AN INTEGRATED APPROACH TO REDUCING DESIGN ERRORS IN NIGERIAN CONSTRUCTION FOR SUSTAINALE DEVELOPMENT

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ABSTRACT

(Reason and Hobbs, 2003), define error as the failure of planned actions to achieve their desiredgoals, where this occurs without some unforeseeable or chance intervention. Design error is a deviation from a drawing or specification, also including omissions and ambiguities, the rate of occurrence of design errors on building projects is becoming alarming by the day, this have had several adverse effect on the construction industry such as cost overrun, in extreme cases and prolonged delay in the completion time of construction project which will prevent building projects to achieve sustainability in development through increasing the final cost on construction project. Although design error in construction project seems somewhat inevitable, the aim of this research is to determine the factors that will reduce design errors on construction projects in. Sixty five professionals in Bauchi state of Nigeria were issued well-structured, the data were collected and analyzed using descriptive method of statistics (tables and chats), relative important index (RII) Proper implementation of design management, introduction of multidisciplinary design team during the design stage, Proper implementation of procurement strategies at the design stage should be adopted by both clients and professionals so as to reduce the rate of errors, omission and ambiguity.

Keywords: *Design errors, Sustainaility and construction industry.*

INTRODUCTION

Sustainability has been defined as economic growth that meets the current generation's needs without compromising the opportunity and the potential for future generation needs (WCED, 1987 and El-Zeney,2011).

When asked to define "design error," not all disciplines in the construction process agree on a common definition. Depending on which discipline you address, the

owner, the designer or the contractor there will be a common understanding surrounded by varied conclusions, "a mistake." From the basic definitions of "design" and "error" we conclude that a design error is a deviation from a drawing or specification, also including omissions and ambiguities. It is the seriousness of this error that must be considered to determine its consequences on the overall outcome of the project One of the most important challenges facing management today is controlling the all too frequent cost and schedule overruns that affect the construction industry (Diekmann and Thrush, 1986). One of the major issues to control growth in project costs and time is the reduction of design errors.

The owner, designer and contractor all have different interests in, or uses for the design of a facility. But what they do share is the commitment to complete the project safely and within a given budget and completion time. There are many initiatives being conducted to control the growth of cost and schedule within the construction industry.

The principle parties for the project. Since design errors have an impact on the outcome of the effectiveness of the contractor's effort on the project it is essential that all parties determine what the definition of a design error should be.

John. et al, (2001) explained that majority of structural failures and associated damage costs are due to errors in planning, design, construction, and utilization, rather than variability in

REVIEW OF RESEARCH WORKS

Factors that control designs and construction

There has been a huge swing in the factors that dictate the control of design and construction. In the early 1900's owners demanded high quality facilities to show their wealth or prestige to the rest of the world. The structure was to make a strong statement of longevity and style. They understood that this quality took time and Initial Cost considerable money. Initial Cost was a major consideration but it did not control the project as much as the older factors.

Figure consideration in any design evaluation, but looking at initial cost alone does not consider the effects of design upon construction of operations (Tucker and Scarlett, 1986).

Therefore, it was the intention of the survey to have the principle parties prioritizes the other major controlling factors of Speed, Quality, Quantity and Safety. Respondents were asked to prioritize the list of control factors in order of importance on a scale of 1 - 4, with 1 being the most important.

The total scoring value was determined and divided by the number of responses for each category. The data indicated that the major concern for project accomplishment was speed.

This is particularly true for the owners. For example, in the hotel industry, for every day lost not operating there is a major loss in convention and lodging revenue. For commercial owners, the faster the finished facility can generate funds the quicker the pay off, profits are achieved and other investments can be initiated.

Speed was not as critical to the designer or contractor. The designer prefers more time in order to finish drawings and to coordinate with other disciplines. This can assure that the design development will be driven by quality and not time. The time frames require too much too fast thus producing the fuel for errors. The designer has to decide which drawings will provide a product to satisfy the requirements. The analysis of time and its relation to Computer Aided Drafting (CAD) will be discussed later. It will be noted here that the development of FAX machines and computer drafting became enemies to the designer because now the owner expects results overnight. The design professional must then make decisions that may be less than desirable. The issue of time for the contractor was primarily the brevity of preparing bid documents. Whereas, the designer is given several months to prepare the documents, the contractor is only given several weeks to review and initial cost out the project

The next level down on the pyramid is quality. From the interviews conducted this is the major issue involving the reduction of design errors. From the Construction Industry Initial Costeffectiveness Report (1983), "by common consensus and every available measure, the United States no longer gets its money's worth in construction, the nation's largest industry."

