CAPITAL UNIVERSITY OF SCIENCE AND TECHNOLOGY, ISLAMABAD

The Role of Stakeholder Engagement for Sustainable Building Construction in Pakistan

by

Muhammad Mudasser Ali

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This thesis is dedicated to:

My Parents & Teachers

For unwavering support, guidance, and encouragement and driving force behind my academic journey. Thank you for instilling in me the value of education and for being my constant source of inspiration. I am forever grateful for the support.

CERTIFICATE OF APPROVAL

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Acknowledgement

I am dedicating all my thesis work to Allah Almighty, indeed his mercy prevails over his wrath. In addition, to **Muhammad (PBUH)**, the Divine servant Leader, who has changed my life.

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Abstract

This research examines how stakeholders, both internal and external, affect the social economic and environmental pillars of sustainability in the building construction industry. Social, economic, and environmental are the three main pillars of sustainability. Numerous studies have broadly acknowledged the environmental impact of construction projects, but the social and economic components have frequently gotten less attention. Internal and external stakeholders are important to the successful completion of building projects.

A thorough literature review is the first step in the research process because it provides an initial grasp of the issue and places the study subject in the context of current knowledge. Finding ways for internal and external stakeholders to improve the social economic and environmental sustainability of building projects is the main objective of the study. A questionnaire comprising of 169 experts-clients, CEOs, consultants, contractors, suppliers, architects, and managers from the public and private sectors, was created based on the identified factors of sustainability and stakeholders.

The survey was conducted online and the responses were gathered. Then different tests were performed: normality and non-parametric tests using SPSS and Excel. The Relative Importance Index (RII), a non-parametric method was used to assess the data and to evaluate the ranking of the most important parameters for construction project success and the realization of three pillars of sustainability. The goal of this strategy is to increase sustainability and stakeholders management in building projects.

Finally, the results are that innovation takes top place along with new technology and processes. The second priority is the employee health and safety. The third factor is technology, which boosts production and reduces costs. Capital is the fourth most important factor in ensuring financial sustainability. The sixth priority is the diversity and inclusion, which promotes an engaged workforce. Land is also the sixth most essential factor for sustainable management. Labor is ranked seventh, with an emphasis on employment security and safety conditions. Human right is ranked eighth, providing equitable treatment and ethical procedures. The

research helped stakeholders comprehend social, economic and environmental development more clearly, which made it easier to execute corrective actions at the planning and strategy level.

Keywords: Environmental Sustainability, Social Sustainability, Economic Sustainability, Internal Stakeholder, External Stakeholders, SPSS

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Abbreviations and Symbols

BIM	Building Information Modeling
ES	External Stakeholders
IS	Internal Stakeholders
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
MCA	Multi-Criteria Analysis
NGO	Non-Government Organization
OHS	Occupational Health and Safety
PIS	Practices for Improving Stakeholder Engagement
PMI	Project Management Institute
RBV	Resource-Based Value
RII	Relative Importance Index
SE	Stakeholder Engagement
SPM	Sustainable Project Management

Chapter 1

Introduction

1.1 Background

The world is facing sustainability The world is facing sustainability issues such as social, economic and environmental. Since the building construction industry is developing quite rapidly and it has significantly impacted all three aspects of sustainability. To minimize these impacts, the sustainable practices are introduced in the buildings construction industry. This practice brought together the information taking place sustainability and civil engineering building projects during the most recent two decades, helping to understand the evolution of environmental methodologies. Fig 1.1 gives a graphic representation of the publications on the three pillars [1].

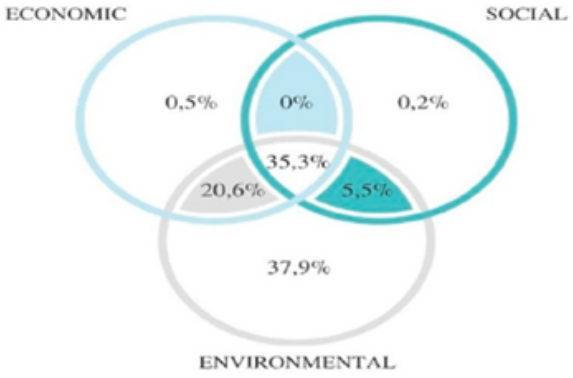

FIGURE 1.1: Evolution of Sustainability Pillars [1].

Sustainability is a concept based on supply and demand, which considers not only the new generation but also three pillars along with engineering. It is necessary to

create plans for community consultation and followed both at local and national levels. The social as well as economic aspects of sustainability are important factors. The main reason of lacking in achieving the sustainability goals in the project management is the ignorance of social aspect [2]. The major barriers in achieving the social sustainability include expense, lack of knowledge and awareness to prioritize the number of criteria from diverse stakeholders. The main problems of construction industry are time and cost overruns; however, the introduction of sustainable practices in construction can reduce the energy use, maximum utilize of renewable energy resources and minimize the water, air, and soil as well as the noise pollutions. The dumping of materials can cause risks to human health and environment [3].

Sustainable construction principles can be differentiated according to the three dimensions of sustainable development, which are environmental, social and economic (Figure 1.2). The aim of this framework is to develop interest in the construction sectors potential for contributing to sustainable development by highlighting the environmental problems and prospects and defining the relationship between construction activities and environmental, social and economic problems. [4].

Concentrating on assessing the consequences of greenhouse gas emissions and energy usage is necessary. Using reused materials such as wood, metal, and glass is suggested to significantly decrease energy consumption and greenhouse gas emissions instead of manufacturing new materials. It emphasizes the environmental effectiveness of reusing materials, emphasizing its contribution to reducing the environmental impact of the building industry and supporting sustainable development efforts. Sustainable construction now relies on building material environmental evaluation for ecological resource efficiency. These practices rely on life cycle assessment, an analytical process that assesses a products environmental implications throughout its life cycle. This approach helps analyze building material reuse, which is essential to a circular economy in construction. Figure 1.3 illustrates the organized approach to Life Cycle Assessment (LCA). LCA is a procedure broken down into three primary stages. The Definition of Objectives and Boundaries section at the beginning of the study establishes the studys objective

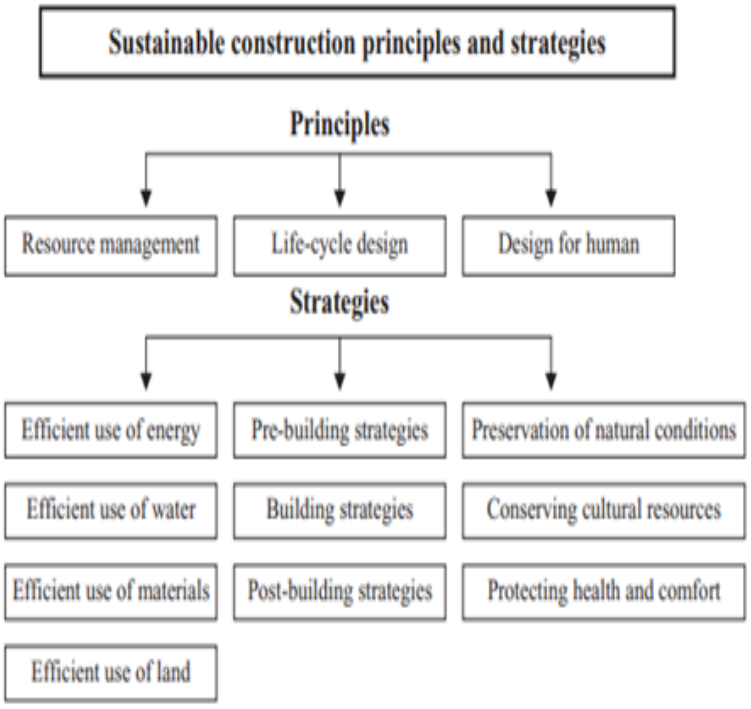

FIGURE 1.2: Framework for evaluating the sustainability of the construction industry [4].

and the scope of the system being evaluated. It is essential to describe clearly and concisely what the assessment seeks to accomplish and the boundaries within which it will function. This includes the product or processs life cycle phases to be evaluated [5].

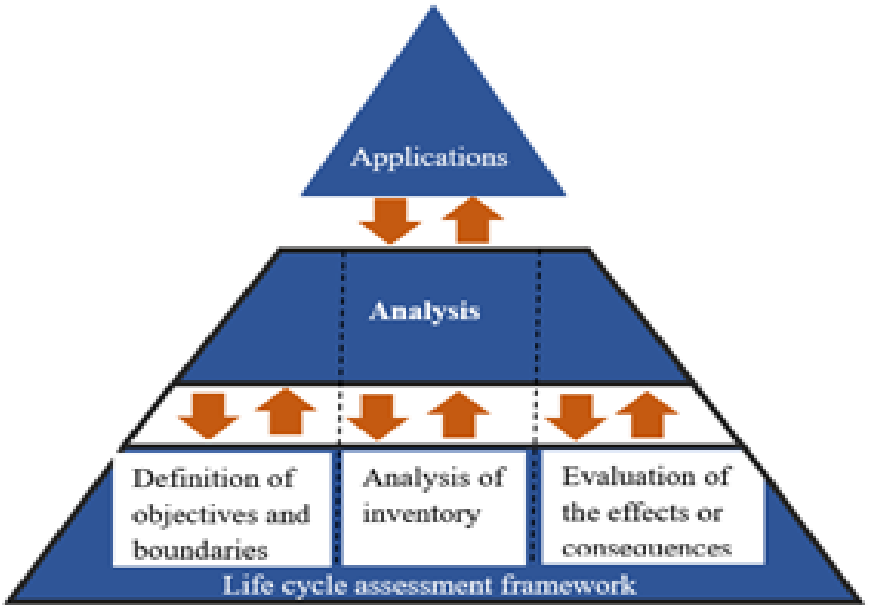

FIGURE 1.3: Life Cycle Assessment Framework [5].

The incorporation of stakeholder participation and social responsibility in construction management has emerged as a vital factor for the success of building construction projects, especially in developing nations like Pakistan. Stakeholders, comprising community people, local governments, internal participants such as architects and engineers, and external organizations like regulatory agencies, are pivotal in the execution of building projects. Social responsibility in construction seeks to harmonize social inclusivity, environmental objectives (such as resource optimization), and economic interests. This necessitates extensive and proactive stakeholder engagement [6]. Research demonstrates that insufficient stakeholder engagement frequently leads to issues, including elevated costs, delays, and the inability to achieve sustainability objectives [7] & [8].

The building construction industry in Pakistan constitutes a substantial portion of the national GDP; however, its expansion is impeded by challenges such as regulatory uncertainty, restricted access to financing, and divergent stakeholder positions [9]. Stakeholder engagement is essential for improved decision-making, risk mitigation, enhanced collaboration, trust-building, and project efficacy [10]. Therefore, active stakeholder involvement in social responsibility is crucial for attaining the social and economic objectives of Pakistan's building sector. Stakeholders are individuals or entities directly engaged in a construction project or whose interests may be influenced by its implementation or conclusion. Efficient stakeholder management during the project is crucial to address their concerns, facilitate their participation, and assure their comprehension and acceptance of the decisions made on the project. This can convert them into proponents rather than adversaries of the idea. Project management has progressively emphasized stakeholder participation, acknowledging it as both a possible risk and an opportunity for project success [11]. The quantity and distribution of stakeholders might differ markedly, from a compact, readily recognizable group to an extensive, distributed network that is challenging to oversee. Essential elements of stakeholder management are identification, planning, administration, and regulation of engagement throughout the project.

Inadequate stakeholder engagement throughout the project lifecycle from planning to execution frequently jeopardizes the expected success of the project. Although

stakeholder participation is essential, its integration is difficult due to constrained resources and conflicting interests among stakeholders [12]. Construction projects exert considerable influence, and enhanced stakeholder involvement correlates with increased collaboration, hence positively affecting the project's overall success. The intricacy of construction projects introduces additional challenges, as inadequate stakeholder management may result in project failure [13].

It is imperative that the customer fulfill their obligations to enable the efficient handling of these variables within the project management process. By reorienting the priorities in cost estimating and management practice across all industry sectors, the findings are anticipated to close a substantial knowledge gap. Moreover, it emphasized the possible impact of stakeholders on the projects technical planning. On-site construction project management may be standardized through the use of suitable construction techniques, efficient reporting, and monitoring protocols for all project stakeholders. This has the potential to reduce many mistakes and errors in the downstream of the construction phase. However, there is a dearth of actual data supporting this claim, particularly from emerging nations. Feasibility study reports from government organization in India are obtained for sixty one projects. Consideration of social sustainability with regards to occupational health and safety, proactive involvement of communities, workers employment practices, and end users are not appropriately addressed. Statistical analysis exposed significant relation between type of project and project delivery system. The findings provide useful information for decision-makers to steer building projects from the start, emphasizing the well-being of vulnerable stakeholders, regardless of their level of importance. Addressing them might improve quality of life for numerous project stakeholders in developing economy. This will also create an attractive image of construction industry as a respectable, ethical, and employee-friendly sector [14].

The Construction Projects Resumption offers several strategies for addressing construction risk engagement that could significantly impact project outcomes. This includes risk assessment, risk identification, planning, and the formulation of solutions aimed at mitigating stakeholder risks, including alterations in rules or regulations within the impacted environment. Additional methods encompass temporal

risk diversification, diplomatic engagement, and collaboration with other stakeholders in the enterprise. Implementing these tactics during project planning and construction would allow stakeholders to address all challenges, thereby stabilizing the construction projects and fostering a climate conducive to their economic and functional success. Risk evaluation, risk management readiness, contingency planning, and stakeholder communication establish the fundamental characteristics and procedures that facilitate the success of building projects [10]. identify resource-based value (RBV) and stakeholder theories as two frameworks for examining the connection between sustainable project management (SPM) and sustainable project success (SPS), along with the role of stakeholder engagement (SE) in this relationship. Only then is the significance of sustainable project management acknowledged.

1.2 Motivation for Research

The building construction industry is one of the composite components of context of economic development in Pakistan but unfortunately beset with issues that emanate from stakeholder engagement (SE) risks and instability and volatility in the legal and regulatory environment.

The risks mentioned can significantly affect project costs, expected net gains, and the resources required, potentially leading to inflated expenses, extended timelines, and even financial losses. These risks undermine profitability across the industry and negatively impact broader economic performance. Despite this, limited efforts have been made to assess how specific socio-economic (SE) risks influence key measures of economic sustainability. Gaining this understanding is essential, as it forms the foundation for developing strategies aimed at enhancing the sustainability of construction projects in Pakistan, ultimately contributing to the industry's growth and advancement. Globally, the building construction sector is inherently complex and filled with uncertainties, particularly when evaluated through the lens of the three pillars of sustainability: environmental, economic, and social. Each pillar has both positive and negative impacts on the industry and

influences project outcomes in distinct ways. In practice, however, environmental sustainability tends to receive more attention than the economic and social aspects. While efforts to promote economic sustainability have been identified through ten specific action points, progress in the area of social sustainability remains slow. An ontology has been proposed to highlight how human consumption patterns influence the use and depletion of natural resources, thereby affecting environmental outcomes [15].

As societies confront challenges like climate change, social inequality, and economic instability, there is a growing recognition of the interconnectedness between social, economic, and environmental systems. Sustainable development requires a holistic approach that considers the integration of these factors and involves the active participation of various stakeholders. These stakeholdersranging from individuals and communities to governments, businesses, and organizationsplay a crucial role in both shaping and implementing sustainable practices. For businesses, policymakers, and decision-makers involved in sustainability efforts, this study offers practical insights. By better understanding the relationships between stakeholders and the three pillars of sustainability, they can more effectively allocate resources and adjust strategies to achieve sustainability goals. Ultimately, the aim of this research is to deepen our understanding of sustainable methods and promote practices that will benefit both current and future generations.

1.3 Problem Statement

The construction sector in Pakistan encounters numerous obstacles that prevent its expansion and competitiveness. Participants in construction projects concur that enhancing collaboration and communication among contractors, designers, and other stakeholders is vital for bolstering the sector's capabilities. Currently, inadequate communication frequently leads to initiatives that surpass their budgets and timelines. The involvement of various stakeholders, including government bodies and supply chain members, introduces significant challenges that delays the achievement of national economic and sustainability development objectives.

Government bodies often enforce stringent regulations and bureaucratic procedures, which can slow down decision-making processes and delay project implementation. At the same time, supply chain members may face issues related to resource availability, cost fluctuations, and inefficiencies in sustainable material sourcing. The lack of effective coordination among stakeholders further exacerbates these challenges, leading to project delays, increased costs, and suboptimal sustainability outcomes. Addressing these challenges requires a collaborative approach, where transparent communication, streamlined regulatory frameworks, and incentivized sustainable practices can help align stakeholder interests and drive national economic and sustainability goals forward. The complicated network of parties has resulted in inefficiencies, inadequate regulation, and misalignment with international norms. As a result, the Pakistani construction sector is less sustainable and competitive internationally, marked by protracted building durations, inefficient material utilization, and little or negative profit margins.

1.4 Research Questions

The research questions are:

- How does stakeholder engagement at various project stages influence the outcomes of construction projects in Pakistan in terms of sustainability?
- What challenges do stakeholders face in contributing to sustainable building construction in Pakistan?
- Which stakeholder engagement practices are the most effective in promoting sustainability?

1.5 Objectives of Study

The main goal of this thesis is to explore the relationship between stakeholder involvement and the sustainability of building projects. It will investigate how a lack of stakeholder engagement affects various aspects of a project's sustainability,

including costs, funding, risk management, and long-term success. Based on the findings, the thesis will propose policies to improve stakeholder participation and enhance the sustainability of construction projects.

- To assess how stakeholder engagement impacts the sustainability of building projects.
- To identify key stakeholder concerns that influence project costs, funding, and risk management.
- To analyze the effect of stakeholder-related risks on the overall sustainability of building projects.

1.6 Research Methodology

FIGURE 1.4: Brief Research Methodology.

1.7 Research Scope and Limitations of the Study

This study explores the development of building construction projects, focusing on how stakeholder disengagement influences project outcomes. It investigates

the role of various factors, such as policies, guidelines, and regulations, in shaping the sustainability indicators of construction projects, with particular attention to the socio-economic and regulatory context of Pakistan. The research looks into how disengagement among both internal and external stakeholders affects resource allocation, as well as the long-term environmental and economic sustainability of construction projects. It also examines the changes in project costs, financial performance, and resource distribution resulting from inadequate stakeholder involvement. The primary goal is to identify and analyze these impacts in order to prevent delays, cost overruns, and other negative effects on financial performance. Ultimately, the research aims to provide project managers with valuable insights to mitigate cost overruns and improve overall project efficiency.

The study critically assesses current stakeholder engagement risk management practices in the sustainable construction sector, emphasizing existing frameworks and their deficiencies in mitigating risks arising from stakeholder disengagement. The research will present practical, significance-oriented techniques for mitigating these risks to increase project outcomes and boost stakeholder participation. This research will yield practical recommendations to enhance stakeholder participation in Pakistan's building construction sector, resulting in more sustainable and successful projects.

1.8 Research Significance

The importance of this research stems from critical need to address sustainability challenges contained by the construction industry. The construction projects have major impacts on economic, social, and environmental factors, making them key focal points for sustainability efforts. However, there is increasing awareness regarding significance of sustainability in construction industry; which lacks the comprehensive understanding of the specific factors that influence the social and economic aspects of sustainability within the industry. By employing the questionnaire base approach, this research seeks to fill up the awareness gap by systematically investigating the relative importance of internal as well as external stakeholders in enhancing the social and economic sustainability in construction

projects. Understanding the perspective and priorities of stakeholders is essential, as they play vital roles in shaping project outcomes and influencing sustainability practices.

