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PROJECT MANAGEMENT TECHNIQUES FOR SUSTAINABLE CONSTRUCTION PROJECTS

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Abstract

In this study, project management strategies that are specifically adapted for environmentally responsible building projects are investigated, with a particular emphasis on improving green building tactics. It was a mixed-methods approach that was used, and sixty people from ten different environmentally friendly building projects were included. Through the use of structured questionnaires, quantitative insights were obtained regarding the development of strategies, the roles and responsibilities of project managers, environmentally responsible building methods, and essential success criteria. These findings were supplemented by qualitative data, which provided further in-depth insights through the usage of thematic analysis. The findings show the extensive participation of project managers and team members, the majority of whom were from commercial organizations, highlighting the vital role that they play in creating sustainable construction methods. This research makes a contribution by providing recommendations that can be implemented to improve the efficiency of project management in the construction of environmentally friendly buildings.

Keywords: *Sustainable construction, Project Management, Green Building, Environmental impact, Life Cycle Assessment.*

1. INTRODUCTION

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Project management in the context of sustainable construction projects plays a pivotal role in shaping the future of the built environment. As global awareness of environmental sustainability grows, the construction industry faces increasing pressure to adopt practices that minimize environmental impact, conserve resources, and enhance the overall quality of life. Sustainable construction projects aim to achieve these goals through innovative building practices, materials selection, and efficient project management techniques.

The concept of sustainable construction encompasses a holistic approach to building design, construction, and operation that considers environmental, economic, and social dimensions. It emphasizes reducing the environmental footprint of buildings and infrastructure over their entire lifecycle, from planning and design through construction, operation, maintenance, and eventual demolition or reuse. Key principles include energy efficiency, use of renewable materials, waste reduction, water conservation, and improving indoor environmental quality.

Effective project management is essential for successfully implementing sustainable construction projects. Project managers are tasked with coordinating various stakeholders, including architects, engineers, contractors, suppliers, and regulatory bodies, to ensure that sustainable principles are integrated into every phase of the project. This involves strategic planning, resource management, risk assessment, and communication to align project goals with sustainability objectives.

1.1. Sustainable construction projects

"Sustainable construction projects" refer to building initiatives that prioritize environmental responsibility, resource efficiency, and social well-being throughout their lifecycle. These projects aim to minimize negative impacts on the environment by adopting sustainable practices from planning through to demolition or reuse. Key aspects include using renewable energy sources, employing eco-friendly building materials, optimizing water and energy efficiency, managing construction waste, and promoting healthy indoor environments.

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Figure 1: Sustainable Construction

Sustainable construction projects often integrate green building certifications, such as LEED (Leadership in Energy and Environmental Design) or BREEAM (Building Research Establishment Environmental Assessment Method), to validate their environmental performance. By focusing on sustainability, these projects not only reduce carbon footprints and operational costs but also contribute positively to local communities and enhance long-term economic viability.

1.2. Features of Successful Green Building Projects

In the early 1990s, project goals regulated performance measures, which determined project success. One can assess a project's success based on its timeliness, cost, performance, and safety.

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Figure 2: Consolidated Framework for Features Project Success

Declare that a project is successful if it meets specific requirements, such as cost-effectiveness for safety, time-saving for running maintenance, and user quality. The success of a project can also be evaluated from the perspectives of its various stakeholders, including users, developers, contractors, individual owners, and the general public.

1.3. Techniques of Sustainable Construction

Techniques for sustainable construction projects in project management encompass a range of strategies aimed at integrating environmental, economic, and social sustainability principles into the planning, execution, and completion phases of construction projects. These techniques are essential for achieving green building certifications and meeting sustainability goals set by regulatory bodies, stakeholders, and project owners.

- **Strategic Planning:** Project managers play a crucial role in aligning project goals with sustainability objectives from the outset. This involves conducting feasibility studies to assess the environmental impact of the project, identifying opportunities for resource efficiency, and establishing clear sustainability targets.

- **Materials Selection:** Choosing sustainable building materials is fundamental to reducing the environmental footprint of construction projects. Project managers collaborate with architects, engineers, and suppliers to prioritize materials with low

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embodied energy, recycled content, and certifications indicating sustainable sourcing and manufacturing practices.

