Poor Workmanship and Lack of Plant/Equipment Problems in the Construction Industry in Kumasi, Ghana

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Abstract

The construction industry globally is faced with numerous problems which have become imperative to identify the major causes at regional levels for solutions to ensure economic growth. The purpose of the study was to investigate the major factors contributing to poor workmanship and lack of equipment in the construction industry in Ghana. Five-point Likert-scale questionnaire was used to collect data from construction professionals. Descriptive statistics, ANOVA at 0.05 level of significance and Gabriel′s post hoc test were used to analyse the data. The study found poor supervision of work and use of inferior or adulterated materials as the major causes of poor workmanship in the construction industry. In addition, high cost of modern equipment was found to be the major cause of lack of plan/equipment in the construction industry in Ghana. Recommendations for Government and local authorities and construction firms in the construction industry have been discussed.

Key words: construction industry, poor workmanship, lack of plant/equipment, contractors, consultants, engineers

Introduction

One major sector of emerging economies which is receiving increasing attention as a possible area for the development of better institutional structure is construction, an industry present in every developmental activity. However, the construction industry is confronted with many problems. Poor workmanship and lack of equipment are some of the common problems that are associated with the construction industry especially in the developing countries. Defects in building can therefore arise from either or a combination of the occurrence of the following situation; error in design by the Architect, flaws from the manufacturer, defects in materials, wrong use or inappropriate installation of equipments, and unconformity to specification by the contractor, among others (Carillon, 2001). All these are human errors that can result in various defects in buildings and other structures, and can therefore be attributed to poor workmanship. The quality of the workmanship is an aspect that has been given contractors a bad name (Kasim, 2009). Another issue that can give contractors a bad name is lack of equipment.

Outmoded equipment, low level of trained personnel, lack of qualified supervision and unused equipment at building sites are some of the nagging problems confronting local contractors in Ghana (Ayarkwa *et al*., 2010). A study by Laryea (2010) on the challenges and opportunities facing contractors in Ghana revealed that most contractors do not have equipment and have to hire. The study further explained that in 2005/06 the government of Ghana tried to support contractors through an equipment supply scheme managed by the

National Investment Bank (NIB). This indicates that there is problem with equipment availability to contractors for use in the construction industry in developing country context.

Poor workmanship leading to rework was ranked first by contractor related factors that were associated with time overrun in telecommunication tower construction in Ghana in a study conducted by Danso and Antwi (2012). A study by Kaming *et al.* (1997) identified lacks of equipment, supervision delays among others as factors influencing productivity in the Indonesian construction industry. Another study by Danso and Manu (2013) recommended that future researchers should consider investigating the major causes of other problems such as poor workmanship, lack of equipment among others in the construction industry especially in the context of developing countries.

In view of the above, there is the need to investigate the major factors that contribute to the poor workmanship and lack of equipment in the construction industry in Ghana. This study therefore, examines the major factors contributing to poor workmanship and lack of equipment in the construction industry in Ghana from the view point of professionals such as contractors, consultants and engineers. In order to achieve this purpose, the following objectives will be pursued: (1) to determine the major causes of poor workmanship in the construction industry in Ghana, and (2) to determine the major causes of lack of equipment in the construction industry in Ghana.

Poor workmanship

The most important aspect of a quality project is the workmanship; unfortunately, poor quality workmanship can destroy projects already put in place (Iwaro and Mwasha, 2012). Poor workmanship is one of the serious issues facing local contractors in most developing countries (Moavenzadeh and Rossow, 1995) and a portion of the payments due to the contractors is almost always withheld as a guarantee against poor workmanship, hidden defects, and similar faults which might be observed only after project completion.

A study by Kasim (2009) on building defects in Malaysia found that poor workmanship is the major contributor to poor quality of construction, and further recommended that contactors have to provide workers with necessary experience and skills. Shittu *et al.* (2013) examined the problem of poor workmanship as a major cause of building defect in Minna, Nigeria. They found that limited cost or poor funding of public project as the major that cause poor workmanship quality out of eight factors.

