BUILDING DEFECTS: POSSIBLE SOLUTION FOR POOR CONSTRUCTION WORKMANSHIP

A.S. Ali* & K. H. Wen

Center for Construction, Building and Urban Studies, Faculty of Built Environment, University of Malaya, Kuala Lumpur, Malaysia
Corresponding Author: asafab@um.edu.my

ABSTRACT

This paper aims to investigate workmanship quality performance of construction projects referring to number of defects occurred for new completed building. The research objectives are the factors contribute to poor workmanship and possible measures to minimise the problem, and also the relationship between measures identified with the factors. Based on a combination of literature review and questionnaire surveys, this paper explores the factors contribute to poor workmanship and possible measures to minimise the problem, and also the relationship between measures identified with the factors. A quantitative research was conducted by sending 75 sets of questionnaire to the respondents who experienced in construction projects. The results from 30 sets of completed questionnaire were used for the quantitative analysis. This paper concludes that construction projects suffered from low quality of workmanship produced by the contractors. The most significant factor contributing to poor workmanship is lack of experience and competency of labours. Correlation test result shows that the significant factor can be sovled by providing training and education to the labours, well manpower management and proper design. This paper singles out the factors contributing to poor workmanship and possible measures that can be implemented by contractors. This would help the contractors improve quality performance on their construction projects.

Keywords: Poor Workmanship, Construction Industry.

Introduction

In Malaysia, construction industry can be known as major productive sector since the construction started in the early 1990s with the development of mammoth projects (Abdul Razak *et al*., 2010). Low and Tan (1994) stated that quality development unit (QDU) in Singapore has adopted ISO 8402 defines quality as "*the totality of features and characteristics of a project or service that bear on its ability to satify stated or implied needs"*. In construction context, quality of construction projects can be considered as poor when project objectives cannot be accomplished, customers' needs are not satified and specifications connot met. Usually, quality is one of the constraints in project success and most of the time because of poor workamnship during construction period. As a result, many issues are arised.

Poor quality in construction projects is a common phenomenon in the world. Many disputes happened among clients, house owners and parties involved in construction (especially contractors) on construction defects cases. According to Baiden and Tuuli (2004), *"defects and variations in construction products from standards is persistently a problem of concern in the construction industry in Ghana"*. Kazaz and Birgonul (2005) stated that the satisfaction of quality level in the construction projects has not been achieved and is a serious problem in Turkey. Abdul Razak *et al*. (2010) quoted from Pratt (2000) stated that quality of the certain construction projects in Malaysia are not always meet satisfaction.

Nevertheless, Wai Kiong and Sui Pheng (2005) quoted from the study of Josephson and Hammarlund (1999) found that *"most of the defects due to human factors were caused solely by "forgetfulness and carelessness," 29% by lack of knowledge, and a very small percentage were intentional. As for workmanship defects, lack of motivation dominated the costs, but the presence of risks directly increased the chance of defects"*. On the other hand, through a survey on the 27 building projects which had been done by Andrew (1999), *the "quality related events" would due to "lack of skill", "lack of knowledge" of the*

site operative, "careless", "hard to build" and "unclear project information" (quoted from Bentley, 1981). All of these causes reflect the low quality of workmanship in construction.

In a research had been done in Singapore, *"the most common defects found were pointing, hollowness in tiles, rough finishing, chip offs, evenness problem, cracks, stains, gap, and alignment out"* during the construction phase and these defects are mainly due to poor quality of workmanship (Wai Kiong and Sui Pheng, 2005).

Hence, it is necessary to identify the source of the problems and then find out the alternative to solve it. By identifying the significant factors, it provided more information about low quality of workmanship on construction projects to the contractors. Therefore, the main objective of this research is to identify the significant factors and measures that have been considered by contractors in construction projects and show the relationship between measures identified with factors contribute to poor workmanship.

General view of Malaysian construction performance

According to Sodangi *et al.* (2010), Malaysian construction industry is vital to improve the Malaysia's development process. Abdul Rahman *et al*. (2006) stated that construction sector contribute a great percentage to the economy in the growing countries, which includes Malaysia. They futher quoted from Department of Standard 2004 mentioned that *"in Malaysia, in the third quarter of 2004, the construction sector contracted by 3.0% compared to a positive growth of 2.4% in the same quarter a year ago. Up to the Asia-crisis average annual growth rate of 14% and budget 2001 allocates 24 billion RM for infrastructure projects (Bank of Malaysia 2001)."* In other words, the construction sector still plays an important role in Malaysian economy although there was economy crisis in the past.