Design Errors

Tuker and Edmonson (2002) define design error as the carrying out of a task that is either unnecessary or incorrectly done. Furthermore, (Reason and Hobbs, 2003), define error as the failure of planned actions to achieve their desired goals, where this occurs without some unforeseeable or chance intervention. Design error is a deviation from a drawing or specification, also including omission and ambiguities. Failure is usually used interchangeably with error, but however there is a slight difference between expected and observed performance. (Ayininuola and Olalusi, 2004).

Sustainability

Sustainability has been defined as economic growth that meets the current generation’s needs without compromising the opportunity and the potential for

future generation needs (WCED, 1987 and El-Zeney, 2011). Sustainable construction is also regarded as a way forwards for the construction industry to achieve sustainability in development, while taking environmental, socioeconomic and cultural issues into consideration (Shafii et al., 2006). In order to accelerate the sustainability awareness among construction players, the government of Malaysia has allocated RM 20 billion in the Budget 2010 (Ministry of Finance, 2012). In the budget, emphasise and promotion on the green buildings initiatives have been highlighted with attention in its ability to reduce the overall cost while maintaining the quality of environment. Earlier on, the government has launched the National Green Technology Policy to provide guidance towards the management of asustainable environment (The Star Online, 2009). Hence, Budget 2010 is a continuity of the earlier green policy formulated by the government. In materialising this effort, the construction industry is urged to move from traditional wet construction method towards environmental friendly, energy efficient and less waste generation methods of construction (Abdullah et al., 2009). To achieve as a developed nation status in 2020, the great demands on the infrastructure projects in Malaysia has resulted in a large quantity of construction waste (Begum etal., 2010) which comprises of 28.34% wastes generated from the construction activities (Mohd Nasir etal., 1998).

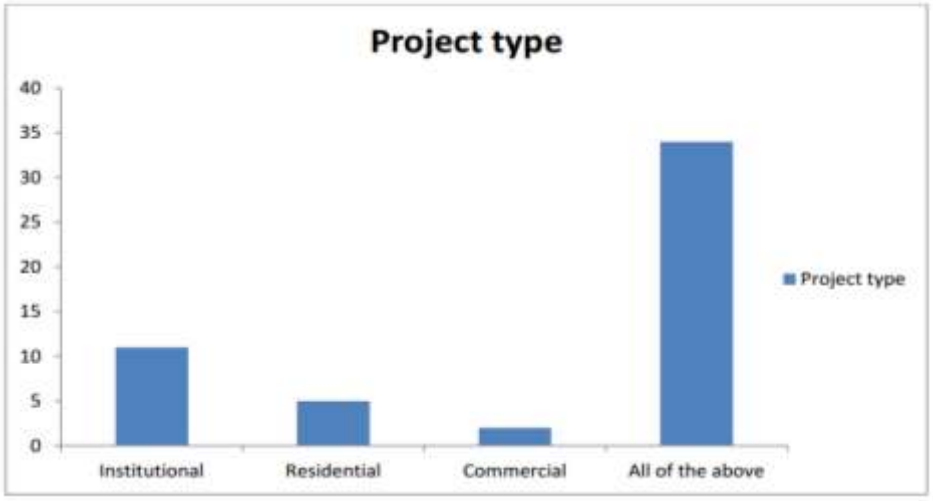
Rework and Design Errors

Previous studies have shown that substantial quantity of rework is design related (Love, 2005). This design related rework are changes made by different parties involved in the process which includes clients, contractors, subcontractors, end users and regulatory bodies. The design related factors as outlined by (Palaneeswaran,2006) includes factors such as;

i. Ineffective use of quality management practices.
ii. Ineffective use of information technology
iii. Poor coordination between different design team members
iv. Time boxing/fixed time for a task
v. Poor planning of workload
vi. Lack of manpower to complete the required task
vii. Design team turnover/reallocation to other projects
viii. Not enough time to prepare contract documents
ix. Insufficient client brief to prepare detailed contract document

