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AN ANALYSIS OF FACTORS INFLUENCING THE QUALITY OF HOUSING CONSTRUCTION PROJECTS IN THE WESTERN CAPE, SOUTH AFRICA

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Abstract

Quality measurement is the trigger for quality improvement; things that cannot be measured therefore can be improved. The result of poor quality in the house hold construction projects in the Western Cape hence might be the lack of quality measurement methods or standards. The research intended to provide clients, building inspectors, building inspectors, project managers, designers and contractors with the necessary information needed to better manage the quality of house hold construction projects in the Western Cape Province. Factors that affect the quality of house hold construction projects during the construction phase were identified. The use of hybrid was implemented in order to exhaust all possible ways to obtain data and questionnaires were developed and used as research tools to obtain the opinions of respondents that included the contractors, building inspectors, household and project managers, on the factors affecting construction projects and how these factors can methodology be addressed to ensure the construction of quality buildings. It was concluded that the most important factors affecting the

quality of house hold constructions projects are, the skills and experience of contractors and project managers, site lay-outs, materials, equipment used, Mediterranean weather conditions, lead time in decision making. Therefore the authors recommend that the construction industry should have a stand-alone board that deals with quality standards and controls the quality standards of buildings by taking into considerations the factors identified and also this board should behavior *have rights to demolish buildings that are not up to standard.*

Keywords

Quality, housing, construction, projects

1. Introduction

The construction industry plays a significant role in the economy of South Africa; as major construction activities account for about 80 % of total capital assets and 15 % of the Gross domestic products, in addition this industry provide high employment opportunities (Jekale, 2004). Despite the significant contribution of this industry to the South African economy and its role in the country's development, the quality performance of the industry still remains low. As (ldoko, 2008) quoted by (Nyangwara & Datche, 2015), noted that many construction projects in developing countries encounter considerable time and cost overruns , and fail to realize their intended benefit as a result quality suffers and these projects will be totally terminated and abandoned before or after their completion. In the modern world's construction market, quality is a major function in this industry and it is rapidly becoming an important factor, as price has been traditionally as noted by (Davis et al., 1989). "Housing is about everything other than houses. It is about the availability of land, about access to credit, about affordability, about economic growth, about social development, about environment" (South African Minister of Housing, cited in Khan, 2003: xxiii). According to ISO 9000; 2000 quality is the degree to which a set of inherent characteristics fulfills requirements. The construction Industry Indicators (CIIs) defined quality in terms of construction as Client satisfaction with the quality of the completed construction work delivered; the condition of the facility at the time of handover/practical completion with respect to defects and client satisfaction with the overall quality of materials used. In the face of ever-changing economic conditions, residents have continuously observed that their buildings are dilapidating at a faster rate hence it is costing them more money to renovate now and then.

2. Research aims and objectives

2.1 Research Questions

What are the major factors that impact quality in the housing construction industry? To what extent do the factors identified affect the quality of residential constructions in the Western Cape? Do the Western Cape Construction industry's stakeholders such as: building inspectors and contractors adhere to the standards set by the South African National Standards 294?

2.2 Problem Statement

In Cape Town, situated in the Western Cape Province of South Africa, the construction industry is facing challenges with regards to quality. Many up-coming buildings of either a residential or commercial classification are of poor quality. Observations by the Cape Town Community Housing Company over the past year, the quality of residential construction in the Western Cape has come into question. Numerous residential construction faults were observed.

2.3 Research Aims

- To establish the problems relating to the quality of housing and to gain more knowledge about the South African construction industry and to identify factors that impact quality of house construction.