- **Energy Efficiency:** Implementing energy-efficient design strategies and technologies helps minimize energy consumption during the operational phase of buildings. Project managers oversee the integration of renewable energy sources, such as solar panels or wind turbines, and the implementation of energy-efficient HVAC systems and lighting solutions.

- **Water Conservation:** Sustainable construction projects prioritize water conservation through the use of efficient plumbing fixtures, rainwater harvesting systems, and drought-tolerant landscaping. Project managers coordinate with engineers and landscape architects to implement water-efficient designs and technologies.

- **Waste Management:** Effective waste management practices are crucial for reducing construction waste and promoting recycling and reuse of materials. Project managers develop waste management plans, monitor waste generation on-site, and collaborate with contractors and recycling facilities to divert waste from landfills.

- **Green Building Certifications:** Project managers guide projects through the certification process for green building standards such as LEED or BREEAM. This involves documenting compliance with sustainability criteria, conducting audits, and ensuring that project activities align with certification requirements.

- **Stakeholder Engagement:** Engaging stakeholders, including local communities, regulatory agencies, and project team members, fosters support for sustainable practices and ensures alignment with project goals. Project managers facilitate communication, manage expectations, and address concerns related to environmental impact and sustainability.

- **Lifecycle Assessment:** Conducting lifecycle assessments helps project managers evaluate the environmental impact of materials and design choices over the entire lifecycle of the building. This holistic approach informs decision-making and identifies opportunities for improving sustainability performance.

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- **Continuous Improvement:** Sustainable construction projects require ongoing monitoring and evaluation to identify areas for improvement and optimize sustainability performance. Project managers implement feedback loops, conduct post-project evaluations, and share lessons learned to inform future projects.

1.4. Green building Project Management

Green structure is regularly connected with the design and the execution of cycles which are naturally capable and asset productive in a structure's life-cycle from plan, development, activity, support, remodel, to destruction. Green structure configuration remembers finding the equilibrium for both homebuilding and the practical climate. This needs more collaboration of the plan group, the modelers, the architects, and the client at various phases of task. The green structure practice grows and contributes the old-style building configuration related with economy, utility, sturdiness, and solace. Green structure incorporates a few parts including Energy Effectiveness and Environmentally friendly power, Water Productivity.

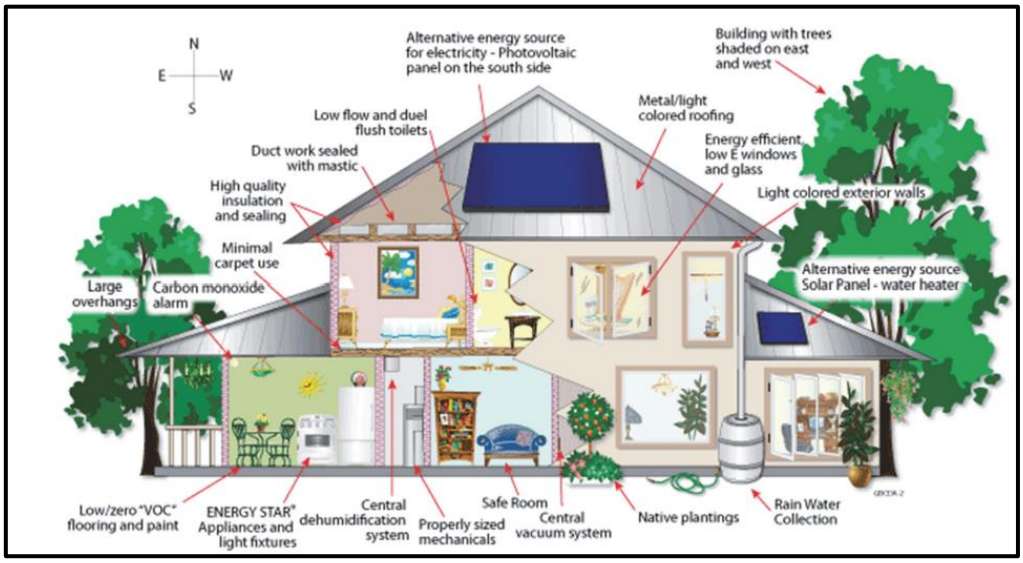

Figure 3: Green Building

Ecologically Ideal Structure Materials and Details, Squander Decrease, Toxics Decrease, Indoor Air Quality and Shrewd Development and Manageable Turn of events. Fig. 3shows various parts of a normal house which are subject of green structure. In 2010 structures utilized around 32% of complete worldwide last energy and consumed 19% of energy-related GHG

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emanations. They additionally accept that this kind of energy use could be multiplied or possibly more by mid-century.

