Quality of low-income housing projects in South Africa

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Abstract. One of the major duties of any government is to ensure that there are enough houses for the citizen. In view of the shortage, government and many private organisations have been involved in the provision and production of houses for the populace. It is therefore necessary to examine the level of conformance of these houses to acceptable level of quality. Several literature materials were reviewed and various factors causing low quality of buildings were extracted accordingly. To examine these factors, quantitative research method was adopted through administration of close-ended questionnaires on relevant construction professionals, which include Quantity Surveyors, Construction Managers, Architects, Engineers, Town Planners and Project Managers who have been involved in low-income housing projects in South Africa. Factors that contributes to non-adherence to required quality in low-income housing projects are poor site management, less focus on quality and much on production, focus on time by contractor, inadequate contractor’s quality expertise and usage of inexperienced personnel. The implication of these are tarnished image of the professionals involved in the project, defective buildings, unsafe structures and cost overruns. In order to ensure conformance to quality of these houses, contractors that handles construction of low-income houses should be knowledgeable with the National Builders Regulations and there should be monitoring and sufficient inspection of work in progress. Other measures include training and education of stakeholders, use of skilled labours, planning and risk assessment as well as use of appropriate construction materials.

Keywords: Building construction, Building Quality, Housing, Low-Income Houses (LIH), Total Quality Management (TQM)

1. Introduction
The submission of [1] shows that construction plays a vital part in the economic and social growth of a country. It provides the physical infrastructure and foundation for economic activity to thrive and it is a large-scale provider of employment [2]. Therefore, it is imperative for this industry to run smoothly so as to affect the economy in a positive light. However, [3] stated that judging by international standards, construction industry in most developing and developed countries are performing very badly in the area of quality delivery of projects. Poor material and non-conformance to quality lead to site accidents, buildings collapse and costly reworks and maintenance. Quality in construction is regarded as meeting or exceeding the requirement of client, owners and other relevant stakeholders through production of standard infrastructure. By altering the quality below the required standard mostly result in project failure and dissatisfaction of the clients and/or occupants. Moreover, it can also lead to reworks, cost overruns and time wastage [4]. However, it was noted that poor quality of building projects is a worldwide occurrence. Hence, this study evaluates factors
determining low-income houses (LIH) quality, resultant effect of non-conformance to quality and various ways to mitigate the challenge.

2. Related Works

2.1. Quality Issues in LIH
Houses built within South Africa are expected to confirm with the provisions of National Home Builders Registration Council (NHBRC) [5]. Studies have shown that defects in newly built houses are caused by non-conformance with the provided building codes and other existing rules and regulations. Various researches give a vast number of causes of poor quality houses. Alink [6] compiled a list of factors that affect the structural integrity of a building as: inadequate soil examination, improper design, uncalculated load impact, uncalculated environment conditions, inadequate material, poor supervision, poor maintenance and poor substandard workmanship. The Building Research Establishment of 1977 highlighted a number of factors that cause structural failure in a building to include improper design and inadequate quality of construction. Adamu [7] indicated that the primary factor that affect structural strength of buildings are unexpected ground conditions, inadequate site inspection, unexpected loads, improper design, unreliable workmanship, lack of supervision, inadequate material, and lack of proper maintenance.

Based on the conducted research by Building Research Establishment (BRE) [8], 90% of failure of building structures stem from problems arising at the construction and design phase of the project. These problems arises as a result of design errors from architect, adopted procurement strategy, actual construction process, defects of materials used, wrong equipment being used and deliberate non-compliance to specifications by the contractor [7]. Inadequate checks and controls; and poor communication during the construction stage has been noted to be the major cause of defects in LIH [9]. To corroborate this, [6] reported that workmanship, poor supervision on site and incorrect building procedures are the major contributors to building failure. This is also supported by the submission of [8]. In the research study of [6], non-achievement of the desired quality and eventual building failure in the LIH sector are cause by unskilled labour usage; insufficient finance; low contribution of the private sector; inexperienced contractor usage; little or no commitment by the management towards achieving quality; and quality of workmanship below standard. Egwu [8] indicated that the roots of most of these issues are people related. Wai-Kiong [10] also highlighted that 30% of these human errors are due to insufficient knowledge while the remainder are attributed to willingness of the contractor. It was further noted that defects occur because of insufficient information, lack of knowledge, motivation and carelessness.