However, Nima *et al*. (2002) pointed out that the construction industry today undergo a lot of problems such as decrease of the standard of quality, rise of cost and delay of construction project.

Abdul Razak *et al*. (2010) quoted from Wong (1991) pointed out that the weak points in the construction sector in Malaysia are lack of efficient training skills in construction field and insufficient status acknowledgement of construction technologists. From a research has been done by Tatiana (2005), who quoted from Morris *et al*. (1989) pointed out that the rate of accomplishment of construction projects was commonly considered as weak because more than 4000 projects were not finished completely among 1959 and 1986.

This can be concluded that construction sector in Malaysia still in high demand and similarly, lots of problems also arise in this sector. These problems will affect the quality performance of the construction projects. Therefore, criteria of quality measurement in construction projects need to be identified prior to the factors and possible measures.

Criteria of quality measurement in construction

Manuel *et al*. (2008) quoted from Abdel-Razek (1998a) highlighted the significant of measurement of quality in the costruction sector. Low and Wee (2001) quoted from Chung (1999) stated that construction quality can be defined as the meet of the requirements of the parties involved – *"meeting contractual requirements of the client, legislative and regulatory requirements of the authorities, social requirements of the public and even cost requirements of the contractor"*. Therefore, construction quality can be measured based on these criteria.

Besides, Tan (2009) quoted from Molenaar et al. (1999) streesed that there are three criteria of measurement of quality in construction, that are the conformity with expectations, administrative restriction and client's/ customers' satisfaction.

Conformity with expectations

According to Robby *et al*. (2001), a construction project success as well as the quality of the project, can be emphasised on the implementation of expectations of those parties involved (quoted from Sanvido *et al*, 1992; Barrett, 2000). These expectations could be the objectives have been created in the early phase of the project, such as "quality or zero defects" objectives.

Administrative restriction

Many construction projects are bonded with the administrative system. Some of the standards and guidelines are enforced in many companies for the purpose to ensure that the products of contruction projects are within the standards of quality. Takim *et al*. (2003) also agree that the approved guidelines and standards is one of the objectives of Quality Assessment System in Construction model which is recently applied by the Construction Industry Development Board of Malaysia (CIDB) to evaluate the quality measurement in construction. He further pointed out that the evaluation of workmanship can be done derived from the approved specificantions.

Clients' or customers' satisfaction

Adnan *et al*. (2000) stated that nowadays the important of quality has expanded to concentrate on the clients' or customers' satisfaction. Tatiana (2005) mentioned that the quality performance of a project is assessed by the client or project owner and also the buyer of the product. According to Takim *et al*. (2003), performance measurements apply to customer satisfactions, requirements, and needs meanwhile the customers may consist of shareholders, buyers and workers. Chinny *et al* (2010) quoted from Liu and Walker (1998) stated that the level of the statisfaction experienced decides the degree of the project success. Clearly, client satisfaction can be considered as common criteria in quality measurement in construction.

Factors contribute to poor workmanship in construction

According to Abdul Rahman *et al*. (1996), workmanship was classified as one of the most frequent non-conformance on construction site. Through literatures, eight variables that related to the causes of poor quality in construction projects had been found out. The variables are:

i. Poor project management
ii. Complicated role of subcontractor
iii. Lack experience and competency of labours
iv. Language barrier to communication and lack of communication
v. Unsuitable construction equipments
vi. Poor weather condition
vii. Limited time
viii. Limited cost

Poor project management

Dai *et al*. (2009) mentioned that ineptitude management is generally recognized as a major factor of poor construction productivity (quoted from BRT 1983; Sanvido 1988). From the research of Dai *et al*. (2009) further stated that the management factors may due to the insufficient of supervision on site. In fact, poor supervision on site contributes to the poor workmanship on construction site and it can be seen at many occasions on the jobsite (Kasun and Janaka, 2006). In addition, the ability of management on the construction site is the primary cause that affects labours' daily productivity (Dai *et al*., 2009). Jha and Chockalingam (2009) stated that the quality of porject manager is one of the causes in affecting project quality (has quoted from Anderson, 1992). Therefore, poor project management is one of the factors contribute to poor workmanship.

