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Information Disclosure: A Panacea to Effective Building Development

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Abstract

The level of information disclosure by all stakeholders, especially the project execution team (PET) members, during a building development project, significantly influences the project outcome. The quality content of information available to the design team reflects on the quality of the working drawings. Similarly, the project management system, level of information and knowledge sharing have overarching implications on the construction phase, as well as on the ability to resolve any emerging constructability challenges. However, if any PET member treats their knowledge area as patent right, rather than open secret, that will create clogs in the wheel of progress, resulting in project delays, and time and cost overrun. The case study strategy of qualitative research was adopted, to study the cause of the delays experienced during the construction of a building project, in a higher education (HE) institution in Nigeria. The findings revealed that the delay was because the project architect was economical with information on the concept adopted for design. This created constructability challenges, significant time and cost overrun as well as lingering maintenance problems. This research observed that because the project architect, who doubled as the project manager (PM), was reticent about the design concept, he held the project to ransom. Therefore, to ameliorate the negative impacts of being judge in one's own case, this research recommends that the PM, in any building project, should be an independent individual or organisation and not anyone from among the consultants involved in the project.

Keywords

Design concept, Project manager, Project outcome.

1. Introduction

Effective and functional building design should be looked at beyond the aesthetics and glamour of the 3D presentation. It should include the buildability, operation and ease of maintenance; indeed, the life cycle considerations of the proposed building. It is important, therefore, to harness the strength and professional expertise of all the professionals involved in the development of building projects, through detailed and progressive information and knowledge sharing, from design, construction, operation and maintenance phases (Davis, 2018). The ingenuity, functionality, or otherwise of the building design is seen during the construction phase. The ease with which the design details are translated into the physical edifice demonstrates the level of team integration, clarity of the design and specifications, as well as the technical abilities of the project execution team (PET) members, especially the contractor (Tey, et al., 2018). On the other hand, the construction phase can turn into a chaotic nightmare if plagued by design constraints and a disorganized construction team. There will be endless variations in the design components, unhealthy debates about the buildability of components, choice of materials, repeated reworks, disputes and possible suspension of work, litigation, or outright abandoning of the project (Asmone and Chew, 2020). Furthermore, the quality of the construction phase significantly influences the maintenance phase (Ganisen, et al., 2015). Effectively addressing challenges during the construction phase and managing them as they arise requires seamless team integration, open communication, active knowledge sharing, and the humility to embrace constructive feedback. However, if any of the team members hold on tenaciously to their ideals, it may constitute a clog in the wheel of progress during construction (Suprapto, et al., 2015).

The focus of this research is to evaluate the impact of the lack of information disclosure on the part of the project architect, on the buildability challenges of the roof structure during the development of a twin lecture theatre, in a higher education (HE) institution in Nigeria, and the resulting delay, in terms of the time and cost overrun experienced. Section two of this paper presents a comprehensive review of the literature on building design development, constructability, maintainability, and project management challenges in building development. Section three provides a discussion of the research method, approach, and procedure of execution. The findings and discussion follow in section four, while section five contains the conclusion, recommendations and suggested areas for further research.

2. Literature Review

A literature review helps researchers to harness the rich potential found in previous research endeavours, integrate them with current realities and identify observable gap(s) and how current research has helped to address the gap(s). This section took a critical look at the relationship between concept, aesthetics and cost during building development. Similarly, this section also examined the challenges of buildability during construction, the need for effective project management, the observed gap and suggestions on how to address the gap.

2.1 Concept, Aesthetics, and Cost of Building Development

The architectural management process is a complex activity encompassing the understanding of the intent and content of the project brief, the problem(s) to be addressed from the brief, the search for solutions, draft designs and consultations, detailed design, and visualising the construction process to the post-occupancy phase. Proposing solutions to a design problem gives birth to the creativity of the architect during the problem-solving process (Dash, 2021).