2.2. Implications of Non-Adherence to Quality
LIH development in South Africa has received a lot of criticism based on the fact that achieving targets is focused on more than achieving quality houses [11]. Rust [12] indicated that subsidised houses are mostly found to be plagued with problems as construction is carried out without having a good understanding and knowledge of the basic needs of the end-users, neither are the developer concerned about type of housing choices that would satisfy their client. Additionally, [13] highlighted that existing LIH which have been delivered through different methods employed in the past may be in better condition compared to the current ones meant to replace them. The challenge associated with LIH projects include inadequate house designs, unsuitability of environment for houses, adaptability of houses to the local climate and high levels of maintenance needed for houses [14]. A report by [15] stated that over R2 billion has been spent by the department in fixing houses that are poorly built within the last three (3) years. In summary, it is estimated that it would cost R300 000 to fix just one house. This cost is thrice the estimated cost of building a standard house under the Reconstruction and Development Programme (RDP).
A major effect of non-conformance to quality is rework. Wait [16] stated that reworks are unnecessary effort of doing something again because it was done incorrectly the first time. According to [17], this process provides the building with necessary conformity to the original set standard. It requires the repetition of a construction activity after it has been done initially to make corrections to the existing structure in order to meet the set quality/requirements. Alarcón [18] and [19] indicated that all construction activities that need time and resources or requires manpower but consumes more than expected on a project can be regarded as waste. For instance, when reworks come up, waste activities which are associated with costs arise, bringing up change in building design and unnecessary disputes resulting into claims [20].

2.3. Improving Quality of LIH

NHBRC is a statutory body which the national government’s policy established in 1998 with the responsibility of stabilising house environment in South Africa. Houses constructed within South Africa are expected to conform to the standards set by NHBRC [5,6]. According to the “1996 Housing Consumer Protection Measures Act”, houses builders are required to register with NHBRC and also ensure all houses built are enrolled for the warranty provided by Standard Builders. This essence of obtaining this warranty is to provide protection to the home owner in situations whereby there are certain structural defects neglected by the home builders within a period of five years of construction. The home builder’s certificate/permit to build is withdrawn by NHBRC after intervention to fix the defects. This measure was put in place by NHBRC to regulate and maintain house delivery quality by home builders. The warranty is also extended to government housing schemes by the “housing Consumer Protection Measures Act, 1998”.

3. Research Methodology

Quantitative research method was adopted for this study as a means to evaluate factors affecting quality of LIH, implications to non-conformance to quality and ways to minimize these factors. Using survey design, multiple choice questionnaires were adopted to collect information from identified respondents. The survey was conducted on LIH occupants/beneficiaries, construction professionals and housing contractors identified through the NHBRC database. These professionals were selected with the believe that due to their experience and training, they can provide necessary and accurate information for the study. The research questionnaire was structured into two phases and the first section focused on the background information of identified respondents. The second phase addressed the main objectives of the study and focused on factors of non-conformance, implications of non-conformance to quality and methods used to minimise non-conformance to quality in the construction of the Tshwane Lo-income housing in Gauteng province of the country. The province was selected due to high number of completed and on-going LIH projects in the area at the time of the study. The respondents were adequately informed about the essence and motive of the study and the required time for completing the questionnaire. No payment was made to respondents to complete the survey in order to eliminate bias in their opinion and they are free to participate and withdraw from participation at any time. Prior to the distribution of the final questionnaire, a list of possible respondents was developed. After completion, some of the questionnaires were emailed while others were physically collected by the researcher from the respondents. For the purpose of data analysis, the 5-point scale were transformed to mean item score (MIS) and standard deviation (SD) for each of the identified variable and they were used to rank them accordingly in descending order. The standard deviation value shows whether there is a statistically difference in the opinion of the respondents with values less than 1.00 indicating difference and vice-versa.
4. Results

4.1. Respondents’ Information
Findings from retrieved and workable questionnaires indicated that 64.7% of the respondents are male and 35.3% are female with an average age of 32 years. 35.1% are Quantity Surveyors, 5.9% are Architects, 9.0% are Engineers, 14.7% are Project Managers, 11.8% are Construction Managers, 2.9% are Construction Project Managers, 8.8% are Project managers while the remaining 12% are Town Planners, Building Inspectors and site agents. Also, 29.4% are working in consulting firms, 47.1% are employed by contractors and 23.5% are employees of government at various levels. All of the respondents are currently involved in LIH projects. 67.7% works in the private sector, 29.4% in the public sector and 2.9% work in both sectors.