Complicated Role of Subcontractor

Khalid *et al*. (2006) agreed that the role of subcontractor is one of the factors contribute to construction deficiency (poor workmanship) and many people are not always focus on this factor. However, in fact, the role of subcontractor is important in construction work. This is because most of the site work is completed by subcontractors and the main contractors just depend on the subcontractors (Khalid *et al*., 2006). Khalid *et al*. (2006) further stated that approximate 90% of the site work is executed by variety of subcontractors whereas main contractor is focus on management and coordination. Besides, Chan *et al*. (2006) also mentioned that labour sub-contracting also arise severe problems in the co-ordination of work and attainment of quality standards (quoted from Shui On, 1991; Fan, 1994). Since there are various types of subcontractor involve in the same construction project, the main contractor is difficult to inspect, supervise and control the works that have been done by the subcontractors. Therefore, complicated role of subcontractor in construction projects can contribute to poor workmanship.

Lack Experience and Competency of Labours

Kasun and Janaka (2006) mentioned that "productivity cannot be achieved by speed and harder work only without adopting better work practices" (quoted from Banik, 1999). Besides, industry stakeholders agreed that insufficient of skilled manpower is the most important matter that they concern about (Jorge et al, 2005). According to Kazaz and Birgonul (2005), some construction companies in Turkey usually prefer to employ short-term unskilled labours and consequently cause the fault in the process of attaining the stability of quality associated issues. Hence, lack of experience and competency of labours must be taken into account as a factor contributes to poor workmanship.

Language Barrier to Communication and Lack of Communication

Different language between the foregin labours and local supervisors causes the communication failure on the jobsite. From a research of Augusto *et al*. (2009), it found that 82% of the respondents in the survey mentioned that the most general trouble faced on the jobsite by the America supervisors is the language obstacle when communicating with the foreign labours. Additionally, from a survey of Kasun and Janaka (2006) showed that exceed 40% of the respondents from the construction site protested about the insufficient of communication. Indeed, language barrier indirectly causes the lack of communication between the supervisors and labours. This consequently causes the misunderstanding by the labours in their work scope and then lead to poor workmanship.

Unsuitable Construction Equipments

Suitability of construction equipments can influence the workmanship quality in construction. Faisal *et al*. (2006) quoted from Adrian (1983) and Al-Hazmi (1987) stated that insufficient of latest information about the obtainable equipments can influence the project quality. In a research of Kazaz and Birgonul (2005), the poor quality of mass housing projects in Turkey mostly because low cost construction techniques which are totally disregarded. Therefore, unsuitable construction equipments can cause low quality of workmanship in construction.

Poor Weather Condition

Dai *et al*. (2009) stated that extreme climate condition is one of the factors that affecting construction labour productivity and workmanship. From the research of Faisal *et al*. (2006) found that the climate of Saudi is hot and severe during summer that causes some of the construction works very hard to carry out, such as concreting. As a result, the quality of workmanship is affected.

Limited Time

Insufficient time caused the construction projects executed to be rushed. According to Andrew (1999), a number of "show houses" on the site were required for many construction projects. Many concurrent works were carried out and inadequate checking had been carried out by the senior managers sequentially caused by the speed of working. As a result, the deficiency of workmanship had been happened. In short, limited time causes low quality of workmanship in construction.

Limited Cost

Insuifficient cost or budget would cause inadequate allocation of cost in construction project. Labour cost is included in construction cost. Proverbs *et al*. (1999) stated that labour element is considered as the most difficult component to price within the reasonable level of accuracy. Obviously, labour costs estimation is considered as uncertainty (Proverbs *et al*., 1999). In addition, contractors who are not preparing sufficient budget for the project will cause the labour cost cut down correspondingly. As a result, the labours supplied are not sufficient to complete a project and construction defects may appear.