Wai Kiong and Sui Pheng (2005) assessed the defects at construction and occupancy stages in Singapore, and found out that the majority of human errors arise as a result of forgetfulness and carelessness, and about 30% were due to inadequate knowledge while the least error arises from the willingness of the contractor. All these factors are associated with poor quality workmanship in Singapore. Abdul Rahman *et al*. (1996) examined the cost of non-conformance on construction sites and established that workmanship was one of the most frequent non-conformances on construction site and further indentified eight variables that relate to the causes of poor quality of workmanship in construction projects.

Ali and Wen (2011) studied the factors contributing to poor workmanship and possible measures to minimise the problem in Malaysia. They found lack of experience and competency of labours, language barrier to communication and lack of communication,

unsuitable of construction equipments, poor weather condition, limited time and limited cost as the causes of poor workmanship.

Iwaro and Mwasha (2012) investigated the effects of ISO 9001 certification on organization workmanship performance using the construction industry as a case study in Trinidad and Tobago, which found that ISO 9001 certified organizations performed better in workmanship performance compared to non-ISO 9001 certified organizations. The use of ISO 9001 certification to improve workmanship on construction projects is a research area that is presently receiving attention due to the competitive demand for quality projects and infrastructure in the market.

Lack of equipment

Construction in Ghana is labour intensive with basic hand tools and equipment are used, the extensive use of major equipment is rare on many projects (Fugar and Agyakwah-Baah, 2010). They further explained that where equipment are required, the contractors have the option to hire, and in the rare cases where some plant and equipment are owned by a contractor, breakdown is a major factor perhaps owing to old age or lack of planned maintenance. Laryea (2010) found that contractors in Ghana do not have the full complement of equipment; most of their equipment is over 20-25 years, which results in frequent and occasional breakdown of the equipment and impedes the progress of work. In some cases, the spare parts are not available to buy, because the machines are obsolete.

The cost of plant/equipment for construction project varies from 10-30% of the total cost of project, depending upon the extent of mechanisation. Proper planning, selection, procurement, installation, operation, maintenance and equipment replacement policy plays an important role in equipment management for successful completion of project (Anbhule and Kumthekar, 2012). With the growing use of plant/equipment it has become necessary for construction firms to be able to acquire wide range of modern equipment to ensure timely completion of projects.

Methodology

The study employed survey method with researcher-designed questionnaire for data collection to achieve the research objectives. Since the study sought to find out the major causes of poor workmanship and lack of plant/equipment problems in the construction industry, the survey research method was deemed appropriate. The population for the study comprised of building and road contractors, civil engineering consultants and building engineers/architects in Kumasi Metropolis, Ghana. These professionals are at the unique position to examine the factors and give accurate information that exists in the industry (Danso and Manu, 2013). The researcher adopted purposive sampling technique for data collection because according to Bernard (2002) and Lewis and Sheppard (2006) the researchers decide what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience. The sample for the study was 86 professionals in the construction industry, which consisted of 20 contractors, 22 consultants and 44 engineers and architects.

Questionnaire was deemed most appropriate for the study although a number of instruments for data collection could have been used. The questionnaire consisted of items for demographic data, and data on causes of poor workmanship and lack of plant/equipment

problems. Four (4) and three (3) items on poor workmanship and lack of plant/equipment respectively formed the basis of the findings reported in this paper. The questionnaire consisting of Likert-type, close-ended and open-ended items were employed for the study. Five-point Liket-scale was used for the study, the responses for the study were: strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5).

The instrument was pilot-tested and the reliability co-efficient (Cronbach's alpha) determined to be 0.78, which was above the recommended value of 0.70 (Jonson & Christensen, 2008; Straub, Boudreau & Gefen, 2004). The questionnaire were personally administered by the researcher that gave them the opportunity to interact with the respondents, explained in detail the rationale for the research and gave explanation where necessary. Enough time was given to the respondents to answer the questionnaire of which some were collected on the same day and others after a few days. 68 questionnaires were returned out of the 86 representing 79% response rate (Table 1).

