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Impact of Internal and External Stakeholder on Economic and Social Pillars of Sustainability for Construction Industry

by

Ahmed Fraz

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To my beloved parents,(Afraz Hussain and Zubaida Khatoon), I dedicate this thesis to you, with love and gratitude. Your unwavering support, guidance, and encouragement have been the driving force behind my academic journey. Your sacrifices and belief in me have made this achievement possible. Thank you for instilling in me the value of education and for being my constant source of inspiration. I am forever grateful for your love and support.

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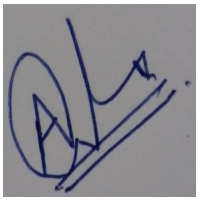

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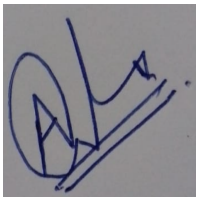

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Acknowledgement

• 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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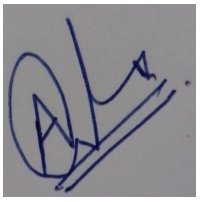

Ahmed Fraz

Abstract

This research examines how stakeholders, both internal and external, affect the social and economic pillars of sustainability in the 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 construction 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 and economic sustainability of building projects is the main objective of the study. A questionnaire comprising of 300 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 social and economic sustainability. The goal of this strategy is to increase sustainability and management in building projects.

Finally, the results are that entrepreneurship 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 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 and economic development more clearly, which made it easier to execute corrective actions at the planning and strategy level.

Keywords: Sustainability, Social Sustainability, Economic Sustainability, Internal Stakeholder, External Stakeholders, Spss,

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Abbreviations

AHP	Analytical Hierarchy Process
CSFs	Critical Success Factors
DWM	Demolition Waste Management
GDP	Gross Domestic Product
$\mathbf{H_{12}}$	Land with Owner
$\mathbf{H_{14}}$	Land with Supplier
$\mathbf{H_{18}}$	Land with Government
$\mathbf{H_{22}}$	Labor with Owner
$\mathbf{H_{23}}$	Labor with Manager
$\mathbf{H_{32}}$	Capital with Owner
$\mathbf{H_{33}}$	Capital with Manager
$\mathbf{H_{34}}$	Capital with Supplier
$\mathbf{H_{38}}$	Capital with Government
$\mathbf{H_{41}}$	Entrepreneurship with Employees
$\mathbf{H_{43}}$	Entrepreneurship with Manager
$\mathbf{H_{44}}$	Entrepreneurship with Supplier
$\mathbf{H_{46}}$	Entrepreneurship with Customers
$\mathbf{H_{48}}$	Entrepreneurship with Government
$\mathbf{H_{51}}$	Health and Safety with Employees
$\mathbf{H_{52}}$	Health and Safety with Owners
$\mathbf{H_{53}}$	Health and Safety with Managers
$\mathbf{H_{58}}$	Health and Safety with Government
$\mathbf{H_{61}}$	Human Rights with Employees
$\mathbf{H_{68}}$	Human Rights with Government

$\mathbf{H_{71}}$	Diversity and Inclusion with Employees
$\mathbf{H_{73}}$	Diversity and Inclusion with Managers
$\mathbf{H_{75}}$	Diversity and Inclusion with Shareholders
$\mathbf{H_{77}}$	Diversity and Inclusion with Society
$\mathbf{H_{81}}$	Technology with Employees
$\mathbf{H_{84}}$	Technology with Manager
$\mathbf{H_{87}}$	Technology with Society
IEQ	Indoor Environment Quality
ILO	International Labor Organization
KPI	Key Performance Indicator
RII	Relative Importance Index
SEAM	Saudi Environment and Assessment Method
SS	Social Sustainability

Chapter 1

Introduction

This research work deals with general idea of social and economic pillars of sustainability with internal and external stakeholders of construction industry. It is described by introducing the concept of sustainability, the problem statement, the scope, objectives, significance of the research and thesis's structure.

1.1 Background Information

The world is facing sustainability issues such as social, economic and environmental. Since the construction industry is developing quite rapidly and it has significantly impacted all three pillars of sustainability. To minimize these impacts, the sustainable practices are introduced in the construction industry.

This practice brought together the information taking place sustainability and civil engineering projects during the most recent two decades, helping to understand the evolution of environmental methodologies [1].

The construction industry's significant contribution to environmental degradation and CO2 emissions makes the environmental dimension of sustainability the most well studied of the sustainability dimensions is shown in Fig 1.1. The rising theme of sustainable project management in construction industry demands the three criteria must be examined together [2].

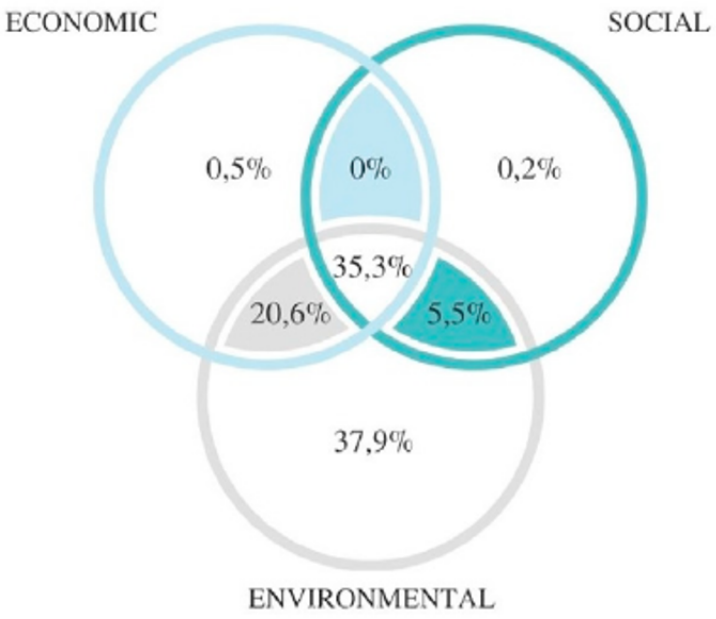

FIGURE 1.1: Evolution of Sustainability Pillars [1].

