or services produced. This situation is known as quality supervision.

The success of supervision does not merely depend on the number of supervisors in a project, but on how inspection is conducted. Both supervisors and project managers agree that there is not much point in inspecting goods at the end of the process. Since causes of rework are generated during the process, supervisors need to be more proactive in discovering these causes. In addition, they should communicate their concern, instructions, and take action(s) whenever necessary to deal with the identified problem.

### Site Documentation

From the contractors' point of view, the quality of site documentation is significantly important. Most interviewed project managers believe that one of the best way to produce top quality documentation is to closely follow ISO 9000 standard which is relatively new in Indonesia. They also advocate that site documentation should start as early as possible. Another general trend was also observed by managers; labourers are not using their own initiative, they rely on supervisors' ability to check and approve all works. This includes checking the work done and highlighting rework.

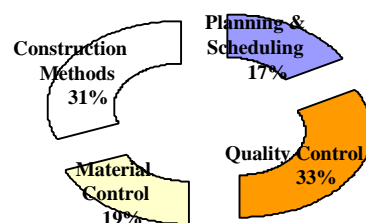
### Quality supervision and training

Many project managers and supervisors agree that formal training is one of the best instrumental tools in improving supervisors' skills. However, some of them argue that it is quite difficult to quantify such improvement. Project managers describe that training programs are needed for:

- Improving supervisors' self-confidence;
- Reducing rework costs;
- Improving operations efficiency; and
- Encouraging continuous development.

### Training and rework cost

The project managers acknowledge that the subject of the training programs have to be specific and tailored to the needs of both the project and the individuals involved in it and, of course, should be determined by prior analysis. Project managers proposed a list of recommended training themes, combined and are reflected in Figure 2.



**Figure 2.** The training themes

The survey findings highlight the following facts:

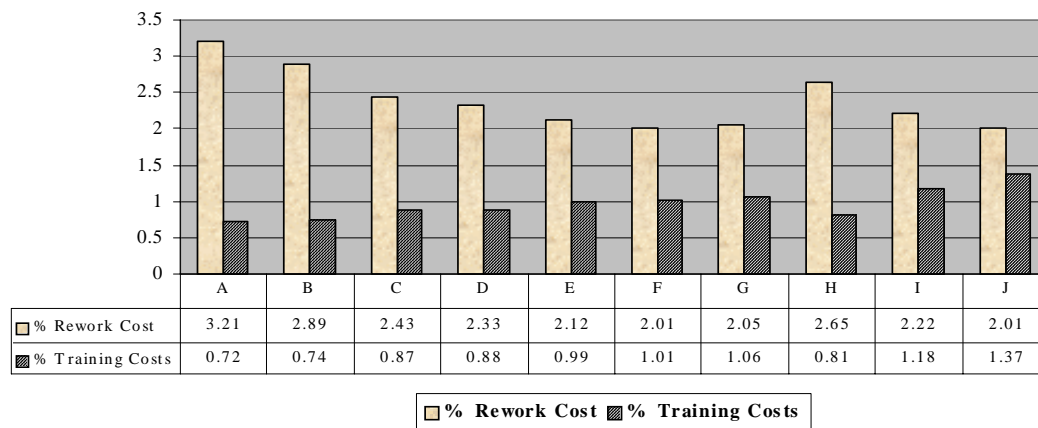
1. Training is more useful when it is designed to accomplish a specific task.
2. There are many training programs available, which can be obtained from contractors associations, consultants and universities. These training programs include both theoretical and practical knowledge.
3. Some contractors are dissatisfied with some training programs and believe that an analysis is required to choose the right program to meet the defined need.
4. Many contractors have developed their own formal 'in-house' training and evaluation process and generally they do not share their programs with others.
5. Contractors should finance the training within their company overhead budgets.
6. Occasionally the project promoter may contribute towards financing the training.
7. Training costs range between 0.72% and 1.37% of the total budget (see Figure 3).

According to the survey and interviews, all the rework incidents have been categorised qualitatively and quantitatively. The findings gave a clear description of rework causes. They are:

- Inexperienced supervisor;
- Labour skills shortage;
- Unclear site-drawing;
- Error in choosing construction method;
- Resource shortage; and
- External factors such as, changes by owner, inclement weather, etc.

The project managers acknowledge that in some cases, the causes might be inter-related or lead to one another. For example, an inexperienced supervisor who makes a mistake in choosing the suitable construction method will certainly affect the construction process. However, they strongly agree that inexperienced supervisors and lack of labour's skill are major causes of rework.

For the ten high-rise buildings, the focus of this study, the rework costs range from 2.01% to 3.21% of the total project costs (see Figure 3.) Figure 3 demonstrates that usually, rework costs and training costs have a negative relationship. With the exception of a single project, it seems the more money spent on training, the less the rework cost is.



**Figure 3.** Training and rework costs

### Savings

Based on the interviews, any estimate of savings to these contractors accruing from construction supervisory training would be subjective. However, according to company documentation and annual records, supervisory training has consistently indicated substantial savings. The savings may result from reduced rework costs. Contractors who have been conducting training programs regularly can reasonably reduce their rework costs between 11% and 22% (Alwi et al., 1999).

### CONCLUDING REMARKS

A number of leading contracting companies in various countries have started to aggressively adopt the principles of lean construction for reducing defects (Koskela,



1994). Many researchers (Ballard, 1993; Taskanen et al., 1993; Alarcon, 1995) argue that identifying rework, to improve the construction output (increase quality), is a core activity in applying the lean construction concept. However, understanding and appreciating the investment associated with it needs to be well understood by construction personnel.

This paper has argued that the supervisors have a vital role in reducing the amount of rework in the Indonesian construction industry. They need to be educated and properly trained to be able to adopt a more proactive approach to detect and deal with rework causes. The success of supervision is more likely to be dependent on the experience, rather than merely the number of supervisors involved in a project.

Further research is required to confirm the relationship between the state of economic development and quality of site supervision.

This paper has suggested that the quality of site supervision, represented by the supervisors' level of experience gained from formal training, has a strong negative relationship with the rework cost on a construction project.

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