The conceptualisation phase in design should be grounded in practical reality rather than remain overly abstract, to allow for flexibility and alterations during the latter phases of design and construction (Al-Qemahci, 2022). The emphasis should be on visually representing creativity and innovation throughout the design problem-solving process. Ideally, the architectural management process should anticipate the financial implications of the finished product (Dash, 2021; Lee, 2017). Furthermore, the choice of material for various building element especially the facade, should consider availability, ease of application, maintenance, and sustainability (Idi and Khaidzir, 2015; Eilouti, 2018). Aesthetics and functionality are two critical components the architects consider during building design (Bradecki and Cherek-Bradecki, 2017). Aesthetics adopts the principles of beauty and artistic taste to conceptualise the client's brief in a functional edifice. It provides a blend of nature, culture, religion, materials, and colours to create an appreciable building, in both

the exterior and interior space. Aesthetics covers issues of size, proportion, symmetry, form, pattern, and contrast (Bradecki and Cherek-Bradecki, 2017; Alajmi, 2021).

In a bid to develop heroic or iconic projects, many architectural designs result in costly solutions. The cost factors in architectural design lie in the aesthetics and not the functionality, evidenced in the geometry, size, material choice and composite material combinations, which require high skills, techniques, and time during construction (Bradecki and Cherek-Bradecki, 2017; Alajmi, 2021). However, if the architect is cost-conscious, it is possible to develop modest buildings that are aesthetically pleasing, functional, and cost-effective throughout their life cycle (Lee, 2017).

In practice, architectural features with simple and regular shapes are easier to construct, leading to reduced waste and lower costs compared to complex and irregular shapes. During the design phase, it is important to note that although concept, aesthetics and cost are critical factors, they are influenced by time, change in taste, availability of materials and skills required during construction and the maintainability of the proposed edifice (Aina, 2015; Izam, et al., 2019). Therefore, it is imperative to include "… life-cycle considerations in the design process from the outset, so that materials and systems are selected not only from environmentally friendly resources but most importantly, to match service life performance expectations" (Mora, et al., 2011, p. 1469). Therefore, concept, aesthetics and cost should be integrated into the building project from conceptualisation to implementation (Bradecki and Cherek-Bradecki, 2017). During the design phase, efforts should be made to pre-empt some possible challenges that might be encountered in the construction phase and tacitly envision possible solutions.

2.2 Addressing Construction Challenges During Building Development

During the construction phase of a building project, the quality of the working drawings, the bill of quantities, other project documents, the competence of the contractor and the supervising consultants significantly influence the progress or delay. The buildability of the proposed edifice, as depicted by the 3D pictorial view of the completed edifice, poses a real-life challenge to the contractor, especially, and other PET members. In this context, buildability refers to the ease with which design drawings and component parts, arranged in sequence, can be translated into a physical structure. The terms "buildability" and "constructability" are often used interchangeably in practice to convey the same concept.

To achieve the desired project objectives, the contractor and indeed all PET members, should apply the appropriate construction knowledge, principles, and procedures during the execution of the building project, by putting the component parts in their correct sequence. It enhances the prospect of achieving the quality, cost and timely delivery of the edifice to the satisfaction of all stakeholders (Jadidoleslami, et al., 2016). It is important that the design and other project documents must be comprehensive in detail and that necessary revisions during construction should be communicated to the contractor on time (Sanjaya, et al., 2019). The specifications, materials schedule, and choice should take into consideration that the materials are readily available (or can be sourced with relative ease). It is equally important to ensure that the necessary skills for the installation and the general execution of the project are available (Olatunji and Ojuri, 2013).

To ameliorate the incidence of delay resulting from discrepancies in the working drawings, related documents, construction processes and procedures, all PET members should be willing to practice effective communication, knowledge sharing, show humility in accepting faults and being ready to make timely corrections. The effective and functional development of the proposed building requires synergy of thoughts, effective coordination by the PM, team building and management of the human dynamics to achieve the objectives of the project (Cosa et al., 2021).