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, as 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 [3]. The major barriers in achieving The social sustainability includes 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 [4].

A matrix is shown to demonstrate the beneficial outcomes created by lean processes, taking place the three aspects of sustainability and the philosophies are employed to determine how lean constructing approaches contribute to all three areas of sustainability. The framework is used to develop the priorities assessment tools. In the resource management, it determines how to use the energy, how to use the land, how to use the materials, and how to use of water. The life cycle design

involves pre-building, constructing, and post-construction methods. Pre-building operations involve site selection, as well as adaptable and durable design. Building focuses on the minimization of site accident, using harmless environment, and waste administration. Post-construction activities include the reuse of surrounding buildings, the reprocessing of building resources, and material recycling. The new design approach is based on the natural and civilizing resources of the local, provincial, and global environments [5].

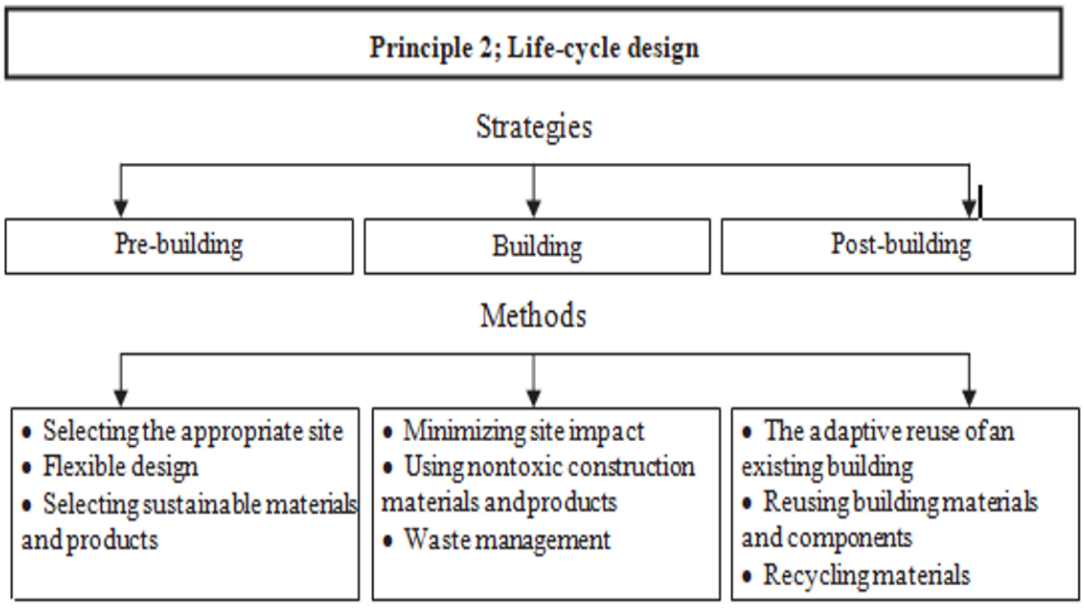

FIGURE 1.2: Project life-cycle layout [5].

The focus on environmental sustainability related issues is due to its prime concern over the past two decades. The study reported a multi-criteria analysis of four cement powders, aiming to calculate and analyze the effects of the industrial process on the environment, human health, and socioeconomic. This research has multiple objectives aimed to secure the environmental sustainability, human health, and waste minimization. By using Analytic Hierarchy Process (AHP), pair wise comparisons are made among the four cement types with respect to three pillars of sustainability. The analysis revealed that for environmental consideration; the cement 3 emerged as best option, while for socio-economic factors; the cement 2 would be an optimal choice. For overall sustainability, the cement 4 is identified as the most favorable choice based on the presented findings of producing 1 mega gram (Mg) of cement of grade 32.5 at four separate plants [6].

Numerous research concepts are discussed in the literature of sustainability for construction projects. Two metric analysis tools; Bib Excel and Delphi are used for analysis and identified that the idea of sustainability needs to be considered early design phases of building projects, as well as feasibility studies and ongoing project monitoring. The growing relevance of sustainability in construction project management may be seen from a variety of perspectives. Further investigation into the intricate interrelationships inherent in environmentally friendly project management might yield more significant insights. Additionally, the common relation between sustainability and benefits administration in the construction industry can be included for investigation as well as conducting a relative analysis of sustainability in urbanized and developing countries for construction projects [7].

Sustainability has been embraced by multiple companies using their goal statements and approaches. Nevertheless, incorporation of social and environmental scope of sustainability into programs and projects is a challenging task. This necessitates a framework that evaluates projects considering profits, economics, environmental impacts, and the social implications. Four viewpoints (triple-bottom line, stakeholder, internal processes, learning and growth) are discussed each with its set of important performance indicators and suitable targets for defined projects. Project managers utilize these key performance indicators to make decisions. The goals are depend on the organization needs, while sustainability criteria are hinge on organizational, ecological, and socio-economic factors. Hence, the formulation of portfolio selection and project monitoring problems are explained [8].

Seventy three input qualities related to cost performance are highlighted for further inquiry after a comprehensive examination of the literature. These issues are mostly related to consultants' and contractors' duties in controlling project cost overruns.

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 project's 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 [9].