The research aims to assess the stakeholders perception regarding the sustainability pillars, which encompasses various aspects of social and economic sustainability such as community engagement, labor practices, supply chain management, and economic viability. The focus is to identify the key areas of concern, major priorities for actions and opportunities for improvements within the construction industry. The conclusion of this research work is expected in the direction of suggest several practical implications for construction stakeholders. The insights gained from this study can help project managers, policymakers, and industry practitioners to make informed decisions, better resource allocation, and strategic planning aimed at enhancing sustainability performance. By identifying those areas where stakeholders perceive the greatest need for improvement, the construction industry may prioritize interventions and allocate resources more effectively to address sustainability challenges. Overall, the research contributes in advancing knowledge and understanding in the field of sustainable construction, thereby facilitating more informed decision-making and driving positive change within the industry

1.9 Thesis Structure

This thesis is organized into five chapters. **The initial chapter**, Introduction, highlights the basic introduction of the topic and research focus. It explains the background of the sustainability in construction industry along with its (environmental, social, and economic) pillars of sustainability, research problem, research objectives and significance. **The second chapter**, Review of Literature, the thorough literature is reviewed on sustainability with (internal and external) stakeholder, its benefits and role in construction industry. It also covers the tools and techniques usually adopted and reported in previous studies for sustainability achievement. **Chapter three**, Research Methodology, provides detail about the

research design, matrix, and questionnaire develop stages along with data evaluation for further elaboration. **Chapter four**, Results & Analysis, contains the results and discussions. It presents the detail about the tests, analyses, findings, and discussions about the achieved results and their significance. **The fifth chapter**, Conclusions and Recommendations, presents the findings based on the results and thorough evaluation, as well as future recommendations.

Chapter 2

Literature Review

2.1 Introduction

The literature has separated into three phases to cover the studys topic. First, it examined the literature on sustainability and its three pillars related to the building construction industry/projects. Which aimed to scrutinize the literature on sustainability and its three pillars, environmental, social, and economic, specifically in relation to the building construction industry and projects. Second, it explored the influence of stakeholders engagement on building construction projects. The study delved into how the engagement of stakeholders, such as project owners, contractors, architects, engineers, government authorities, and the community, affects the outcomes of building construction projects. Stakeholder engagement referred to the active involvement of all parties who have an interest in or are impacted by the project. This exploration included understanding how stakeholders contribute to decision-making, project planning, implementation, and evaluation. The research investigated the ways in which stakeholder collaboration can influence project success by addressing critical aspects such as conflict resolution, project efficiency, quality and innovation, social impact, etc. Third, comprehensive study of impact of stakeholders engagement on sustainable building construction. It involved an in-depth analysis of how the participation and collaboration of various stakeholders influence the achievement of sustainability goals in construction projects. Sustainable building construction focused on integrating environmental,

social, and economic sustainability principles throughout the lifecycle of a project, and stakeholder engagement plays a pivotal role in realizing these objectives.

2.2 Overview of Sustainability

Sustainability in the construction sector is essential for meeting present and future demands through the conservation of energy, water, and resources via strategies such as reuse, recycling, innovative design, and waste minimization. This research undertook a comprehensive review of various pertinent scholarly articles on sustainability and its three foundational pillars, despite the extensive discourse on the environmental impacts of the construction sector. Nonetheless, the majority of publications focused on environmental concerns. The literature inadequately addressed the planning and execution phases of on-site work, highlighting the necessity for further research on the operation and maintenance phases. Sustainability is a crucial global issue in contemporary society, with several definitions attributed to it. A study published by the UN World Commission on Economic Development (WCED) defined sustainability as "development that meets present needs without compromising the ability of future generations to meet their own needs." The United Nations defined sustainable development as "the collective obligation to attain a high standard of living for all." This work is essential for establishing a shared comprehension of sustainability when its concepts are broadly adopted [16].

Figure 2.1 shows the stages during which sustainability aspects can be incorporated into the value engineering (VE) job plan. In the first step of the VE Job Plan, clients information and project requirements have to be determined. At this stage, therefore, sustainability related needs and clients requirements and the possibility of adopting sustainability aspects in the project must be identified. In the functional analysis stage, in addition to the VE functions, Sustainable construction (SC) criteria too must be included so that the functions of the elements could be evaluated against both VE and sustainability aspects. At the creative stage, strategies that enhanced the value of the project while making it sustainable must be generated. However, during this stage both VE and sustainability aspects have

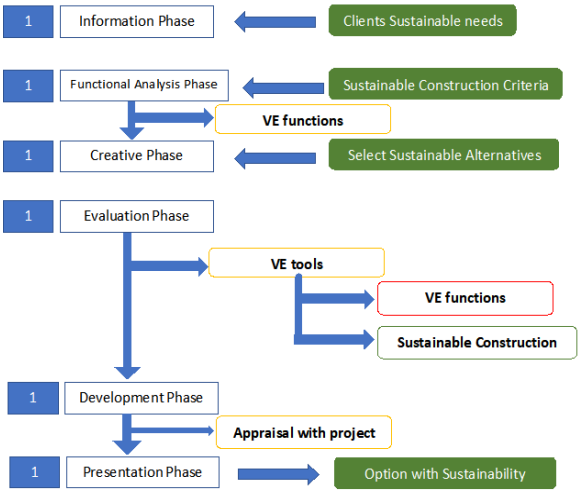

FIGURE 2.1: Framework of Value Engineering & Sustainable construction [17].

to be considered through brainstorming sessions in order to formulate the required strategy. In the evaluation stage, appropriate tools need to be used so that the option selected would be acceptable under both VE functions and sustainable criteria. The ranking of the functions/criteria shall be done accordingly and the most viable proposal has to be selected. At the end of the project, the best solution that has been enhanced the value for money along with sustainability must be selected for implementation. Additionally, it has been observed to the idea of sustainability should be integrated in building construction projects throughout the early on phases of design and feasibility studies, as well as monitored during the projects life cycle. The rising relevance of sustainable building project management has been seen from a variety of perspectives. Building construction projects can be mega undertakings that are essential for continuing economic and social progress but have not ecologically sustainable owing to the planned use of the end results or the materials employed in the projects [17].

The life cycle assessment (LCA) has been used for the building industry. The construction industry, now more than ever, prioritized enhancing social, economic, and environmental sustainability indicators. To address the growing concerns of resource depletion and environmental impact, LCA can be a valuable implement in managerial processes, aiming to improve sustainability within the construction industry. While numerous LCA studies focus on specific stages of the building life cycle, there is a specific part of studies covering the entire life span, particularly

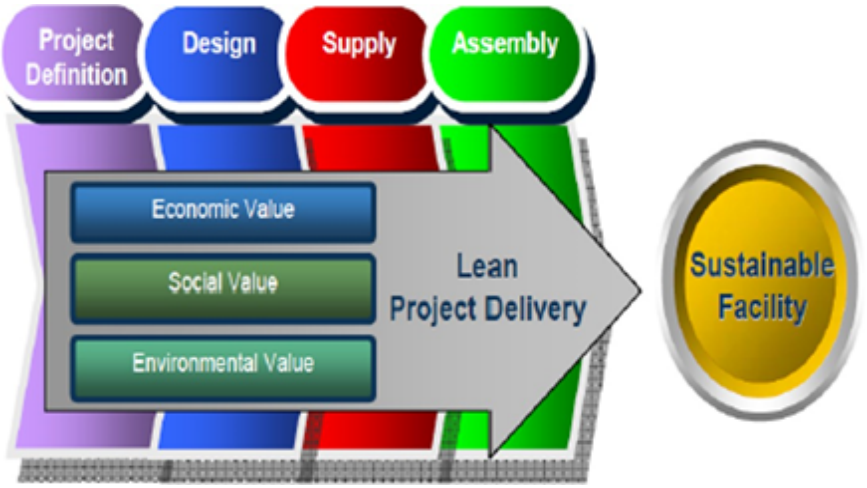

FIGURE 2.2: Implementation of lean practices to achieve sustainability [19].

in developing countries. Furthermore, there is a lack of comparable studies from developing countries in the literature. Governments and environmental agencies must implement construction rules and other environmental policies in order to improve sustainability in the building sector. Furthermore, all stakeholders should show a high degree of effort and dedication. As a result, there is little question that the use of LCA in the building industry is crucial in attaining sustainable development [20].

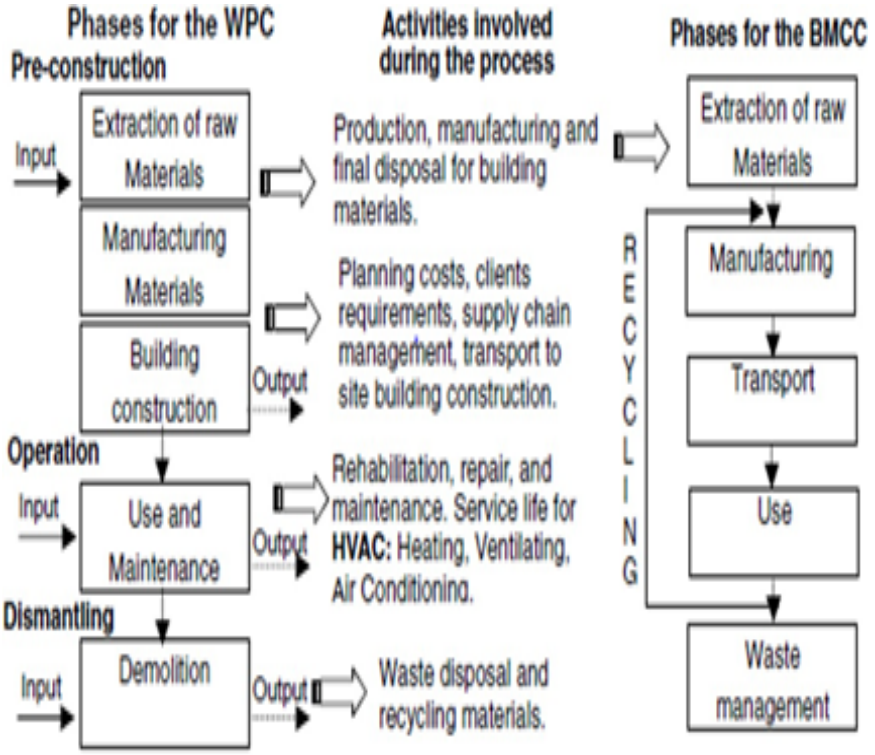

FIGURE 2.3: Diagram illustrating building lifecycle [20]

2.3 Spheres of Sustainability

In construction project management, a clear sustainability plan has essential for effectively managing projects while considering social, environmental, and economic factors. This methodology enabled optimal resource management by focusing on identifying and resolving the root cause of an issue rather than merely addressing its symptoms. By adopting a proactive and analytical approach, it ensured that resources whether financial, human, or material have allocated efficiently to prevent recurring problems and enhance long-term sustainability. It clarified expectations for all stakeholders, ensuring that the project objectives are mutually agreed upon and comprehended. This method primarily aimed to optimize energy usage, utilized sustainable materials, and reduced waste while promoting social justice, workers' rights, and community engagement, among other factors [21].

The concepts of sustainable construction involved designing and constructing buildings to fulfill present requirements without jeopardizing the capacity of future generations to satisfy their own needs. It necessitates not just efficiency in architectural design but also the appropriate utilization of eco-efficient materials and techniques to mitigate long-term environmental impact. For example, green technologies like solar panels or green roofing systems can reduce the emissions produced by a structure. Projects must address environmental considerations throughout their entire life cycle, encompassing design, construction, operation, and deconstruction, to minimize waste and facilitate the recovery or recycling of materials [22].

These principles aligned with the comprehensive notion of sustainable development, wherein construction projects have effectively assimilated into the environment, society, and economy, thereby facilitating the realization of a circular economy, while mitigating the adverse effects of traditional construction practices. The incorporation of sustainability as a fundamental principle enabled all stakeholders, including investors, designers, contractors, and communities, to collaborate towards the shared objective of sustainable development. This principle application ensured that the built environment is healthier, energy-efficient, and

adaptable to future needs, thereby confirming the sector's role in addressing climate change and enhancing societal welfare. Advancing this design has promoted a construction and development surge that fosters healthy building practices and, crucially, preserves the global workplace. A framework for sustainability in project management has crucial for sustainable construction. This framework has considered social, environmental, and economic aspects throughout the projects lifecycle stages. It helped the project teams to identify needs from the start, aligning them with project requirements and constraints. Creating a healthy built environment using resource-efficient, ecologically based principles is the definition of sustainable construction [23].

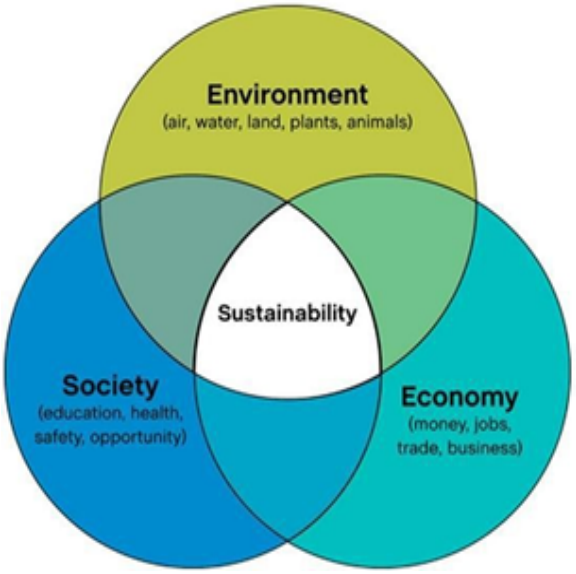

FIGURE 2.4: Sustainability Spheres [23]

2.3.1 Environmental Pillar

It is our responsibility to safeguard the environment's natural resources and potential worldwide ecosystems to enhance health and well-being for the present and future. A variety of environmental assessment tools have been available, each fulfilling a specific function in assessing the impacts associated with a development site [4]. The ozone layer, greenhouse gas emissions, and global warming can all has affected human health. Structures can attain sustainable design by utilizing material proportions that reduce carbon dioxide emissions. The average carbon

dioxide emissions for steel has calculated to be 0.11 kg, whereas for concrete, it has determined to be 0.04 kg. A case study with diverse beam diameters has analyzed. Concrete and steel have prevalent construction materials, with carbon dioxide emissions differing by 276% and 863% of total emission, respectively [24].

Demolishing structures posed significant challenges to sustainable urban development due to the generation of waste materials that require landfill space, contaminate water, consume excessive energy, and emit hazardous gases. The improper management of demolition waste has a complex process that need systematic consideration and analysis.

The objective has to simulate and examine how changing attitudes and dynamic interactions among various stakeholders may influence the environmental performance of demolition waste management (DWM). Therefore, to reduce demolition waste, enhance source reduction, reuse, and recycling efforts, and maximize financial, ecological, and social benefits, all stakeholders have encouraged to use sustainable demolition waste management practices [25].

2.3.2 Social Pillar

Social sustainability encompassed addressing the needs of individuals at every phase of the construction process, from commissioning to dismantling. This entailed guaranteeing elevated customer satisfaction and cultivating strong partnerships with clients, suppliers, employees, and local communities. It also entailed recognizing and addressing both beneficial and detrimental effects on individuals. In sustainable project management, essential characteristics include profitability, safety, transparency, ethics, environmental sustainability, social acceptability, stakeholder engagement, and customer expectations. Sustainability concerns in projects have been assessed by employing metrics as weighting variables in multi-objective sustainable project management issues [10].

The study has [26] investigated the social and economic development in emerging nations. The construction sector has encountered multiple issues, including delays and budget excesses in projects. Implementing sustainable construction practices have mitigated these problems by decreasing energy consumption, optimizing the

utilization of renewable energy sources, minimizing pollution of water, air, and soil, and lowering noise pollution. It elucidated Malaysia's gross domestic product (GDP) and the health risks associated with material dumping. Conventional design and construction predominantly emphasized cost, performance, and quality goals. The implementation of green building principles at different construction phases mitigated carbon dioxide emissions, energy consumption, and solid waste production, which constitutes roughly 70% of total trash. This study indicated that technological developments, including lean methodologies, value engineering, building information modeling (BIM), and sustainable supply chain management (SSCM), has enhanced construction procedures.

A crucial issue in assessing the feasibility of a project in the building sector has the social aspect of sustainability. While there are explicit guidelines for minimizing carbon footprints, particularly with the selection of construction and urban development materials, corresponding measures that tackle social aspects are often overlooked. Proposed solutions have addressed the diverse needs of present and future communities, mitigate environmental issues, enhance quality of life and safety, all grounded in this fundamental understanding.

The amalgamation of social ontology with environmental and economic elements offers developers and pertinent stakeholders a more comprehensive understanding of sustainable issues associated with urban development and construction. In the last two decades, sustainability has garnered significant attention and has become an essential element of most project and socioeconomic activity. The International Commission on Environment and Development initiated an endeavor that is the foundation of this sustainable agenda [15].

2.3.3 Economic Pillar

The economic aspect of sustainability focuses on the preservation of natural and financial resources to establish enduring financial stability. Economic sustainability focuses on enhancing productivity through the efficient use of resources, including labor, materials, water, and energy. Although the significant advantages of economically sustainable construction have crucial, they frequently remained

poorly comprehended by many developers and users. Traditionally, the primary aim of construction has been to achieve optimal quality while minimizing costs and adhering to a strict timeline.

A study [27, 28] assessed the advantages and expenses associated with implementing scenarios aimed at enhancing the indoor environmental quality (IEQ) of buildings in the United States. These scenarios enhanced ventilation rates through the incorporation of outdoor air economizers and the regulation of indoor temperatures to remain below 20C during winter. The numerical estimates carry significant uncertainty, and there has potential for considerable advantages. The estimated yearly economic advantages of the examined scenarios varied between USD 17 billion and USD 26 billion, contingent upon the data source for current ventilation rates. It has essential to focus on implementation scenarios that contribute to energy conservation. It has important to note that the data collected is around 15 years old, and the survey may not fully represent the entire building stock, as it excluded small offices.

Hill and Bowen [29] classified Kiberts principles into four main categories: social, economic, biophysical, and technical. They highlighted the importance of systematically utilizing resources to enhance advantages for all stakeholders and the environment. Life cycle costing served as an effective economic tool for assessing the long-term advantages of sustainable construction. Nonetheless, given the absence of pertinent live cost data and the restricted experience in utilizing it to tackle these challenges, it is crucial to inform both clients and professional consultants about the advantages of sustainable construction. By implementing sustainable construction practices, clients have achieved immediate returns while also securing enduring advantages.

2.4 Sustainable Project Management (SPM)

Sustainable Project Management (SPM) represents a developing methodology that incorporated sustainability principles into the planning, execution, and monitoring phases of projects across diverse sectors, such as construction. SPM emphasized the attainment of project objectives while maintaining a balance among

environmental, social, and economic factors throughout the project lifecycle. In construction, SPM encompassed the implementation of energy-efficient practices, utilization of sustainable materials, reduction of waste, and collaboration among stakeholders to achieve durable and environmentally friendly results. This approach highlighted the necessity of a comprehensive perspective, in which short-term goals are synchronized with long-term sustainability objectives. Embedding sustainability into all phases of project management, from conception to completion, enabled SPM to reduce the ecological footprint of the industry while enhancing project value, stakeholder satisfaction, and adherence to global sustainability standards. This research examined the implementation of SPM principles in construction management, providing insights and strategies to enhance sustainable development in the built environment [30].

Sustainable Project Management (SPM) has a novel theme in construction industries of developing countries and very little has known (so far) about the sustainability performance of construction projects in those settings. Accordingly, the quantitative measurement of SPM as a higher-order construct has not well established and lacked a holistic approach and homogenous taxonomy of indicators. This study explored the SPM practices of construction firms by validating SPM as a second-order construct in the Pakistani construction industry. Data were obtained from 146 construction firms, which were then analyzed using partial least square structure equation modeling. Results of the first and second level measurement model assessments showed that construction firms practice SPM, with varying degrees of attention paid to three sustainability aspects. Environmental dimension surfaced as the most important, in-terms of practice and social sustainability as least. The analysis of the second-order measurement model yielded significant results, thus, validating the higher-order structure of SPM [31].

