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ASSESSING THE DETERMINANTS OF EFFICIENT STEEL STRUCTURE ERECTION IN THE BUILDING INDUSTRY

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Abstract

The presence of steel structures significantly impacts the ecosystem of building construction. However, in order to have a successful erection of steel structures, many factors steel erectors and contractors must take into consideration. As a result, this study aims to investigate the factors that influence the erection of steel structures in the construction industry. This study adopted a survey research method to ascertain the determinants of efficient steel structure erection in the building industry. A convenient sample of fifty-five (55) project managers, project engineers, and site engineers involved in the erection of steel structures in Edo State, Nigeria, participated in the study. The analysis indicated that funding (23.13%) represents the primary factor affecting steel erection. Followed by manpower (20.21%), equipment (16.12%), project type (13.16%), and management (13.11%), while safety measures (12.92%) ranked as the lowest factor affecting steel structure erection in the building industry. The findings provide an in-depth insight into the factors affecting steel structure erection in a construction project that can help project managers develop strategies for improving the erection of steel structures in the construction industry.

Keywords: *steel, structures, building industry, engineers*

INTRODUCTION

Steel represents a ubiquitous engineering and construction material used in a variety of construction projects (Broniewicz & Broniewicz, 2020; Cadoni & Forni, 2020; Durmisevic & Noort, 2003; Liu et al., 2021; Maydl et al., 2007; Moynihan & Allwood, 2014; Putri & Firmansyah, 2020; Sansom, 2003; Shan & Pan, 2020; Wanrg et al., 2022). In most cases, composed of an iron-carbon alloy containing less than 2% carbon and 1% manganese in addition to trace amounts of silicon, phosphorus, Sulphur, and oxygen. Importantly, Steel is completely recyclable, possesses excellent durability, and, compared to other materials, requires relatively low amounts of energy to produce. Innovative lightweight steels (such as those used in automobiles and buildings) help to save energy and resources. In recent decades, the steel industry has made immense efforts to limit environmental pollution. Producing one ton of steel today requires just 40% of the energy.

Steel structures are being increasingly adopted for various building applications since their construction method offers many benefits over conventional constructional methods (Senanayake et al., 2019). Steel structures are fast becoming exciting and a safe way of building in the construction industry. Steel structure plays a significant role in civil engineering and is widely applied in multi-storey buildings, bridges, warehouses, skyscrapers, parking lots, stadiums, malls, and railways, among others (Batista & Ghavami, 2005; Bosco et al., 2017; Klongaksornkul & Phuvoravan, 2021; Manai, 2021; Martín-Sanz et al., 2019). Steels are used in building applications due to their resistance to local corrosion attacks initiated by chlorides (Maslak et al., 2021). The benefits of steel structures include strength, stability, durability, low weight, usability, recyclability, design flexibility, construction speed, cost efficiency, performance characteristics, and aesthetics. Steel structures have long been recognized as excellent earthquake-resistant systems (Fang et al., 2022). Indeed, previous studies have identified steel as the most reliable structural material against seismic loads (Dong et al., 2022; Han et al., 2021; Hashemi et al., 2021). especially in earthquake-prone areas (Arjuna et al., 2020). Indeed, the characteristics of steel structures can easily be highlighted when looking at construction sustainability principles, such as their durability, adaptability, or recyclability (Andrade et al., 2016). Notably, the use of steel structures is becoming more beneficial to the construction industry in recent times.

Steel structures are more commonly used in the building and construction sector (Liu et al., 2020). The steel structure is a metal framework that relies on a network of interconnected steel components for transporting stacks and providing overall rigidity. This type of structure is dependable and requires fewer raw materials than others, such as solid and timber structures, because of the high-quality strength grade of steel used. Because concrete needs time to cure after being cast, steel construction progresses noticeably more quickly than concrete construction.

A steel structure is one of the most fundamental types of building structures, and it is so named because it is typically constructed out of steel. Shafts, sections, supports, and various segments made of steel and steel plates make up the majority of the structure. Commonly, the term structure refers to the joints, jolts, or bolts that connect the various layers or parts of the structure. Lightweight and functional, it finds widespread application in settings as diverse as massive manufacturing facilities, stadiums, and skyscrapers. Steel structures are used for everything from the foundation to the connection to the tower to the emotional support network, the connection to the tower, the connection to the enormous mechanical plant to the pipe rack, and so on in today's construction. Even social networks of emotional support can be built with steel. Steel is used in the construction of high-rise buildings due to its constructability and superiority to concrete in terms of its strength-to-weight ratio. Concrete is thinner than steel and has a much lower strength-to-weight ratio than steel.

