

An Investigation into the Quality Level of Recently Constructed Residential Buildings in Ghana

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Abstract

Construction process is one of the oldest economic activities of humanity since creation. The primary purpose of any construction activity is earning profit through selling products or services. In recent times, for every human need, there is a product or services. Clients are therefore subjected to many choices as there are more than many construction providers for services or products. The quality of residential building construction in Ghana leaves much to be desired. There have arisen numerous complaints from clients, professionals as well as the media within the Ghanaian construction industry about building failures that have occurred in recent times. These include both structural and aesthetical failures as well as several defects that have emanated from poor design and constructional methods employed. This paper seeks to investigate the quality of domestic buildings construction in Ghana in recent times. Questionnaires were formulated based on information gathered from literature and administered to professionals in the construction industry as well as building owners and occupants residing in buildings that are ten years or less. Statistical tools were used for the analysis of the data gathered. It was revealed that some of these have resulted from designs and construction faults as well as choice of materials used for the construction process. Furthermore, in trying to reduce cost by some clients, they rather employed the services of half baked professionals or apprentices for the construction project. It is recommended that, clients should always seek the services of qualified specialists in the procurement of buildings so as to avoid unnecessary alteration and preventable problems and defects that may occur during and after construction.

Keywords: quality, recently constructed, residential buildings, Ghana

1. Introduction

The Ghana Skills and Technology Development Project, ((GSTDP), May, 2010)), estimates that the Ghanaian construction industry accounts for approximately US\$500-600 million annually to GDP. It comprises of about 23,000 registered contractors and other bodies including professionals registered under an association. The industry accounts for about 2.3% of the working force formally, although this figure could be higher if the informal sector is properly accounted for. Residential construction offers the largest opportunity for the informal sector growth and job creation with a current annual output of about US \$250-300 million and labour earnings could be totaling about US \$60-80 million (GSTDP, May, 2010).

According to a survey on Quality of Construction by FIDIC within Member Associations in 2001 confirmed that failure to achieve appropriate quality of construction is a problem worldwide. The pressure to reduce the initial costs of erection and supervision of construction projects were found to have had an adverse effect on quality, as could be predicted. The problem is serious and is evident in both developed and developing countries, including Ghana.

The construction process involves a lot of professionals from different industries coming together to produce an edifice which is bulky in nature and involving a number of activities and tasks. Construction contractors in their quest to increase their profits to stay in business have continued to massage the system. An aspect is the procurement of construction contracts within the traditional processes of appointing contractors with lowest tender figure has often lured, contractors, to submit low tenders with the aim of winning contracts at prices they purposely know cannot complete the construction projects at required specifications to meet quality expected from clients. Consultants, also in the same vein may be under pressure to reduce the initial cost of construction and construction supervision so that contractors are not able to produce the required quality.

These have often resulted in lack of quality in the constructed products which are mostly manifested in poor or non-sustainable workmanship, and unsafe structures, and sometimes characterized by delays, cost overruns and disputes in the execution of construction projects.

Consultants are often appointed by clients for a partial service only during construction, thereby increasing the risks to the client and the consultant with respect to the quality and safety of construction. This frequently increases the overall cost of the project when account is taken of delays and disputes emanating from such acts. Longer-term costs such as increased maintenance in the process of operation will also be incurred.

Quality today has assumed a high level of importance as the durability of building envelope is directly related to the quality of materials and components used therein (Mittal 2009). Quality is always the result of thorough planning and effort and never an accident. This paper seeks to investigate the perceive level of quality of residential buildings construction in Ghana in recent times. Opinions are obtained from stakeholders within

the Ghanaian construction industry on residential buildings that are ten years or less in age.

1.1 Problem Statement

The population and housing censuses in the year 2000 reported the existence of about 3.88 million dwelling units in Ghana less than half of which are classified as houses, thereby explaining that a deficit of about a million is needed. These have arisen as a result of the rural urban drift.