2.5 Advantages of Sustainable Construction and Sustainability

The ability to balance the aspects of the economy, society, and environment has one of sustainability's advantages. Promoting social life and human health has

the goal of sustainability's social pillar. A technique for reducing waste production during project lifecycles and protecting the environment from destruction was developed as a result of the advantages of the environmental element in the construction industry. Lastly, from an economic standpoint, a contractor benefits from enhanced operating efficiency by lowering waste and expenses, and clients profit by obtaining a better lifecycle value for their investment [32].

The conceptual underpinnings of three fundamental sustainability principles resource management, life cycle design, and design for persons and the environment have provided by another study [33]. Sustainable building tackled three main aspects: social, economic, and environmental, as opposed to the antiquated notion of economic use and durability. The building industry's role in sustainability has a worldwide concern. But the problems facing growing nations have much bigger and more complex than those facing the poor world.

Sustainable building design and construction represented a holistic and interconnected process with a larger objective in mind, rather than merely being a collection of discrete elements. The process of creating healthy and ecologically mindful environments has the main focus. These spaces promoted interaction between people and nature, fostering a bond that is vital for mental and physical well-being. Additionally, the use of sustainable building practices supported regional cultures and economies. By putting sustainability first, communities have built spaces that meet people's immediate needs while also promoting the planet's and people's long-term health and vitality [4].

Four green building rating systems (GBRSs) have employed [34] in accordance with how well they matched the goals of the study. Both directly and indirectly, the range of accessible GBRSs have been utilized to enhance sustainable building design. While LEED emphasized indoor environmental quality, BREEM, GSAS, and Pearl building rating systems place more emphasis on the energy category. In addition to being useful for directing a project's environmental sustainability, the GBRSs have also crucial for analyzing the project's social and economic sustainability objectives. By promoting eco-friendly behavior and raising people's standard of living, the GBRSs not only helped the long-term development of the surrounding areas but also better served the community. Although the building

and construction industries have vital to the world economy, their enormous energy consumption made it clear that more must be done to promote sustainable.

2.6 Sustainability in Construction Social and Economic

Construction projects success in the building construction industry depended on environmental sustainability. All communitys social realities have reflected in social ontology. It has predicated on the notion that these realities did not emerge out of thin air. Rather, they have shaped by the dynamic interaction of disparate ideas and perspectives inside a particular culture. By recognizing and comprehending these social dynamics, players in the construction industry may better address social challenges and include community view- points in project design and implementation. This strategy encouraged a more inclusive and socially responsible approach to the construction projects, eventually contributing to the overall success and sustainability of projects [35].

A specification for the ontological topography has reflected in Fig. 2.5 and shows the highest-level categories adopted for developing lower-level entities. Fig. 2.5 defines three broad categories: those which represent spatial (occupying) scales, urban systems and development life cycles, and sustainability dimensions and their associated issues and sub-issues, such as stakeholders, impact, influences and polices associated with any entity. The three broad categories have further elucidated in the sections below to provide their relevance to sustainability of urban environments [15]. The government, assisted by research bodies, has taken the first steps toward encouraging sustainable construction techniques. However, further funding and incentives have been required to fully fulfill these initiatives. This case study has conducted at Sultan-Caboose University, a public entity with limited tendering and procurement procedures. Public knowledge of environmental concerns has critical to the effective application of sustainable construction techniques. Therefore, comprehensive measures for increasing awareness and cultivating a culture of sustainability among the public have been required to promote genuine change in the construction sector [36].

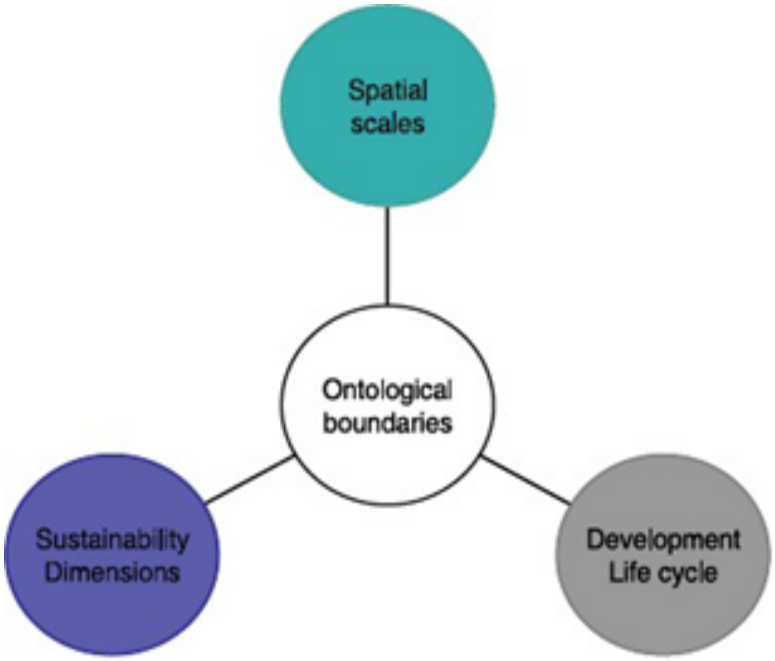

FIGURE 2.5: Common types used to classify sustainable urban areas [15].

Sustainable construction took into account both the initial capital expenditure and the continuing operating expenses connected with green building methods. Improved building performance and durability have important economic benefits of sustainable architecture, resulting in long-term savings through lower maintenance and operational expenses during the structures lifecycle. Furthermore, a sustainable building sought to provide optimal living and working conditions that increase productivity. The primary goal was to save energy and reduce environmental impact while encouraging healthy and comfortable living circumstances. However, developers and consumers frequently failed to see or comprehend the substantial economic benefits of sustainable building. As a result, raising awareness and educating people about the economic benefits of using sustainable construction techniques was crucial [37]. Giunipero [38] emphasized on sustainability through buying and supply supervision. Based on a Delphi analysis of twenty-one senior supply management executives from domestic and international companies with US headquarters, the research was conducted. The goal was to discover and evaluate a complete list of supply chain sustainability drivers and obstructions. The data indicated that buying and supply management executives may help their CEOs to implement sustainable practices. They also appreciated the need to follow government regulations. The supply chain management remained a top

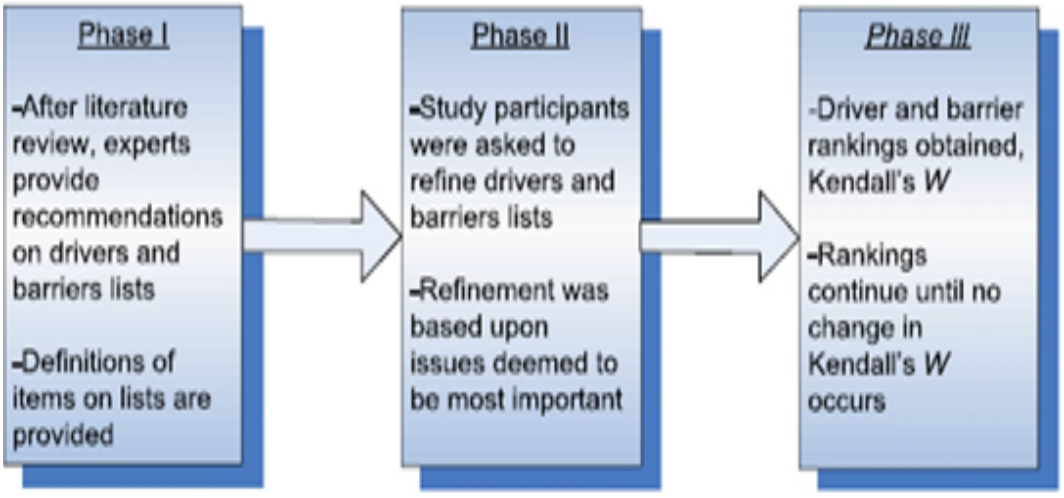

FIGURE 2.6: Various phases of buying and supply management [38]

concern for CEOs, purchasing and supply management teams while the strategies and approaches may differ among firms as shown in Fig.2.6.

2.7 The Significance of Sustainability in Management of Building Construction

Economic indicators were essential in the construction business for assessing whether a project has completed on schedule, under budget, and in compliance with other predetermined scope requirements. The significance of key success factors (CSFs) for integrating sustainability into project management techniques at every level was measured using a novel paradigm. The thorough investigation offered distinctive perspectives on how to include sustainability into project management methodologies, especially in developing nations. These results were essential for enhancing project performance, guaranteeing sustainability, and promoting economic growth in construction projects around the world [39]. Throughout the project's life cycle, the Triple Bottom Line concept was a crucial instrument for tracking and enhancing sustainability. Additionally, a concept known as "green information modeling for buildings" (BIM) has been put out, which linked BIM technology to sustainability in the building industry. It was suggested that Indonesia concentrate on raising awareness and educating people about BIM. Cost

reduction, maintaining economic stability, and improving life-cycle asset management were all possible using BIM technology. This all-encompassing approach ensured that sustainability considerations were included into every stage of development, leading to long-term benefits for the environment, society, and economy. A great economic method for assessing the long-term worth of sustainable buildings was life cycle costing. However, a lack of pertinent "live" cost data and a lack of implementation experience limit its effectiveness. The benefits of sustainable building have explained to clients and expert consultants in order to resolve these problems. Prefabrication technology has been widely endorsed by the Chinese government as a way to boost building productivity and efficiency. Prefabrication and cast-in-situ were two different building methods that were used in the two projects that are being compared. This comparison aimed to evaluate prefabricated technology's effectiveness in achieving sustainability objectives and improving project results overall [16]. There were significant environmental and socioeconomic problems due to the world's growing population and the impending threat of climate change. Investigated were methods for integrating sustainability concepts into building project management. Essential sustainability criteria were identified and prioritized using a survey approach. In addition to guiding decisions about the selection of project portfolios and the allocation of financial resources, these criteria aid in the analysis of the sustainability of business ventures. The goal of the research was to create a more sustainable built environment by addressing these challenges [40]. Adherence to constraints like cost, time, and budget was often essential to the success of the project. Project success in a developing nation with a thriving infrastructure sector, such as Pakistan, depends on effective stakeholder management. A quantitative investigation was carried out [11] to ascertain how stakeholder management affects project success. Three hundred responders from both public and private companies provide their data. Smart PLS software and structural equation modeling (SEM) were used in the inquiry. The results emphasize how important it has to raise project teams' knowledge of the official application of stakeholder management techniques. For projects to become more successful and efficient over time, this kind of integration was essential. In construction, a greater focus on stakeholder management may yield more significant

and long-lasting results.

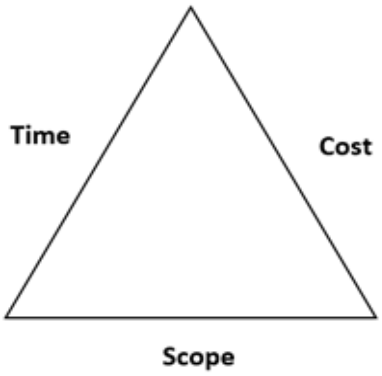

FIGURE 2.7: Sustainable development triangle [11].

2.8 Involving Stakeholders in Sustainable Building Construction

Achieving sustainable growth in Chinas construction sector required a meticulous consideration of stakeholder interests while addressing the challenges that arise. The gray theory served to categorize expert opinions into comparable and analyzable indices. The results emphasized the important parties involved (suppliers, businesses, and sustainable communities) whose cooperation could lead to shared advantages. The primary contributions consisted of developing a framework for evaluating co-benefits among stakeholders and implementing a mixed-method approach to assess the building scene. Utilizing co-benefits lead to the simultaneous resolution of both global and local environmental challenges. In order to enhance accuracy amidst information uncertainties, gray theory and the Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS) were employed to quantify stakeholder rankings and criteria, leading to actionable insights [41]. The relationships with stakeholders significantly influenced the outcomes of construction projects. Successful project outcomes hinge on proficient stakeholder management, which encompassed thorough stakeholder analysis. Prabhu [42] identified the primary stakeholders and evaluated them based on their interests, influence, and perspectives. A comprehensive strategy was employed for identifying and

managing stakeholders. An analysis of stakeholders informs decisions aimed at enhancing quality, minimizing costs, and accelerating decision-making processes, all while safeguarding human resources. This empirical study offered valuable insights into strategies for managing stakeholders. Efficient management of stakeholders improved project quality, regulated costs, and adhered to timelines. The findings offered valuable insights relevant to stakeholder management across diverse project scenarios.

The methodologies for project management hold significant importance in the workplace. They function as essential elements, propelling advancements, enhancing worth, and bringing ideas to fruition. Although these projects hold considerable importance, they often encountered challenges and exhibit notable failure rates, prompting concerns within both business and academic circles. This study [48] integrated stakeholder theory into project management by merging quantitative survey analysis with SEM methodologies to identify six critical stakeholder traits that impact achieving project success. The two frameworks have been developed: TSIA (Total Stakeholder Influence Analysis) and SBPMM (Stakeholder-Based Project Management Model), facilitating the integration of stakeholder concepts into projects. Both frameworks (TSIA and SBPMM) stand out as essential instruments.

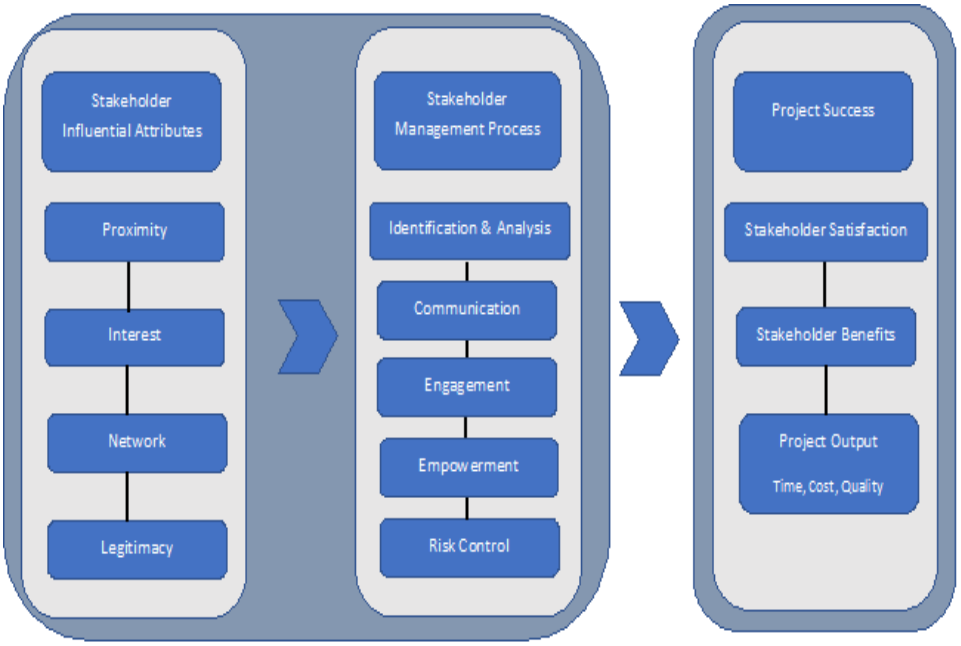

FIGURE 2.8: Engaging Stakeholders in Sustainable Business Construction [43].

A study by [43] examined the determinants of social sustainability in construction projects, specifically in developing countries. The study evaluated the feasibility studies of 61 Indian government-funded construction projects, revealing insufficient focus on critical aspects of social sustainability, including occupational safety, workforce employment practices, and local community engagement. The research illustrated, through statistical comparison, that the elements of social sustainability considered were significantly correlated with the project type and its delivery method. These findings were beneficial for individuals responsible for executing social sustainability methods that produce favorable effects for marginalized communities. This study aimed to enhance the discourse by providing the construction sector with a hybrid methodology that incorporates both quantitative and qualitative dimensions of social sustainability in construction projects within poor nations [44].

2.9 The Role of Stakeholder Engagement in Sustainable Construction

In the building construction sector, stakeholders are categorized into two primary groups, according to [45].

A. Internal Stakeholders (IS)

These stakeholders directly contribute to the building development process and are further categorized as follows:

(a) Demand side: It encompasses clients, financiers, and others.

(b) Supply side: This includes architects, engineers, suppliers, and similar entities.

B. External Stakeholders (ES)

These stakeholders indirectly contribute to the construction process and are further defined as:

(a) Private: This category comprises local inhabitants, local landowners, etc.

(b) Public: This encompasses regulatory authorities, governmental agencies, and similar entities.

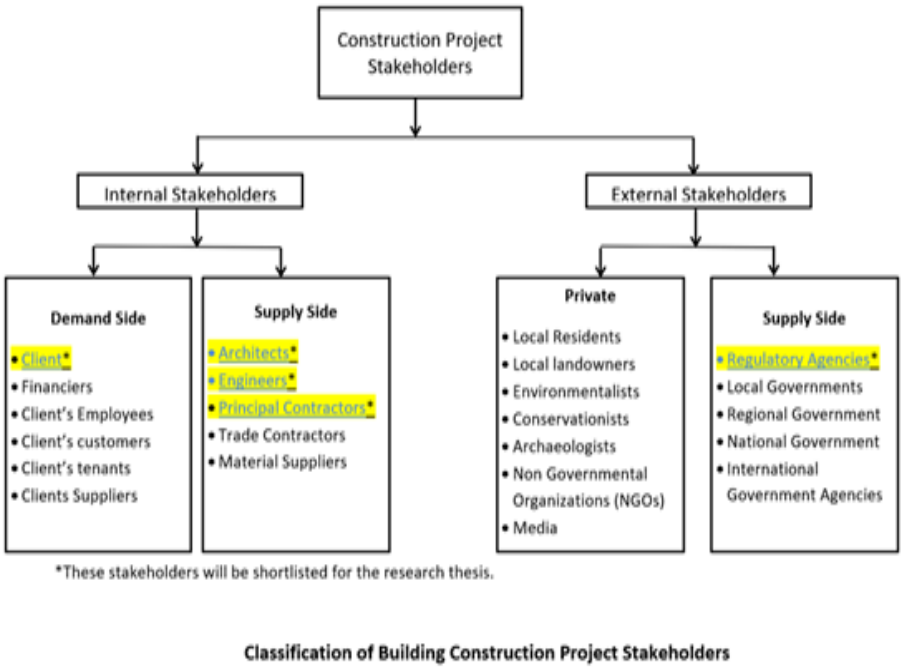

FIGURE 2.9: Internal and External stakeholders in construction project stake holders [45]

Construction management prioritized stakeholders, as their involvement has essential to uphold sustainability objectives in the construction process. Stakeholder engagement, as defined by the Project Management Institute (PMI, 2023), is the act of identifying and analyzing all relevant parties and managing their intended engagement in the project. In the development of sustainable buildings, stakeholder involvement is not merely for its own sake; instead, it consistently promoted sustainability throughout the construction process [45]. When executed well, such participation enhanced communication, mitigated risks, and enabled the project to attain comprehensive sustainable social, environmental, and economic development [46].

In Pakistan, a significant difficulty hindering the completion of construction projects is the inadequate involvement of stakeholders throughout the entire process. Delays in numerous building projects were attributed to inadequate coordination among stakeholders, insufficient awareness of sustainable measures, and the disregard for local communities during the planning phase [47]. These gaps hindered

incentive for the adoption of sustainable practices in construction, hence affected the overall sustainability of construction projects.

