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Building design for buildability: an investigation of the current practice in Nigeria

I. Mbamali[a,*], O.A. Aiyetan[b], J.O. Kehinde[a]

[a]Department of Building, Ahmadu Bello Univerity, P.M.B. 1044, Samaru, Kaduna State, Zaria
[b]Department of Quantity Surveying, Federal University of Technology, Akure

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Abstract

The paper is an interim report of an ongoing research project into the "Improvement of the Building Design and Production Practices in Nigeria". It examines the extent to which issues relating to easy and efficient construction are being considered and incorporated into building designs in the country. A total sample of 60 professionals: 15 each of Architects, Builders, Engineers and Quantity Surveyors; having not less than 5 years of professional experience were interviewed. The designs of 20 randomly selected public buildings completed as from the year 2000, were also assessed for their content of buildability features of: standardization, simplicity, and single integrated elements. All the professionals wanted construction methods and site operations, thoroughly considered in building designs, but they expressed varied opinions on how this should be achieved. Their responses (average of 3.39 and 3.35 respectively on a scale of 0–4) were also indicative of a high awareness, and application of the standardization and simplicity principles. This is, however, lower for the single integrated element which has an average score of 2.40. The assessed building designs showed that standardization and simplicity were at least fairly reflected in at least 65% of the cases, and that single integrated elements were fairly reflected in only 20%.

Keywords: Buildability; Building design practice in Nigeria

1. Introduction

Buildings constructed with the least variation to design are known to give satisfaction to all the major parties to a building project—client, design team and construction team. Several scholars [1–4] have observed that the extent to which construction experience was brought into the design of a building plays an important role in achieving such satisfaction.

Recorded history of the early organization of construction industry showed no significant separation between the designer and the constructor [5]. Building designs therefore reflected the right blend of artistic insight and technical knowledge.

Moore [2], however, observed that beginning from the period of the renaissance, Architects in the UK sought a social distinction between themselves as practitioners of the liberal art of decoration, and practitioners of the mechanical art of building. Thus, the Architects began a deliberate estrangement of themselves from the technical knowledge of building production processes and site operation. This subsequently reflected in the training programmes of the UK Architects, which contain very little emphasis on building construction processes and site operations. A different set of professionals—the Builders— were trained for this. The situation in the Northern European countries: Denmark and Germany for example, was however different as they continued to place greater emphasis upon knowledge of construction processes in the training and practice of Architects.

*Corresponding author. Tel.: +234 69 505 63; fax: +234 69 50581 5.

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In Nigeria, the construction industry developed largely after the UK pattern. Most of Nigeria's foremost Architects were trained in the UK. Also, the schools of architecture in Nigeria have training programmes that are mainly adaptations of those of the UK. Invariably, therefore, the embodiment of the technical knowledge of building production processes and site operation was to be vested in another professional—the Builder. Consequently, building designs which are products of the Architect reflect more artistic insight of decoration, than the technical knowledge of building production processes. This gives rise to designs, which do not communicate effectively, and precisely, what is to be constructed, which in turn contribute to the sad problems of delays in project execution and difference between the designed and built works.

This paper examines the extent to which issues relating to easy and efficient construction (buildability) are currently considered and entrenched in building designs in Nigeria. The study was carried out by means of questionnaire interview of selected relevant professionals: Architects, Builders, Quantity Surveyors, and Engineers in the industry. Some randomly selected designs of public buildings completed from the year 2000, were also assessed with respect to their buildability features content.

2. Building design and construction practice in Nigeria

The public sector constitutes the major client of the construction industry in Nigeria, and the traditional approach in this sector is to handle building design and construction in two separate phases and by two separate teams—the design and construction teams. The design team usually consists of consultant or in-house professionals such as: Architect, Quantity Surveyor, Structural Engineer and Services Engineer—electrical/mechanical. The construction team, on the other hand, usually consists of a major contractor and a number of sub-contractors, who are selected on the basis of lump sum competitive tender, undertaken after completion of most of the design activities. Adesanya [6] observed that this approach offers the lowest chance for integration of construction experience into design. The result is the problem of delay in project execution and high level of differences between the designed and constructed products as mentioned earlier.

Gidado [7], Ogunsanmi and Bamisile [8], opined that the system of contract procurement is a strong factor in determining the nature of relationships between the design and the construction teams. Other procurement methods that aim at better integration of the two sets of experience, and better overall project successes have also evolved in the country. Such other methods include: Management Contracting, Construction Management, Partnering, Design and Build, and Design and Manage, and are discussed in [6,9,10].

3. Buildability concepts

The construction industries research and information association (CIRIA) defined buildability as the extent to which a building design facilitates ease of construction subject to the overall requirements of the completed building [11]. The clause "subject to the overall requirements for the completed building" brings to focus the fact that ease of construction is only one of the features of a good design. Other features include: functionality, cost effectiveness and aesthetics. It is a well-known fact that the client's interest is best served by securing the optimum balance amongst the various design criteria.

The buildability requirement is however one of the major factors necessitating the integration of construction experience into building designs. The principle entails bringing together the technical experience of a Builder/Constructor and the design experience of Architects and Engineers early enough at the design stage of a project. Hence, the comparative ease of construction is kept in mind at every stage of the design process, particularly at the early stages. The overall result is the technical efficiency of the design, which reflects in the following areas:

(a) *Geometry/layout of the building*: The general rule is to use simple shapes with lower perimeter/floor area ratios [12] . This usually results in savings in material and site labor involved in setting out, site works and drainage, external walls and roofing.
(b) *Design details*: All aspects of the building receive adequate consideration of the construction implications and decisions are reached after careful examinations of the various options. This includes the structural system, the roofing system and even subsidiaries—entities in the work such as fitments and positioning/layout of services.
(c) *Construction methods*: The choice of construction methods is made with full knowledge of detailed construction processes and techniques. The principal aim is to achieve ease of construction, minimize waste such as excessive cutting of components, and optimize site labor and plant utilization to increase productivity.

4. Buildability procedure and features

In designing for buildability, consideration is first given to external factors such as soil condition, access and circulation at the site, availability of resources, skills and technology, sequence of operations, etc., so as to determine the most appropriate system to be used. The principle of standardization, simplicity and single integrated elements are then applied to achieve the