China is the world's biggest energy customer and CO2 producer. China has been going into a time of flourishing for development, around 1.6-2.0 billion m2 structures are built every year, which are around 40% of the world's all out new structures. To decrease CO2 emanations from the assembling period of building materials, supportable foundational layout has been presented. In the exemplified CO2emission information carried out as of late, the rate distinctions in CO2 discharge information for cement and steel viewed as 267 and 863%, separately.

1.5. Objectives of the study

1. To increase the strategies of project managers in green building construction.
2. To characterize the roles and obligations of project managers and outline relationships between contractual and subcontractor worker groups.
3. To discuss green construction processes in detail to enhance project managers' employment strategies and skills in green building.
4. To identify critical success factors that significantly impact measurable improvements in green building construction.

2. LITERATURE REVIEW

Xing, W., et.al., (2021) The lean construction (LC) approach, presented in 1993, expects to expand project esteem, diminish waste, and cost. Be that as it may, it wasn't applied to a Chinese construction project until 2005. A contextual analysis in Suzhou, China, showed that executing lean practices like Last Organizer Framework, Kanban framework, JIT, construction, IoT, quality and security the board, and nonstop improvement further developed project execution. Interviews with partners and a study of worldwide lean specialists uncovered that LC can diminish project holding up times and deformities, further develop construction work process, and lessen squander.

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Hossain, M. U., et.al., (2020) The construction business is moving towards a circular economy (CE) model to ration resources and advance productive use. This audit means to recognize the ramifications, contemplations, and difficulties of CE in the business. Challenges incorporate plan, materials choice, inventory network, plan of action, uncertainty and hazard, joint efforts, strategy, metropolitan digestion combination, and CE assessment system. A planned coordinated structure for CE reception and assessment is proposed, meaning to help further foster CE research and add to practical construction.

Tereso, A., et.al., (2019) looked to advance theory and practice by distinguishing the task the board approaches utilized by most business undertakings and areas. The effect of experts' attributes on project the executives' techniques and gathering use is additionally analyzed. The most widely recognized project the board approaches incorporate start up gatherings, action records, progress gatherings, Gantt outlines, and standard plans, yet action areas and professionals contrasted. The information additionally shows that the most well-known project the board approaches are toolsets.

Silvius, G., & Schipper, R. (2020) Concerns about sustainability make organizations take social responsibility. Projects help organizations change to reduce negative outcomes. Project sustainability is a hot topic in project management and requires tools to evaluate. Several instruments have been published, but few have had much influence. This study examines three sustainability effect assessment tools. All three tools evaluated a project's sustainability on various levels and using holistic criteria. The assessment instruments ranged in specificity and adaptation to the project setting. Assessment process descriptions were lacking in the tools. The report gives real sustainability tools for project management.

Zhao, X., et.al., (2019) The information showed that designing, natural sciences and biology, and construction and building innovation ruled green structure examination, and 'building envelope' and 'living wall' acquired reference explodes. Bunch investigation and content examination distinguished green and cool rooftops, vertical greening frameworks, water productivity, inhabitant solace and fulfilment, monetary advantages of green structure, life cycle evaluation and rating frameworks, green retrofit, green structure project conveyance, and green structure data and correspondence advancements as hot exploration points. Knowledge gaps were in corporate social responsibility, green building performance validation, ICT

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application, and green project construction safety and health concerns. Future research should fill these gaps and expand green building research.

3. RESEARCH METHODOLOGY

3.1. Research Design

The research was designed to analyze and evaluate project management techniques for sustainable construction projects. The primary aim was to identify strategies that enhance the role and effectiveness of project managers in green building construction. The review embraced a blended techniques approach, consolidating quantitative and subjective information assortment and examination. This approach considered a far reaching comprehension of the methodologies, jobs, commitments, and basic success factors in maintainable construction project the executives.