3. Literature review

3.1 Hot and Dry Conditions

One of the most prevalent negative challenges around construction sites during dry conditions is dust. Dust generates dirt that needs to be removed from interior surfaces during the construction process and also creates build-up inside the moving parts of machinery. The filters on machinery have to be checked and replaced regularly to ensure continued safety and functioning of the equipment. Additionally, a water truck must often be used to spray a fine mist on the dusty surface that is being worked on to prevent the dust from creating totally chaotic conditions. Therefore, there is an additional cost attached to water usage according to Crissinger, 2005. The weather can have an adverse effect on the application and performance of paint. When the actual or surface temperature of the substrate is too high or the relative humidity is too low, the solvents (reducers) in the paint evaporate too rapidly. Due to the rapid solvent evaporation the paint does not cure properly. Some of the problems that could be experienced are: delamination, wrinkles and blisters as well as peeling and cracking (Crissinger 2005).

3.2 Wet Conditions

Heavy rain can cause a construction site to turn into a gigantic mud pit. The formation of mud will hinder access to the building site for all the building trades. This will prevent or slow down, earthwork (grading, trenching, & backfilling) as well as paving and foundation work significantly. The formation of excessive mud will also hinder foot traffic (worker movement on site). When foundation work needs to be performed on a site, one fear for all builders is a high water table. Concrete used for the foundations cannot be cast in water, because the concrete will not set correctly. Excessive rain increases groundwater and if the construction site already has a high water table, there will be significant additional costs attached to a dewatering process before casting can begin. A brick could be described as a dry sponge, it is a reservoir for moisture and capillary action causes it to absorb liquid at an incredible rate, Crissinger (2005).

3.3 Resources

Time, resources, procurement processes, clients, project managers, leakages, seepages and redesign are some of the many factors that have a significant impact on the quality of construction projects in the Western Cape. Resources are the means of production needed to complete a project. These resources may be in the form of: human, technical or financial resources that are required to successfully execute a project and achieve the stated project goals, (Knipe et al, 2002). Resources may either be tangible or intangible and both have an impact on the quality of construction projects, especially if the resources are not readily available or if mismanagement of the available resources occurs. Project resources provide the means to accomplish the stated work objectives (Padilla & Carr, 1991). Construction resource management is the most important factor contributing to cost success (Meeampol & Ogunlana, 2006).

3.4 Employees

According to Dessler, 2008, manpower is the first and foremost crucial resource that determines project success. Therefore, in a construction project employing competent people with the required expertise is considered to be crucial. Enshassi, 2009, notes that “employee belonging to work is an important aspect as a sense of belonging motivates them which will result in improved productivity and performance”. Quality is also influenced by job satisfaction. According to Chan & Tam, 2000if site staff is incompetent and constantly changed it will have a negative impact on the quality of the building being constructed and the project may take longer

to be completed at a higher cost. Therefore, employees need to be trained continuously to increase their experience as well as reduce the staff turnover rate and enhance employee loyalty.

3.5 Project managers

Project managers with little or no experience go about selling themselves as professionals and convincing people about their capabilities. These managers will most likely deliver projects which are of poor quality; because they have no experience or competency and they do not possess the capacity to complete construction projects successfully. Enshassi et al., (2009) mentions that the project manager may approve the use of substandard and inadequate materials due to ignorance and wanting to save costs. These decisions will affect the delivery of the project with regard to quality.

3.6 Financing

Financing is considered one of the most crucial resources required for any construction project, because no work can be performed without the necessary funding to successfully implement all the project plans. The managing of finances is a preliminary requirement for all the parties involved in a construction project to allow the achieving of successful project completion, but if not well managed it could lead to serious problems with regard to project quality. Chan & Park, (2005) indicates that most contractors lack financial management as evidenced by poor planning in the distribution of costs attached to projects and this may lead to poor cost performance. Therefore, it is advisable to monitor project financial spending thoroughly.

3.7 Equipment

The selection and utilization of equipment in a project must be an integral part of the total plan (Meeampol & Ogunlana, 2006). Machinery may lead to poor quality if there are no special reservations in place in the event that faulty machinery is hired. This may affect construction projects adversely, because most stages of construction should be finished before others commence (stages of construction follow one another sequentially). The extensive use of machinery would be a great advantage in the Western Cape, because it could avoid manual labor in many instances where people would have difficulty working in harsh weather conditions, according to Vender (2011).