4.2. Factors Affecting Quality of LIH Projects
Table 1 shows ranking of factors causing the production of poor-quality LIH projects in the study area using mean item score and standard deviation. The highest ranked factor is poor site management with 4.77 and 1.80 MIS and SD values respectively. This was followed by more focus on production and less on quality with MIS of 4.74, focus on time by contractor with MIS of 4.53, lack of contractors’ quality experience and the use of inexperienced personnel with MIS of 4.50 and 4.47 respectively. Others are ineffective use of quality management practices, monitoring and supervision, insufficient or no inspection of work in progress, poor communication with design consultants and poor planning of resources. The factors ranked in the last four are incorrect design issued by the architect or engineer, inadequate information, lack of understanding of the National Building Regulations by contractors and poor design.

| Factors                                           | MIS  | S.D  | Rank |
|---------------------------------------------------|------|------|------|
| Poor site management                              | 4.77 | 1.80 | 1    |
| More focus on production and less on quality      | 4.74 | 1.11 | 2    |
| Focus on time by contractor                       | 4.53 | 1.92 | 3    |
| Lack of contractors’ quality expertise            | 4.50 | 1.84 | 4    |
| The use of inexperienced personnel                | 4.47 | 1.53 | 5    |
| Non-compliance to specifications                  | 4.45 | 1.77 | 6    |
| Focus on cost by contractor                       | 4.44 | 1.80 | 7    |
| Corruption                                        | 4.41 | 1.35 | 8    |
| Contractors inexperience                          | 4.38 | 1.03 | 9    |
| Ineffective use of quality management practices   | 4.38 | 1.59 | 10   |
| Monitoring and supervision                        | 4.32 | 1.39 | 11   |
| Insufficient or no inspection of work in progress  | 4.30 | 1.66 | 12   |
| Poor communication with design consultants         | 4.28 | 1.98 | 13   |
| Poor planning of resources                        | 4.26 | 1.96 | 14   |
| Selection of inappropriate material               | 4.15 | 1.13 | 15   |
| Lack of funding allocated for site investigation   | 4.13 | 1.93 | 16   |
| Shortage of skilled labour                        | 4.13 | 1.27 | 17   |
| Lack of knowledge of the contraction process      | 4.09 | 1.03 | 18   |
| Incorrect design issued by the architect or engineer | 3.85 | 1.56 | 19   |
| Inadequate information                            | 3.62 | 1.11 | 20   |
| Contractors do not understand the National Building Regulation | 3.61 | 1.58 | 21   |
| Poor design                                       | 3.52 | 1.38 | 22   |
4.3. Implications of Low Quality LIH Projects

The major effect of low quality of LIH project as ranked by respondent in table 2 are tarnished professional image with MIS of 4.21, defective buildings with MIS of 4.12, unsafe structures with MIS of 4.03, cost overruns and dissatisfaction from the beneficiaries both with MIS of 4.00. Others are poor project performance, time overruns, reworks, loss of profit to contractor, lack of trust from the citizens, waste of tax payer’s money and litigation. The least ranked implications are claims/disputes and arbitration.

| Implications                        | MIS   | S.D. | Rank |
|------------------------------------|-------|------|------|
| Tarnished Professional Image       | 4.21  | 1.61 | 1    |
| Defective buildings                | 4.12  | 1.02 | 2    |
| Unsafe Structures                  | 4.03  | 1.40 | 3    |
| Cost overruns                      | 4.00  | 1.80 | 4    |
| Dissatisfaction from the beneficiaries | 4.00 | 1.57 | 5    |
| Time overruns                      | 3.85  | 1.77 | 6    |
| Impact on project performance      | 3.85  | 1.92 | 7    |
| Reworks                            | 3.79  | 1.38 | 8    |
| Loss of profits to contractors     | 3.76  | 1.72 | 9    |
| Lack of trust from the citizens    | 3.61  | 1.28 | 10   |
| Waste of tax payer’s money         | 3.56  | 1.27 | 11   |
| Litigation                         | 3.52  | 1.83 | 12   |
| Claims/Disputes                    | 3.48  | 1.58 | 13   |
| Arbitration                        | 3.36  | 1.18 | 14   |