Ghana needs more new residential housing units each year due to the rural-urban drift. The inability of the country to meet these high demands of housing supply have led to the engagement of both registered and unregistered local contractors trying to construct them. The deficit is still great that pockets of slums and communities have sprung all over the major cities and towns in Ghana. These comprise of entirely of kiosks and containers where plumbing or drainage are mostly non-existence (Business World, 2012).

The legislative Instrument that regulates the Ghanaian construction industry L.I. 1630 has not been reviewed since 1996. This has led contractors getting the liberty to build more than thousands of structures in the country devoid of guideline (Citifmonline.com, 2014). This was revealed when a six-storey hotel under construction at Nii Boi Town in Accra collapsed in the dawn of 13th of March, 2014, claiming a life and injuring another. This raised questions on the effective adherence of building construction regulation in Ghana. In 2012, a six-storey building shopping mall collapsed at Achimota also in Accra claiming the lives of many and injuring many more (Citifmonline.com). In January, 2013, two people also died on the spot and three others were seriously injured, when a two-storey residential building under construction collapsed on them at Antwirifu, near Dormaa-Ahenkro in the Brong Ahafo Region of Ghana (GNA, 10 January, 2013). These raises questions as to the design and construction methods employed as well as the workmanship of the work force.

Most construction clients or residential building owners have found the Ghanaian construction workers to be unreliable, as most of them are unskilled and the skilled ones are also thought to be too expensive in the payment of professional fees. The final residential buildings also lack the required quality standards and most of which have experienced some form of defects even before handing over. It is against this background that this paper is proposed with the following research questions:

What is the quality of the design produced for usage in the construction of the residential buildings?

What is the level of quality of the construction products as seen by both occupants and building construction professionals?

What is the standard of workmanship employed for the works?

1.2 Objectives of the Study

The objective of the study is to investigation into the quality of recently constructed residential buildings in Ghana. Specific objectives include:

- i. To identify the quality of design produced for usage in the construction of the residential buildings
- ii. To determine the level of quality of the construction products as seen by both occupants and building construction professionals
- iii. To determine the standard of workmanship employed for the projects
- iv. To compare the views of occupants and professionals about the level of quality of residential buildings in Ghana.

1.3 Hypothesis

The level of quality of residential buildings in Ghana varies between occupants of these residential buildings and building construction professionals.

2. Literature Review

There are several definitions of quality, each author defining it based on his or her profession or expertise. Most manufacturing-based companies identify quality as “conformance to requirements” (Crossby, 1979). It is also defined as conformance to specifications and defect avoidance (Crosby 1984). Eight dimensions were also defined to be the attributes of quality comprising these variables namely; aesthetics, performance, conformance, serviceability, features, durability, reliability and perceived quality (Garvin 1987). The American Society for quality (ASQ) also defines quality as “A subjective term for which each person has his or her own definition”. However, the most acceptable definition is the one proposed by the ISO which defines quality as “the degree to which a set of inherent characteristics fulfils requirement (International Organisation for Standardisation 2004). Customers’ expectations and perceptions were also considered as what quality entails in the service industry (Parasuraman et al. 1985; Wild, 2002). This definition is influenced by design quality and process quality. Quality in construction, thus, refers to meeting the provided specification and with constructing the building elements, fittings and fitments right the first time.

2.1 The Concept of Quality in Construction

The Ghanaian construction market is changing faster as demands for shelter; a basic need of humanity is on the increase. Most clients have placed these needs on both licensed and unlicensed contractors to provide these residential buildings within budgeted cost and at an acceptable quality.(Imants 2002).however, the construction industry is often criticized for poor performance, and cited for having been unable to satisfy its clients (Egan 1998).

Residential buildings in Ghana comprise; Single family homes, Multi-unit town houses, Garden Apartments, High-rise apartments and Condominiums. The reasons and causes of quality in residential buildings construction in Ghana are as a result of standard of the products, the building materials used in the construction process and the type of contractors selected. Residential housing developments are springing up with at such a rapid rate that builders and developers have a tendency to cut corners when they can. One area to do this is with selecting inexperienced contractors, as some contractors cost more than others. This is clearly based on their qualifications and whether they are licensed or not. These contractors intend use inferior building materials in constructing the house. These could be appliances, plumbing equipment, dry wall material, and so on as well as workmanship problems. Poor workmanship has frequently caused construction defects, both aesthetics and structural.