3.8 Materials

Materials are the essence of any construction project and represent a substantial proportion of the total value of the project. Materials are considered to be the backbone of

construction projects, and usually account for approximately 70% of the projects cost. This highlights the importance of efficient management of project resources. A material management system includes the fundamental functions required in any construction project such as identifying, acquiring, storing, distributing and disposing of materials. Additionally, in Mediterranean weather climates materials may be affected by moisture during transportation or in storage facilities, this may cause a profound impact on project quality, because project managers and clients may end up purchasing poor quality material in an effort to recover costs (Dessler, 2008).

3.9 Client

The client plays an important role in achieving the desired quality level. Not only are they responsible for the preparation of a clear and unambiguous specification, but they must also monitor the actual work at the site. It is well recognized that having the clients' inspectors work with the contractor to establish good quality control procedures before the work is done, is much more effective than walking around after , as postulated by Barnes & Trottier, (2004). Poor communication with design engineers and architects lead to poor housing and commercial buildings. Often the client decides to change the design of the building when work has already been started. The lack of knowledge of knowledge and experience of the design process as well as lack of knowledge and experience of the construction process causes the client to give invalid points leading to construction defects. Insufficient money and time spent on the briefing process, lack of funding allocated for site investigation as well as payment of low fees for preparing contract documentation also affects construction quality (Ndikokubwayo, 2012).

If the owners desire a quality job, they should stick to the specification since any relaxation in quality performance, even for few times, can set a bad precedence. Thus competence of the owner plays a prominent role in defining the expected level of quality from the contractor organization, Iyer (2006).

3.10 Design

Design refers to the broadly based architectural, engineering and technical application to the design of the business. Like any other country, South Africa, allows people to design light residential houses without an architectural license because their service is affordable to the majority (Ndikokubwayo, 2012). Lack of design coordination and integration between project team members can lead to design deficiencies and exacerbate the causes of rework and constant renovations .Source of design-related rework is attributable to communication problems or as per

client request. It was revealed that engineers used CAD technologies and the architects used manual systems to document their designs and as a result, some drawings were issued with dimensional errors and missing information (CIDB, 2011).

3.11 Aggressive tender competition

Aggressive competition sometimes forces the bidders to quote low for the project. Once awarded the project they are not motivated enough to do a quality job. To make some profit out of the project they sometime try to use inferior materials and bad technical practices, leading to poor quality. The problem of a low bid is quiet common in cases of government-owned projects.

3.12 Seepage and cracks

In order to solve quality problems for residential construction, studies have been conducted in different countries, mainly on wall seepage and cracks. There are four different types of cracks namely: horizontal, vertical, diagonal and random cracks. These cracks have different names because of how they appear and that also helps in identifying the causes of the cracking. According to Kwok-key, N.G. (2009) Water seepage in buildings increased after the outbreak of severe acute respiratory syndrome (SARS). Lam, E (2007) indicates that seepage is identified by carrying out thermo-graphic inspections after conducting water tightness tests, flooding tests or hydraulic tests. Seepage is also due to the use of sea-water in the flushing system and the using of it during construction.

According to Drew, Love, and Li (2000), "excessively prolonged overtime work can generate quality problems, such as rework, and additional resources." The organization could plan for overtime to meet their deadlines, although construction workers do more labour intensive work than office workers and due to this they are subjected to overtime work, because they want their tasks to be finished. This could lead to fatigue in the work place and could subsequently lead to poor concentration, absenteeism, accidents, errors, injuries, and even worse, fatalities according to NSF, 2013. According to Aibinu, & Jagboro (2002), the effects of time delays on project quality are evidenced in both project cost and time overruns and in the event of attempting to minimize these costs contractors usually cut costs at the expense of quality.

4. Research Methodology

The research incorporated a qualitative approach to the investigation. This approach allowed the researchers to analyze the data collected in an empirical method by utilizing the advantages of both the qualitative and quantitative methods.