4.4. Measures to Improve Quality of LIH

In evaluating measures to improve quality of LIH, table 3 indicate different initiatives that could be taken to minimise non-conformance to quality of LIH as ranked by the respondents. Contractors knowledge of the National Building Regulations is the most important factor with a MIS of 4.48 and SD of 1.51, followed by monitoring, sufficient inspection of work in progress, training and education, planning and risk assessment and upper management commitment with MIS of 4.41, 4.38, 4.36, 4.28 and 4.26 respectively. Others are use of skilled labour, strict supervision, communication among project parties, appropriate construction management technique, selection of appropriate material and fixing corruption. The least important measures according to respondents are workers participation, appropriate design, organisational culture, goal setting and focus on quality and less on production.

| Measures                                                   | MIS   | S.D. | Rank |
|------------------------------------------------------------|-------|------|------|
| Contractors familiarisation with the National Builders Regulations | 4.48  | 1.51 | 1    |
| Monitoring                                                  | 4.41  | 1.02 | 2    |
| Sufficient inspection of work in progress                   | 4.38  | 1.62 | 3    |
| Training and Education                                      | 4.36  | 1.93 | 4    |
| Planning and risk assessment                                | 4.28  | 1.53 | 5    |
| Upper management commitment                                 | 4.26  | 1.93 | 6    |
| The use of skilled labour                                   | 4.26  | 1.02 | 7    |
| Strict supervision                                          | 4.21  | 1.56 | 8    |
| Communication among project parties                          | 4.18  | 1.03 | 9    |
| Appropriate construction management                         | 4.12  | 1.24 | 10   |
| Selection of appropriate material                            | 4.06  | 1.42 | 11   |
| Fixing corruption                                           | 4.03  | 1.81 | 12   |
| Workers participation                                       | 3.97  | 1.29 | 13   |
Appropriate designs & 3.91 & 1.66 & 14  
Organisational culture & 3.71 & 1.32 & 15  
Goal setting & 3.71 & 1.18 & 16  
More focus on quality and less on production & 3.65 & 1.89 & 17  

5. Discussion
In support of the results of this study, [7] observed that poor project management, lack of experienced and competency of labourers, limited time and limited cost are factors leading to non-conformance to quality in LIH construction projects. Similarly, results of [4] indicated that more focus on production and less on quality is the major causes of non-conformance to quality as pointed out also by the findings of this study. These factors have adverse effect including defective and unsafe building, it also leads to dissatisfaction of stakeholders, especially clients and end-users.

Zunguzane [4] noted that accidents or injuries due to defective buildings is as a result of poor quality of LIH projects. Endut [21] also highlighted issue of cost overruns and that non-conformance to required quality will always results to damaged reputation of the contracting organisation in agreement to the result obtained by this study as the implications of low quality of LIH projects in South Africa.

In order to curb, manage and control this menace, [6] suggested that strict supervision as well as training and education are possible solutions. This is in agreement with this study where monitoring, inspection and supervision are the major control measures. This is also in tandem with the submissions of [4,5].

6. Conclusion and Recommendation
The study has been able to identify and evaluate the factors causing non-conformance to quality in LIH projects, implications of low quality LIH projects and measures for ensuring quality in LIH projects in South Africa. It can be concluded that housing projects are regulated by NHBRC but little or no attention is given to government subsided housing projects. In order to minimise the problem of poor quality of LIH projects, measures that can be taken by construction professionals and other stakeholders are related to effective monitoring, inspection and supervision of construction process and activities. In view of this, it is recommended that training and retraining of workmen involved in the construction of LIH must be taken into consideration largely by construction professionals and stakeholders. Contractors should be tasked with the responsibility of ensuring their employees obtain adequate training on total quality management. Competent professionals should be engaged in the construction of LIH projects to ensure that the technical requirements are met. It is also necessary for professionals to keep themselves abreast with the relevant building codes and regulations and be more interested in the enforcement of these standards.

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