3.2. Research Sample

The research sample consisted of 60 participants who were involved in 10 sustainable eco-friendly building projects. The participants included colleagues or team members and venture proprietors or project executives. The participants were further categorized based on their organizational affiliations and academic qualifications to ensure a diverse and representative sample.

3.3. Classification of Respondents

Team Members: 50 participants

Project Managers: 10 participants

3.4. Data Collection Methods

Data collection involved a structured questionnaire administered to the participants. The questionnaire was designed to gather detailed information on the following:

- **Development of Strategies for Construction Managers:** This domain included 15 investigations focusing on various aspects of strategy development in green building construction.

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- **Roles and Obligations:** This section characterized the roles and responsibilities of project managers and explored the relationships between contractual and subcontractor worker groups.

- **Green Construction Processes:** Detailed questions on green construction processes were included to enhance the employment strategies and skills of project managers.

- **Critical Success Factors:** This part identified and analyzed the critical success factors that significantly impact measurable improvements in green building construction.

3.5. Sources of Data

The primary data sources were the responses data and supported the identification of best practices and critical success factors. obtained from the structured questionnaire distributed among the participants. The secondary data sources included relevant literature, industry reports, and case studies on sustainable construction and green building practices. The data from these sources provided a context for interpreting the primary

3.6. Data Analysis

The gathered information was examined utilizing both quantitative and subjective techniques. Quantitative information from the poll reactions were measurably examined to distinguish patterns, examples, and relationships. Subjective information from genuine inquiries and meetings were thematically dissected to acquire further bits of knowledge into the experiences, perceptions, and difficulties faced by project directors in economical construction projects.

The outcomes were then synthesized to reach exhaustive determinations and give significant proposals to improving task the board methods in green structure construction. The discoveries were examined with regards to existing writing and industry practices to guarantee relevance and immaterialness.

4. RESULTS AND DISCUSSION

There was a total of sixty people that participated in the event, and ten different building projects that were sustainable and good to the environment were presented. When all of the information is taken into account, fifty of the sixty individuals who took part in the activities

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were members of a team or coworkers, and ten of them were business owners and executives of projects that were related to these activities. Before commencing the procedure, the academics made the necessary preparations to ensure that the questionnaire would be filled out by a diverse variety of individuals who are involved in the building industry.

Furthermore, it suggests that only four of the participants were employed by government organizations, whereas fifty of the participants were employed by commercial enterprises. However, just ten of the participants are currently employed by firms that are engaged in joint ventures. This is a significant disparity. Because of this, a bigger number of the participants are employed by private companies, which may result in an easier way of convincing them to comprehend and provide aid to construction companies. Consequently, this trend is expected to continue.

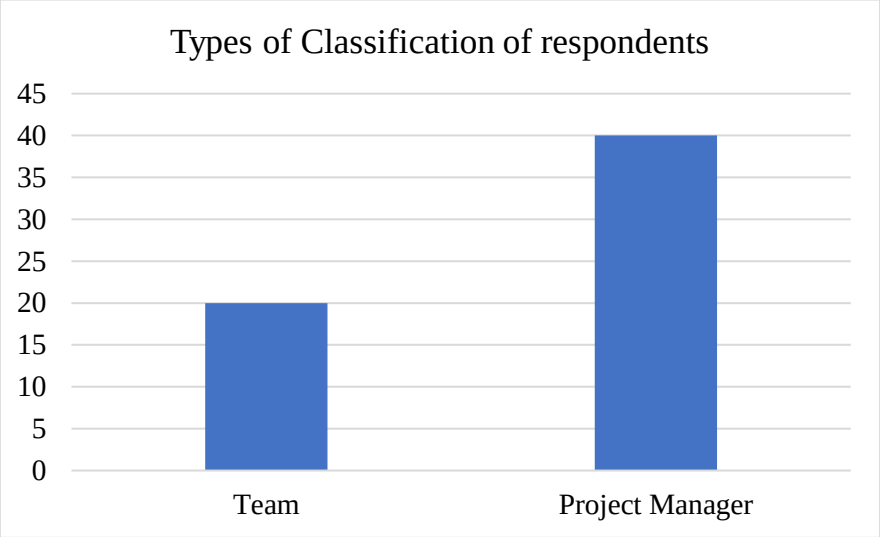

Figure 4: Type of classification of respondents

Interpretation: "The table titled "Types of Classification of Respondents" displays the distribution of respondents. The table is separated into two categories, which are referred to as "Team" and "Project Manager." Comparatively speaking, there are a significant number of Project Managers present in relation to members of the Team.