1.2 Motivation for Research

The construction business is well complex and full of uncertainties worldwide when examined through the lens of sustainability's three pillars. Each of these pillars exerts several positive and negative impacts on the industry and influences every project. However, in the construction sector, environmental sustainability appears to be prioritized over the other two pillars. Efforts to achieve the economic sustainability are outlined through ten action points. On the other hand, social sustainability is progressing slowly. An ontology is proposed suggesting that people's consumption behavior drives the utilization and reduction of natural resources, thus impacting the environment [10]. As societies interact with issues such as climate change, social inequality, and economic instability, here is an increasing identification of the connection between social, economic and environment systems. Sustainable development necessitates a comprehensive strategy

that takes into account the integration of these factors and the participation of several stakeholders. Stakeholders are also essential to the development and application of sustainable practices. They comprise people, groups, governments, communities, and other organizations and entities that either directly impact or have an impact on the sustainability results.

Businesses, policymakers, decision-makers, and other stakeholders interested in sustainability programs can benefit practically from this study. They may more effectively allocate resources and modify plans to meet sustainability objectives by learning more about the interactions between stakeholders and sustainability pillars. Finally, the goal of this research is to further understanding and implement sustainable methods that will benefit current and future generations.

1.3 Problem Statement

The environmental, economic, and social pillars of sustainability are integral components not within the construction industry but also within the broader community. The issues related to environmental, economics, and social factors, particularly those involving stakeholders throughout the project's execution, take part in a pivotal position in contributing to sustainable growth. It is widely recognized that the achievement of a project is deeply influenced by considering these factors during the early stages of planning. This forward-thinking approach represents a strategy aimed at achieving environmental, economic, and social sustainability by actively involving stakeholders in decision-making processes. However, Lime et al. [1] communicated that the interaction between social and economic pillars of sustainability is least studied area; whereas the environmental aspect had been the prime focus point in the literature. As construction projects continue to grow complexity and cost, they present an array of economic, social, and environmental challenges. While environmental concerns are frequently addressed, it is observed that social and economic dimensions receive comparatively less attention. Many studies primarily focus on planning and execution stages overlooking the importance of operation and maintenance stages.

- The literature has mostly focused on environmental sustainability, with limited attention given to social and economic sustainability in the construction industry.
- The impact of internal and external stakeholders on social and economic sustainability in the construction industry has not thoroughly studied.
- Stakeholder involvement is a critical component of social and economic sustainability that impacts the development of useful strategies.

Research Question 1; Is there any relation between social and economic pillar of sustainability with internal and external stakeholders of the construction industry?

Research Question 2; Which one of the internal and external stakeholders has significant role on social and economic pillar of sustainability?

Research Question 3; How do different stakeholders affect social and economic sustainability at various stages of the construction projects?

1.4 Research Objectives

The objectives of the current study are to:

- Analyze of components contributing to the improvement of social and economic aspects of sustainability with stakeholders.
- Investigation of relative importance of internal and external stakeholders for enhancing social and economic sustainability.
- Assessment of sustainable practices for construction projects and operation.

1.5 Significance of Research

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.

1.6 Thesis Structure

There are five chapters in the format of this thesis.

Chapter 1: This chapter 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.

Chapter 2: In this chapter, 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 3: The research methodology is covered in this chapter, also provides detail about the research design, matrix, and questionnaire develop stages along with data evaluation for further elaboration.

Chapter 4: This chapter contains the results and discussions. It presents the detail about the tests, analyses, findings, and discussions about the achieved results and their significance.

Chapter 5: This chapter presents the findings based on the results and thorough evaluation, as well as future recommendations.

Chapter 2

Literature Review

The literature review examines the past academic research that provides new insights and ideas. The literature is separated into three phases to cover the study's topic. First, it examines the literature on sustainability and its three pillars related to the construction industry/projects. Second, it explores those aspects that contribute to the social and economic sustainability. Previous studies have comprehensively examined each of these improving elements. Finally, the literature is assessed on internal and external stakeholders.

2.1 Introduction to Sustainability

Sustainability in the construction industry is critical for addressing current and future demands by means of conserving energy, water, and resources via methods including reuse, recycling, creative plan, and waste reduction. While the environmental effects of the construction sector have been widely addressed, this research conducted a thorough analysis of 433 relevant pieces of literature on sustainability and the three pillars of sustainability. However, the bulk of publications concentrated on environmental issues. The planning and execution phases of on-site work are not well covered in the literature, which emphasizes the need for more research on the operation and maintenance phases. Sustainability is a critical worldwide issue in today's society, with numerous definitions assigned to it. It has been defined

in several ways. According to a study issued by the UN World Commission on Economic Development (WCED), sustainability is defined as "development that fulfills current needs without risking future generations' capacity to meet their own needs". Also, the United Nations defines sustainable development as "the comprehensive responsibility for achieving a high standard of living for all." This paper is crucial in building a common understanding of the sustainability when its principles are widely embraced [11].