Table 1: Response rate

Professionals	**Questionnaire sent**	**Questionnaire returned**	**Response rate (%)**
Contractors	20	16	80.0
Consultants	22	16	72.7
Engineers/Architects	44	36	81.8
Total	**86**	**68**	**79.0**

The mean rating of each of the three sub-groups (professionals) for each item and the corresponding resultant mean rating were computed with version 16 of SPSS. Thereafter, the computed mean ratings were compared with the theoretical mean rating (assuming normal distribution of responses above neutral) of 4.0 to determine the causes of poor workmanship and lack of plant/equipment in the construction industry. Any computed mean of an item relating to the causes of poor workmanship and lack of plant/equipment exceeding 4.0 indicated expression of major cause of the problem, while values below 4.0 indicated expression of minor cause of problem with land acquisition and high cost of materials

The computed mean ratings for the three sub-groups were compared using one-way analysis of variance (ANOVA) at 0.05 level of significance. Where significant differences were established, the Gabriel′s post hoc test was used to make multiple comparisons of means to determine differences in the ratings of consultants, engineers/architects and contractors on the causes of poor workmanship and lack of plant/equipment problems in the construction industry. ANOVA assumes that the data are normally distributed and that there is homogeneity of variances. Ofori and Dampson (2011) strongly advise for the prior verification of the homogeneity assumption and further suggest the use of non-parametric tests when there is marked heterogeneity of variances. Owing to the disparity in the sample sizes of the three sub-groups ($n_1 = 16$, $n_2 = 36$, $n_3 = 16$), the ANOVA was preceded by a test of homogeneity of variances to verify the homogeneity assumption.

Results and Discussion

The research findings are presented into three sections, according to the respondents' demographics and the two research objectives posed above.

Respondents' demographics

The characteristics of the respondents are presented in Table 2. In terms of gender, 58 (85.3%) of the respondents were males and 10 (14.7%) were females. The result indicates that majority of the respondents were males. This shows the male's dominant of the professionals in the construction industry. For work position, 16 (23.5%) each were contractors and consultants while 36 (52.9%) were engineers and architects. This result is true reflection of the high numbers of engineers and architects than that of contractors and consultants in the construction industry. A total of 52 (76.5%) were between the ages of 31 and 50 years, indicating that majority of the professionals are in their middle age. In terms of academic qualification, 38 (55.9%) of the respondents were diploma and high national diploma (HND) holders while 28 (41.2%) were bachelor degree holders. These levels of education are the basic qualification for middle-level manpower to management level in the construction industry. For work experience, a total of 60 (88.2%) have worked for between 5 to 14 years in the industry. They therefore deserve to work at the positions of consultant, contractor, engineer and architect due to the length of time they have practiced in the construction industry.

Table 2: Demographic profile of respondents (N = 68)

Category		**Number of respondents**	**Percentage (%)**
Gender:	Male	58	85.3
	Female	10	14.7
Age:	21 – 30 years	16	23.5
	31 – 40 years	30	44.1
	41 – 50 years	22	32.4
Qualification:	Diploma/HND	38	55.9
	Bachelor	28	41.2
	Masters	2	2.9
Experience:	< 5 years	8	11.8
	5-9 years	34	50.0
	10-14 years	26	38.2
Position:	Contractor	16	23.5
	Engineer/Architect	36	52.9
	Consultant	16	23.5

Major causes of poor workmanship problem in the construction industry in Ghana

The mean rating of each of the three sub-groups for each item and the corresponding resultant mean rating were computed. The computed means were then compared with the theoretical mean rating (assuming normal distribution of responses above neutral) of 4.0 to determine the problem of poor workmanship in the construction industry. Two of the items (e.i. poor supervision of work and use of inferior or adulterated materials) had mean ratings and resultant mean ratings that exceeded the theoretical mean. However, two of the items (e.i. inadequate training of the workers and lack of skilled/trained workers) had mean ratings and

resultant mean ratting less than the theoretical means. As indicated in Table 3, poor supervision of work had the highest resultant mean rating of 4.468. The lowest resultant mean rating of 3.491 was for lack of skilled/trained workers given as the causes of land acquisition problem by the professionals in the construction industry in Ghana. This indicates that poor supervision of work is a major rated problem of poor workmanship. This really needs to be addressed in order to reduce the effect of the problems on the construction industry.