The commencement of a building project begins with a client whose decision needs to be evaluated thoroughly before it comes to fruition. The first step is to survey the factors that will impact these decisions. An important factor to consider is the geography of the site. Does the builder know what kind of soil upon which the building will be built? Whether there exist accesses to and from site? Whether there exist any obstructions above, on, or below the site? The type of plant items, whether stationary or mobile depending on storage, space and security? What type of contractor would be selected by the client and what is the budget for them? The client also has to decide what products and what building materials will be used. Before groundbreaking, the builder has to make a lot of decisions that can either help prevent or may actually cause some building issues. Soil issues are a leading cause of construction defect. If the land is not properly prepared, the soil, whether expansive or collapsing, can cause damage to all areas of the residential building, i.e. the floor, the wall, the foundation and even roofing defects.

2.2 Framework for Assessing Quality in Construction

A comprehensive view of construction quality of recent residential housing in Ghana of up to ten years in age is proposed by critically evaluating both the workmanship (as exhibited by both design and construction teams) and product (as received by the end-user) aspects of the construction project. Such a classification of construction activity facilitates developing strategies to define quality as meeting the requirements of client, legislative and regulatory requirements of authorities, social requirements of the public and even sometimes cost requirements of contractors. Hence, quality can be measured based on these criteria (Ali and Weng 2011). A frame work for the assessment of residential housing product constructed ten years or less and contractor's quality performance is established.

Another related theory to customer satisfaction that has been adapted by Bartlett and Han (2007) in customer satisfaction is the SERVQUAL model by Parasuraman, Zeithaml & Berry (1991), was adopted in evaluating the construction team or companies.

The model to be used to evaluate the level of quality exhibited by any building evaluates the quality of design, the quality of the product and finally, the workmanship for the execution of the building.

The quality of design considers the following factors as very necessary for the production process; economy, efficiency, energy efficiency, safety, utility, environmental friendliness, comfort, ease of access and use, consistency and shape and size. The quality of product was obtained from (Garvin, 1987). These include; aesthetics, performance, conformance, serviceability, features, durability, reliability and perceived quality. Finally, from various literature the components making up the quality of workmanship are; structural integrity, effective utilization of materials, finishings, performance of day lighting and ventilation, electrical and plumbing installation, drainage and tolerance.

3. Research Method

3.1 Methodology of the research

The research was designed to give comprehensive information on the field research work that was used to achieve the research objectives. The study area used was the Accra, Tema and Kumasi metropolitan areas in Ghana jurisdiction. The study and target population was centred on houses built in these metropolitan areas of Ghana. Data collection techniques were designed to explain the procedure used to collect the field information.

The research design combined both desk research and field research. The desk research focused on establishing the quality of recently constructed residential buildings in Ghana, especially buildings within the above mentioned metropolitan areas in Ghana. The literature review was from refereed journal papers, textbooks,

institutional and statutory publications and magazines. The field research concentrated on data obtained from demographic factors and condition of buildings quality and workmanship of existing buildings selected for the research assessment by professionals within the Ghanaian construction industry (statutory bodies) and occupants of buildings in the study area as samples for this research.

The field research was therefore designed to assess the quality of recently constructed residential housing in Ghana. This is to identify areas where improvement can be made to enhance comfortability or end-users satisfaction. The researchers had two main options, a qualitative or quantitative research design to select from. The decision on which research strategy to employ depended on the purpose of the study and type and availability of information required (Wisker 2001) and (Denscombe 1998). A quality design is suitable for exploratory, attitudinal and placement of theory, whilst quantitative research design is ideal for objective measurement or placement theory (Naoum 1999).

The numerical form of measurement scale was selected as data collected which is attitudinal in nature. The Likert scale was used to classify and rank for non-parametric statistical test methods of analysis using the Spearman rank correlation coefficient (White 2000) and (Naoum 1999).