Rational construction management integrated environmental, social, and economic factors throughout all phases of the project cycle, including planning, execution, and closing [48]. In recent years, there has been a significant emphasis on ensuring that construction projects adhere to their technical and economic specifications while also mitigating adverse environmental impacts and enhancing the quality of life for local residents [49]. For stakeholder involvement to improve sustainability, it must address the requirements of all involved parties local communities, regulators, investors, and contractors [50]. Sustainable construction, which adhered to environmental norms, is shaped by stakeholder with varying roles in the construction project. In Pakistan, various stakeholders influence the sustainability of construction projects, including local authorities, architects, engineers, and the public. Construction projects may directly affect community people, either positively or negatively.

2.10 Difficulties in Involving Stakeholders in Pakistan's Building Sector

Numerous obstacles hindered stakeholders in sustainable construction projects within Pakistan's construction industry, notwithstanding previous challenges,

according to policy initiatives. [51] contend that the sluggish adoption of sustainable methods in the construction sector was due to political instability, insufficient understanding of construction sustainability, and limited stakeholder engagement. Moreover, the fragmented nature of the construction industry in Pakistan resulted in diverse stakeholders, such as contractors, subcontractors, financiers, and suppliers, pursuing divergent objectives, thereby complicating efforts towards sustainable development [52].

Conversely, the primary obstacle has been the insufficient awareness and education regarding sustainable construction among experts and stakeholders. A multitude of stakeholders, including developers and contractors, were motivated by financial

and temporal limitations, along with a failure to see the long-term benefits of sustainability [53]. As a result, stakeholder engagement often remains superficial and does not address the deeper challenges of sustainability, including resource management, energy conservation, and social benefits.

2.10.1 Internal Stakeholders' Contribution to Economic and Social Sustainability

In Uganda, issues in construction sustainability have hindered the government's efforts to improve carbon reduction and energy efficiency. A superior comprehension was a hybrid model, as mentioned by [54], which utilized the exchange of knowledge and skills across the construction chain to attain the shared objective of sustainable buildings. The paper suggested an online application to facilitate systematic stakeholder engagement, ensuring that construction operations align with government policy objectives. Nonetheless, deficiencies in expertise, excessive workload, and institutional constraints such as insufficient governmental and regulatory support constitute significant obstacles. Overcoming these obstacles necessitates collaboration to promote sustainable development and streamline participation procedures [55].

Furthermore, perspectives on sustainable development must be integrated into all construction-related activities, encompassed the procurement of raw materials and the disposal of construction waste. It is essential to incorporate all facets, including planning, design, building, and subsequent demolition. The geographical location of suppliers is crucial for sustainability, as local suppliers save transportation costs and emissions. Multi-Criteria Analysis (MCA) has a prevalent and extensively utilized method for vendor selection, considering environmental, economic, and social implications. evaluate stakeholder participation in construction projects and their engagement through two methodologies: simple descriptive statistics and factor analysis. This study benefited from these elements; nonetheless, there were deficiencies in this methodology, especially with the assessment of perceptions and the evaluation of interface efficacy inside the organization. Due to the absence of a dynamic model in this study, adequate administrative oversight and monitoring

of changes were necessary. Simply categorizing stakeholders by their significance is insufficient; it was important to address their expectations by comprehending the interactions among and between the stakeholders. Stakeholder management extends beyond merely identifying their interests; it also included the mobilization and enhancement of their relationships as cultural activities [56].
These interventions also assist in improving the image of the construction industry as a moral and decent employer. The research indicated that stakeholder management should be implemented in every stage in the process in the planning and in the execution phase due to the shifting societal backdrop. By adopting stakeholder management principles and addressing their concerns, businesses can considerably improve their chances of attaining project success and long-term goals [57]. The study conducted by Maier and Aschilean [58] provided significant information for decision-makers who want to manage building projects in ways that assist disadvantaged stakeholders, regardless of their perceived prominence. In developing economies, such interventions can improve the quality of life for many project stakeholders while also cultivating a good social impression of the construction sector as ethical and employee-friendly. Stakeholder management is vital throughout the planning and execution phases owing to the changing nature of society. Adopting stakeholder management concepts and meeting their requirements may considerably boost an organizations ability to achieve its goals.

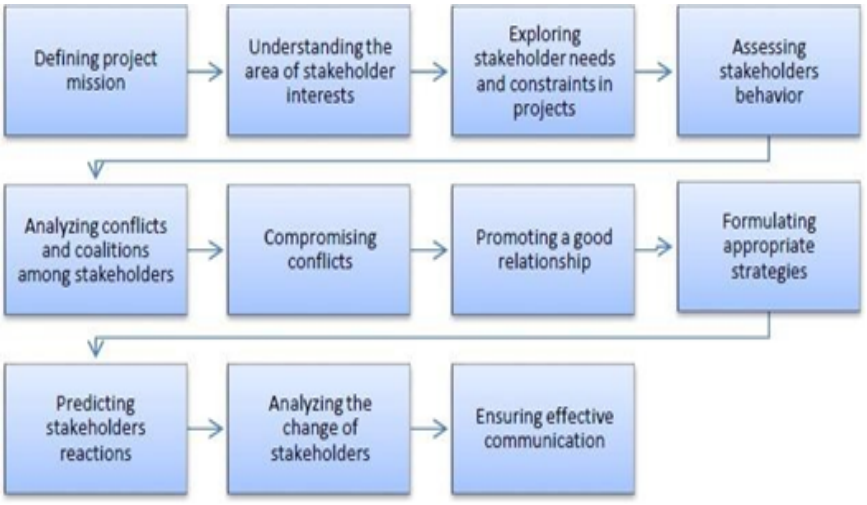

FIGURE 2.10: Construction stakeholder's structure; a complete approach [65].

The construction industry largely faced obstacles in adopting sustainable practices due to the stakeholders' lack of understanding, particularly among landowners and

executives unfamiliar with construction principles. Identifying key stakeholder groups and conducting studies within the context of started changes aimed to highlight opportunities and hazards. In building projects, it is essential to encourage open communication among employees to facilitate two-way dialogues rather than merely issuing directives to workers and subordinate personnel. This resulted in enhanced worker satisfaction and superior project outcomes [59].

With the onset of the Fourth Industrial Revolution, Building Information Modeling (BIM), cloud computing, and modularization were more pivotal in the construction industry. Nonetheless, issues persisted regarding their utilization. Nevertheless, they were perceived to enhance building through performance and expansion efficiencies. Social aspects, including the imperative for collaboration and an overall openness to innovation, significantly influenced the capacity to implement technology inside the sector [60]. Engaging stakeholders is crucial for the successful execution of projects, particularly those financed by government entities aimed at sustainable growth within the construction sector. Land sellers, land buyers, and local governments were stakeholders who can ensure the success of a project. Given that land sellers may be overridden by municipal authorities, it was imperative that the dynamics of power relations and stakeholder interests remain uncompromised. Properly cultivating these relationships allows for the consideration of all stakeholder perspectives, hence assuring the attainment of optimal, cost-effective, and ecologically sustainable building solutions [61].

Moreover, it was essential to guarantee that communication with clients is efficient to manage expectations and prevent misunderstandings. This also aided in the effective management of liquidity, profitability, and financial risks. The efficient operational performance of a firm relied, among other factors, on a thorough understanding of the client, a long-term perspective, and prudent capital management [61].

Capital stability management was a crucial component of a companys overall financial and economic picture. It involved various organizational tasks such as operational and planning management, as well as the establishment of an adaptable coordination framework for the management of the business as a whole and its units. Working and savings cash were the foundation for enhancing the average

balance of all cash, in addition to keeping an eye on the absolute liquidity level. Customer value consisted of three elements: status, value for money, and reputation for excellence. Marketing direction has always placed a strong emphasis on the demands of the client, with the goal of satisfying them in order to generate profits. In explain the positioning advantage, acknowledge the importance and role of client focus and initiative [62].

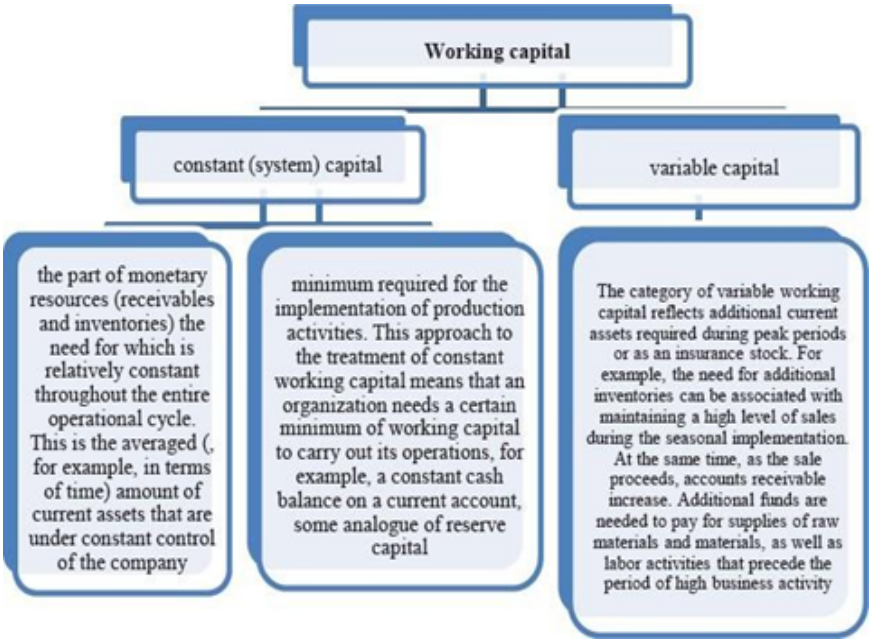

FIGURE 2.11: Analysis of working Capital structure [70]

2.10.2 The Influence of External Stakeholders on Economic and Social Sustainability

The International Labor Organization (ILO) defined collective engagement as negotiations between employers or groups of employers and one or more employee organizations to reach agreements on working conditions and terms of employment with the goal of promoting workers interests through consultation and joint decision-making. Employers have a duty to present appropriate information in workplace forums. The ILO sees occupational health and safety (OHS) as a basic part of social protection emphasizing on all workers right to have a safe and healthy workplace. The stakeholder approach to OHS encompassed all areas of corporate social responsibility including protecting worker well-being and encouraging a collaborative approach to the workplace safety [63].

The Bangladesh Readymade Garments Manufacturers and Exporters Association (BGMEA) is a well-known organization that represented woven garment factory owners and other stakeholders. The BGMEA advocates a zero tolerance approach to safety concerns. The association routinely audited member factories for compliance, implements social compliance development programs, and arranged training sessions to improve compliance and environmental standards. Owners of construction projects were the key consumers of construction services and frequently supply project finance. Additionally, they have a good impact on projects safety performance [64]. Similarly, in the construction sector, safety outcomes were influenced by clients, who were often the project's funders, hence impacting workplace health and safety [65]. Researching construction safety indicated that achieving "zero injuries" may be accomplished by reducing and ultimately eliminating accidents on the job. Achieving effective occupational health and safety management in construction projects is particularly challenging due to the sector's technological, cultural, and organizational complexities. These complexities necessitate coordinated actions and foster a collaborative safety culture [66].

Governments were encouraged to spearhead the formulation and implementation of occupational health and safety legislation to improve workplace safety. This entailed the incorporation of economic and social sustainability objectives through the execution of strategies such as:

1. Elevating taxes on enterprises that contribute to energy consumption and environmental damage.
2. Offering incentives for the adoption of energy-efficient technologies.
3. Enhancing the enforcement of energy management regulations at project locations.

These steps are essential for the construction sector in Pakistan to attain sustainability while fostering efficient energy management systems. Enhancing comprehension and optimizing worker performance in the construction business, which heavily depends on human effort, necessitates a strategic knowledge. Changes in

worker productivity were a significant driver of a nation's overall economic performance and industrial sector. Factors such as insufficient workplace health and safety measures, inadequate skills development, inferior materials, and low wages adversely affected employee mental well-being. Certain variables were crucial in influencing the work environment to enhance productivity in the construction sector [67]. Sustainable development can be broadly defined as a means of safeguarding the well-being of humans, animals, plants, ecosystems, and natural resources. Primary priorities encompass poverty alleviation, women's empowerment, the promotion of human rights, and universal education (UN, 2023).

In response to the increasing importance of sustainability in the construction industry, the Construction Confederation Environmental Forums (CCEF) established six sustainability objectives. Nonetheless, a deficiency persisted concerning the culture and level of environmental consciousness among the general populace and industrial stakeholders. Sustainability education was crucial for addressing sustainability-related issues as it fosters awareness, encourages ongoing learning, and equips individuals to adopt environmentally friendly habits and processes. The overarching objectives for sustainable development and environmental conservation has probably be realized solely with the active participation of pertinent stakeholders and the utilization of industrial resources [68].

An increasing acknowledgment has emerged that inclusivity and diversity will enhance productivity. Over the past decade, employers in the construction industry have sought to address these difficulties by improving recruitment methods to better comprehend recruitment processes and the significance of managing workplace diversity. Diverse employees, encompassing various genders, races, and cultures, contribute distinct talents and methodologies to workplace decision-making, ultimately influencing corporate performance. Both small and large construction companies used personnel from diverse ethnic backgrounds and cultures, significantly enhancing the overall work culture and atmosphere of the firm. Significant reductions in the workforce resulted in a concomitant rise in the representation of women and ethnic minorities in top roles across the majority of global construction companies. In this context, "diversity" pertains primarily to recruitment tactics

aimed at attaining equilibrium among various demographic groups, whereas "inclusion" encompassed a wider scope, integrating these variations to enhance both individual and organizational outcomes. Diversity management entailed a comprehensive transformation of the organizations culture, practices, and policies at all hierarchical levels, including senior management, fostering an environment of openness, belonging, trust, and engagement through transparent and effective hiring and development practices [69].

2.11 Factors Affecting Stakeholder Involvement in Pakistani Sustainable Building Construction Management

In the global construction business, particularly in Pakistan, stakeholder participation is crucial for achieving sustainability in the construction process. Several resource elements influence the level of participation and the efficiency of interactions among the involved parties. These elements can be classified into institutional, economic, social, and environmental components.

2.11.1 Political and Regulatory Structure

The construction of a structure undeniably possesses a political dimension, which influenced stakeholders and their active participation in sustainable construction projects in Pakistan. The political will of various governmental bodies significantly influenced the scope of construction inside the country and the durability of projects. Effective stakeholder participation in the construction sector has best attained through a well-defined regulatory framework that is rigorously implemented, egalitarian, and fosters environmental and sustainable development. Bashir [70] asserted that the absence of clarity and consistency in policies regarding green building certifications, particularly concerning sustainability requirements and acceptable standards, hinders stakeholder involvement in sustainability initiatives. Political instability and frequent governmental changes frequently resulted in inconsistent policies that did not support long-term engagement in the sustainable construction sector [51].

2.11.2 Awareness and Knowledge of Sustainability Practices

Mozhdeh [71] recognized the significance of the social dimension across all three pillars of sustainability. Consequently, it was essential to evaluate how the level of awareness and knowledge concerning sustainable construction techniques among them served as a determining factor. In her op-ed on social sustainability, which implied that construction professionals, including developers and state department contractors, have been deficient in systematic training for sustainability. In such circumstances, without recognizing the environmental, economic, and social benefits of sustainable construction, stakeholders were inclined to choose non-sustainable building approaches. This was crucial because, as [72] indicated, the absence of expertise results in stakeholders, including locals, residents, developers, and contractors, becoming more entrenched in their self-serving objectives rather than considering what may benefit the initiative; strategies such as a multi-stakeholder approach could have been utilized.

2.11.3 Economic Incentives and Financial Considerations

Economic concerns served as a basis for persuading certain stakeholders to support the building industry's sustainability, as Pakistani construction practiced now prioritize short-term financial gains and cost reductions over long-term objectives [49]. Certain developers and contractors rejected sustainable development, viewing it as financially impractical. This was particularly applicable in developing democracies, where the notion of finance sustainability is a novel domain. There may be hesitance to engage in sustainable building projects due to the substantial initial investments needed for eco-friendly materials, energy-efficient technologies, and sustainable construction processes [49].

2.11.4 Stakeholder Conflicts and Collaboration Challenges

Sustaining positive relationships with stakeholders is a critical issue in stakeholder engagement due to their often-conflicting interests. Pakistan's construction sector

is segmented, indicating that developers, architects, engineers, contractors, and local communities possess distinct objectives and interests. The observed differences underlie the various frictions that hinder effective participation and collaborative action. Zubair [73] indicated that contractors and developers prioritize profit and time, while locals and environmentalists advocated for environmental and social protection. It has inappropriate to assume that all stakeholders desire participation in decision-making when no clear method for conflict resolution and consensus-building has been established. This typically leads to a general inability to promote environmental sustainability.

2.11.5 Cultural and Social Factors

The political and socio-economic climate influenced stakeholders' attitudes toward adopting sustainable models in construction projects in Pakistan. In Pakistan, social factors such as community involvement, cultural perceptions of the environment, and attitudes towards sustainability engagement influenced the effectiveness of public engagement programs. If communities have excluded from planning and decision-making, they may resist sustainable practices if such changes were perceived as threats to their established livelihoods or lifestyles. Major decisions in projects were often constrained by the government or regulatory environment that can include both broader government policy initiatives [73].

Contend that people in the local communities should be involved at the early stages of planning so that their issues have integrated and therefore improve the probability that the interventions will be adopted and supported. Community opposition, particularly out of distruster lack of participation in the project, improving sustainability measures ineffective.

Chapter 3

Research Methodology

3.1 Background

This chapter defines the methodical strategy employed to tackle the research challenge and fulfill the study's objectives. Research methodology is an essential component of any study, offering a systematic framework that directs the complete process of data gathering, analysis, and interpretation. This chapter provides a detailed account of the research process, commencing with the selection of the suitable study design and the identification of the principal components affecting the phenomenon being studied. This chapter explains the method used to establish the sample size and outline the demographic traits of the participants. After that, it looks at the questionnaire development process, outlining how the survey tool was created to gather crucial information on the relevant factors. This chapter also describes the methods for gathering and analyzing data, ensuring that the approaches are suitable for solving the research challenge. The research technique underpins the study by connecting the research design with its aims and objectives, so ensuring that the findings are credible and significant. The methodology facilitates the researcher in describing, evaluating, and predicting the phenomena under investigation using a structured approach, while also guaranteeing transparency and reproducibility in the process. This research outlines methodologies that address the specific issues of the construction industry, emphasizing their ability to yield significant insights regarding sustainability and stakeholder engagement factors.

3.2 Framework of the Research Methodology

This study seeks to evaluate the roles of both internal and external stakeholders in construction projects and their contributions to enhancing the social and economic aspects of sustainability, ultimately aiming to achieve the overarching goal of sustainability. The key study topics have been organized, and the connection between stakeholder participation and sustainability pillars is clarified through a comprehensive literature review. A questionnaire has been created, and insights from the respondents are collected through a review of the literature. After conducting a statistical analysis of the data, the factors influencing sustainability are prioritized through the relative importance index method. The flow chart and methodologies utilized in the present study are illustrated in Fig 3.1.

3.2.1 Stage 1-Problem Identification

This study was initiated with a preliminary literature review to select the appropriate and suitable topic for carrying out the research work. The major criteria for topic selection were to identify a topic that can address the current issue of the construction industry of Pakistan.

3.2.2 Stage 2-Literature Review

The initial phase of the research process entails performing a comprehensive literature review. This phase is essential as it establishes a fundamental comprehension of the research issue and situates the study within the current body of knowledge. The review not only informs the formulation of the issue statement but also assists in delineating the research objectives by emphasizing critical themes and deficiencies in existing research.

3.2.3 Stage 3-Defining the Problem

Based on the conclusion of the thorough literature review, problems in the area of stakeholders management in Pakistan were summarized and construction industry-based problem was defined.