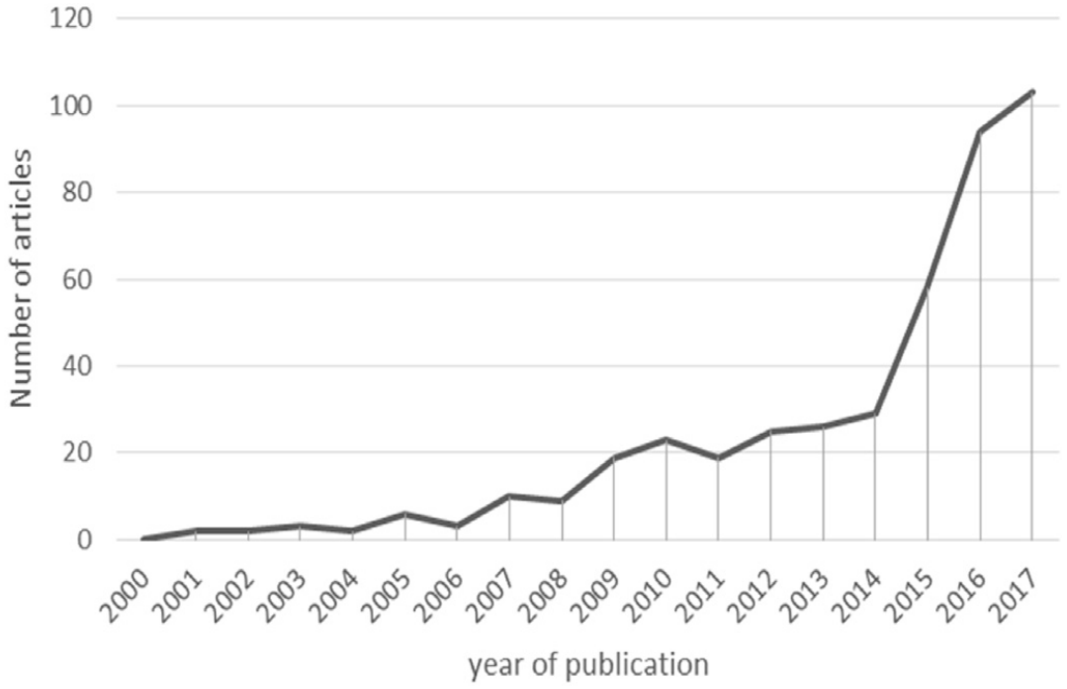

FIGURE 2.1: Trend of sustainability literature during the last two decades.

Additionally, it is observed to the idea of sustainability should be integrated in construction projects throughout the early on phases of design and feasibility studies, as well as monitored during the project's life cycle. The rising relevance of sustainable building project management may be seen from a variety of perspectives. Construction projects can be mega undertakings that are essential for continuing economic and social progress but are not ecologically sustainable owing to the planned use of the end results or the materials employed in the projects [12].

In South Africa, practical developments have been recognized as vital for the climate security and detrimental effects on the climate are highlighted in terms of waste of energy, water exhaustion, and numerous others that hurt the climate.

However, the primary issue of the construction sector is to play an important role in decreasing the consequences of building operations on sustainability [13].

Developing countries prioritize social and economic sustainability and growth. However, the nature of their industry presents major challenges such as time and cost overruns in projects. Cost overruns are important concerns during the life-cycle of a project. Unfortunately, many projects failed to get completion within the allocated budget. This trend is particularly severe in developing countries, where these overruns sometimes reach up to 100% of the predicted project cost. By using natural assets carefully, reducing waste, and, when possible, improving the environment, environmental sustainability aims to stop negative and potentially irreversible effects on the environment. Figure 2.2 shows specific principles of sustainable construction related to sustainability in social, economic, and environmental domains. Moreover, it provides an example of how to implement a lean technique in a traditional approach. To achieve sustainable facilities for construction projects, lean practices are implemented. Sustainable values such as economic, social, and environmental are identified through lean practices to achieve sustainable construction [14].

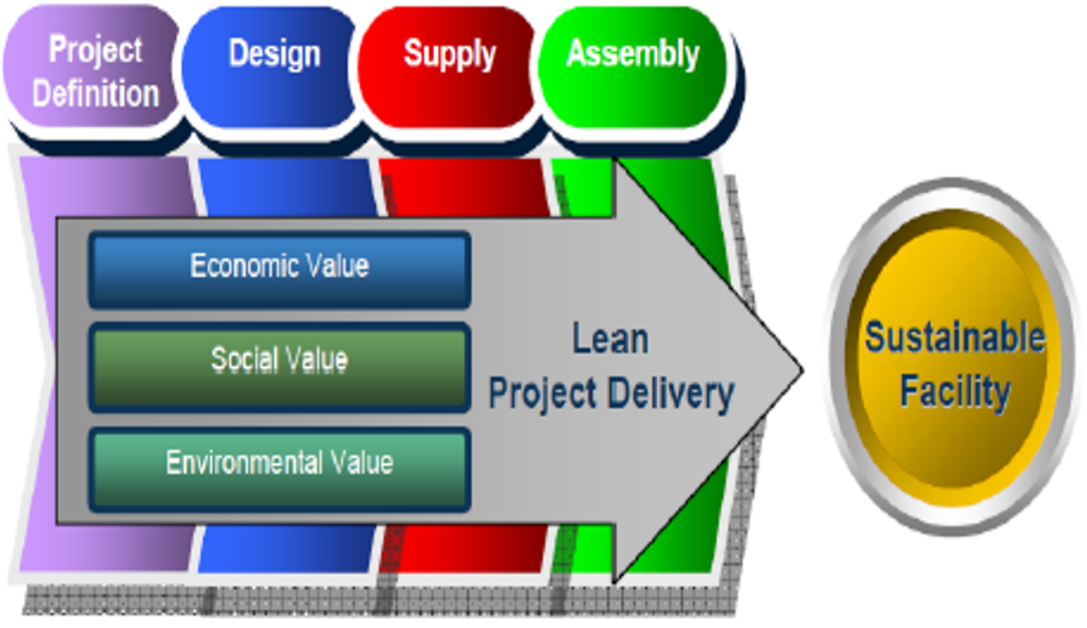

FIGURE 2.2: Implementation of lean practices to achieve sustainability [14].

The life cycle assessment (LCA) is used for the building industry. The construction industry, now more than ever, prioritizes 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 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 [15].