The contractor should be meticulous, following standard construction principles and procedures in unpacking the different components in their correct sequence, using quality materials, deploying adequately skilled personnel to achieve the geometry and aesthetics of the edifice. Equally important is the need to progressively tests the materials, component and fixtures to ensure their stability and functionality (Sanjaya, et al., 2019). The contractor's team and supervising consultants should have eyes for detail, identify deviations early and correct them, to reduce the incidence of component or structural failures, tasking the competence level of the contractor (Ogbeifun, et al., 2023). Okereke, et al., (2022) opined that the failures arising during and after construction projects can be traced to the quality of the contractor engaged in the project. The authors further

suggest that far-reaching and broad-based criteria should be adopted during the selection of contractors, beyond the concept of the lowest bidder (Okereke, et al., 2022). When there are contending areas of discrepancy in the working drawings, the specific consultant and the contractor should endeavour to resolve the differences. If the differences persist, the PM, in collaboration with other PET members should arbitrate or use the option of technical session(s) (Ogbeifun, et al., 2018).

Similarly, during construction, PET members should be conscious of what may happen during the operation and maintenance phase of the building being developed. Thus, maintenance concerns should be considered during the design and construction phase (Alao and Jagboro, 2017). No edifice, no matter how much care is exercised during construction, will remain the same throughout its life cycle. The building will require periodic repairs, replacement of faulty component(s), renovation, rehabilitation, or restructuring to accommodate any change of use (Che-Ghani, et al., 2023). Effective maintenance management suggests incorporating simplicity and functionality during the design phase, ensuring that the materials used for the construction are readily available during operation and maintenance, coupled with adequate skill set (Aina, 2015; Izam, et al., 2019; Mkasi, et al., 2021). In a nutshell, to achieve the objectives of the proposed building project, due diligence must be observed during the construction, operation, and maintenance phases (Che-Ghani, et al., 2023). Delays seem inevitable during construction but can be reduced through effective project management.

2.3 Effectiveness in Project Management

Delays, to varying degrees, are a common experience in the execution of building developments, depending on the size, complexity of the project, and the procurement system (Durdyev and Hoseini, 2020). Delay means that the proposed project was not delivered within the scheduled delivery dates. It is a construction project challenge worldwide, with a higher degree of intensity in developing countries (Ogbeifun and Pretorius, 2024). It is worth noting that ineffective project planning, design, technical feasibility studies and poor monitoring and control of project progress during implementation phases are instrumental to the delays experienced in many infrastructure projects (Ubani and Ononuju, 2013). To reduce delays, great care should be exercised during the planning phase, through the critical review of the feasibility studies reports, providing comprehensive documentation of the project concept, and stakeholders' involvement. Produce user friendly design details, identify the funding policy, risk management, the project execution process and selection of PET members, and be pragmatic in resolving emerging conflicts Ogbeifun and Pretorius, 2024).

In many developing economies, the architect is the first point of contact during the development of building project. The architect translates the client's brief into the working drawings, along with other professionals, depending on the size, use and sophistication of the building project. The mode of execution, the preference of the client and the procurement system, determine if the specialist service providers who participated in the design stage progress to the project execution phase (Ogunsanmi, 2015). In some instances, many of the PET members may be new and unknown to one another and the project until the construction phase. It is a common practice, in many developing economies, that the project architect doubles as the PM (Ogbeifun, et al., 2023; Ogunsanmi, 2015). However, when there are observed discrepancies and the discrepancy emanates from the architectural design, the architect, who doubles as the PM, usually assumes a defensive stance, causing the PM to act as 'judge in its own case'.