4.1 Research Design

According to Mertens , 2010), a research design is a detailed outline of how an investigation will take place and it will typically include how data is to be collected, what instruments will be used and how data will be analyzed. The research incorporated a qualitative research methodology by combining the various techniques ascribed to a qualitative approach. Interviews and questionnaires were chosen as the primary techniques for the investigation. Respondents included: project managers, building inspectors, contractors and a sample of residents currently residing in Cape Town. The quantitative data was subsequently analyzed and the results of the analysis could then be used to formulate findings, (Welman et al., 2005).

4.2 Research strategy

Singh & Nath, 2010, propagate that research strategy is a generalized plan for a problem which includes structure as well as desired solutions with regard to the objectives of the research. Furthermore, it includes an outline of planned devices necessary to implement the strategies envisaged and these strategies form part of a larger development scheme of the research approach

5. Data Collection Strategies

5.1 Observations

In research observations are defined as the watching of behavioral patterns of people in certain situations to obtain information about the phenomenon of interest. The advantage of observations is that the researcher is able to record actual behavior, rather than to rely on secondary information to determine exactly why people behave as they do (Dixon et al, 1990).The reason for using a questionnaire: A questionnaire is far less time consuming than conducting an interview. A questionnaire could be distributed to many people, therefore providing the opinions of many people in a shorter length of time, Welman et al, 2005.

5.2 Sampling

5.2.1 Residents

The authors used cluster sampling, because one type of cluster sampling is known as geographical cluster sampling. These clusters consist of geographical areas and because a geographically dispersed population can be expensive to survey, greater economy than simple random sampling can be achieved by treating several respondents within a local area as a cluster,

Welman et al, 2005.

5.2.1 Contractors and builders

Accidental or incidental sampling was used. This to a greater extend allows the researcher to acquire the contractors perspective randomly.

5.2.2 Building inspectors

The authors approached the Spatial Planning and Urban design building inspectors from the City of Cape Town. A meeting was scheduled with the department to interview the building inspectors. The author used a face to face questionnaire and interview to acquire information from these respondents.

5.2.3 Data analysis and Interpretation

After the collection of all the relevant information the data will be analyzed and interpreted in an attempt to create consistency and answer the research questions. According to Dixon and Nicholson, 2000, data analysis is the application of one or more techniques to a set of data steered by the problem to facilitate further understanding by eliminating unnecessary data and combining linking data in order to interpret the data.

6. DISCUSSION OF FINDINGS

6.1 Contractors Evaluation

A contractor specific questionnaire was designed, consisting of one page and contained eleven questions in total. With regard to contractors inspecting their equipment regularly, respondents were divided. Fifty percent of the respondents acknowledged that contractors inspected their equipment regularly during warm weather. Following the acknowledgement of contractors inspecting their equipment regularly, only thirty percent of the respondents indicated a positive response pertaining to the regularity of equipment inspection. Therefore, it could be said that even though certain contractors do inspect their equipment, they are not inclined to do so regularly. This would most likely result in premature equipment failure.

Eighty percent of the respondents indicated that one of the predominant causes for poor quality on buildings that these individuals have been directly involved with themselves, is assignable to the inadequate skill level of the construction workers employed. This statistic is overwhelming and it is clear there is a general consensus among contracting staff that the skill level of employees should be addressed acutely. Seventy percent of the respondents indicated

that they were not aware of an admixture or similar product that could be added to concrete and mortar to maintain the moisture content required to prevent subsequent failure of concrete or mortar in various manners, particularly in warm and dry conditions. The use of admixtures may increase the initial cost of the concrete work for a construction project initially, but the costs of complete sub structure failure should be compared to the costs of incorporating admixtures.

Sixty percent of the respondents mentioned that architects do design various building components for the allowance of differential movement. Even though sixty percent reflects the majority of respondents, this statistic is not convincing. It appears that a certain amount of Architects neglect differential movement in their designs, and the neglect of differential movement could cause component failures. Eighty percent of respondents indicated that Architects do not specify sealants and paints that are of the highest quality, particularly pertaining to the products ability to resist ultraviolet exposure. There could be two reasons for this: Either the Architects are not aware of the highest quality products available on the market or they are forced to specify a product of inferior quality, due to the projects costing and limitation of funds.