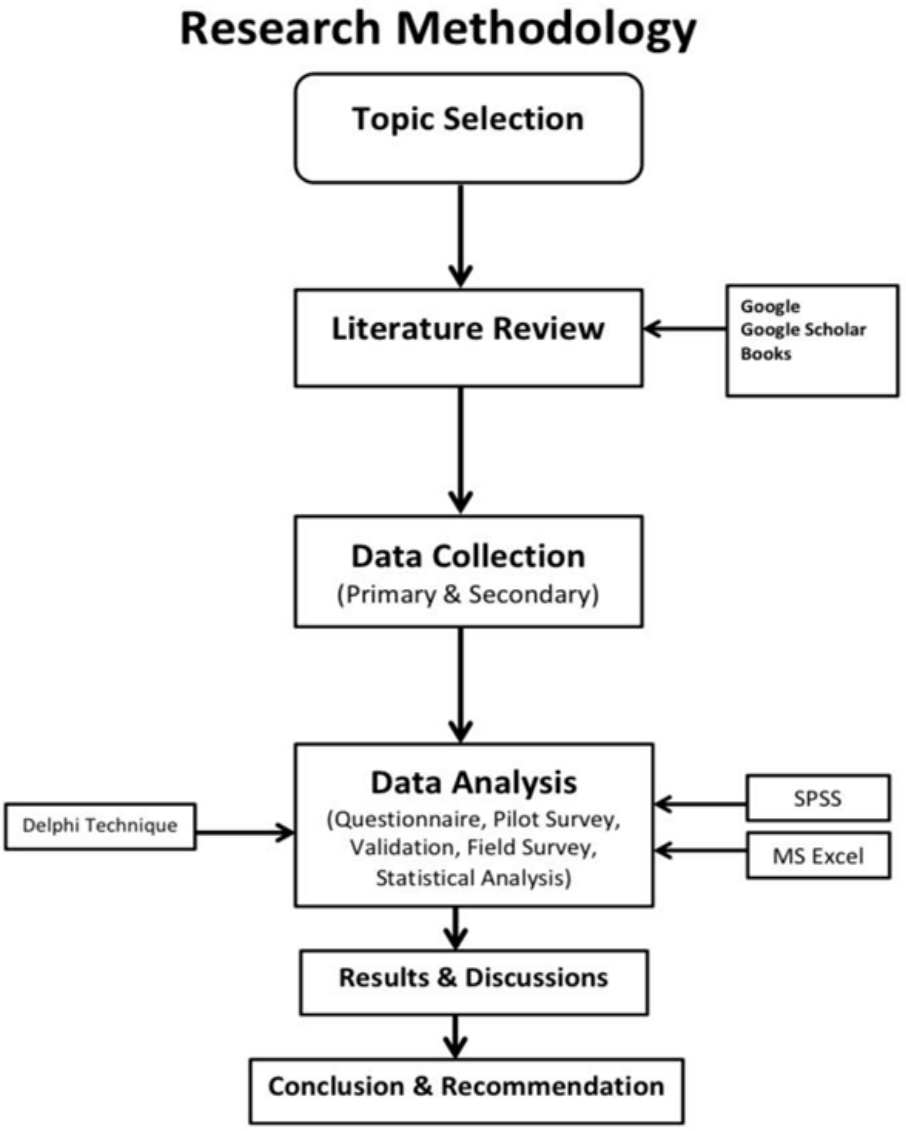

FIGURE 3.1: Flow chart of Research Methodology

3.2.4 Stage 4-Aim and Objectives

Following the identification of the problem, the study's aim and objectives were established to tackle the issue of enhancing the performance of Pakistan's construction industry.

3.2.5 Stage 5-Design of Data Collection Tool

This investigation employed a quantitative methodology for data gathering to fulfill its aims. A structured questionnaire was created as the main instrument for

data collection. The questionnaire was meticulously crafted to investigate the correlation between stakeholder engagement and the sustainability of construction projects. The study concentrated on evaluating the effects of stakeholder disengagement, pinpointing significant stakeholder issues, and examining risks associated with stakeholder participation. The collected data formed the basis for recommending policies to enhance stakeholder engagement and promote sustainable construction practices.

3.2.6 Stage 6-Data Collection

The data collection process involved administering a survey that utilized a structured questionnaire. The questionnaire was transformed into a digital format through an online data collection tool, resulting in the creation of a shareable link for streamlined distribution. The information was disseminated to participants through email and messaging platforms to guarantee wide accessibility. The questionnaire was first distributed to a broader audience, and responses are collected. After collecting responses, a validation process is conducted to ensure the quality and reliability of the data. This process included checking for completeness (i.e., whether all required questions were answered), consistency (i.e., logical flow of answers), and accuracy of responses. Any responses with excessive missing data, random or contradictory answers, or evident response bias were excluded from further analysis. Furthermore, a reliability analysis (using Cronbachs Alpha) is conducted after data collection, which led to the exclusion of six responses that compromised the internal consistency of the dataset. Only the final set of 169 responses that met all quality criteria is retained for the main analysis. This multistep validation approach ensured the credibility and robustness of the dataset used in this research.

3.2.7 Data Analysis

Data analysis aimed to categorize and rank the parameters in the investigation. Collected data was converted and transformed into SPSS format for analysis. For the analysis purpose in this study, SPSS V25 and Microsoft Excel were used.

3.3 Conduct of Survey

The questionnaire is distributed among a wide range of stakeholders involved in the construction industry, including clients, developers, contractors, consultants, etc. The survey, conducted via Google Forms, aimed to gather insights into the role of stakeholder engagement in sustainable building construction management. Responses were collected from registered participants across Rawalpindi and Islamabad which shows the geographical boundaries of the survey respondents. This ensures that the feedback reflects a diverse range of perspectives from various stakeholders within the construction sector.

To assess the significance of stakeholder engagement, a five-point Likert scale was used, where respondents rated the importance of different aspects of engagement, from "strongly not agree" to "strongly agree." Participants were also invited to suggest any additional aspects of stakeholder engagement that were not included in the questionnaire. The survey was distributed through both direct and indirect methods, with construction industry organizations facilitating outreach, and a list of relevant construction professionals compiled for direct contact. The questionnaires were sent via email or paper format, with follow-up reminders issued to ensure maximum participation.

3.4 Sample Size and Questionnaire Development

The sample size is a small group of people (respondents) taken from the exposed population to represent the whole population Sample size in this research was determined by the formula suggested by [74] as in equation 3.1. Yamanes formula, 1967, is one of the common methods in survey research used to estimate an appropriate sample size for any given population with concern for precision and practicality. This formula approximates the sample size based on the total size of a population and desired margin of error. For using this method, 95% confidence levels are considered. The formula for Yamane's sample size calculation is:

$$n = \frac{N}{1 + N(e^2)} \tag{3.1}$$

Where:

n = sample size; N = population size; e = margin of error

$$n = \frac{185}{1 + 185(0.05^2)} \approx 126 \tag{3.1}$$

From the above formula, the required sample size for this study is considered 126. Since, number of samples collected in the research work is more than 126 [75], hence the samples used in this study are adequate for analysis.

3.5 Scale for Data Measurement

The questionnaire was made for the statistical analysis of data. The parameters used in the survey were investigated for measuring the level of the adoption and level of effectiveness with the help of a5-point Likert scale. Several measurement scales were used for different parameters of investigation as presented in table 3.1. The questionnaire with a 5-point Likert scale is used to enable respondents provides the appropriate solution to the questions raised. It was developed to collect quantitative data which used a stratified random sampling technique to determine the sample size and respondents who were a representation of the entire population.

TABLE 3.1: Likert Measurement Scale

Level of Adoption	**Scale**
Strongly not agree	1
Not agree	2
Neutral	3
Agree	4
Strongly Agree	5

3.6 Method of Data Analysis

3.6.1 Reliability Test

A reliability test is performed to assess the consistency of the collected data. The measurement is determined by the value of Cronbach's alpha (α). The Cronbach

Alpha value was calculated using the SPSS software package and evaluated according to specific criteria: a value below 0.5 is deemed unacceptable, between 0.5 and 0.6 is considered poor, between 0.6 and 0.7 is questionable, above 0.7 is acceptable, and values between 0.8 and 0.9 are regarded as good to excellent, as illustrated in table 3.2 there range from unacceptable to excellent as referenced from [75].

TABLE 3.2: Ranging Scale of Cronbachs Alpha, [76].

Internal Consistency	**Cronbach's Alpha**
Excellent	Alpha ≥ 0.9
Good	0.8 Alpha < 0.9
Acceptable	$0.7 \leq$ Alpha < 0.8
Questionable	$0.6 \leq$ Alpha < 0.7
Poor	$0.5 \leq$ Alpha < 0.6
Unacceptable	Alpha < 0.5

3.6.2 Normality Test

Shapiro-W-test Wilk's (1965) is a well-established and reliable technique for determining normality. The Shapiro-Wilk test, often known as the normality test, is used to determine whether or not the data obtained is normal. If data is normally distributed (parametric data), then the significant level should really be larger than 0.05, but a value less than 0.05 indicates that the data range is not normal (nonparametric data).

3.6.2.1 Parametric and Non-parametric Evaluation

In statistical analysis, the choice between parametric and nonparametric tests is made when the results do not confirm the test hypothesis. The parametric test is valid for a stable, regularly distribution pattern with precisely defined spreads for each group, as well as for linear data. However non-parametric tests are performed. when data is examined on ordinal and ordered scales, doesnt really follow a specific distribution, and exhibits non - linear behavior [77]. Non-parametric tests reveal

that the data are not distributed normally, whereas parametric tests demonstrate that the data are distributed normally. Kim and Park [78] demonstrated that a non-parametric test is utilized when data do not have a normal distribution. The normality hypothesis is rejected if p-value is less than or equal to 0.05. The normality assessment hypothesis is as follows: H0: The data follows a normal distribution if p-value greater than alpha level. H1: The data does not follow a normal distribution if p-value less than alpha level.

3.6.3 Relative Importance Index

TThis study methodology consisted of identifying and evaluating the intensity level of results associated with accidents and hazards, harmful behaviors, unsafe settings, management systems and social groups, and natural factors. The value of each component was calculated by averaging the data set values supplied by respondents. Therefore, the intensity level selected by respondents was used to compute the relative significance index for each piece. The 1-to-5 ranking scale was converted into a relative relevance index for each component in order to quantify the ranks of all the elements. RII is determined by the equation (3.2).

$$RII = \frac{W}{A \cdot N} \tag{3.2}$$

Where:

W = Weightage given to each factor by respondents ranges from 1 to 5 using Likert scale

A = Highest value for factors (which is 5 on the Likert scale)

N = Total number of respondents.

3.7 Summary

This is grounded in an extensive literature review that examines the challenges facing the Pakistani buildings construction sector, with a particular focus on the role of stakeholder engagement in promoting sustainable building construction.

The research aims to identify and analyze the key role that influence the adoption of sustainable practices in buildings construction projects, with the ultimate goal of meeting established sustainability criteria for construction sites. A survey-based approach was employed to collect data through questionnaires distributed to project managers, construction specialists, and other key personnel involved in the building projects. Descriptive research methods were used to assess the current implementation of sustainability practices. The Delphi technique was employed to identify critical strategies for effective stakeholder engagement and to guide the development of the questionnaire. A statistical approach was then applied to analyze the gathered data, leading to the formulation of key findings and actionable conclusions.

Chapter 4

Results and Analysis

4.1 Background

This chapter outlines the findings of the study, which were derived from a questionnaire survey designed to meet the studys objectives. The survey included Likert-type questions, allowing respondents to rate their level of agreement with various statements on a scale ranging from "strongly disagree" to "strongly agree." This format was chosen to capture more precise data, offering a clear measure of respondents' attitudes and opinions. Once the data was collected, responses were coded and analyzed using SPSS software, a tool commonly used in research for statistical analysis. This approach allowed for a structured and systematic analysis of the responses, ensuring that the findings were both reliable and accurate. To present the results effectively, tables and figures are used throughout the chapter. These visual aids help to highlight key patterns and trends in the data, making it easier to interpret and understand the findings. The chapter also includes background information on the respondents, such as demographic details, which provide important context for interpreting the data. These details help explain how factors like age, gender, and education might influence respondents' answers. The findings are then discussed in relation to the studys research objectives and questions. Each objective is addressed in detail, with the results analyzed and linked to the broader theoretical framework and existing literature. Where relevant, comparisons with similar studies are made to offer additional insight into

the significance of the findings. Overall, this chapter provides a comprehensive overview of the data collected through the questionnaire survey, presenting the results in a clear and organized manner. This analysis will form the basis for further discussion and conclusions in later chapters of the study.

4.2 Development of Questionnaire and Finalization

4.2.1 Coding of the Questionnaire

The coding of the questionnaire was done to systematically categorize and organize the questions for efficient analysis, as shown in appendix. Each question was assigned a unique alphanumeric code to represent its specific theme or focus area. For example, questions related to stakeholder engagement were coded under the prefix SE (e.g., SE.1 for the main question and SE.1a, SE.1b, etc., for the sub-questions). Questions regarding the Relevance of Project Success were categorized under the code RPS, with sub-codes like RPS.2a for specific stakeholders (e.g., clients, architects, Contractors). Similarly, questions addressing Role of Stakeholders Sustainability Challenges were grouped under the SSC code, such as SSC3 for the importance of communication tools and SSC6 for the impact of high costs on stakeholder engagement. Additionally, Practices for Improving Stakeholder engagement were assigned the code PIS, with sub-codes like PIS.18a for early involvement of stakeholders and PIS.18b for clear communication and transparency. This coding system allows for easy identification and referencing of each question within its thematic category, facilitating the organization and analysis of the responses in relation to key themes such as stakeholder engagement and sustainability in construction projects.

4.3 Analysis of Pilot Survey

Before the main survey was conducted, a pilot survey was carried out to test the effectiveness of the questionnaire and refine the research methodology. The selection criteria for experts in the pilot survey are based on their relevant expertise,

industry experience, and familiarity with the subject matter. Experts are considered for their in-depth knowledge in the field, ensuring the feedback provided is both credible and valuable. The feedback from these experts is crucial in refining the survey instrument, improving its reliability and validity. The primary goal of this pilot phase was to identify any potential issues with the questionnaire design, ensuring that the questions were clear, relevant, and likely to provide the desired information. Additionally, the pilot survey served as an opportunity to evaluate the overall research approach and make any necessary adjustments before administering the survey to the full sample. A selected group of individuals, representing a diverse cross-section of the target population, participated in the pilot survey. This diverse group was chosen to ensure that the questionnaire would be effective across various demographic segments, such as experience and educational background. By involving participants with different characteristics, the researcher was able to test how the questions would be understood and interpreted by people from various walks of life. The details of the participants in the pilot survey are provided in Table 4.1, 4.2, 4.3 4.4 & 4.5 which includes key demographic information about the sample.

The pilot survey used a smaller sample size compared to the main survey, which allowed for more focused feedback collection. This smaller group made it easier to engage with participants and gather detailed input on their experiences with the questionnaire. Participants were asked to provide feedback on various aspects of the survey, including the clarity of the questions, the length of the questionnaire, and whether any questions were confusing or difficult to answer.

The pilot survey was conducted to evaluate the clarity, relevance, and structure of the questionnaire designed for the main study. Feedback from respondents highlighted areas requiring improvement, including the need for simpler language, clearer instructions, and the removal of redundant or ambiguous questions. Respondents also suggested minimizing the number of questions to reduce the response burden, rephrasing technical terms for better understanding, adjusting the response scale for consistency, and improving the logical flow of sections. Based on these comments, necessary revisions were made to enhance the surveys reliability, conciseness, and ease of completion. After incorporating all recommended

changes, the final version of the survey questionnaire was approved for distribution in the main data collection phase.

TABLE 4.1: Details of Respondents Organization Type on Pilot Survey

S. No.	Response	No's	Percentage (%)
1	**Organization Type**		
a	Client	4	29%
b	Consultant	2	14%
c	Contractor	4	36%
d	Education and Research	3	21%
	Total	**13**	**100%**

TABLE 4.2: Details of Respondents Designation on Pilot Survey

S. No	Response	No's	Percentage (%)
2	**Designation**		
a	Assistant Professor	2	15%
b	Contracts Manager	1	8%
c	General Manager	1	8%
d	Owner/CEO	1	8%
e	Project Director	2	15%
f	Project Manager	5	46%
	Total	**13**	**100%**

TABLE 4.3: Details of Respondents Total Experience on Pilot Survey

S. No	Response	No's	Percentage (%)
3	**Highest Education Level**		
a	B.Sc. Civil Engineering	4	29%
b	M.S. Civil Engineering	6	50%
c	Ph.D.	3	21%
	Total	**13**	**100%**

In addition to this, the researchers were able to observe how long it took participants to complete the survey and identify any logistical challenges that could arise when conducting the main survey. The feedback from the pilot survey was invaluable in refining the questionnaire. Any questions that were unclear or ambiguous were reworded for clarity, ensuring that they would be better understood by the

TABLE 4.4: Details of Pilot Survey Respondents

S. No	Response	No's	Percentage (%)
4	**Total Years of Experience**		
a	11-15 years	2	16%
b	16-20 years	2	15%
c	20-25 years	5	38%
d	More than 26 years	3	31%
	Total	**13**	**100%**

TABLE 4.5: Details of Respondents Experience in Buildings on Pilot Survey

S. No	Response	No's	Percentage (%)
5	**Years of Experience in Building Construction**		
a	6-10 years	2	15%
b	11-15 years	3	23%
c	16-20 years	1	8%
d	20-25 years	5	38%
e	More than 26 years	2	15%
	Total	**13**	**100%**

larger group of respondents in the main survey. Moreover, the pilot phase helped identify any technical or operational issues related to survey administration, such as issues with online survey tools or difficulties with data collection. By addressing these issues early on, the research team was able to ensure that the main survey would run smoothly. Overall, the pilot survey was an essential step in the research process. It allowed the research team to test the questionnaire and research approach, making necessary modifications before the main survey was distributed to the full sample. The insights gained from the pilot survey helped improve the reliability and validity of the data collected in the main survey, contributing to a more accurate and effective study.

4.3.1 Demographic Analysis of Actual Survey

The details of the respondents provided are based on the final questionnaire survey conducted to examine the role of stakeholders in sustainable building construction projects. A total of 175 responses were initially collected; however, 6 responses

were excluded after screening for not meeting the criteria for the targeted respondents. This left 169 valid responses, which were analyzed to gain insights into the involvement of various stakeholders in sustainable construction projects. The respondents were drawn from diverse positions within the construction industry to ensure a comprehensive representation of the sector.

From the main survey, six responses were excluded based on the results of the reliability test and data quality assessment. These responses showed low internal consistency, with indicators such as extremely low item-total correlations and poor Cronbach's Alpha contributions. Additionally, patterns such as straight-lining (selecting the same option repeatedly), incomplete answers, or illogical response sequences further justified their removal. The decision was made to ensure the validity and reliability of the overall data analysis, maintaining a high standard for statistical integrity in the study.

Among the 169 valid responses, 16 respondents were Owners/CEOs, offering strategic-level insights into sustainability decision-making and organizational priorities. Additionally, 15 Project Directors and 48 Project Managers provided their expertise on project planning and execution, shedding light on the management processes that drive sustainability in construction. Twenty-one Resident Engineers and 28 Construction Managers contributed practical insights based on their experience in overseeing daily operations on construction sites, addressing challenges related to resource management, energy efficiency, and waste reduction. Five Contract Managers shared their perspectives on the legal and financial aspects of sustainable construction, while 34 Site Engineers provided input from an operational standpoint, focusing on the technical implementation of sustainable practices. Finally, 2 Assistant Professors offered academic perspectives, adding theoretical insights to contextualize the survey findings.

The validity of the 169 responses was ensured through several steps. First, the questionnaire was refined based on expert feedback and a pilot survey, which helped improve clarity, relevance, and question structure. Second, data screening was conducted to remove incomplete, inconsistent, or patterned responses. Third, content validity was maintained by aligning the survey items with well-established constructs from the literature. Finally, construct validity was assessed through

reliability tests (e.g., Cronbach's Alpha) and factor analysis, confirming that the responses accurately measured the intended variables. These steps collectively supported the robustness and validity of the final dataset.