Possible measures to minimise workmanship quality problem

There were six possible measures that suggested by researchers in order to minimise workmanship quality problem. The six measures are:

i. Strict supervision
ii. Training and education
iii. Proper communication among parties involved
iv. Proper construction management
v. Proper manpower management
vi. Proper design

Strict supervision

Ghaffar *et al*. (2010) quoted from Howell and Ballard (1998) noted that enhance the quality by strict supervision in construction site is one of the criteria of recent pratices in construction sector. Daily supervision should be carried out by the contractors or subcontractors so that workmanship problem can be identified and the remedy work can be executed immediately. Besides, when executing the supervision, contractor supervisory staff must possess the knowledge, expertise, and capabilities to administer the construction work and superintend the craft worker efficiently (Maloney, 2002).

Training and Education

According to Chan *et al*. (2006), many researchers agreed that appropriate training and enlarging experience is necessary in transfering the quality project. Osama and Khan (2010) added that labour productivity is become significant in construction because of its impact in the process of completing projects. Chan *et al*. (2006) further supported that the construction quality can be enhanced by increasing the capability of site labours.

Proper Communication Among Parties Involved

Proper communication is a necessary in construction. From a research had been done by Augusto *et al*. (2009), 80% of the Hispanic workers in U.S. construction sector mentioned that the communication with the supervisors is vital and need to be improved. Therefore, American supervisors suggested that the training in communication skills is essential to eliminate the language gap among themselves and the foreign labours. Ling *et al.* (2007) stated that effective communication leads the projects complete faster (quoted from Walker, 1998). As Tai *et al*. (2009) mentioned, *"no communications means no management"*. Apart from the communication between supervisors and construction

labours, proper communication and teamwork are also necessary between contractors and subcontractors. Through a continual communication among parties involved, working relationship among the construction parties can be closer. From a research of Xiao and Proverbs (2002), it found that better quality performance of Japanese construction projects can be attained attribute to steady and durable working relationship between Japanese contractors and subcontractos. Therefore, proper communication is very important to improve the relationship among the construction team and consequently improve the workmanship quality in construction.

Proper Construction Management

Proper construction management would enhance the workmanship quality in construction. Dai *et al*. (2009) quoted from Olson (1982) stated that the capability of construction managers to manage, arrange and lead the work would affect the construction labour productivity. If a construction manager failes to lead and control the construction project, the quality problems may arise. Therefore, a proper construction management is very crucial for every construction project.

Proper Manpower Management

Robby *et al*. (2001) have proposed that manpower management in term of amount and quality of skill workers is an important determinant of contractor performance and extremely prioritised by employers. A construction project which has a well arrangement of manpower will produce a high quality of the project. Besides, Abdulaziz (2010) mentioned that manpower is the sole productive resource; hence construction productivity is essentially relying on human endeavour and performance. Therefore the management of manpower in every construction project should be arranged skillfully.

Proper Design

Wai Kiong and Sui Pheng (2005) found that better design can get rid of workmanship defects and help to avoid the defects. Inadequately worded specifications and uncertain designs always cause the low construction quality (has quoted from Calder, 1997). Wai Kiong *et al*. (2006) quoted from Anand's *et al.* (2003) suggestion also stated that a better design may correct some defects which due to workmanship in masonry work. In addition, Robby *et al*. (2001) stated that well-prepared designs and drawings affect the future works to become easier and the defects can be identified and rectified more effectively.

Research Methodology

The quantitative method was used in this research. Questionnaire surveys had been used in the process of data collection. In order to get high respone rate, the questionnaire surveys were designed in short and did not take much time for respondents to answer. Below shows the sample of questions asked in the questionnaire survey.

Please rate the degree of the effectiveness of the following methods to overcome quality problems.

		1	2	3	4	5
Execute Strict Supervision effective	Very Least effective [	][	][	][	][	]Highly
Training and Education	Very Least effective [	][	][	][	][	]Highly effective

The respondents in this survey were building surveyor, quantity surveyor, architect, project manager, M&E engineer, C&S engineer and other profession who are involved in Klang Valley construction projects. A set of 75 questionnaires sent to the targeted

respondents. Through filtration made from 31 replied questionnaires, 30 sets of questionnaire are useful and valid for analysis, giving a response rate of 40 percent.