In order to provide a more precise description, the number of Project Managers is around forty, while the number of members of the Team is approximately twenty. It is made abundantly

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evident by this new development that there were twice as many Project Managers as there were Team members that took part in the survey or study that was being referred to.

Consequently, the perspectives of project managers are more prominently reflected as a consequence of this distribution, which may have implications for the analysis and conclusions that are drawn from the data.

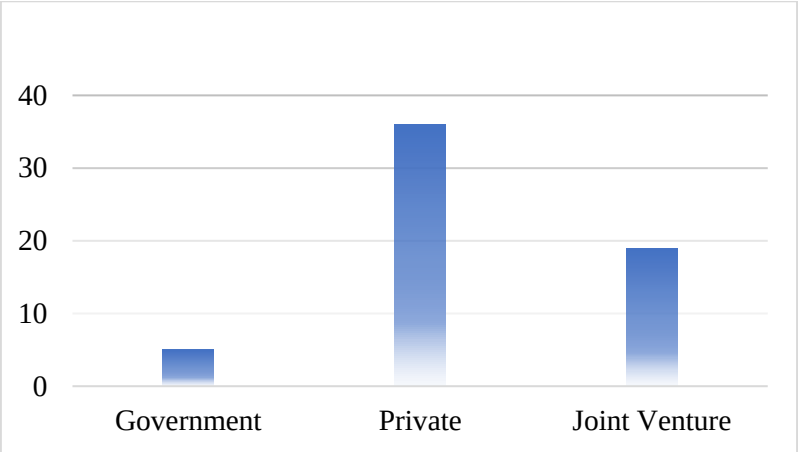

Figure 5: Types of Organisations

Interpretation: Specifically, this study investigates the manner in which replies are distributed among three distinct categories of organizations: government, commercial, and joint venture respectively. It was determined that the vast majority of respondents come from private organizations, with a total of approximately 35 individuals offering their responses. This was the conclusion reached by the researchers.

Twenty people answered to the poll, making joint venture groups the second most represented group after the individuals that participated in the study. On the other hand, the government organizations have the lowest representation, with only about five people responding to the survey. Other organizations have the most presence. As a result of this distribution, which demonstrates that the private sector is the dominant contributor to the survey or study, it is likely that the study or survey will have a focus or bias toward insights from privately run enterprises.

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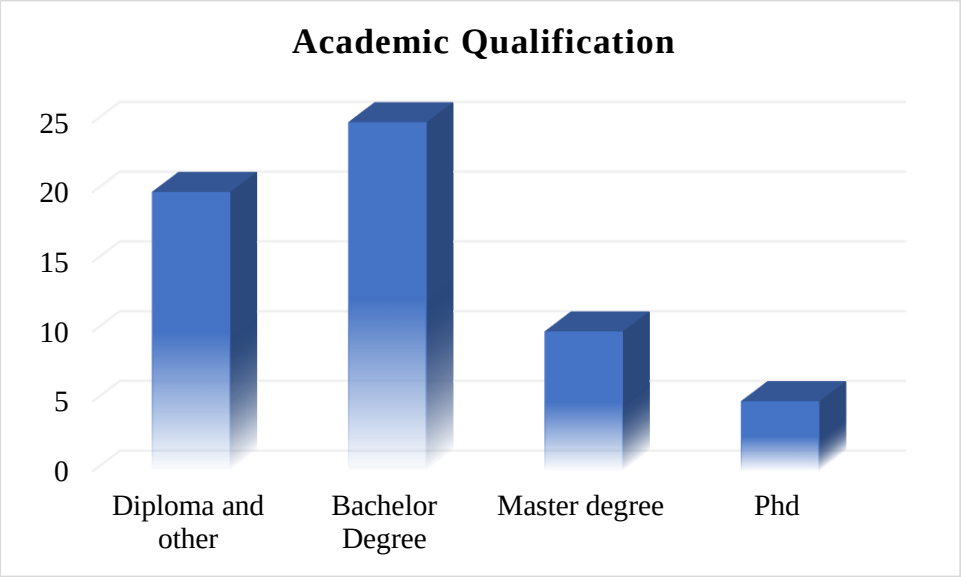