Table **3:** Professionals' ratings of the causes of poor workmanship in the construction industry

Cause	Consultant Ratings (n_1 = 16)		Engineer/Architect Ratings (n_3 = 36)		Contractor Ratings (n_3 = 16)		Resultant Mean	Sig. (P-Value)
	Mean	SD	Mean	SD	Mean	SD		
1. Poor supervision of work	4.375	0.500	4.278	0.815	4.750	0.447	4.468	0.128
2. Use of inferior or adulterated materials	4.250	0.447	4.222	0.797	4.250	0.447	4.241	0.120
3. Inadequate training of workers	3.750	0.683	3.889	0.887	3.875	0.806	3.838	0.002*
4. Lack of skilled/trained workers	3.250	0.856	3.722	1.003	3.500	1.155	3.491	0.007*

*Significant at 0.05 level, P = < 0.05

Notwithstanding the high level and closeness of the mean ratings of the four causes of poor workmanship problems among the three sub-groups, it was deemed appropriate to determine whether there were any statistically significant differences among the respondents in their ratings using ANOVA at the 0.05 level of significance. Due to the disparity in the sample sizes of the three sub-groups (n_1 = 16, n_2 = 36, n_3 = 16), the ANOVA was preceded by a test of homogeneity of variances. The results indicated that the variances of the three sub-groups for each item were homogeneous. Thus, all the four items met the requirements that the three sub-groups were from a homogenous population.

The item-by-item ANOVA results which appear in Table 3 (P-Value), show that for two of the items (e.i. poor supervision of work and use of inferior or adulterated materials), there was a uniform agreement in the responses of the respondents as there were no statistical significant differences in the ratings of consultants, engineers/architects and contractors. However, for other two of the items, the ratings of the respondents significantly differed. The respondents differed in their ratings regarding inadequate training of the workers and lack of skilled/trained workers as causes of poor workmanship problem in the construction industry. To determine which sub-groups significantly differed in their ratings of the two items, Gabriel′s post hoc test at 0.05 level of significance was used to make multiple comparisons of the mean ratings of the three professionals in the construction industry.

The multiple comparisons revealed that the ratings of consultants for both items were significantly lower than those of engineers/architects and contractors. The differences perhaps laid in the fact that the consultants had relatively lower conviction that the problems of the poor workmanship are mainly caused by insufficient training and the absence of qualified construction worker in the country. On the other hand, the contractors and

engineers/architects who have direct association or contact with the worker in the execution of the projects rated inadequate training of the workers and lack of skilled/trained workers as the causes of poor workmanship problems significantly higher than the rating of consultants. The reason may be that, the contractors and engineers/architects due to their direct involvement and association with other workers of the construction activities have realised that there are more probability of inadequate training of the workers and lack of skilled/trained as the causes of poor workmanship.

Supervision of building and road construction works is vital for the growth of the construction industry. Problems of poor supervision of work have existed many years in most developing countries. According to Kasun and Janaka (2006), poor supervision contributes to the poor workmanship on construction site and it can be seen at many occasions on the jobsite. The result of the presents study is in line with the above problem identified by Kasun and Janaka. Poor supervision of work had the highest resultant mean rating of the respondents indicates a major problem of poor workmanship in the construction industry in Ghana.

This is indeed a serious problem confronting the construction industry as Moavenzadeh and Rossow (1995) explained that poor workmanship is one of the serious issues facing local contractors in most developing countries. Jorge et al. (2005) also confirmed that the industry stakeholders agreed that insufficient of skilled manpower is the most important matter that they concern about. In furtherance, Ali and Wen (2011) stated that lack of experience and competency of labours must be taken into account as a factor contributes to poor workmanship. Poor supervision of work is a major problem or concern expressed by the professionals in the construction industry, especially in the developing countries. In view of the above Ali and Wen (2011) suggested that 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. In addition, Ghaffar *et al*. (2010) noted that enhancing the quality by strict supervision in construction site is one of the criteria of recent practices in construction sector.

Major causes of lack of equipment in the construction industry in Ghana

The result of professionals' ratings of the problem of lack of equipment in the construction industry as presented in Table 4 indicates that one of the items (e.i. high cost of modern equipment) had mean ratings and resultant mean ratings that exceeded the theoretical mean. Two of the items (unavailability of modern equipment and use of obsolete equipment) had mean ratings and resultant mean rating less than the theoretical means. High cost of modern equipment had the highest resultant mean rating of 4.296. Whereas use of obsolete equipment had the lowest resultant mean rating of 3.171 as the causes of lack of equipment in the construction industry by the ratings of the professionals in the construction industry in Ghana. This result indicates that high cost of modern equipment is a major cause of lack of equipment in the construction industry in Ghana. There is therefore the need to find appropriate means to curb the problem in the construction industry.