Respondents were to rank by circling the appropriate rank number which was arranged with never as rank '1' to always '5'.

A pilot trial was conducted which helped revised and refined the questions before issuance (Coolican 2004). The sample coverage was to include all the metropolitan authorities in the country but due to cost and time constraints it was limited to only Accra, Tema and Kumasi.

Table 1: Respondent rate

Code	Categories of Respondents	Questionnaire sent	Questionnaire returned	Response Rate in percentage
P/001	Professional	80	55	68.75
O/001	Occupant	100	75	75%
Total		180	130	72.2%

The data analysis framework considered the completed questionnaire in both descriptive and statistical test forms. As a result, pie charts, line graph and spearman correlation coefficient tests were used. The demographic of the respondents was analysed using the descriptive analysis method whilst for the building quality and workmanship, a combination of descriptive analysis and the statistical test methods was used to compare the perceptual level of building quality and workmanship of recently constructed housing in the metropolitan areas in Ghana.

The mean scores were applied in ranking the necessary factors. This provided the results with level of probability that allows decision to be taken based on whether the results were significant or were due to chance (Naoum 1999). In particular, the test results would end up stating the probability (figure of statistical test at the expression $P < 0.05$. meaning the probability of the results is due to chance was less than 5 per cent or 5 in 100. Hence, the less the probability figure, the more likely you could have your results being significantly different. Hence, for the significant test to be performed, the mean scores of the two categories (variables) were calculated out of the formula:

$$MS = \frac{\sum(f \times s)}{N}, (1 \leq MS \leq 5)$$

Where:

s = score given to each factor (question) by respondents and ranges from 1 to 5, where 1 is never and 5 is always

f = frequency of response to each rating (1-5) for each factor

N = total number of response concerning that factor.

MS = Mean score

The significant test was performed using the spearman rank correlation coefficient test method to compare the perceptions of the two categories for E significant difference. The formula used is as follows:

$$Rho = 1 - \frac{6 \sum d^2}{N(N^2 - 1)}$$

Where:

d= the difference in ranking between each pair of factors

N = number of factors

4. Results and Discussions

The outcome of the five-point Likert scale questionnaire that was used to collect the results from the two categories of respondents (occupants and professionals) was compared. The questionnaire which contains 26 factors indicating residential buildings level of quality was tested using the spearman rank correlation coefficient as designed with the correlation found to be significant at $P < 0.05$ (rho found to be 0.728 above). This means that high ranking to one factor indicating level of quality of residential buildings by occupants in most cases corresponded to high ranking by the professionals and vice versa. The research hypothesis therefore had been rejected and the null hypothesis accepted. This concludes the research finding that the difference in opinion between occupants and professionals regarding level of quality of residential buildings in Ghana is not significant.

The scores obtained were built into ranking using the Likert scale was based on opinion and not an objective measurement. However, according to (Naoum 1999), analysis could be made by using factors of high and low scores and rankings of the responses.

From analysis no significant difference in opinion on level of quality of residential buildings in Ghana exists between occupants and professionals. This provided some information about the level of quality of residential buildings in Ghana. The analysis were therefore made based on the scores and the rankings list of the results with emphasis placed on factors given low and high scores. The results and information obtained in the tables together with line graphs of the individual groups of respondents as well as combined responses indicated some amount of evidence about the level of quality of residential buildings in Ghana.

Though each of the 26 factors indicating the level of quality of residential buildings in Ghana provide some information and therefore needed to be analysed, only selected factors were analysed. The rankings of the factors which ranged between 1 and 26 were further classified into high and low rankings, in which case 1 to 13 were classified to be high rankings (always / high used factor) and the 14 to 26 were considered to be low rankings (rarely/ low used factor) to facilitate easy analysis.