Figure 6: Academic qualification

Interpretation: The "Academic Qualification" provides an overview of the respondents' educational backgrounds, categorized into four groups: Diploma and other, Bachelor Degree, Master degree, and PhD. The chart reveals that the largest group of respondents hold a Bachelor's Degree, with a count of about 25. This indicates that a significant proportion of the respondents have completed undergraduate studies, suggesting that they may possess a solid foundational knowledge in their respective fields. The second largest group consists of respondents with a Diploma or other equivalent qualifications, numbering around 20. This group represents individuals who have pursued post-secondary education, but not to the extent of a full bachelor's program.

This could include vocational training, associate degrees, or other forms of certification that provide specialized skills or knowledge. Respondents with a Master's degree form the next group, with around 10 individuals. This indicates a smaller yet notable segment of the population that has engaged in advanced studies beyond the undergraduate level, potentially reflecting a deeper specialization in their areas of expertise.

The smallest group, with approximately 5 respondents, holds PhDs. This group represents the highest level of academic achievement among the respondents, indicating extensive research experience and a deep understanding of specialized subjects. The relatively low number of PhD

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holders suggests that while such advanced qualifications are highly regarded, they are less common among the broader respondent population.

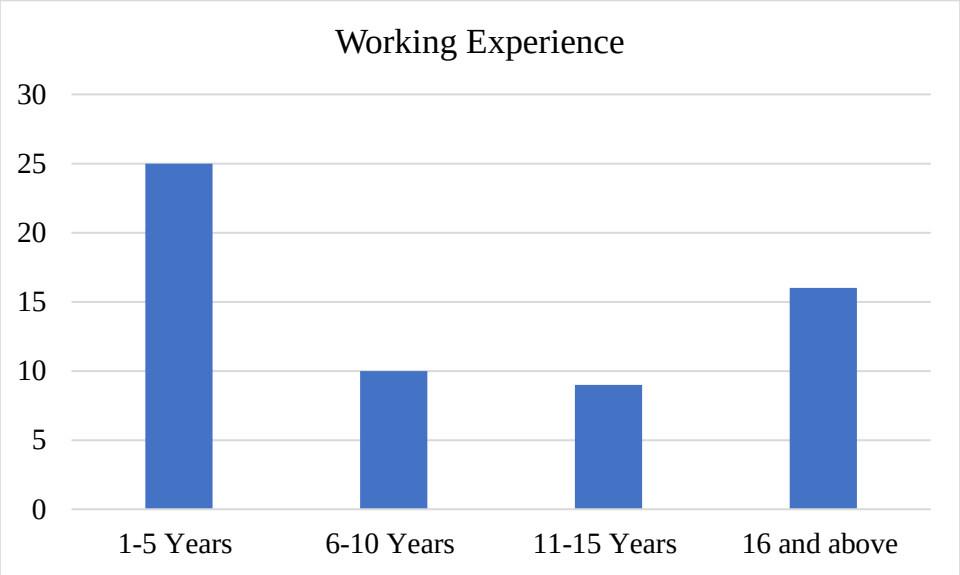

Figure 7: Working experience

Interpretation: This table illustrates the distribution of employees inside an organization according to the number of years they have spent working for that organization. Among the sixty workers, twenty-five have one to five years of experience, ten have six to ten years, nine have eleven to fifteen years, and sixteen have sixteen years or more of experience. This suggests that there is a wide range of experience levels already present in the workforce, with the largest group consisting of those with one to five years of experience.

5. CONCLUSION

The findings shed light on the incredibly important role that project managers play in ensuring the success of environmentally responsible construction projects. The study demonstrates that participants have a significant focus on strategy formulation and awareness of green construction processes. The majority of the participants come from commercial enterprises, which is representative of the dominating representation. Important insights into duties and responsibilities provide light on the complex connections that exist among contractual and subcontractor labor groups, which are essential for the successful execution of the project. Furthermore, the complex nature of sustainable construction management is shown by the essential success elements that have been found. These factors include collaboration among

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stakeholders and the incorporation of technological advancements. This information is essential for the development of project management strategies, the promotion of a more environmentally friendly built environment through the implementation of informed practices, and the improvement of industry collaboration.

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