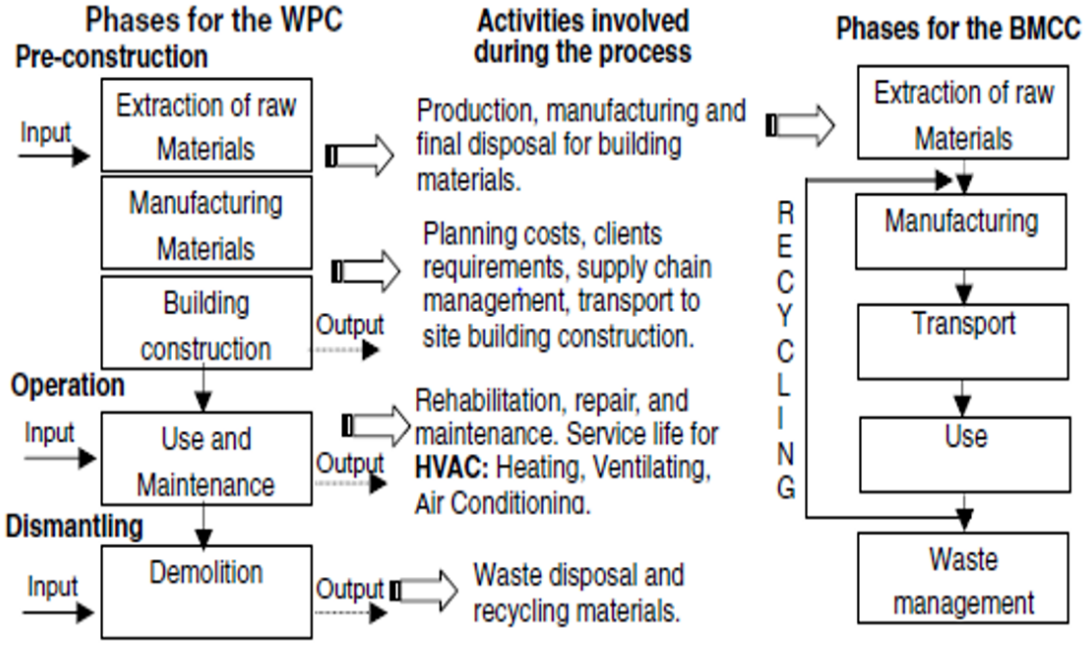

FIGURE 2.3: Diagram illustrating building lifecycle [15].

According to the integrated LCA-LEED® sustainability evaluation approach, approximately 80% of students and instructors in the United States and Canada spend at least eight hours each day at school, which can be harmful to their health and learning capacity. These findings highlight why sustainability concepts

are not being adopted in school buildings. This study presents an integrated model that accurately applies LCA and LEED to the exterior and structural systems of Canadian school buildings. The model compares several choices based on envelope types (e.g., pre-cast steel studs, wood studs, hollow walls, etc.) and structural materials (concrete, steel, and masonry). Energy LEED simulation is conducted using eQUEST software, while the life cycle assessment utilizes the ATHENA Impact estimator [16].

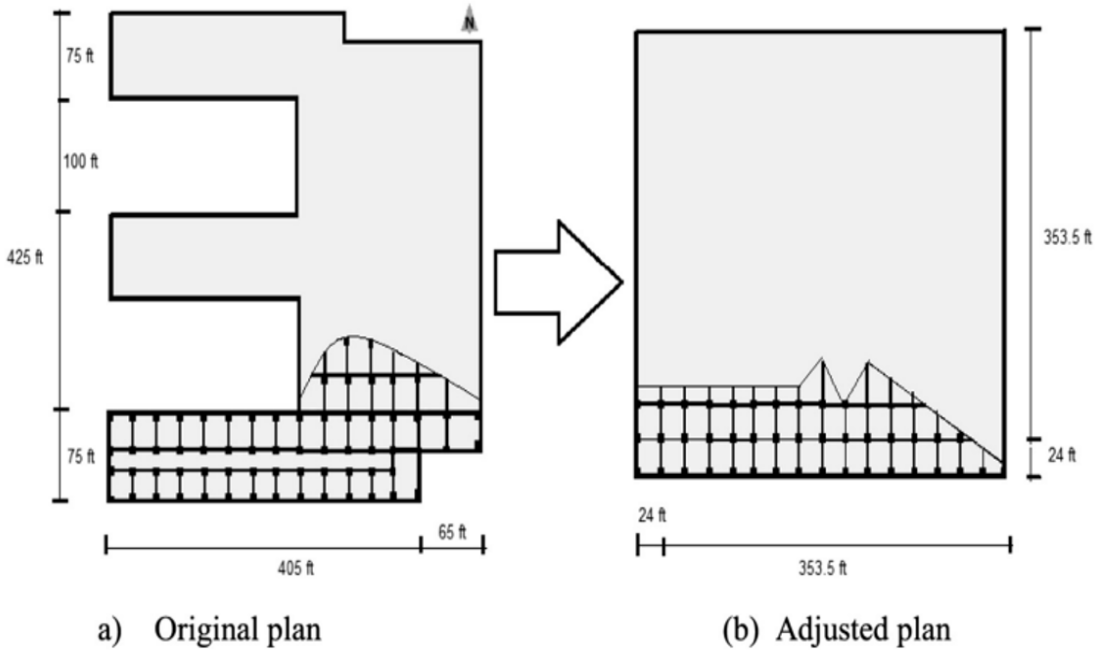

FIGURE 2.4: Original and revised structural frame layout [16].

To integrating sustainability issues into project management, many companies have embraced sustainability by incorporating it into their procedure statements with strategies. However, the inclusion of social and environmental dimensions of sustainability into programs and projects can be challenging. To address this, a framework is developed to evaluate projects, taking into account their profitability, economic impact, environmental considerations, and social impacts. The triple bottom line, stakeholders, internal procedures, and learning and growth are the other four viewpoints that are covered. KPIs, or key performance indicators and appropriate targets are defined for each goal, which are used by the project manager to make decisions. While the sustainability criteria are based on organizational, regional, and socioeconomic conditions, the goals are contingent upon

the requirements of the business. This study delves deeper into the formulation of difficulties related to project monitoring and portfolio selection as shown in Figure 2.5 [8].