To prevent the scenario of the PM acting as judge in his own case, the PM should be an independent individual or organisation, not linked to any of the specialist service providers in the project. This individual or organisation must have the requisite PM competencies, able to coordinate the engagement, operations of other PET members, and act as an umpire (Cosa, et al., 2021). The PM must demonstrate technical skills, human management, and team building as well as have soft skills in effective communication. Adopting the concept of an independent PM enables the PM to source for expertise outside the PET members, to address teething problems, even if the service may be at an ad hoc level (Hachem-Vermette, 2018). The literature reviewed suggests that teamwork approach by PET members facilitate the ease of construction and resolving construction disputes, which helps to ensure the smooth execution of the project and achieve the set objectives. However, if the conflict emanates from any of the project's consultant, who double as the PM, the PM may act as a judge in his own case, which may increase the intensity of the conflict and delays. Thus, the contribution of this research, is to advocate for the adoption of the concept of the independent PM, to bridge the observed gap.

3. Research Methodology

The case study strategy of qualitative research was adopted, collecting the research data through document analysis from project archives, and complemented with key informant interviews (Bowen, 2009; Lee, 2017). This approach provides opportunities for the intensive, in-depth, and purposive study of the research problem to understand the research scenario, make sense of the data collected, and propose solutions to the research questions (Harrison, et al., 2017). Since the projects for this research have been completed, the data were obtained predominantly from project operation documents, published articles, and complemented with interviews. The data collected were analysed by adopting the principles of qualitative document analysis (QDA). QDA is a research method used for the rigorous, and systematic evaluation of archived information in different (printed or electronic) formats (Bowen, 2009). A typical QDA process includes finding, selecting, and identifying the areas of analysis, verification, appraising, and synthesising data contained in documents (Bowen, 2009). In this research, the documents analysed were the minutes of site meetings, ad hoc and specialised technical meetings. Complementary interviews were limited to the quantity surveyor (QS) and the maintenance staff since the other documents analysed contained logs of the activities of the project architect and the structural engineer. The document analysis and interviews aimed to identify how the roles of the PET members contributed to the delays experienced during the execution of the project. The three critical areas of concern in this research were the controversies around roof design and construction, space management, and maintenance.

The details of the research process and the results are presented in the findings and discussion section.

4. Findings and Discussion

This section outlines the findings and discussion based on the information gathered from document analysis and interviews. It begins by addressing the research background, explores issues related to roof design controversies and inadequate functional space management, and concludes with concerns about maintenance. The building project used for this research are twin lecture theatres, seating 500 each with interconnected service areas. Other projects in the same complex include a single-storey multipurpose building, drainage, and landscaping of the environment. However, the focus of this paper is on the lecture theatres. The architectural design shows a circular-shaped hall with inclined steps, a restaurant and office space at the lower end of the hall. At the upper end of the steps, the ground floor was designated as a utility space. The first floor provides for interconnection and circulation space between the two halls, a three-storey high office for academics, a fourth floor reserved for the management of the solar system, and more than 6 m high open headroom supporting a steep sloped roof. The sloped roof was expected to discharge the roof run-off water down to a 'jigsaw' like roof over the restaurant and office space, which would, in turn, discharge the run-off water through roof gutters at intermittent spaces.

(a) (b)

Figure 1. The source of the design concept.

When the construction process got to the roof level, **the contractors observed that it was not possible to achieve the curvature of the roof beam as provided in the working drawings**. Unfortunately, the controversy in the roof construction was exacerbated by the low level of information disclosure by the PM. It was during the handing over of the partially completed project to the client, that the architect revealed the concept he used for the design of the lecture hall was the shape of a cut off tree stump, as shown in Figure 1a. This is because the building was situated in a semi-forested area.

Unlike the natural single plane shown in Figure 1a, the roof structure for the lecture hall featured a two-step configuration. Ideally, to achieve two-step cutting planes on the same tree, the cuts should be made from opposite sides of the tree's circumference. This mean that the cutting planes will slope in opposite directions, as illustrated in Figure 1b. If this concept was adopted for roof design, the roof in the lower plane will be susceptible to leakages. Consequently, the challenges of constructing the roof beams caused considerable time and cost overruns, leading to three critical issues that are discussed as research findings, as follows:

i. Roof design controversies.
ii. Inadequate functional space management; and
iii. Maintenance concerns.