The distribution of respondents by designation is shown in Figure 4.1 below, reflecting the broad spectrum of roles involved in building construction projects. This diversity underscores the critical need for collaboration across various sectors, with each role playing a vital part in effectively integrating sustainability into construction practices. The varied representation of stakeholders emphasizes that successful sustainability implementation relies on contributions from all sectors involved in the project. Furthermore, this diverse input is essential for addressing the complex challenges associated with sustainable building construction projects and ensuring a holistic approach to project success.

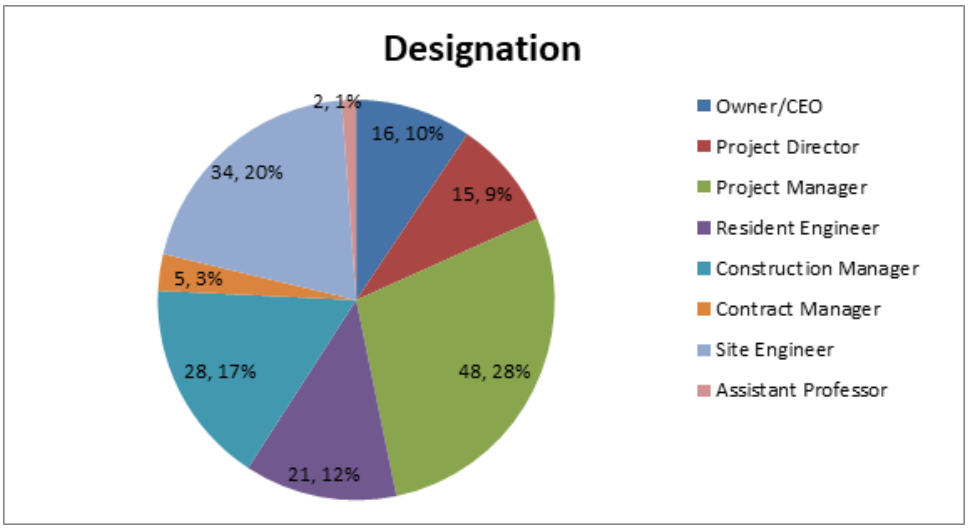

FIGURE 4.1: Designations of Respondents

The educational background of the survey respondents highlights a diverse range of academic qualifications, as illustrated in the figure 4.2. Among the 169 valid responses, 2 respondents held a Ph.D., showcasing a high level of expertise and research-based knowledge in the field. A significant portion of the respondents, 71 individuals, held an M.Sc. in Civil Engineering, indicating a strong foundation in advanced civil engineering concepts and practices. Additionally, 79 respondents held a B.Sc. in Civil Engineering, reflecting a broad base of professional experience and technical knowledge in the field. Finally, 17 respondents had completed

an Associate Diploma in Civil Engineering, demonstrating a practical, hands-on approach to the industry. This varied educational background enriches the survey results by incorporating insights from both academic and practical perspectives, contributing to a well-rounded understanding of sustainable building construction.

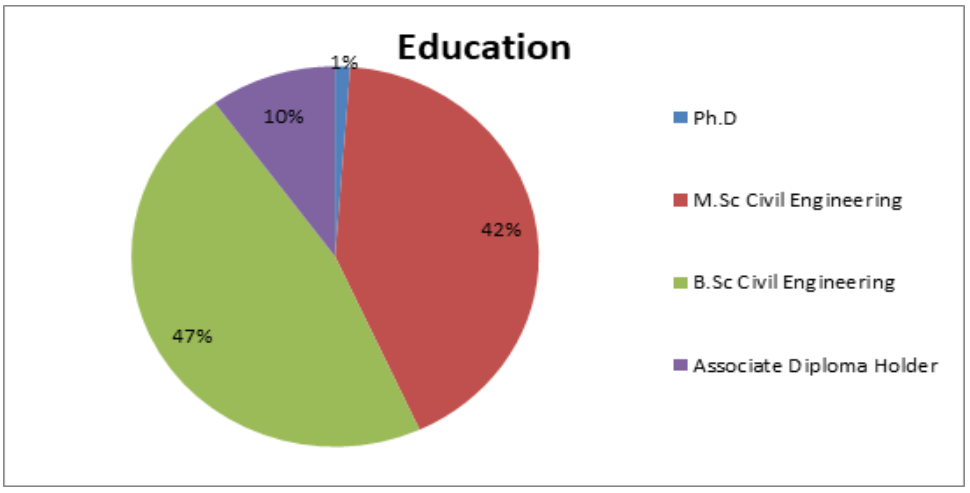

FIGURE 4.2: Education of Respondents

The professional background of the survey respondents reflects a diverse range of roles within the construction industry, as shown in the figure 4.3. Among the 169 valid responses, 54 respondents were Developers/Clients, providing insights from a strategic and decision-making perspective on sustainable building construction projects. A larger portion, 75 respondents, were Contractors, contributing valuable practical knowledge regarding the execution and management of construction projects on the ground. Additionally, 37 respondents were Consultants, offering expertise in design, planning, and project management, with a focus on sustainability considerations. Finally, 3 respondents were Academics, bringing an academic and research-based perspective to the analysis.

This diverse representation of professional roles ensures a comprehensive understanding of the factors influencing sustainable construction practices from multiple viewpoints within the industry.

The survey respondents varied in terms of their years of experience in the construction industry, as shown in the figure 4.4 below. Eighteen respondents had 1-5 years of experience, while 48 had 6-10 years, reflecting a solid foundation in the

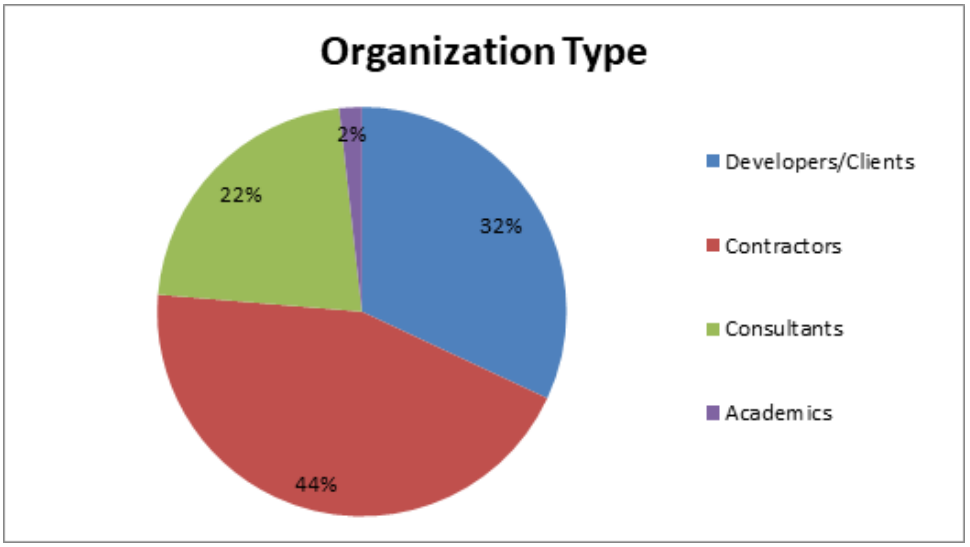

FIGURE 4.3: Respondents Organization Type

field. Thirty-eight respondents had 11-15 years of experience, and 24 had 16-20 years, showcasing significant expertise. Additionally, 20 respondents had 20-25 years of experience, with 21 respondents boasting more than 25 years, offering a wealth of knowledge and long-term industry insights. This diverse experience range provides a comprehensive view of the industry's evolving dynamics.

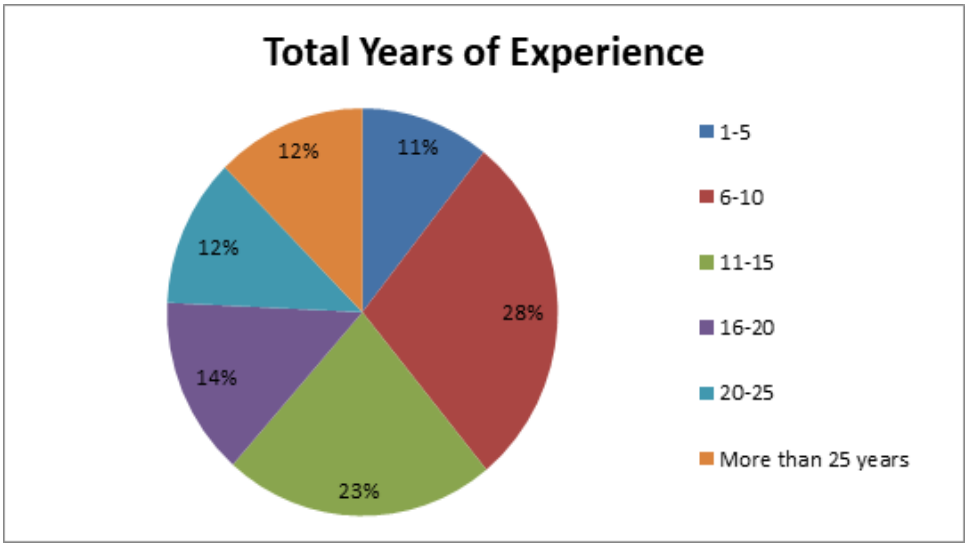

FIGURE 4.4: Total Years of Experience of the Respondents

The survey respondents also varied in terms of their years of experience specifically in building projects, as shown in the figure 4.5. Thirty-two respondents had 1-5 years of experience in building projects, while 46 had 6-10 years. Thirty-seven respondents had 11-15 years of experience, and 24 had 16-20 years.

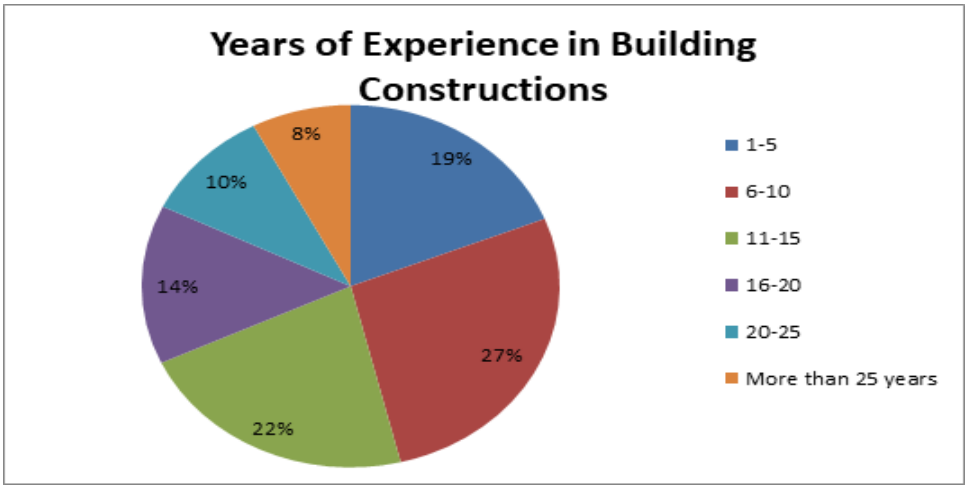

FIGURE 4.5: Years of Experience in Building Projects of Respondents

Additionally, 17 respondents had 20-25 years of experience, with 13 respondents bringing more than 25 years of expertise in building projects. This range of experience provides valuable insights into the practical challenges and innovations in sustainable building construction across different stages of professional development.

4.3.2 Response Rate

Out of the 200 potential respondents, 175 responses were received. Hence the overall response rate of the survey was 87.5%. This response rate is above the acceptable range (5% to 30%) as per already published literature [79].

4.4 Statistical Analysis

In this section, the statistical methods used to analyze the data is outlined. The aim is to provide insights into the reliability, validity, and general consistency of the data, ensuring that the results are accurate and trustworthy for the analysis that follows.

4.4.1 Reliability Analysis

The table 4.6 summarizes the data used for analysis, including the valid and excluded cases. This step is crucial in ensuring the integrity of the dataset and

informing readers about the proportion of valid data that is being considered in subsequent analyses.

TABLE 4.6: Reliability Analysis

Category	**N**	**%**
Valid Cases	162	95.9%
Excluded Cases	7	4.1%
Total	**169**	**100%**

A total of 169 cases were initially available for analysis, 162 cases were valid for analysis, representing 95.9% of the dataset, while 7 cases were excluded, which constitutes 4.1%. Exclusion was based on list wise deletion, meaning that cases with missing data across any of the variables included in the analysis were excluded from the dataset. This ensures that the analysis is conducted on a complete dataset, avoiding any bias that could arise from missing values. Reliability analysis is conducted using Cronbach's Alpha to assess the internal consistency of the scale items as shown in Table 4.7. A higher Cronbachs Alpha value indicates a more reliable scale.

TABLE 4.7: Cronbach's Alpha

Cronbach's Alpha	**No of Items**
0.941	**31**

The Cronbach's Alpha value of 0.941 indicates excellent internal consistency across the 31 items measured. Generally, a value above 0.9 is considered excellent [80], suggesting that the items in the scale are highly correlated and measure the same underlying construct. This high level of reliability assures that the scale used in the study is dependable and provides meaningful results for further analysis.

The table 4.8 displays the descriptive statistics for each individual item, including the mean, standard deviation, and the number of valid responses. These statistics offer insight into how participants rated each item and the consistency of their responses. Mean values for most items are above 4, suggesting that respondents generally provided positive ratings across all items, with 4.0 being close to the higher end of the scale (the scale is from 1 to 5).

The standard deviations reveal how much variability there is in the responses for each item. For example:

Items like SSC5 (Mean = 3.605, Std. Dev. = 1.1919) and SSC4 (Mean = 3.802, Std. Dev. = 1.0386) show higher variability, meaning responses to these items were more spread out.
Items like PIS18a (Mean = 4.414, Std. Dev. = 0.8010) have relatively low variability, indicating that respondents were more consistent in their responses for these items.
Several items received comparatively lower ratings from the respondents. The item SSC5 exhibited the lowest mean score of 3.605, indicating that this particular aspect was rated less favorably by the participants. Similarly, SSC4 and SSC6 followed closely with mean scores of 3.802, suggesting that these items also received relatively lower evaluations.

This distribution of means and standard deviations reflects a generally positive and consistent trend in the data, with slight variability in certain items (likely influenced by the nature of the questions or the diversity of respondents views).

These statistical analyses provide a comprehensive overview of the dataset. The reliability statistics indicate that the scale is highly reliable, and the item statistics show that most items have strong internal consistency with moderate variability. This ensures that the data is well-suited for further analysis.

In terms of validity, while the primary focus of the analysis is on reliability, the consistency in the data and the structure of the items suggests that the scale is likely valid for measuring the intended constructs. The high Cronbach's Alpha value of 0.941 (as shown in the Reliability Statistics table) supports the idea that the items in the scale are highly inter-correlated and consistently measure the same underlying concept [81]. This internal consistency is an important indicator of construct validity, which is the extent to which the items reflect the theoretical construct they aim to measure. Furthermore, the relatively high means across most of the individual items (as detailed in the Item Statistics table), combined with the low to moderate standard deviations, suggest that the scale is effectively capturing respondents' perceptions and experiences in a way that is both consistent and meaningful. While content validity and criterion-related validity were

TABLE 4.8: Mean Value Analysis

	Mean	Std. Deviation	N
SE1a	4.531	0.7655	162
SE1b	4.321	0.8752	162
SE1c	4.278	0.8506	162
SE1d	4.383	0.8048	162
RPS2a	4.389	0.8285	162
RPS2b	4.123	0.9107	162
RPS2c	4.457	0.8045	162
RPS2d	4.432	0.7549	162
RPS2e	4.056	0.7979	162
SSC3	4.352	0.7679	162
SSC4	3.802	1.0386	162
SSC5	3.605	1.1919	162
SSC6	3.802	0.9112	162
SSC7	4.006	0.9938	162
SSC8	4.056	0.9408	162
SSC9	4.093	0.9178	162
SSC10	4.037	0.9645	162
SSC11	4.019	0.9618	162
SSC12	3.84	1.027	162
SSC13	4.093	0.9178	162
SSC14	4.148	0.9983	162
SSC15	4.179	0.9184	162
SSC16	4.105	0.9755	162
SSC17	3.84	0.9517	162
PIS18a	4.414	0.801	162
PIS18b	4.37	0.7793	162
PIS18c	4.216	0.8245	162
PIS18d	4.389	0.7414	162
PIS18e	4.08	0.856	162
PIS18f	4.395	0.7589	162
PIS18g	4.315	0.845	162

not directly assessed in this analysis, the strong internal consistency provides preliminary evidence that the instrument is likely valid for the purpose of this study.

4.4.2 Normality Analysis

To check the normality of the data, Shapiro-Wilk and K-S normality test was conducted as the sample size was less than 2000. This test was performed to evaluate whether the collected data was normally distributed or not, i.e. the

data was parametric or non-parametric. The results presented in the table 4.9 below provide the outcomes of two normality tests, the Kolmogorov-Smirnov (K-S) test and the Shapiro-Wilk (S-W) test, for each variable in the dataset. The tests aim to assess whether the data significantly deviate from a normal distribution. For all variables, the significance (Sig.) values for both tests are reported as 0.000, which is below the commonly used threshold of 0.05. This suggests that for each variable, the null hypothesis of normality is rejected, implying that the data for all the variables in the analysis do not follow a normal distribution. The Kolmogorov-Smirnov test, which is based on the largest distance between the empirical cumulative distribution function and the expected cumulative distribution for a normal distribution, shows relatively higher statistics (ranging from 0.197 to 0.378). The Shapiro-Wilk test, which tests the null hypothesis that the data is normally distributed by comparing the sample distribution to a normal distribution, consistently shows statistics ranging from 0.640 to 0.873 [82]. Despite the fact that the Shapiro-Wilk test statistics are generally higher, both tests indicate significant departures from normality, as evidenced by the extremely low significance values. The skewness values for most items are negative and exceed the usual threshold of -1 to +1, indicating that the data is not perfectly normal. A negative skew means the data is somewhat "left-skewed" (with a longer tail on the left side), suggesting most responses are clustered towards the higher end of the Likert scale. The kurtosis values for most items are positive and exceed 3, which suggests leptokurtic distributions (more data clustered at the center with heavier tails). This also indicates that your data is not following a normal distribution.

These results suggest that the data from all variables are not normally distributed, which may have implications for subsequent statistical analyses. It considers using non-parametric tests or transforming the data before proceeding with further analyses that assume normality.