The Statistics Package for Social Science (SPSS) software version 17.0 is used for statistical analysis. Ranking analysis was used to rank the degree of importannce of the factors contributing to poor workmanship and the degree of effectiveness of measures to overcome quality problems. Besides, correlation analysis (spearman's rank correlation cofficient) was used to identify the significant relationship between two variables in this research, which were factors contribute to poor workmanship and possible measures to minimise the problem.

Data analysis and discussion

The descriptive analysis was used in analysing data in this study. Table 1 shows the job title of the respondents in Klang Valley construction.

Most of the respondents were C&S engineers and project managers. This is because their scope of work was normally based on the site work; they had their certain experience and expertise in construction. Therefore the reliability of the questionnaire response was accepted. Figure 1 shows types of defect on building elements in the new completed buildings.

From the Figure 1 above, most of the respondents agreed that plaster crack was the most frequent defect in the new completed buildings, with 16.88% of the overall responses. Meanwhile, the least defects found are pointing and settlement, with 2.6% of the overall respinses.

Table 2 shows the ranking of priority based on mean readings for the poor workmanship variables in construction projects. In order to rank the variables, calculation of central tendency using mean was carried out. Five-point Likert scale used in the questionnaire was transformed to mean readings to determine the ranks of each variable.

From the Table 2, it found that lack experience and competency was considered as the most important factor contributes to poor workmanship. Labours cannot perform their works well if they do not own any experience and expertise in the certain field. It is agreed by Chan et al. (2006) mentioned that all the expertise possessed by the construction labours are significant to the quality of construction. However, poor weather condition were rated the least important among all other factors.

Limited cost is the second highest rank for factors affecting workmanship quality. The labours cost is the most difficult component to price within a standard level. It is supported by Proverbs et al. (1999). Usually, for the contractors who do not prepare a sufficient budget to commence a construction project, they may cut down the labour cost and use that budget for other items of the project. As a result, low quality of workmanship produced. Other factors that need to be considered are complicated role of subcontractor, poor project management, limited time, unsuitable of construction equipments and language barrier to communication and lack of communication.

On the other hand, Table 3 shows the ranking of possible variables to minimise workmanship quality problem.

From the table 3, the highest ranked of the measures used in overcoming quality problem is proper communication among parties involved. The parties in one project should communicate in proper way so that a harmony sitution can be existed and help the project goes smoothly, then workmanship quality would reach the acceptable level. It is agreed by Ling et al. (2007) who mentioned that effective communication leads the project to be completed earlier. In contrast, proper manpower management reached the least ranking of the measures.

The second higher ranked is proper construction management. This method is suggested by Dai et al. (2009) who mentioned that the capability of the construction manger to monitor and lead the work on site would give the effect of contrustion labour productivity. The construction management also involves the labour management. Other possible measures that should be taken into account to minimise the workmanship quality problem are strict supervision, proper design and training and education
.
In order to check significance relationship between factors contribute to poor workmanship and possible measures, correlation test using Spearman rank correlation coefficient had been used for the analysis. The results of the correlation test are shown in Table below.

From the results above, it found that lack of experience and competency of labours can be reduced by having training and experience, well manpower management and proper design. It is supported by Ling *et al.* (2007) mentioned that skills of labours can be demonstrated once the training completed.

Besides, poor project management can be solved by conducting proper communication among parties involved, proper construction management and manpower management. It is supported by Tai *et al*. (2009) that there is no management if no communication existed.

In order to minimise language barriers to communication and lack of communication, strict supervision should be conducted; training and education should be given; proper construction management and well manpower management should be executed.

Additionally, proper design would overcome the problem of limited time. Proper design can reduce the probability of variation order from the cilent, therefore no delay on construction and the problem of limited time will not happen.

Conclusion

The objectives of the research had been achieved based on the literature review from articles, journals and books; findings from questionnaire survey; and anaylsis results.

The factors that contribute to poor workmanship are identified based on the literature reviews and questionnaire survey. Based on the literature review, the factors contribute to poor workmanship includes poor project management, complicated role of subcontractor, lack experience and compentency of labours, language barrier to communication and lack of communication, unsuitable of construction equipments, poor weather condition, limited time and limited cost. The factors were ranked based on their degree of importance. It found that lack experience and competency of labours was the most significant factor that contributes to poor workmanship.