Respondents were divided about the techniques used by construction companies to eliminate or reduce excessively muddy or wet conditions on a construction site. Fifty percent of the respondents indicated that equipment was used to pump water off site and the other half of the individuals in the study mentioned that there would be rain delays to allow the ground on the construction site to settle (absorb excess water naturally). Both of these techniques would significantly increase the cost of the project, but the authors believe that a cost comparison between these two approaches would reveal which technique is the most cost effective. Most of the respondents indicated that that there are no provisions for the storage of building materials on site prior to use and they additionally indicated that the product that would be affected the worst by moisture absorption is cement. An overwhelming statistic of 100% of the respondents believed that builders in the Western Cape did not possess the required knowledge to install all the waterproofing products on the market. This clearly indicates that there is a fundamental problem with the existing training programs for builders.

6.2 Residents

Generally 50 percent of the residents in the Capricorn and Westlake were not satisfied with their houses whilst the rest are not really affected. This finding shows that their houses are not in proper order as there is always something wrong with it. Some residents aired that the

problems further cause a detriment to their families health which aggravates costs. Other costs that residents incurred were cleaning costs and high water pills because of pipe leaking. The finding even show that the residents who were satisfied still aired they experience d problems although they decided they were not out of the ordinary, which drives us to the fact that housing quality is poor on average. Only 75 percent of the residents reported that they had renovated their houses at least once. This finding shows that people in the Muzeinberg area renovate probably because of the fact that there are close to the sea and the heavy winds.

50 percent of the respondents reported that they had changed their design construction due to different reasons but mainly to do with the safety of the building in the long run.100% of these are not very satisfied with their houses. This finding attest the fact that when the design is changed, usually things to start to get wrong.

75 percent of the residents are price sensitive which means they will always go for the cheaper option and still they do not trust their contractors. The finding shows that disposable income and what you settle for has a relationship. Many times clients hire people who have no qualification but have experience from observing and offer a cheaper service. The problem with observing is you do not get the technical details of the work.

Results also show that the older people are the home owners and the younger ones are tenants. Generally home owners know more about the history of their houses than the tenants. Most residence in the Retreat area are satisfied with their houses. This could be that they are medium income earners and can afford better contractors which will deliver a better product. However, they are experiencing major problems of cracking walls and tiles. Some residence said they are situated close to a train station and the movement of the train can cause shaking of the house hence causing cracks.

6.3 Contractors

Builders complained that they were ordered to work overtime even if they were tired which made them just do work because they needed to finish. They also complained that there was little or no motivation for work that is why most South African builders leave the trade. We also found out that most constructors are foreigners who are in desperate need for jobs but they are not skilled enough to do the job.

Contractors reported that they inspect their equipment during hot and dusty condition and at one site in the absence of the contractor the builder reported that the equipment was not inspected. Findings show that contractors might be covering their tracks as they are afraid that

their reputation can be destroyed if they are truthful. Different technical causes for poor quality and they all pointed out to the lack of communication and strict upholding of standards related to the factors identified earlier in literature review. Amongst these were an unaligned design and poor mixes.75 percent reported that there are admixtures for concrete were available, yet the rest say there is nothing available

.This shows that some contractors do not know of some things which should be of common knowledge to them, reason why some houses are of poor quality.

Many contractors reported that architects normally design building components that allow for thermal movement whist the rest disagree. The finding show that either the other contractors have no clue what thermal movement is or they just giving credit to the architects. Regardless of the answers I think it is high time contractors get their grip. Architects do not specify where water proofing must be installed and this can be the reason why some building are of poor quality leading to poor quality.

75 percent reported that there are no special provisions for transportation of different materials. This finding rooted out how reckless contractors can be at times. Keeping in mind the fact that different materials need different care before they are even used on site, this might be a cause to poor quality housing. Contractors reported that they do not think builders in the Western Cape understand how all waterproofing systems should be installed .These findings show the reluctance of the people who should be trusted to build safe and durable homes in the province.