4.4.2.1 Kruskal Wallis Test for Non-Parametric Data

The results of the Kruskal-Wallis test for all variables are summarized in Table 4.10. Across all tests, the significance values (Sig.) were consistently above the

TABLE 4.9: Normality Test for Questionnaire Survey

Tests of Normality						
	Kolmogorov-Smirnova			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
SE1a	0.378	162	0	0.64	162	0
SE1b	0.293	162	0	0.734	162	0
SE1c	0.259	162	0	0.743	162	0
SE1d	0.328	162	0	0.739	162	0
RPS2a	0.313	162	0	0.706	162	0
RPS2b	0.24	162	0	0.81	162	0
RPS2c	0.349	162	0	0.683	162	0
RPS2d	0.33	162	0	0.716	162	0
RPS2e	0.238	162	0	0.832	162	0
SSC3	0.282	162	0	0.732	162	0
SSC4	0.197	162	0	0.868	162	0
SSC5	0.247	162	0	0.873	162	0
SSC6	0.259	162	0	0.869	162	0
SSC7	0.275	162	0	0.814	162	0
SSC8	0.273	162	0	0.808	162	0
SSC9	0.275	162	0	0.802	162	0
SSC10	0.256	162	0	0.824	162	0
SSC11	0.27	162	0	0.822	162	0
SSC12	0.29	162	0	0.838	162	0
SSC13	0.275	162	0	0.802	162	0
SSC14	0.256	162	0	0.77	162	0
SSC15	0.262	162	0	0.773	162	0
SSC16	0.272	162	0	0.786	162	0
SSC17	0.252	162	0	0.865	162	0
PIS18a	0.324	162	0	0.707	162	0
PIS18b	0.303	162	0	0.735	162	0
PIS18c	0.249	162	0	0.791	162	0
PIS18d	0.301	162	0	0.725	162	0
PIS18e	0.222	162	0	0.825	162	0
PIS18f	0.306	162	0	0.724	162	0
PIS18g	0.291	162	0	0.751	162	0
Total	0.117	162	0	0.85	162	0

standard threshold of 0.05. Consequently, the null hypothesis was retained for each variable. This implies that no statistically significant differences were observed in the distribution of stakeholder engagement attributes (e.g., SE1a, SE1b, etc.) across different stakeholder categories. To evaluate whether stakeholder engagement perceptions and practices vary across different stakeholder groups (ID), the Kruskal-Walli's test was applied. The test examined responses to multiple

variables, including:

Importance of Stakeholder Engagement (e.g., setting project goals, resource allocation, project execution).

Relevance of Stakeholders (e.g., clients, architects, engineers, contractors, regulatory agencies).

Barriers to Engagement (e.g., lack of funding, unclear regulations, technical expertise).

Strategies to Enhance Engagement (e.g., early involvement, capacity building, adoption of technology).
If the p-value is less than 0.05, reject the null hypothesis, meaning there is a significant difference between the groups in terms of their Likert responses [83].
If the p-value is greater than 0.05, you fail to reject the null hypothesis, indicating there is no significant difference between the groups.

This consistency in responses highlights a shared perception among stakeholders on critical issues like the importance of effective communication, the impact of funding limitations, the need for capacity-building initiatives, and the challenges posed by unclear or changing regulations. The uniformity in stakeholder views suggests that barriers to engagement, such as high costs, insufficient funding for training, and limited technical expertise in sustainable practices, are systemic rather than specific to any particular stakeholder group. Furthermore, it underscores the importance of collaborative efforts in addressing these challenges to achieve sustainability goals.
The findings also indicate opportunities for implementing standardized approaches across the industry to enhance stakeholder engagement. Strategies like early involvement, transparent communication, the use of advanced technologies such as BIM, and culturally sensitive decision-making practices are likely to be well-received across different stakeholder groups. Additionally, policymakers and project managers can leverage this alignment to establish clear sustainability guidelines and foster industry-wide solutions to common challenges. Overall, the results reinforce the significance of stakeholder engagement in sustainable buildings construction management and provide a foundation for developing targeted strategies to improve collaboration and project outcomes.

TABLE 4.10: Kruskal Wallis Test Result

Null Hypothesis	Sig	Decision
SE.1a	0.485	Retain the null hypothesis
SE.1b	0.485	Retain the null hypothesis
SE.1c	0.485	Retain the null hypothesis
SE.1d	0.485	Retain the null hypothesis
RPS.2a	0.485	Retain the null hypothesis
RPS.2b	0.485	Retain the null hypothesis
RPS.2c	0.485	Retain the null hypothesis
RPS.2d	0.485	Retain the null hypothesis
RPS.2e	0.485	Retain the null hypothesis
SSC3	0.485	Retain the null hypothesis
SSC4	0.485	Retain the null hypothesis
SSC5	0.485	Retain the null hypothesis
SSC6	0.485	Retain the null hypothesis
SSC7	0.485	Retain the null hypothesis
SSC8	0.485	Retain the null hypothesis
SSC9	0.485	Retain the null hypothesis
SSC10	0.485	Retain the null hypothesis
SSC11	0.485	Retain the null hypothesis
SSC12	0.485	Retain the null hypothesis
SSC13	0.485	Retain the null hypothesis
SSC14	0.485	Retain the null hypothesis
SSC15	0.485	Retain the null hypothesis
SSC16	0.485	Retain the null hypothesis
SSC17	0.485	Retain the null hypothesis
PIS.18a	0.485	Retain the null hypothesis
PIS.18b	0.485	Retain the null hypothesis
PIS.18c	0.485	Retain the null hypothesis
PIS.18d	0.485	Retain the null hypothesis
PIS.18e	0.485	Retain the null hypothesis
PIS.18f	0.485	Retain the null hypothesis
PIS.18g	0.485	Retain the null hypothesis

4.4.3 Prioritization of Stakeholder Roles and Challenges in Sustainable Building Projects

The table 4.11 outlines various aspects related to stakeholder engagement, categorizing them into different groups such as practices, challenges, relevance for

project success, and types of stakeholders. These factors are evaluated using the Relative Importance Index (RII) and rankings, helping to highlight the relative significance of each aspect in sustainable building projects in Pakistan.

Stakeholder Engagement (SE):

The SE.1a practice, with an RII of 0.9065, holds the highest rank, indicating its crucial role in setting project goals and ensuring effective stakeholder participation.

Other practices such as SE.1d (RII = 0.8757, Rank 2), focusing on the smooth operation of project execution, and SE.1b (RII = 0.8615, Rank 11), focusing on project planning and resource allocation, also play a significant role in the overall success of the project.

Relevance of Project Success (RPS):

RPS.2c, which refers to the involvement of engineers (structural, civil, MEP), is ranked 1st with an RII of 0.8899, indicating that these stakeholders are essential for ensuring the technical feasibility and success of the project.

RPS.2a (RII = 0.8769, Rank 3) and RPS.2d (RII = 0.8852, Rank 2) are also highly ranked, underscoring the importance of clients (owners/developers) and principal contractors in achieving project goals.

In contrast, RPS.2e (RII = 0.8118, Rank 23) indicates that regulatory agencies, while important, are considered slightly less critical for the success of the project compared to other stakeholders.

Stakeholder Sustainability Challenges (SSC):

SSC3, with an RII of 0.8710, is ranked 1st, signifying that the use of updated communication and collaboration tools is essential in reducing project failures.

SSC14 (RII = 0.8319, Rank 3) addresses balancing safety requirements with sustainable practices, which is a common challenge in construction projects.

Other challenges like SSC4 (RII = 0.7585, Rank 30) emphasize the prioritization of economics over sustainability, while SSC5 (RII = 0.7242, Rank 31) highlights the issue of involving sustainability experts too late in project execution.

Practices for Improving Stakeholder Engagement (PIS):

PIS.18a, which involves early stakeholder involvement, holds a high rank with an RII of 0.8840, indicating that engaging stakeholders at the early stages of project planning is essential for the successful integration of sustainability.

PIS.18d (RII = 0.8745, Rank 2) and PIS.18f (RII = 0.8733, Rank 3) emphasize the importance of regular stakeholder meetings, feedback loops, and adopting technology tools for collaboration.

In summary, the table identifies the varying importance of different stakeholder types, practices, and challenges in sustainable building projects. The highest-ranking aspects are those directly related to stakeholder engagement, communication tools, and the involvement of key stakeholders such as engineers and clients. The lower-ranking items highlight challenges related to resource allocation, regulations, and balancing sustainability with economic factors. These rankings provide valuable insights into the critical areas that should be prioritized to ensure the success of sustainable building projects.

4.4.4 Analysis of Respondent Trends and Perspectives

The frequency analysis of the questionnaire results provides a clear overview of respondents' opinions and attitudes towards stakeholder engagement and sustainability practices in building construction projects. By examining the distribution of responses across the various questions, we can identify common trends, areas of agreement or disagreement, and key concerns among stakeholders. The results highlight the importance of early involvement, clear communication, and the challenges posed by factors such as high costs and insufficient training. Below are the figures 4.6 (a, b & c) 4.7 (a, b & c) & 4.8 (a, b & c) 4.9 (a, b & c), illustrating the frequency and levels of agreement of the respondents, which further emphasize areas that require attention.

Fig 4.6 illustrates the level of agreement, 92% of respondents show agreement with SE1a, 87% show agreement with SE1b and 86% show agreement with SE1d.

TABLE 4.11: Relative Importance Index Analysis for Data

ID	A*N	RII=W/A*N	RANK	RANKING INDIVIDUAL
SE.1a	845	0.9065	1	**1**
SE.1b	845	0.8615	11	**3**
SE.1c	845	0.8556	13	**4**
SE.1d	845	0.8757	6	**2**
RPS.2a	845	0.8769	5	**3**
RPS.2b	845	0.8284	17	**4**
RPS.2c	845	0.8899	2	**1**
RPS.2d	845	0.8852	3	**2**
RPS.2e	845	0.8118	23	**5**
SSC3	845	0.871	10	**1**
SSC4	845	0.7585	30	**14**
SSC5	845	0.7242	31	**15**
SSC6	845	0.7644	29	**13**
SSC7	845	0.8059	25	**9**
SSC8	845	0.813	22	**7**
SSC9	845	0.8213	18	**4**
SSC10	845	0.8106	24	**8**
SSC11	845	0.8047	26	**10**
SSC12	845	0.7739	28	**12**
SSC13	845	0.8189	20	**6**
SSC14	845	0.8319	16	**3**
SSC15	845	0.839	15	**2**
SSC16	845	0.8201	19	**5**
SSC17	845	0.7751	27	**11**
PIS.18a	845	0.884	4	**1**
PIS.18b	845	0.8721	9	**4**
PIS.18c	845	0.8437	14	**6**
PIS.18d	845	0.8745	7	**2**
PIS.18e	845	0.8153	21	**7**
PIS.18f	845	0.8733	8	**3**
PIS.18g	845	0.8603	12	**5**

Fig 4.7 illustrates the level of agreement, 89% of respondents show agreement with RPS2a, 90% show agreement with RPS2c and 90% show agreement with RPS2d.

Fig 4.8 illustrates the level of agreement, 90% of respondents show agreement with SSC3, 82% show agreement with SSC14 and 85% show agreement with SSC15.

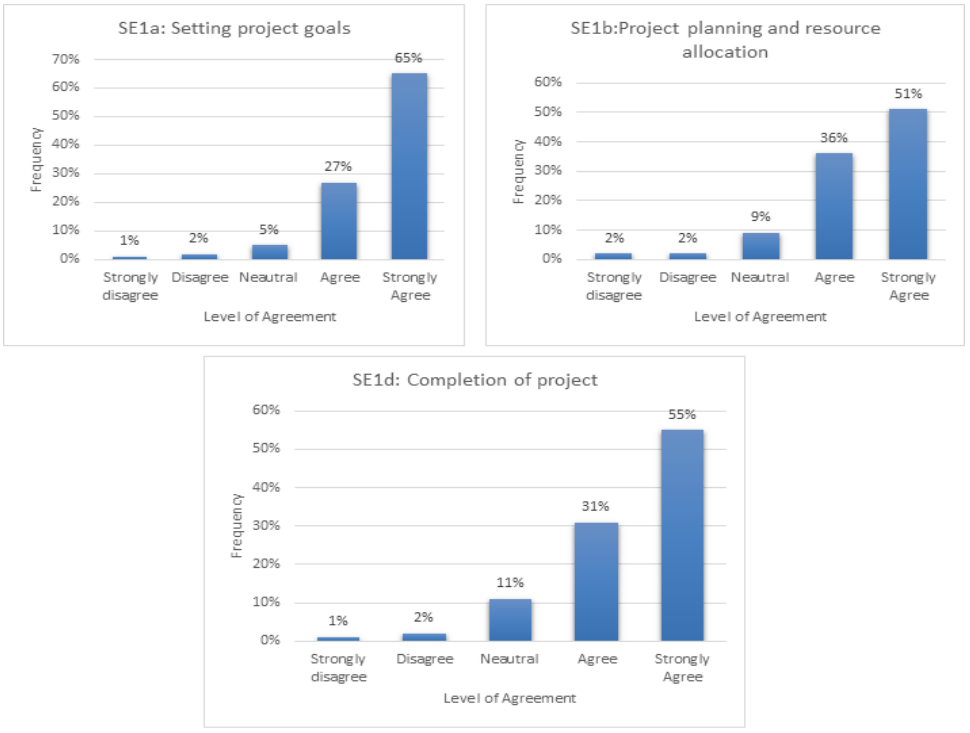

FIGURE 4.6: Frequency Analysis on Importance of Stakeholder Engagement in Building Projects (SE)

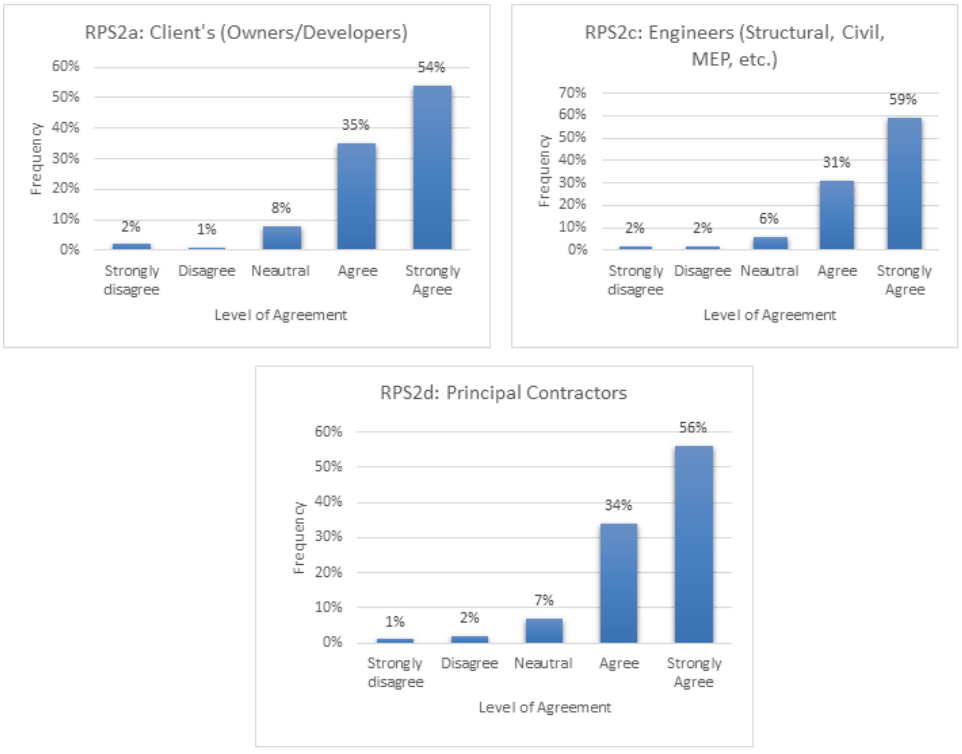

FIGURE 4.7: Frequency Analysis of Stakeholder Relevance for Project Success (RPS)

Fig 4.9 illustrates the level of agreement, 90% of respondents show agreement with RIS18a, 91% show agreement with RIS18d and 91% show agreement with RIS18f.

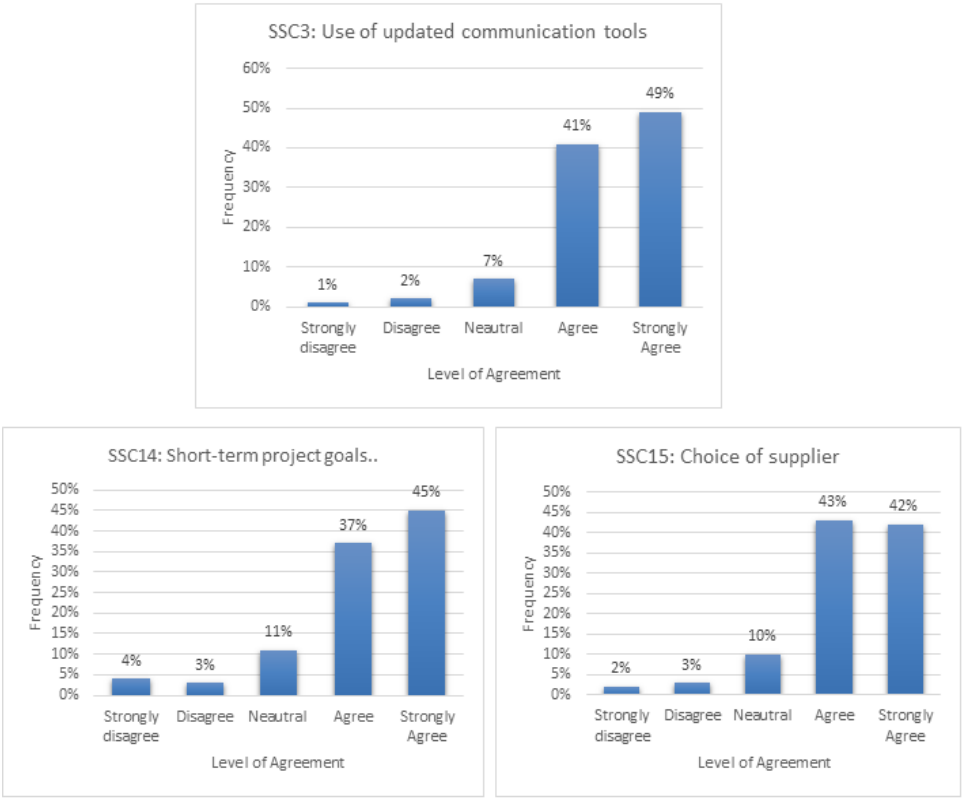

FIGURE 4.8: Frequency Analysis for Stakeholder Sustainability Challenges (SSC)

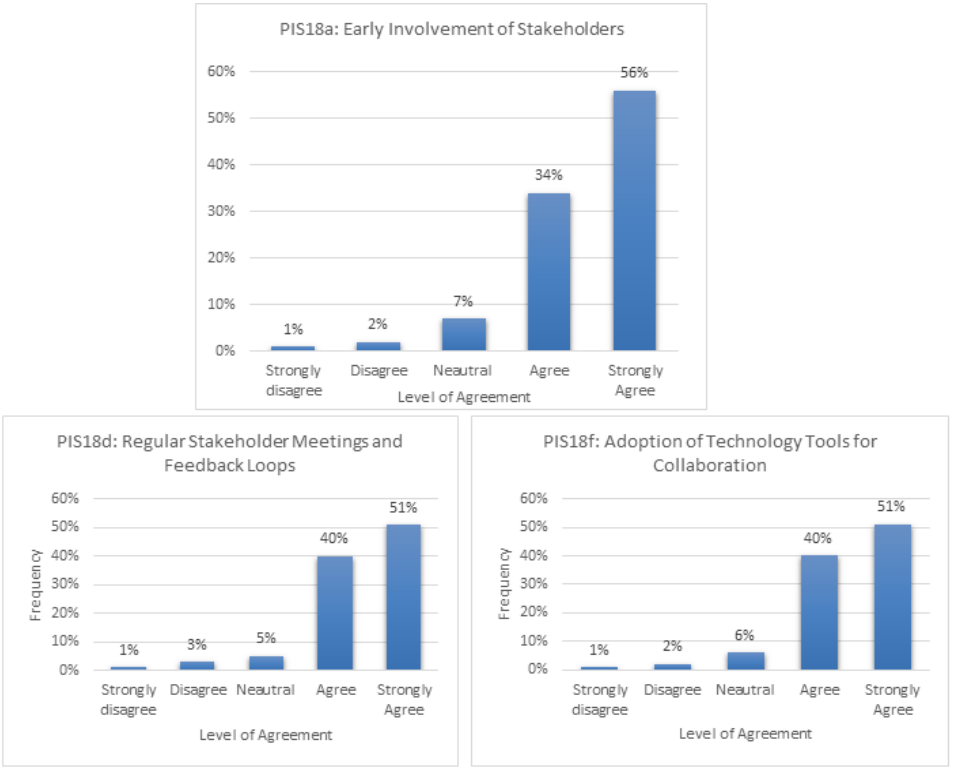

FIGURE 4.9: Frequency Analysis of Practices for Improving Stakeholder Engagement (PIS)

4.5 Main Findings from Questionnaire Survey

The questionnaire survey conducted as part of this research aimed to assess the practices, challenges, and stakeholder engagement strategies in building construction projects in Pakistan. The analysis of the data provides valuable insights into the factors influencing the success of such projects. Based on the Relative Importance Index (RII), the survey results were ranked to identify key practices, stakeholders, challenges, and relevant factors that impact sustainable construction. The survey results indicate that effective role of stakeholder engagement is essential for the success of sustainable building projects. Among the key aspects of stakeholder engagement, SE.1a (setting clear project goals and objectives) emerged as the most critical, with an RII of 0.9065 and ranked 1st [84]. This aspect emphasizes the importance of establishing transparent communication and aligning stakeholders from the start to achieve sustainability goals. SE.1d (Completion of Project), which focuses on continuous stakeholder involvement throughout the project until completion, was ranked 2nd with an RII of 0.8741. This finding reinforces the idea that ongoing engagement ensures the project remains aligned with sustainability objectives and helps address potential issues early on.