Several measures had been suggested by researchers from the literature review, which were strict supervision, training and education, proper communication among parties' invloved, proper construction management, proper manpower management and proper design. The ranking analysis on the effectiveness measures toward workmanship problem was carried out as well. As a result of the ranking analysis, it found that proper communication among parties' invloved was the most effective measure based on the respondents' response.

The relationship between measures identified with factors contribute to poor workmanship was examined by using correlation test-Spearman's rho. Measures identified can be applied to the factors which have significant relationship with them based on the results of correlation test (Spearman rank correlation coefficient) in order to solve the workmanship problem.

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Appendix

Table 1: Number of respondents based on profession

Job Title	Percentage (n=30)
Building Surveyor	13
Quantity Surveyor	7
Architect	10
Project Manager	23
M&E Engineer	3
C&S Engineer	27
Others	17
Total	100

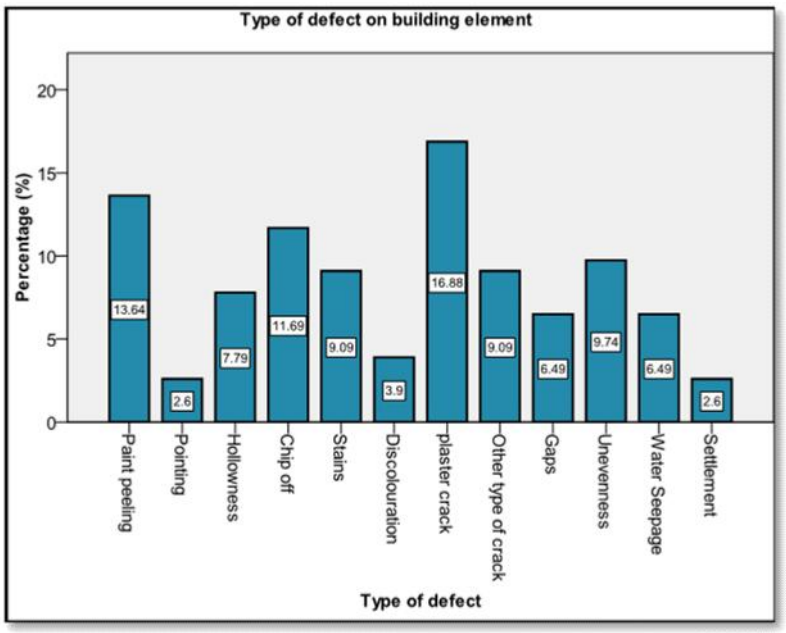

Figure 1: Types of defect on building element

Table 2: Ranking of variables contribute to poor workmanship

Variables	**Mean (n=30)**	**Ranking**
Lack experience and competency of labours	4.45	1
Limited cost	4.25	2
Complicated role of subcontractor	4.21	3
Poor project management	4.15	4
Limited time	4.01	5
Unsuitable of construction equipments	3.65	6

Language barrier to communcation and lack of communication	3.20	7
Poor weather condition	2.92	8

Table 3: Ranking of variables to minimise workmanship quality problem

Variables	**Mean**	**Ranking**
Proper communication among parties involved	4.32	1
Proper construction management	4.13	2
Strict supervision	4.09	3
Proper design	4.02	4
Training and education	3.76	5
Proper manpower management	3.44	6

Table 4: Relationship between factors contribute to poor workmanship and possible measures

	Strict Supervision	**Training and education**	**Proper communication among parties involved**	**Proper construction management**	**Manpower mangement**	**Proper design**
Poor project management	-.014	-.093	.421**	.261**	-.263**	.096
Complicated role of subcontractor	.131	-.222*	-.056	-.246**	-.036	-.133
Lack experience and competency of labours	-.026	.427**	-.017	.177	.409**	.362**
Language barrier to communication and lack of communication	-.346**	.219*	-.115	.205*	.437**	.182
Unsuitable of construction equipments	-.317**	.381**	-.014	.241*	.283**	.385**
Poor weather condition	.134	.504**	.131	.336**	.288**	.133
Limited time	.111	.113	.057	-.097	.040	.200*
Limited cost	.402**	.065	.309**	-.064	-.151	.001