6.4 Project managers

The project manager says he inspects and controls the use of project resources at Dolphin Construction. This finding explains the need for the ability to use the required and not waste as this can be costly in the long run. However a stricter control might mean that substandard proportions might be used. The project manager has six years of experience as a project manager and reported the three main materials affected by moisture are cement, membranes and paints and tylon. These finding show that he was more knowledgeable than other contractors we approached. Project manager further accepts that he takes responsibility of affected material but think contractors should take the fall with them. The project manager reported that they do not offer short courses to workers on how to understand resources transport because it forms part of their daily routine. According to the project manager, knowledge about the Mediterranean weather conditions is not common to many. These findings shows that some project managers would have been recently deployed to Western Cape and are not fully aware of conditions or

they are merely not interested.

Dolphin construction has a quality improvement plan for the next five years , have supportive management and is registered with the Master Builders Association , National Home Builders Registration Council and SEESA. He also reported that he is affiliated with SANS 294. These findings show that the company is trying its best to proceed well in a bid for better quality but however it should be noted that some companies are registered on many boards but do not deliver.

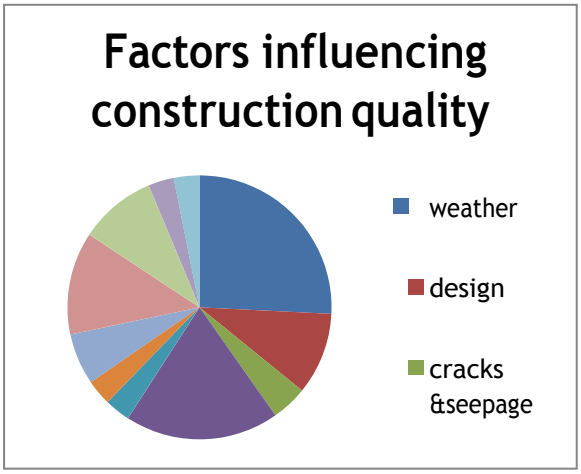

Figure 1: *Factor influencing quality*

6.5 Limitations

Accessing the groups of individuals selected for sampling was challenging, because certain members of the sample were unwilling to provide information and some individuals were not available upon our arrival. Although the authors have chosen a sample of 100 individuals for our study (n = 100). The sample selected was relatively small and subjectively selected. The research was focused on housing construction projects only, but there are additional construction types, for example: bridges and engineering construction projects which duly deserve the researchers' attention. Furthermore, the author decided not to look at other building types, for example: commercial buildings in the Western Cape. The research was based on the opinions of experts in the construction industry.

7. Conclusions

In a nutshell, the factors that have been mentioned above have an impact on the quality of construction in Cape Town and are mainly natural and beyond human control. All the factors identified have an impact on the quality of housing in the Western Cape. Furthermore major factors were the Mediterranean weather which alternates spontaneously, employees and followed by design. The contractors should also identify the major factors in their areas rather than taking it from a broader point of view.

7.1 Recommendations

The problem with the quality of construction cannot be attributed to a single entity. It is therefore imperative that all stakeholders involved in the construction need a holistic approach. The problem with contractors' lies in the very fact that builders are not skilled to the job, it is therefore important that contractors should employ skilled people for the jobs or rather train those that they employ. Provide training to contractors about the effect that the Mediterranean weather has on buildings. Contractors should be encouraged to obtain ISO certificatification and this will allow them to improve their competency skills and construction project management capability. As the literature review showed the management of projects in the Western Cape is highly constrained by scarcity of resources, delays of supplies due to bad weather. This focuses more on the resource management risk and change management, weather conditions can significantly lower their negative impact and improve performance of the construction projects than better planning and use of resources. It is recommended that owners who seek high quality should not award contracts to the lowest bidder whose price is lower than the project fair estimate as many projects were delayed and suffered from quality problem especially when these projects were awarded by open tendering systems.

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