METHODOLOGY

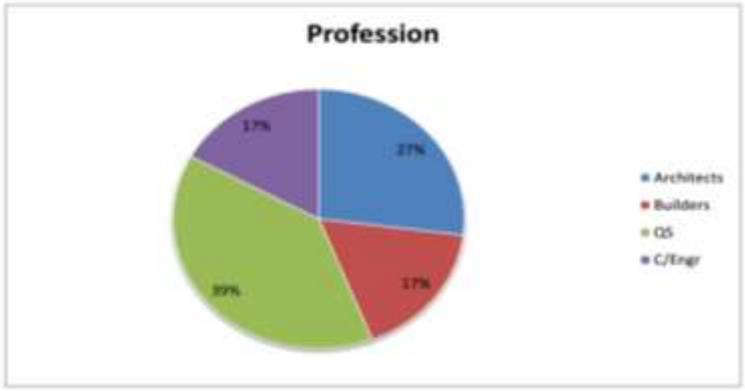
In order to determine the factors that will reduce design errors on building project. survey was conducted through administering questionnaire to various professional construction firm within Bauchi metropolis in Nigeria. A total of 65 surveys were administered, and a total of 52 was retrieved



Source: Researcher's Analysis (2020)

Fig 1 Project type

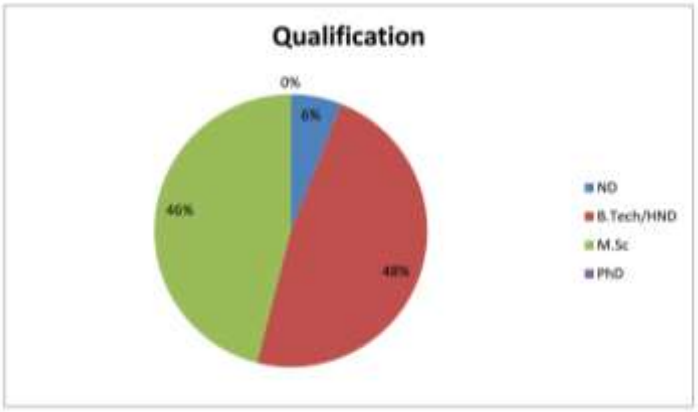
The figure above shows the various building types the respondents engage in. It was observed that majority of the respondents deal with institutional, residential and commercial buildings with an accruing frequency of 34. On the other side, institutional, residential and commercial buildings had 11, 5 and 2 frequency respectively. This indicates that majority of the respondents have worked on the various building types and therefore capable of providing the necessary information needed for the research work.



Source: Researcher's Analysis (2020)

Fig 2 Profession of respondent

Professionals from field of quantity surveying emerged the largest contributor to this research with 39%, this shows that the cost expert in the construction industry are well covered in the research due to the fact that the research work is cost inclined. Followed by Architects with percentage of 27%, next are Civil engineers with percentage of 17% and Builders with percentage of 17%. This indicates that the professionals are capable of contributing immensely to this research work.



Source: Researcher's Analysis (2020)

Fig 3 Qualification of the respondent

The figure above shows the academic qualifications of respondents, respondents with B. Tech/HND made the largest quota of responses to this research with 25, followed by M.Sc. / M. Tech with 24, ND, PhD with 3, and 0 frequencies respectively. This depicts that the respondents are well educated to provide information for this research.

Source: Researcher's Analysis (2020)

Fig 4 Years of Experience

The figure above shows the years of the respondents' experience in the Nigerian construction industry, where less than 5years, 6 – 10 years, 11 – 15 years, 16 years and above have the total number of 5, 13, 18, and 16 number of contribution respectively. This indicates that the respondents are capable of providing reliable information for this research because they have a reasonable

Table 3: Ways of Reducing Design Errors

Strategies	1	2	3	4	5	RII	Rank
Proper implementation of design management.	27	12	5	6	2	0.82	1st
Introduction of multidisciplinary design team.	20	10	11	10	1	0.81	2nd
Proper implementation of procurement strategies at the ign stage.	26	9	3	10	4	0.77	3rd
Use of value management during the design stage.	20	10	11	10	1	0.75	4th
Increased use of computer aided design/engineering nologies	14	11	15	9	3	0.69	5th

Conclusion

Reducing design error to achieve sustainable development is the main objective considered and analyzed. Based on the data received it was found that most construction firms engage in the Proper implementation of design management with RII of 0.82 has the highest ranking, followed by Introduction of multidisciplinary design team with RII of 0.81. Proper implementation of procurement strategies at the design stage with RII of 0.77, Use of value management during the design stage with RII of 0.75 and Increased use of computer aided design/engineering technologies with RII of 0.69this implies that a lot still need to be done in sensitizing professionals on the need to actually introduce the use of multidisciplinary design team approach to the production and management of contract documentation which according to love (2002) could reduce errors and the potential for client initiated changes which was aforementioned to be the highest cause of design errors.

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