Table 4: Professionals' ratings of the problem of lack of equipment in the construction industry

Cause	Consultant Ratings (n_1 = 16)		Engineer/Architect Ratings (n_3 = 36)		Contractor Ratings (n_3 = 16)		Resultant Mean	Sig. (P-Value)
	Mean	SD	Mean	SD	Mean	SD		
1. High cost of modern equipment	4.000	0.894	4.389	0.494	4.500	0.516	4.296	0.175
2. Unavailability of modern equipment	3.125	1.088	3.389	1.178	4.000	0.730	3.504	0.084
3. Use of obsolete equipment	2.750	1.000	3.389	1.128	3.375	1.025	3.171	0.155

Irrespective of the differences of the mean ratings of the three causes of lack of equipment in the construction industry among the three sub-groups, it was deemed appropriate to determine whether there were any statistically significant differences among the respondents in their ratings using ANOVA at the 0.05 level of significance. Due to the disparity in the sample sizes of the three sub-groups, the ANOVA was preceded by a test of homogeneity of variances. The results indicated that the variances of the three sub-groups for each item were homogeneous. Thus, all the three items met the requirements that the three sub-groups were from a homogenous population. The result showed that there was a uniform agreement in the responses of the respondents on all the three causes of lack of equipment as there were no statistical significant differences in the ratings of consultants, engineers/architects and contractors at 0.05 level of significance.

In the present study, the respondents rated 'high cost of modern equipment' as the major cause of lack of equipment in the construction industry. Due to this, extensive use of major equipment is rare on many projects in Ghana (Fugar and Agyakwah-Baah, 2010) and where equipment is required the contractors have the option to hire because they cannot afford to buy. The escalation of major construction equipment costs (Chupka and Basheda, 2007) can be attributed to the fact that the equipments are manufactured elsewhere and shipped to the developing countries. High cost of modern plant/equipment such as the cost of crane, excavators, concrete mixer, testing equipment, among others requires massive capital which is expensive in most developing countries including Ghana. In addition, the plan/equipment is manufactured in the developed countries and has to be imported to the developing countries which relatively increase the cost. This requires the construction firms to raise very huge sums to be able to buy the modern plant/equipment to be used for their operations.

Recommendations

Greater attention should be given to project supervision by regulators in the construction industry in Ghana since poor supervision of work was found to be the major problem of poor workmanship. The supervisory team of construction firms, the local authorities and works and housing ministry of Ghana should increase their supervisory activities on workers of construction sites to improve workmanship quality. Regular in-service training and workshops should be organized by contractors to help improve the quality and skills of their workers. Another major factor of poor workmanship found was the use of inferior or adulterated materials. Government and contractors association of Ghana should develop a

standard for acceptable quality materials that can be used in the construction industry and ensure full compliance by all contractors.

Since high cost of modern equipment was the major cause of lack of equipment in the construction industry in Ghana, it is recommended that Government should wave the task component of the cost of importing construction plant/equipment into the country due to the fact that the plan/equipment are manufacture abroad. In addition, Government should make funds available to the construction firms through the banks in the form of loan so that modern plant/equipment can be purchased by the construction firms and paid installment. Finally, it is recommended that further studies should be conducted to investigate the major causes of other problems such as disputes and unrest, delays in completion of projects, unreliable supply of service among others in the construction industry especially in the context of developing countries.

Conclusion

It has become very important to find out the major causes of the problems associated with the construction industry especially in the developing countries in order to find solution to them for economic growth. The current study investigated the major causes of poor workmanship and lack of plant/equipment problems in the construction industry in Ghana with particular reference to professionals such as contractors, consultants and engineers/architects. Poor supervision of work and use of inferior or adulterated materials were identified as the major causes of poor workmanship in the construction industry. In addition, high cost of modern equipment was rated as the major cause of lack of equipment problem in Ghana. Recommendations for curbing these problems and improvement of the activities in the construction industry have been made for economic growth.

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