4.1 Analysis of the Results

Comparison between the occupants and professionals in the Ghanaian building industry was illustrated using the line graph in figure 2 and this revealed that both types of respondents have similar opinion concerning most of the factors depicting the level of quality of residential buildings in Ghana. This means that high ranking to one factor indicating the level of quality by occupants corresponds to high ranking by the professionals and vice versa. The research hypothesis therefore had been rejected and the null hypothesis accepted.

Table 2: Factors indicating levels of quality levels of Residential buildings

NO.	ITEM	N	Min	Max	Mean Score	Rank
DESIGN QUALITY						
(i)	Economy	88	1	5	3.27	6.5
(ii)	Efficiency	88	1	5	3.72	2
(iii)	Energy efficiency	88	1	5	2.26	26
(iv)	Safety	88	1	5	3.27	6.5
(v)	Utility	88	1	5	2.70	19.5
(vi)	Environmental friendliness	88	1	5	3.97	1
(vii)	Comfort	88	1	5	3.60	3
(viii)	Ease of access and use	88	1	5	2.65	21.5
(ix)	Consistency	88	1	5	2.83	14
(x)	Shape and size	88	1	5	2.77	16.5
BUILDING QUALITY						
(i)	Aesthetics	88	1	5	2.77	16.5
(ii)	Performance	88	1	5	3.03	11
(iii)	Conformance	88	1	5	3.22	8
(iv)	Serviceability	88	1	5	3.07	10
(v)	Features	88	1	5	3.01	12
(vi)	Durability	88	1	5	2.70	19.5
(vii)	Reliability	88	1	5	3.34	4.5
(viii)	Perceived quality	88	1	5	3.17	9
QUALITY OF WORKMANSHIP						
(i)	Structural integrity	88	1	5	2.80	15
(ii)	Effective utilisation of labour	88	1	5	2.60	23
(iii)	Finishings	88	1	5	3.34	4.5
(iv)	Materials types and utilisation	88	1	5	2.34	25
(v)	Tolerances	88	1	5	2.39	24
(vi)	Performance of electrical installation	88	1	5	2.95	13
(vii)	Performance of plumbing installation	88	1	5	2.74	18
(viii)	Performance of drainage system	88	1	5	2.65	21.5

Table 3: Factors indicating levels of quality of residential buildings (Occupants and Building Professionals)

NO.	ITEM	OCCUPANTS		PROFESSIONALS	
		Mean	Rank	Mean	Rank
DESIGN QUALITY					
(i)	Economy	3.20	7	3.33	6.5
(ii)	Efficiency	3.93	2	3.56	3
(iii)	Energy efficiency	2.20	26	2.23	26
(iv)	Safety	3.33	5	3.23	9
(v)	Utility	3.13	8	2.35	25
(vi)	Environmental friendliness	4.03	1	3.92	1
(vii)	Comfort	3.75	3	3.48	4
(viii)	Ease of access and use	2.45	22	2.81	17
(ix)	Consistency	2.75	16	2.90	15
(x)	Shape and size	2.83	13	2.73	22
BUILDING QUALITY					
(i)	Aesthetics	2.75	16	2.79	19.5
(ii)	Performance	2.88	11	3.17	11
(iii)	Conformance	3.30	6	3.15	12
(iv)	Serviceability	2.75	16	3.33	6.5
(v)	Features	2.80	14	3.19	10
(vi)	Durability	2.60	19	2.79	19.5
(vii)	Reliability	3.03	9	3.60	2
(viii)	Perceived quality	2.85	12	3.44	5
QUALITY OF WORKMANSHIP					
(i)	Structural integrity	2.50	20.5	3.04	13
(ii)	Effective utilisation of labour	2.35	23	2.81	17
(iii)	Finishings	3.43	4	3.27	8
(iv)	Materials types and utilisation	2.25	25	2.42	24
(v)	Tolerances	2.30	24	2.46	23
(vi)	Performance of electrical installation	2.98	10	2.94	14
(vii)	Performance of plumbing installation	2.65	18	2.81	17
(viii)	Performance of drainage system	2.50	20.5	2.77	21