4.1 Roof Design Controversies

During the construction phase, when the roof beam was about one-quarter of the roof circumference, shown by the blue arrow in Figure 2, the contractors discovered that it was not possible to achieve the roof curvature as designed. This challenge lingered on for more than six months. Although several suggestions were made, none was found suitable. Finally, the client initiated a technical session to discuss the challenges and proffer solutions. Several options were discussed, the committee resolved that the fourth floor, in the design, should be removed, the 6m empty headroom should be reduced to 2m above the headroom of the third floor. Therefore, about 7m was removed, providing a moderate slope for the roof, which made it easier to achieve suitable curvature for the roof. These suggestions were adopted, and the challenges of constructing the roof beams were addressed.

Figure 2. Arrows showing where the construction exercise stopped for over six months.

The construction process resumed and completed, as shown in Figure 3. In a real-life project scenario, there is a need for the contextual marriage between aesthetics and the realities of being able to transfer the designs as they are on paper to real structure and ensure the development of a functional edifice (Hojbjerg, et al., 2021; William, 2021). *In the interview with the QS later, he observed that the cost of the roof components, for one of the 500-seater lecture hall, was more than 27% higher than the cost of the roof components for a rectangular shaped, 1 000-seater lecture theatre. Both projects were executed about the same period in the same institution. This observation buttresses the opinion gleaned from the research efforts of Aina (2015), that architectural features with simple and regular shapes are easier to construct, leading to reduced waste and lower costs compared to complex and irregular shapes*. As observed by many research efforts, the challenges encountered during construction could be reduced if the contractor and the facilities management

professionals were involved earlier during the project's development process (Jadidoleslami, et al., 2016; Sanjaya, et al., 2019).

Furthermore, if the PM disclosed the concept of his design early, it would have been possible to harness constructive opinions from other PET members and reduced the delays experienced during the construction phase. It would have been reasonable to argued that when a tree stump is cut across its circumference, it assumes a single slope, as shown in Figure 1a. Similarly, to achieve a two-stepped plane in a cut off tree stump, depicted by his design, the tree must be cut from the opposite sides of the tree, as shown in Figure 1b. In this regard, the planes of cut will be opposite each other. Thus, the two-step concept exposes the roof to leakage challenges during operation and maintenance. Evaluating the function of PM during infrastructure development, Cosa et al, (2021) suggested that PM should horn the skill of team building and management of the human dynamics, to be able to harness the synergy of thoughts from the PET members. Bearing in mind that "the best built environment is dependent on the joint involvement and close cooperation of designers, builders and owner" (Piedmont-Palladino, 1996, p. 545). On the contrary, if the PM is deficient in effective communication, information and knowledge sharing or flexible governance, these negatively impacts on progress of work, leading to delays, time and cost overrun (Moyanga and Adeoye, 2021; Strong et al., 2021). In this project, due to the poor management of information, the project architect, who doubled as PM, created the clog in the wheel of progress.

Figure 3. The completed roof

4.2 Inadequate Functional Space Management

It may be safe to postulate that the focus of the architect, when designing the theatre, was to achieve the practice of compact design, aesthetics, iconic or utopic perspective rather than functionality. As he rightly mentioned during the project handing over, he was commissioned to design an 'iconic building'. A close look at the internal enclosure of the lecture hall reveals that the headroom is over 7 m. If the lecture theatre was developed as a stand-alone edifice, moderate headroom would have been achieved for a functional auditorium.