Steel erection describes the process of constructing, altering, or repairing steel buildings, bridges, and other structures. It also involves the assembly, connection, and installation of steel beams, metal decking, and planking used in the erection of a steel structure. Steelworkers assigned to steel erection activities are commonly employed in building, contracting, and construction companies. The erection process in steel construction is a process of assembling steel components to become a unity that will be carried out in the field (Nainggolan et al., 2020). Workers put the building's framework together from prefabricated parts when a steel structure is erected. Erection is the process of assembling a frame from its parts by setting them in place on a solid base. That is to say, the erection of a steel structure requires careful preparation in material delivery and handling, member assembly, and connection. Typically, the steel erection is handled by the steel erection contractor. Whether a steel fabricator employs its erection crews or contracts the work out to a third party, there must be a direct line of communication between the two processes. Several types of connections are used in a steel structure, and the quality of these connections is crucial to the structural system's performance. Hassoon et al. (2017) state that methods to increase construction productivity include decreasing the time and effort spent bolting and welding steel member connections.

Numerous research has underscored the importance of steel structure erection in the building industry. Accordingly, previous studies have provided evidence that steel structures have certain advantages compared to other building systems in sustainable development (Otilia-Alexandra & Mihai, 2013), especially when the steel structure is appropriately erected. Steel erection requires careful consideration of the project's facilities and fields, the tasks at hand, the site's layout, and the site's current condition. Steel erection tasks will be routinely inspected and managed to eliminate potential harm from improper methods, supplies, or machinery. There are numerous dangers that workers, subcontractors, and anyone else on the job site may face during steel erection operations (Nainggolan et al., 2020). Steel Structural buildings are considered a revolution in the new construction era due to their quick erection method (Divya & Murali, 2021). Nevertheless, the

efficiency of steel structure erection depends on a variety of conditions. However, a paucity of research highlighting the determinants of efficient steel structure erection creates a gap in this domain. The present study addresses this gap by examining the factors affecting steel structure erection in the construction industry.

Method

This study adopted a survey research method to ascertain the determinants of efficient steel structure erection in the building industry. The target population was project managers, project engineers, and site engineers involved in the erection of steel structures in Edo State, Nigeria. The reason for these targeted participants was that they participated fully during steel structure erection, and they have experience. Notably, sixty-two engineers were approached in various construction sites and firms between November 2022 and January 2023 and asked to participate in the study. Fifty-seven (57) participants who consented to partake in the study were given the study instrument to fill out. The questionnaire was updated with the input of construction projects' personnel as a result of the pilot test. A convenient sampling method was used to select the target participants. Fifty-five (55) questionnaires were duly filled and used for the study. Thus, the remaining two were discarded due to improper filling.

Result

The data collected were analyzed using descriptive (e.g., frequency) statistics. The analysis used the Statistical Package of Social Sciences (SPSS) v. 23. The frequency analytical tool was used to indicate the ranking of the factors affecting steel erection in the building industry.

Table 1: showing factors affecting steel erection

S/N	Factors	%
1	Fund	23.13%
2	Manpower	20.21%
3	Equipment	16.12%
4	Type of project	13.16%
5	Management	13.11%
6	Safety measures	12.92 %

This table shows the results of the data analysis of factors affecting steel structure erection in the building construction industry. The analysis indicated that funding (23.13%) represents the major factor affecting steel erection. Followed by manpower (20.21%), equipment (16.12%), project type (13.16%), and management (13.11%), while safety measures (12.92%) ranked as the lowest factor affecting steel structure erection in the building industry.

Discussion

The study aimed to ascertain the determinants of efficient steel structure erection in the building industry. The ranking of the six identified determining variables impacting steel structure erection demonstrates that funding was considered an essential determinant of efficient steel erection in the industry. Due to the increasing inflation in Nigeria and beyond, there is a high tendency for poor funding of projects, which could lead to inadequate steel materials and management of available fitting materials. Thus, the project efficiency may be undermined if funding is insufficient. Manpower reflects the totality of experts available to get a job done. In this case, erecting steel requires efficient manpower, which, in its absence, might undermine the effectiveness of steel erection in the building industry. Equipment represents an essential factor in steel erection. However, the result indicates that variables such as funding and manpower come before the equipment in that it takes suitable funding and manpower to install and utilize the equipment in steel construction. Notably, the type of project (for example, large/small, government/private), including management (staff handling/maintenance), affects steel erection. However, safety measures describing the need to safeguard lives and properties within the steel erection site were found to be the least factor affecting steel erection in the building industry. This means that the safety concern is less likely a determining factor in steel erection.

Conclusion

This study explored the factors affecting steel structure erection in the building industry. The result revealed that several factors affect steel erectors and contractors to have a successful erection of steel structures in the building industry. A questionnaire survey of participants consisting of project managers, project engineers, and site engineers involved in the erection of steel in construction sites was conducted to determine factors affecting steel structure erection in the construction project. The study has shown that funding and manpower are the top two factors affecting steel structure erection, followed by equipment, type of project, management, and safety measures. The study's findings provide detailed insights into the factors affecting steel structure erection in the construction industry. Future research can be carried out on steel structure erection strategies in the construction project. This will inform steel erectors and contractors to adopt an effective strategy during the erection of steel structures. An understanding of the factors affecting steel structure erection in construction projects among construction companies is vital for companies' stakeholders in the construction industry

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