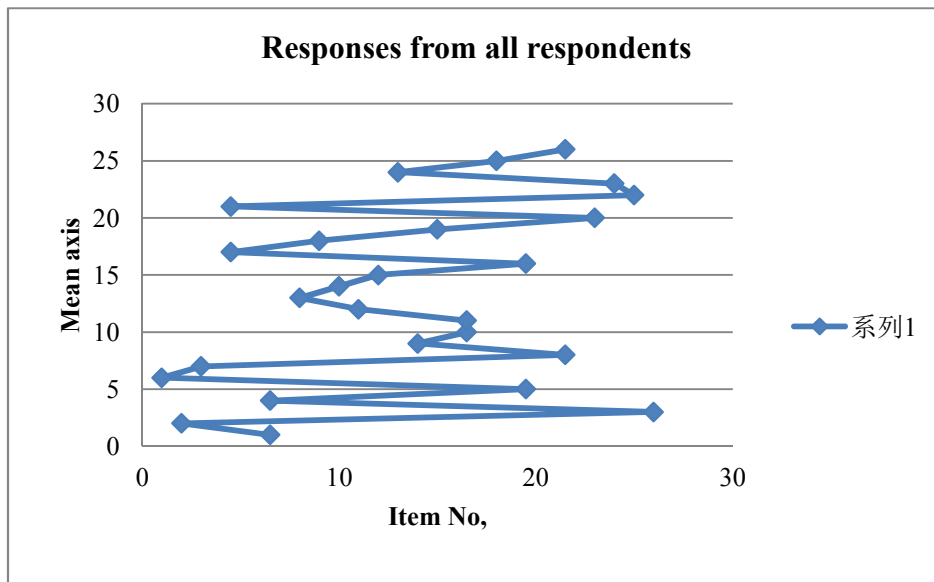


Figure 1: Responses from all respondents

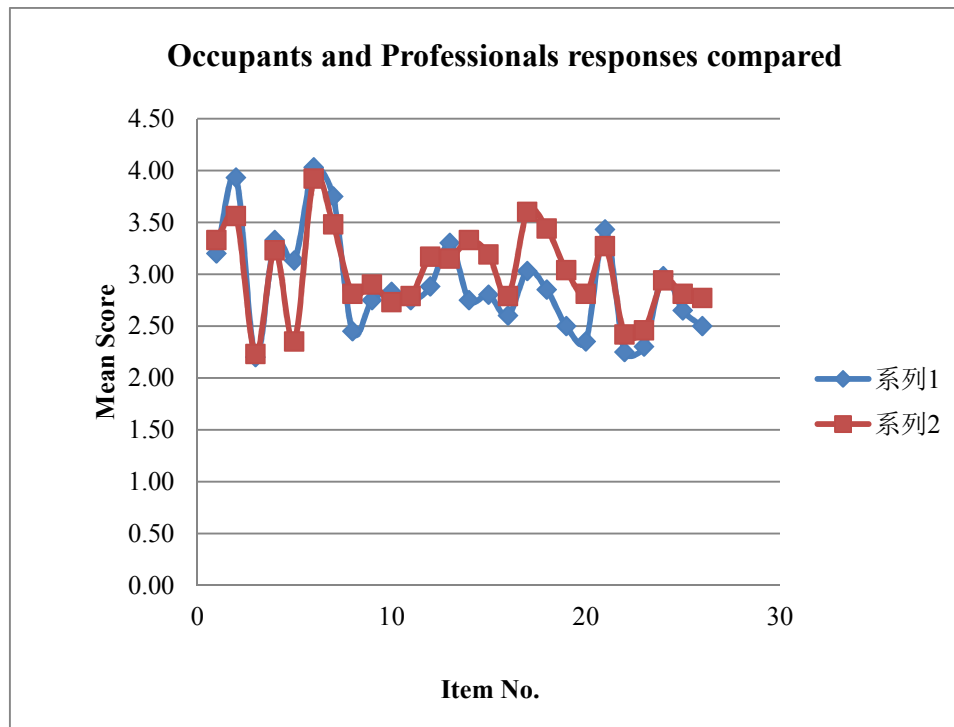


Figure 2: Occupants and Professionals responses compared

4.2 Design Quality

Respondents have similar opinion about the level of design quality of recently constructed residential buildings considering ‘environmental friendliness’ as a very important aspect of quality of a design, as both occupants and professionals within the Ghanaian construction industry both ranked that factor highest as 1. Environmental friendliness depicts the guidelines and policies that reduce or minimise hazards on the ecosystems or the environment. The ISO 14020 and 14024 establishes the principles and procedures needed to guide certifiers. Designs were seen to design to prevent pollution and risk to humans and the environment. Design has balanced both customer needs as well as environmental-economic cost to consumers (Luttrupp and Lagerstedt, 2011). Most of the buildings in the study area are safer for human health and protect the environment. Both occupants and professionals ranked ‘energy efficiency’ very low ‘26’ meaning that most architects were producing drawings that seem to be imported forgetting that the plant and equipment holdings of these contractors are not able to construct every detail needed to produce the quality needed. The objective of reducing the amount of energy required to operate the building facility is a problem in Ghana currently. The reliance of the buildings to rely on natural ventilation and day lighting is minimal. Due to that, most of the buildings have resorted to use electrical energy in the form of air conditioners and electric fans to cool the rooms to obtain an amount of comfort. The energy efficiency of the buildings needs to be improved to reduce the world’s energy needs by one third (Hebden, 2006).

4.3 Building Quality

The professionals ranked reliability a high ‘2’ indicating that when there is ‘reliability’ of executing all necessary attributes to a building then quality will meet the expectations of the end-users as well as the general public. Occupants also ranked ‘conformance’ a ‘6’ also having in mind that when there is conformance to a product quality then it implies that quality is assured. Every consumer or end-user of a building facility expects continuous functioning and operations of such facilities without any disruptions. This is because any form of failure registered on the building can result in injury, loss of life and/or costly lawsuits. Continuous assessment of buildings reliability is indeed a critical necessity in today’s competitive business environment (Engineering Statistics Handbook). This determines whether a building complies with the requirements of a specification, contract or regulation. It measures the level of effectiveness of the design and production functions of a building in fulfilling the building requirements and process specifications while meeting the building process control limits, building tolerance and production targets.