Suffice it to say that if the concept and aesthetics are prioritised over other realities, the outcome of the proposed building project may not serve the ideals of the project's objectives. On the other hand, if all auxiliary functions were isolated from the lecture hall building, it would have been possible to provide a standalone facility, not more than two upper floor height. As it is now, the crowd going in and out of the auditoriums will cause considerable chaos and a scene of continuous

inconvenience to the occupants using the associated offices. Some of these offices are in the third-floor level. The standard practice suggests that public buildings higher than two upper floors should have lift facilities (Darcy, 2023). A vertical passenger lift ought to be provided in public buildings with more than two stories, to facilitate the space suitability and accessibility needs of all occupants (Darcy, 2023. But the project under reference neglected this requirement. It is imperative, therefore, to consider the functionality and buildability, as well as maintenance concerns of any proposed edifice from the design phase (Mora, et al., 2011; Sanjaya, et al., 2019)

4.3 Maintenance Concerns

The maintenance concerns of the buildings for this research, include the challenges of maintaining the auditoriums, the cladding and roof leakages. During operation, the interior of the lecture hall will require periodic maintenance, including cleaning, replacing electrical fixtures or fittings, repairing broken windowpanes, and repainting. Any one or a combination of these activities will attract high costs, which may be the subject of audit queries in the future (Berahim, et al., 2015). This is because the high headroom, complicated by the fixed furniture, demands the provision of an extended network of temporary supports (scaffolding) to affect any repair. Interestingly, the cost of scaffolding will be astronomically higher than the features to be repaired. Therefore, it will not be economical to address minor repairs, and all breakdowns will be treated as 'deferred maintenance' to be addressed latter as renovation or planned maintenance (Ogbeifun, et al., 2018; Dzulkifli, et al., 2021).

The location of this edifice is technically in a virgin site. This is because, most of the trees that once served as windbreaks have been removed, exposing this new development to high wind effects. Within the first five years of operation, different portions of the cladding have been repaired or replaced several times. This is likely going to be a long-term challenge until a suitable solution is found (Kanniyapana, et al., 2015; Madureira, et al., 2017). Similarly, in the restaurant and offices at the lower level of the theatre building, any time there is a considerable amount of rain fall, the activities in this enclosure, technically comes to a standstill because of the deafening noise from the volume of run-off water from the upper roof, falling on the lower roof. The effective period of the rainy season in Jos, Nigeria, can be divided into two consistent periods, namely, steady rainfall from June to August and intermittent but torrential rain between September and mid-November each year. In this regard, considerable man-hours of productive time will be lost (Diloreto, et al., 2022). Fortunately, the magnitude of roof leakages in this lower roof is minimal for now but cannot be guaranteed in the long run (Dzulkifli, et al., 2021).

In essence, aesthetic considerations in building design should incorporate the maintainability of the edifice, otherwise, over time, the ideals of aesthetics will be blurred (Fadi, et al., 2019).

5. Conclusion and Recommendation

The focus of this paper was to evaluate the impact of the quality of information disclosure from PET members on the progress or otherwise of the development of the twin lecture theatres. The case study approach of a qualitative research strategy was adopted, collecting useful research data from the project's archive, complemented by key informant interviews.

The research revealed that the main cause of the delay in the execution of the project was the challenge around the constructability of the roof structure as designed. This delay lasted for more than six months before it was resolved. The bone of contention was the concept used in the design by the project architect, who doubled as the PM. The design concept was inspired by the shape of a cut-off tree stump, featuring an imperfect circle with a sloping, egg-shaped surface aligned along the inclined plane of the roof. Unfortunately, this concept was not disclosed to the PET members. As shown in Figure 1a, the inclined plane of the cut tree is a single continuous surface across the circumference of the tree stump, which meant that the roof over the edifice ought to have a single roof profile, instead of the two-stepped profile. Nevertheless, adopting the principles of mediation, a tool for alternative dispute resolution methods, through technical sessions, the challenges of the roof construction were resolved, and the project was completed.

In conclusion, the lack of information disclosure regarding the design concept significantly contributed to delays in project execution, resulting in time and cost overruns as well as long-term maintenance challenges. To mitigate such issues, this research recommends that, whenever possible, the PM in a building or

infrastructure project should be an independent individual or organization, not associated with other consultants involved in the project. This would help minimize the risk of the PM acting as a judge in their own case.

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