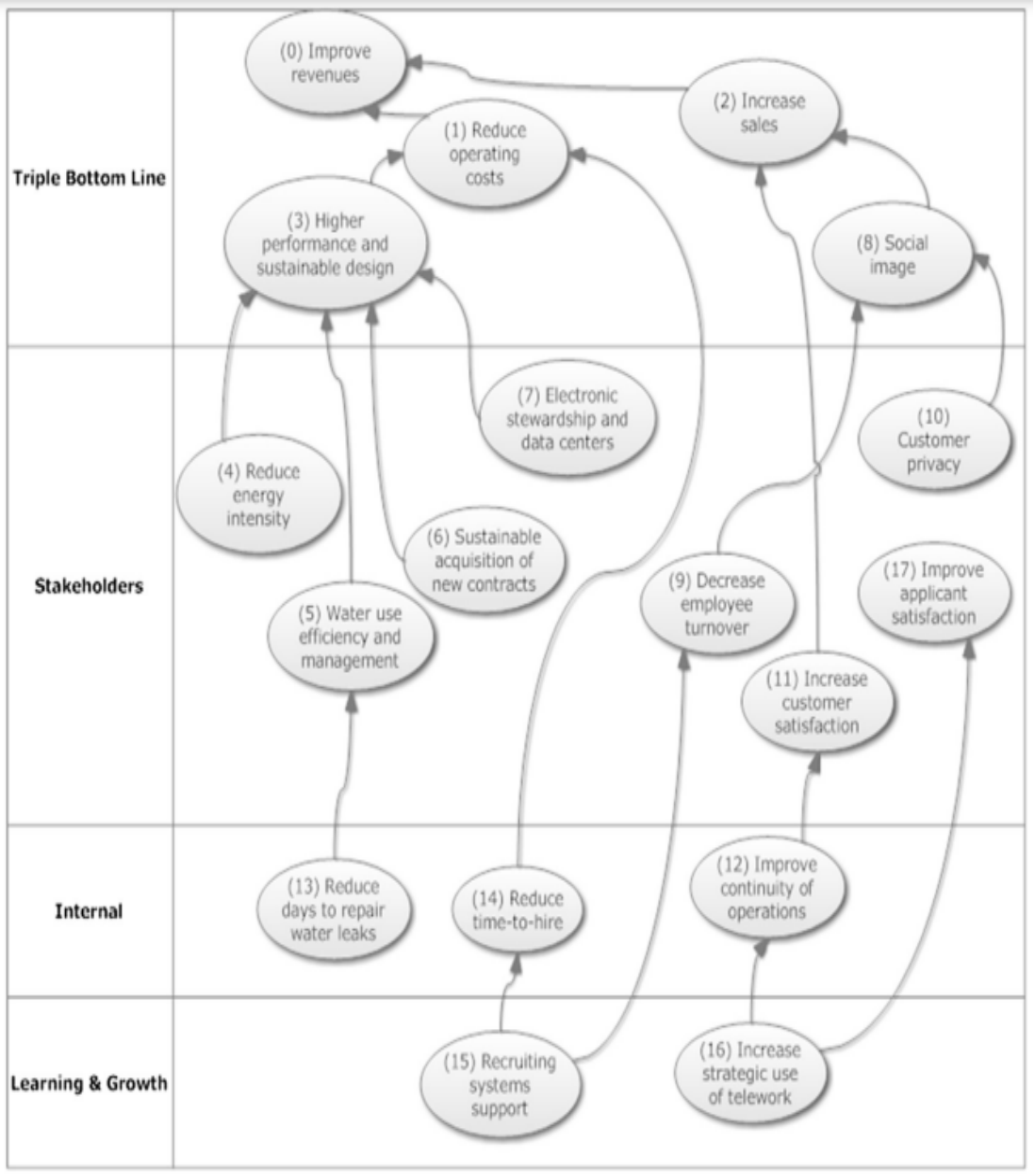

FIGURE 2.5: Linking stakeholder concerns to organizational strategy through strategic mapping of four viewpoints [8].

2.1.1 Sustainability Spheres

A framework for sustainability in project management is crucial for sustainable construction. This framework should consider social, environmental, and economic

aspects throughout the project's lifecycle stages. It helps 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" [17].

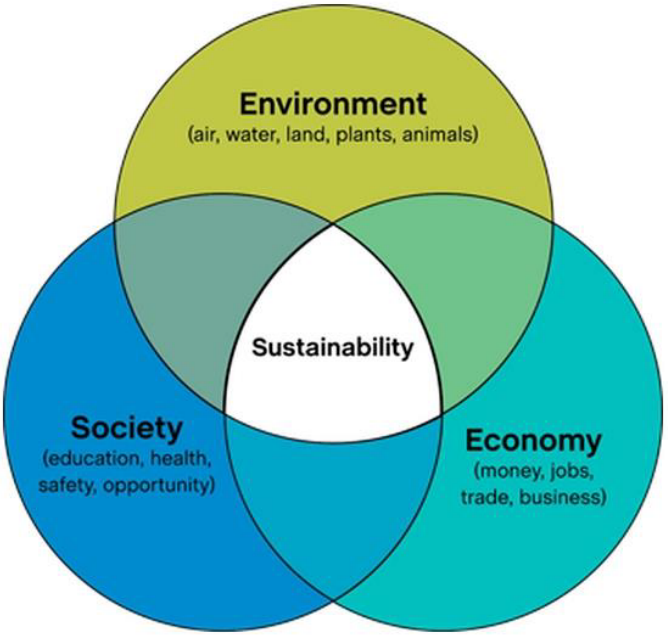

FIGURE 2.6: Financial, social, environmental assessment [17].

2.1.1.1 Environmental Pillar

It is our duty to protect the environment's natural resources along with potential global ecosystem in arranges to promote health and well-being for today and future. Numerous environmental evaluation instruments exist, each serving a distinct role in evaluating the effects linked to a development site [1]. The ozone layer, greenhouse gas emissions, and global warming, all can have an impact on human health. Buildings can achieve sustainable structural design by using structural material proportions that minimize carbon dioxide emissions. The average carbon dioxide for steel is computed to be 0.11kg and for concrete, it is calculated as 0.04 kg. A case study with varying beam dimensions is examined. Concrete and steel are two common building materials and the percentage differences in carbon dioxide data for these two building materials are 276% and 863%, respectively [18].