Both occupants and professionals felt durability comes by itself as it was ranked ‘19.5’ and ‘19’ by professionals and occupants respectively. Durability in product means the building meets its long term needs, resists damage, wear and stays relevant to end-users. They both felt that was not pressing for now as there is the

need to tackle the relevant quality issues presently and then durability will come in.

4.4 Quality of Workmanship

Perception between the two categories of respondents was about the 'finishings'. The factor was ranked '4' and '8' respectively by the occupants and professionals respectively. It is clear that both respondents felt the need for the building construction process was to satisfy aesthetics, where the beauty of the building is formed. This comprises of materials used, environmental conditions and costs.

The 'materials types and utilisation' was given a low rank of '25' and '24' by both occupants and professionals respectively. This factor was ranked low by both respondents. This is because the building constructions products in Ghana have been saddled with the use of inferior materials by most contractors in order to break even due to high fluctuations in material cost. These materials seldom perform their intended functions and within a short time defects arise. There is also lack of thorough supervision during the construction process; hence, corners are cut regarding to mix ratios of concreting products as well as poorly seasoned timber pieces are often used.

5. Conclusions

Upon conducting this research, certain findings were discovered. The field work undertaken necessitated the formulation of a hypothesis that stated the position of the investigation. The hypothesis states that; 'The level of quality of residential buildings in Ghana vary between occupants of these residential buildings and building construction professionals' was found to be not significant at $P < 0.05$ (rho was found to be 0.728). This implies that, occupants of these residential buildings and professionals from the Building industry were unanimous of the view that the level of quality of residential buildings in Ghana was similar, that is not too pleasing.

Generally, comparing the views of the 26 level of quality factors to published literature reveals that the level of quality of residential buildings in Ghana needs to be improved upon.

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