The analysis also highlights the relevance of various stakeholders to project success. RPS.2c, which focuses on the involvement of engineers (structural, civil, MEP), ranked 1st with an RII of 0.8882. This indicates the vital role of technical experts in ensuring that the project meets the required standards and performs efficiently. RPS.2d, which represents the role of principal contractors, ranked 2nd with an RII of 0.8852. This underscores their critical responsibility in executing construction activities, managing resources, and ensuring timely project delivery. Similarly, RPS.2a, which emphasizes the importance of client involvement, ranked 3rd with an RII of 0.8753. Client engagement is crucial for aligning the project's sustainability objectives with the owner's expectations, thus ensuring the project's success.

The highest-ranked factor is the use of updated communication and collaboration tools (SSC3), with an RII of 0.8694. This indicates that the adoption of modern communication tools is essential for overcoming barriers in project coordination.

These tools facilitate real-time communication, data sharing, and project tracking, helping align stakeholders on sustainability goals. By enabling better communication, these tools ensure that all parties are informed and engaged throughout the project lifecycle, which is critical for maintaining project momentum and achieving sustainability targets. In second place is the choice of supplier and its impact on economic sustainability (SSC15), with an RII of 0.8376. The selection of the right supplier significantly affects the project's economic sustainability, particularly regarding the sourcing of sustainable materials and technologies. A supplier who aligns with the projects sustainability objectives can help reduce costs and ensure that building construction materials are used effectively. This reinforces the importance of building long-term partnerships with suppliers who prioritize both environmental and social responsibility, alongside cost-effectiveness, which supports the overall success of the project. Ranked third is balancing short-term project goals with long-term sustainability objectives (SSC14), with an RII of 0.8306. This aspect emphasizes the need to prioritize sustainability even when faced with pressures to reduce costs or meet tight deadlines. Focusing too much on short-term gains can compromise the projects overall sustainability. Therefore, it is essential for stakeholders to collaborate early on to ensure that sustainability is integrated into every stage of the project, ensuring that long-term environmental and social benefits are not overshadowed by immediate project goals.

Additionally, two other important factors are also worth noting. Raising stakeholder awareness about the environmental and social benefits of sustainability (SSC9), ranked fourth with an RII of 0.8200, highlights the importance of educating stakeholders on the long-term advantages of sustainable practices. This helps foster engagement and commitment, ensuring that all involved parties actively contribute to the project's sustainability goals. Lastly, the economic stability of construction companies, influenced by government tax policies (SSC16), ranked fifth with an RII of 0.8188, underlines the need for a favorable economic environment to encourage construction firms to invest in sustainable practices without financial constraints. the survey findings underscore that communication tools, supplier choice, and the balance between short-term goals and long-term sustainability are critical for successful stakeholder engagement in sustainable building

projects. By addressing these factors, stakeholders can contribute to the achievement of both immediate project goals and long-term sustainability outcomes.

The top-ranked practices are the early involvement of stakeholders (PIS.18a), with an RII of 0.8824. Involving stakeholders from the initial stages ensures that diverse perspectives are integrated into the project planning, minimizing conflicts and delays. This approach leads to smoother coordination and alignment with sustainability goals, making it crucial for successful project execution. The second important strategy is regular stakeholder meetings and feedback loops (PIS.18d), with an RII of 0.8729. Regular communication and feedback ensure stakeholders remain engaged and informed, allowing for quick issue resolution and continuous alignment with project goals. This fosters collaboration and enhances the overall effectiveness of sustainable practices.

The adoption of technology tools for collaboration (PIS.18f), ranking third with an RII of 0.8718, is another key practice. Tools like Building Information Modeling (BIM) and project management software facilitate real-time collaboration, streamline workflows, and improve transparency, which are crucial for effective stakeholder coordination and the successful integration of sustainability practices.

4.6 Discussion

The findings of this research affirm that stakeholder engagement is not only essential but transformative in achieving sustainability within building construction management. Early and structured involvement of stakeholders during the planning and design phases ensures that sustainability goals are well-integrated and mutually understood from the outset. Regular communication, supported by structured feedback loops and digital collaboration tools such as BIM and project management software, fosters transparency, reduces conflicts, and enables real-time decision-making. However, the study identifies persistent knowledge gaps among stakeholders, suggesting an urgent need for targeted training and capacity-building programs to enhance awareness and competencies in sustainable practices. Economic constraints and the lack of regulatory incentives are significant barriers,

which highlight the role of governmental support through subsidies, tax relief, and green financing mechanisms. Furthermore, the integration of sustainability criteria into procurement policies and project contracts can institutionalize accountability and reinforce long-term environmental commitments. Engaging local communities and NGOs also emerged as vital for addressing social dimensions of sustainability, ensuring that projects align with the needs and values of their surrounding environments. The development of comprehensive stakeholder engagement frameworks, incorporating multilingual and culturally sensitive communication strategies, is crucial for inclusive participation, especially in diverse project settings. Overall, the study concludes that a holistic and strategic approach to stakeholder engagement can significantly advance sustainability outcomes, improve project delivery, and strengthen the construction industry's contribution to sustainable development.

4.7 Summary

This chapter presents the results and analysis of the study, highlighting key findings from the structured questionnaire survey on stakeholder engagement in sustainable building projects in Pakistan. The research process includes questionnaire development, pilot testing, and statistical analysis to ensure data reliability and validity. The Cronbachs alpha coefficient (0.941) confirms strong internal consistency, while the normality test indicates that the data is not normally distributed, leading to the application of the Kruskal-Wallis test, which shows no significant differences among respondents (p ¿ 0.05). Frequency analysis is conducted to assess response distribution, followed by Relative Importance Index (RII) analysis to rank critical factors. Early stakeholder involvement emerges as the most crucial factor, emphasizing its role in aligning project goals and mitigating risks, followed by regular stakeholder meetings and the adoption of technology tools, both of which enhance collaboration and transparency. The study also identifies major challenges, including communication barriers, lack of sustainability awareness, and insufficient training opportunities, alongside economic constraints such as the prioritization of cost over sustainability and inadequate funding for stakeholder

engagement. These findings underscore the necessity of structured stakeholder engagement strategies, where early involvement, continuous communication, and technological integration drive sustainability in construction projects. Addressing these challenges through capacity-building programs, transparent decision-making, and policy support will be essential in fostering sustainable construction practices in Pakistan.

Chapter 5

Conclusions and Recommendations

5.1 Conclusions

This study explored the role of stakeholder engagement in promoting sustainability within the context of building construction management in Pakistan. The research revealed several key findings related to the involvement of stakeholders in ensuring the successful integration of sustainability in building projects. The following conclusions summarize the main outcomes of the study:

I. Early Stakeholder Involvement is Critical for Project Success, the involvement of stakeholders at the earliest stages of the project, especially in the planning and design phases, is paramount to ensuring that sustainability goals are integrated into every aspect of the project. Early engagement enables the identification of sustainability opportunities, helps mitigate risks, and ensures that the project benefits from diverse perspectives. By ensuring that all key players such as clients, engineers, contractors, and suppliers are aligned on sustainability objectives from the outset, the project has a higher likelihood of achieving its long-term sustainability goals.

II. Communication and Continuous Feedback Mechanisms are Essential Effective communication is at the core of successful stakeholder engagement. The

study highlighted the importance of establishing continuous communication channels that allow stakeholders to remain informed and engaged throughout the project lifecycle. Regular meetings, feedback loops, and real-time updates are necessary to ensure that all parties are aligned with the sustainability objectives and can quickly address issues as they arise. This enhances transparency, fosters collaboration, and reduces the risk of misunderstandings.

III. Technology Integration Enhances Collaboration and Sustainability The adoption of technology tools, such as Building Information Modeling (BIM), project management software, and other collaboration platforms, has a significant positive impact on stakeholder coordination. These technologies facilitate real-time data sharing, improve transparency, and streamline decision-making processes, all of which are crucial for successful project management. The integration of technology tools ensures that stakeholders can track sustainability metrics, optimize resource allocation, and make informed decisions that align with the projects sustainability objectives.

IV. Key Stakeholders Play a Central Role in Sustainability Outcomes Engineers, contractors, and clients play a fundamental role in ensuring that sustainability objectives are met. Structural, civil, and MEP engineers bring the technical expertise needed to ensure that sustainability is integrated into the design and execution phases, while contractors are responsible for efficient resource management and timely execution. Clients drive the projects sustainability agenda by setting clear expectations and goals, ensuring that the project delivers on both environmental and social sustainability objectives.

V. Challenges in Stakeholder Engagement and Sustainability Integration Several challenges in stakeholder engagement were identified, including communication barriers, lack of awareness of sustainability principles, and economic constraints. These challenges can delay project timelines and hinder the adoption of sustainability practices. Overcoming these obstacles requires ongoing education, clear communication, and a commitment to sustainability from all stakeholders involved.

VI. Economic and Policy Barriers to Sustainable Practices Economic constraints, such as limited budgets, and the lack of supportive policy frameworks, remain significant barriers to the integration of sustainability into construction projects. Without financial incentives or regulatory support, construction firms are often reluctant to adopt sustainable practices due to the perceived initial cost burden. Addressing these barriers through policy reforms, financial incentives, and capacity-building initiatives is critical to fostering widespread adoption of sustainability in the construction industry.

5.2 Recommendations

5.2.1 Involve Stakeholders Early:

Engage stakeholders from the start, especially during the design and planning stages, through workshops and regular alignment meetings to ensure sustainability goals are met.

5.2.2 Ensure Continuous Communication:

Use digital platforms like Slack and MS Teams for regular updates and establish feedback loops to keep stakeholders informed and address emerging concerns.

5.2.3 Leverage Technology for Coordination:

Adopt tools like BIM and project management software for real-time collaboration, tracking sustainability metrics, and ensure stakeholders are trained on these technologies.

5.2.4 Promote Education and Capacity Building:

Organize workshops and training programs to fill knowledge gaps and equip stakeholders with the tools needed to implement sustainable construction practices effectively.

5.2.5 Strengthen Sustainable Procurement:

Implement a sustainable procurement policy prioritizing eco-friendly materials and technologies, and develop long-term contracts with sustainable suppliers.

5.2.6 Advocate for Government Support:

Push for government policies that offer financial incentives, such as tax breaks or subsidies, to encourage sustainable construction practices and establish a supportive regulatory framework.

5.2.7 Facilitate Green Financing:

Encourage financial institutions to provide low-interest loans and credit facilities for sustainability-focused projects, supported by public-private partnerships (PPPs).

5.2.8 Enhance Communication for Diverse Stakeholders:

Use multilingual, culturally sensitive communication strategies and digital tools to ensure effective engagement with all stakeholders, especially in diverse communities.

5.3 Practical Implementation in the Field of Building Construction Management

Based on the outcomes of this research, the following practical implementation strategies are suggested for the construction industry to enhance stakeholder engagement and promote sustainability in building construction management:

5.3.1 Develop Stakeholder Engagement Frameworks for Sustainability Integration

The research emphasizes the need for early and continuous engagement of stakeholders in sustainable building projects. Construction firms should develop stakeholder engagement frameworks that outline clear roles, responsibilities, and communication strategies for all parties involved. This framework should include detailed engagement plans during the design and construction phases, ensuring that all stakeholders, such as clients, engineers, contractors, and suppliers, are aligned on sustainability objectives. This will not only improve project outcomes but will also ensure that sustainability goals are integrated into every stage of the project lifecycle.

5.3.2 Adopt Technology-Driven Collaboration Tools

The use of technology has been highlighted as a key enabler of successful stakeholder engagement. Construction companies should implement technology-driven collaboration tools, such as Building Information Modeling (BIM), cloud-based project management platforms, and communication software, to streamline stakeholder interactions. These tools facilitate real-time information sharing, reduce errors, and improve transparency among stakeholders. By integrating these tools into daily operations, construction firms can enhance stakeholder collaboration, monitor sustainability metrics effectively, and drive more informed decision-making.

5.3.3 Training and Capacity Building Programs for Stakeholders

To address the knowledge gaps identified in the study, construction companies and industry organizations should offer training and capacity-building programs for stakeholders involved in sustainable construction practices. These programs should cover topics such as green building certifications, energy-efficient design, sustainable materials, and waste management. By equipping stakeholders with the

necessary skills and knowledge, these programs can enhance the industrys capacity to implement sustainable practices more effectively and consistently across various projects.

5.3.4 Implement Sustainability Performance Tracking Systems

Based on the research findings, construction firms should adopt performance tracking systems to monitor and evaluate sustainability outcomes throughout the project. These systems should track key performance indicators (KPIs) such as energy consumption, carbon emissions, material efficiency, and waste reduction. By incorporating these tracking systems, stakeholders can measure the success of sustainability initiatives, identify areas for improvement, and make data-driven adjustments as needed. This approach will also help in reporting the sustainability achievements to clients and regulatory bodies.

5.3.5 Promote Financial and Policy Incentives for Sustainability

The study identified economic and policy-related barriers to sustainable construction. Construction firms should work closely with governmental bodies to advocate for policies that provide financial incentives for sustainability-focused projects, such as tax breaks, subsidies for energy-efficient materials, or low-interest loans for green building initiatives. These incentives can help offset the initial costs of sustainable construction practices and encourage stakeholders to prioritize environmental and social sustainability in their projects.

5.3.6 Strengthen Collaboration with Local Communities and Non-Governmental Organizations (NGOs)

Construction firms should build partnerships with local communities and NGOs to prioritize social sustainability, such as job creation and environmental protection,

through regular consultations and stakeholder inclusion.

5.3.7 Incorporate Sustainability Metrics into Project Contracts

Embed sustainability goals and performance targets into project contracts to ensure accountability for sustainable practices, including the use of eco-friendly materials, energy efficiency, and waste reduction.

5.4 Future Research

- Future research should explore the integration of environmental sustainability throughout all phases of construction, including operation and maintenance.
- Investigate how technologies like BIM etc. can improve sustainability in construction by optimizing resources and enhancing efficiency.
- Assess the impact of existing government policies on promoting stakeholder engagement and sustainability in construction projects.

5.5 Guidelines for Effective Stakeholder Engagement

Based on the research findings, the following concise guidelines are recommended to enhance stakeholder engagement and support sustainability in building construction projects:

5.5.1 Early Stakeholder Involvement

Identify and engage key stakeholders at the planning stage to align sustainability goals and roles.

5.5.2 Clear Communication

Maintain consistent, transparent, and inclusive communication using meetings, reports, and digital platforms.

5.5.3 Use of Technology

Implement tools like BIM and project management software to improve collaboration and sustainability tracking.

5.5.4 Defined Sustainability Metrics

Establish clear KPIs (e.g., energy use, material efficiency) to guide and monitor sustainability performance.

5.5.5 Capacity Building

Provide training and awareness programs to enhance stakeholder understanding of sustainable practices.

5.5.6 Sustainable Procurement

Prioritize eco-friendly materials and vendors with proven sustainability credentials.

5.5.7 Regular Monitoring

Conduct periodic reviews and adjust strategies based on performance data and stakeholder feedback.

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Annexure-A

Annexure - A

CODING OF THE QUESTIONNAIRE		
S. No	**Questions**	**Code**
1	**Stakeholder Engagement is important for:**	**SE**
A	Setting project goals	SE.1a
B	Project planning and resource allocation	SE.1b
C	Smooth operations of project execution	SE.1c
D	Completion of project	SE.1d
2	**Rate the following Stakeholders in terms of their Relevance for the Project's Success.**	**RPS**
A	Client's (Owners/Developers)	RPS.2a
B	Architects	RPS.2b
C	Engineers (Structural, Civil, MEP, etc.)	RPS.2c
D	Principal Contractors	RPS.2d
E	Regulatory agencies	RPS.2e
3	Use of updated communication & collaboration tools & techniques is important to reduce project failures.	SSC3
4	Economics shall be given more priority than any other sustainability aspect.	SSC4
5	Sustainability experts & communities may be involved late in project execution.	SSC 5
6	High costs of sustainable practices discourage stakeholders engagement.	SSC 6
7	Insufficient funding is allocated for stakeholder workshops or training on sustainability.	SSC 7
8	Unclear or frequently changing sustainability regulations create confusion among stakeholders.	SSC 8
9	Some Stakeholders lack awareness about the environmental and social benefits of sustainability.	SSC 9
10	Limited technical expertise exists in using sustainable materials, renewable energy systems, or green technologies.	SSC 10
11	Stakeholders are hesitant to adopt innovative sustainable technologies due to perceived risks.	SSC 11
12	The involvement of governmental regulatory bodies supports stakeholder engagement by enforcing human rights and promoting social sustainability in building construction projects.	SSC 12
13	Lack of transparency in decision-making processes leads to mistrust among stakeholders.	SSC 13
14	Short-term project goals, such as cost or time savings, often overshadow long-term sustainability benefits.	SSC 14
15	The choice of supplier significantly affects the economic sustainability of a building construction project.	SSC 15
16	The economic stability of construction companies in Pakistan is affected by tax collection policies enforced by government agencies.	SSC 16
17	Balancing safety requirements with the use of sustainable materials or methods creates challenges among stakeholders.	SSC 17
According to your knowledge, select the best option using the following scale. Strongly Disagree=1 Disagree=2 Neutral=3 Agree=4 & Strongly Agree=5		
S. No	Questions	Code
18	**Rate the following Practices for Improving Stakeholder engagement in sustainable building projects in Pakistan?**	**PIS**
A	Early Involvement of Stakeholders Involving stakeholders at the initial stages of project planning and decision-making is important for project success.	PIS.18a
B	Clear Communication and Transparency Maintaining open and transparent communication channels throughout the project lifecycle is essential and can foster trust among stakeholders.	PIS.18b

C	Capacity Building and Training Programs Providing training sessions to stakeholders to enhance their understanding of sustainability principles and practices can empower them to contribute effectively, leading to better implementation of sustainable building practices.	PIS.18c
D	Regular Stakeholder Meetings and Feedback Loops Conducting regular meetings to gather feedback and ensure alignment on project goals can facilitate continuous improvement, identify potential issues early, and keep all stakeholders engaged and committed.	PIS.18d
E	Incorporating Cultural and Local Context in Decision-Making Recognizing and respecting cultural and local preferences when implementing sustainability practices can help in achieving broader acceptance and successful integration of sustainable initiatives.	PIS.18e
F	Adoption of Technology Tools for Collaboration Using tools such as Building Information Modeling (BIM) and project management software for improved stakeholder collaboration can enhance communication & streamline workflows.	PIS.18f
G	Establishing a Stakeholder Engagement Plan Developing a formal plan that outlines roles, responsibilities, and engagement strategies for all stakeholders can provide clarity, align expectations, and ensure active participation in the project, fostering a more sustainable outcome.	PIS.18g