Due to the production of waste materials that need landfill space, pollute water, need more energy, and release dangerous gasses, demolishing structures presents serious obstacles to sustainable urban growth. Inadequate handling of demolition trash is a multifaceted procedure requiring methodical thought and investigation.

Simulating and investigating how shifting attitudes and dynamic interactions among diverse stakeholders may affect demolition waste management's (DWM) environmental performance is the goal. Consequently, in order to minimize the quantity of demolition waste, improve source reduction, reuse, and recycling initiatives, and optimize the financial, ecological, and societal advantages, all parties involved are incentivized to adopt environmentally friendly DWM techniques [19].

Alyami et al. [20] noted that the BREEM and LEED strategies are lacking the ecological advancement treatments. Saudi built environment contributes significantly to both global and local environmental changes.

The study suggests creating a customized weighting scheme that gives the Saudi Environment Assessment Method (SEAM) priority in order to remedy this. The analytical hierarchy process, or AHP, was used in the study technique. In order to promote environmentally friendly goods and services for Saudi Arabia, SEAM is crucial.

It is proven that the SEAM methodology, combined with AHP, is a more suitable for Saudi Arabia compared to other assessment methodologies. Given Saudi Arabia's water scarcity challenges, water conservation emerges as a top priority in the SEAM weighting system.

2.1.1.2 Social Pillar

Social sustainability involves meeting the desires of the people next to every stage of construction process, from commissioning to demolition. This includes ensuring a high level of customer satisfaction and fostering close relationships with clients, suppliers, employees, and local communities. It also involves identifying and managing both positive and negative impacts on people.

In sustainable project management, critical parameters such as profitability, safety, transparency, ethics, nature-friendliness, social acceptability, meeting stakeholders, and customer expectations have been identified. The sustainability challenges for projects may be evaluated by using the parameters as weighting variables in multi-objective sustainable project management problems [21].

The research [22] examines the social and economic growth in developing countries. The construction industry is facing various challenges, including time and cost overruns in projects. Adopting sustainable construction practices can reduce these issues by reducing energy use, maximizing the use of renewable energy resources, minimizing pollution of water, air, and soil, and minimizing noise pollution. It also explains the gross domestic growth (GDP) of Malaysia and why the dumping of materials poses a risk to the human health environment. Traditional design and construction primarily focus on cost, performance, and quality objectives. The introduction of green building practices at various construction stages helps to reduce carbon dioxide emissions, energy usage, and solid waste generation and they account for approximately 70% of the total waste. This study suggests that the advancements in technology such as lean techniques, value engineering, building information modeling (BIM), and sustainable supply chain management (SSCM) can further improve construction practices.

An increasingly important factor in determining whether a project in the building industry is feasible is the social component of sustainability. Although there are well-defined rules for reducing carbon footprints—especially when it comes to choosing building and urban development materials—equivalent actions that address social elements receive less attention. Proposed solutions can fulfill the many demands of current and future communities, solve environmental concerns, improve quality of life and safety, and all based on this basic knowledge.

The integration of social ontology with environmental and economic factors provides developers and other relevant parties with a more holistic comprehension of sustainable concerns related to urban development and construction. Over the past 20 years, sustainability has drawn a lot of attention and is now a fundamental component of the majority of projects and socioeconomic activities in both

built and natural ecosystems. The International Commission on Environment and Development launched an effort that is the origin of this sustainable agenda [10].

2.1.1.3 Economic Pillar

The economic pillar of sustainability involves conserving natural and financial resources to set up long-term financial stability. Economic sustainability aims to increase productivity by efficiently utilizing resources such as labor, materials, water, and energy. Despite the vital benefits of economically sustainable construction, they are often not well understood by most developers and users. Historically, the main objective of the construction has been to obtain the best quality at the lowest cost within a limited timeframe.

A study [23] estimated the benefits and costs of implementing scenarios that improve the indoor environmental quality (IEQ) of U.S. stock building. These scenarios increase ventilation rates by adding outdoor air economizers and controlling indoor temperatures below 20°C in winter. The quantitative estimates have high uncertainty and the potential exists for substantial benefits. The projected annual economic benefits of the analyzed scenarios range from $17 to $26 billion depending on the data source for existing ventilation rates. Priority should be given to those implementation scenarios that save energy. It's worth nothing that the data collected is approximately 15 years old and the survey may not be perfectly representative of the entire building stock as it did not include small offices.

Hill and Bowen [24] categorized Kibert's principles into four pillars; (social, economic, biophysical, and technical) emphasizing on the well-organized use of resources to maximize benefits for all stakeholders and the environment. Life cycle costing is identified as the best economic tool to measure the long-term benefits of sustainable construction. However, due to the lack of relevant "live" cost data and limited experience in its use to address these issues, it's essential to educate both clients and professional consultants about the benefits of sustainable construction. Through sustainable construction practices, clients can realize both short-term returns and long-term benefits.

2.2 Benefits of Sustainability and Sustainable Construction

The benefits of sustainability include the capacity to balance the dimensions of the environment, society, and economy. The social pillar of sustainability aims to promote human health and social life. The benefits of the environmental factor in the construction sector led to the development of a method for limiting waste generation during project lifecycles and safeguarding the natural environment from devastation. Finally, from an economic perspective, clients receive benefits by obtaining a higher lifespan value for their investment and a contractor enjoys increased revenues from operational efficiency by reducing waste and expenses [25].

Another research [26] provides the conceptual foundation of three key sustainability principles: resource management, life cycle design, and design for humans and the environment. In contrast to the out-of-date point of view of economic usability and durability, sustainable building addresses three major dimensions: social, economic, and environmental. The contribution of the building sector to the sustainability is a global issue. However, the issues confronting emerging countries are immense and far more complicated than those impacting the developing world.

Sustainable building design and construction are more than just a collection of separate components; they reflect an integrated and comprehensive process aimed on accomplishing a broader goal. The major focus is on the process of developing environmentally conscious and healthy settings. These areas encourage human engagement with the natural world, building a connection that is essential for both physical and emotional health. Furthermore, the sustainable construction methods help to promote local economies and cultures. Prioritizing sustainability allows communities to create places that address immediate needs and contribute to the long-term health and vitality of both people and the planet [27].

A case study [28] demonstrates the benefits and limitations of employing materials with Environmental Product Declarations (EPDs) from the perspectives of three

stakeholders in Canadian LEED v4 platinum projects. Environmental product declarations are specified by three distinct ISO standards. Existence cycle assessment is the process of quantifying a product's global and regional environmental consequences over the course of its entire existence. This study emphasizes the advantages of EPDs for designers, as independently confirmed data is valuable. Furthermore, the usage of EPDs on building items is analyzed.

Awadh [29] used four green building rating systems (GBRSs) based on how well they corresponded with the study's objectives. The variety of accessible GBRSs may be used to improve sustainable building design, both directly and indirectly. BREEM, GSAS, and Pearl building rating system stress the energy category, whereas LEED focuses on indoor environmental quality. The GBRSs can help in guiding a project's environmental sustainability, it is also equally important in examining the project's social and economic sustainability goals. The GBRSs do not merely contribute to the long-term growth of surrounding regions but they also better serve the community by encouraging environmental friendly actions and improving people's quality of life. The building and construction sectors are critical to the global economy, yet their massive energy consumption highlights the urgent need for increased commitment to sustainable development. To solve these problems, Yan [30] used system dynamics as a major technique. The research is carried out through three key processes: system conception, model creation and validation, and scenario analysis and policy assessment. Using these processes, the study developed an analytical framework and operational model for analyzing project-based competitive marketplaces and assessing policy implications for sustainable development. These insights also help the policymakers to pursue improved consumer satisfaction along with cost reductions in the project.

2.3 Sustainability in Construction Social and Economic

Construction projects' success in the construction industry depends on environmental sustainability. Every community's social realities are reflected in social

ontology. It is predicated on the notion that these realities don't emerge out of thin air. Rather, they are 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 viewpoints in project design and implementation. This strategy encourages a more inclusive and socially responsible approach to the construction projects, eventually contributing to the overall success and sustainability of projects [31].

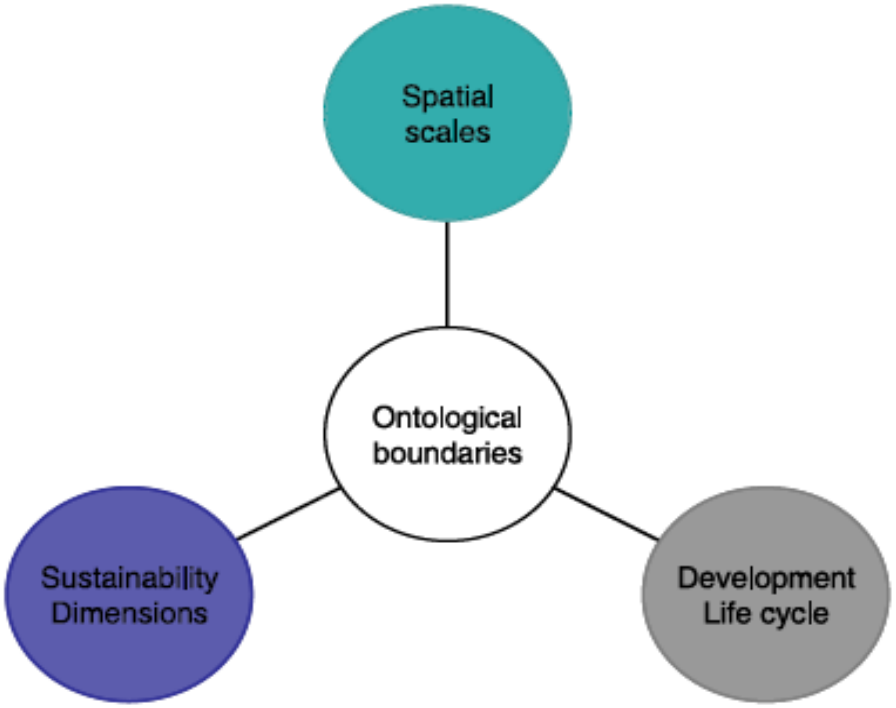

FIGURE 2.7: Common types used to classify sustainable urban areas [32].

The government, assisted by research bodies, has taken the first steps toward encouraging sustainable construction techniques. However, further funding and incentives are required to fully fulfill these initiatives. This case study is conducted at Sultan-Caboose University, a public entity with limited tendering and procurement procedures. Public knowledge of environmental concerns is critical to the effective application of sustainable construction techniques. Therefore, comprehensive measures for increasing awareness and cultivating a culture of sustainability among the public are required to promote genuine change in the construction sector [33].

Sustainable construction takes into account both the initial capital expenditure and the continuing operating expenses connected with green building methods. Improved building performance and durability are important economic benefits of sustainable architecture, resulting in long-term savings through lower maintenance and operational expenses during the structure's lifecycle. Furthermore, a sustainable building seeks to provide optimal living and working conditions that increase productivity. The primary goal is to save energy and reduce environmental impact while encouraging healthy and comfortable living circumstances. However, developers and consumers frequently fail 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 is crucial [34].

Giunipero et al. [35] 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 is to discover and evaluate a complete list of supply chain sustainability drivers and obstructions. The data indicate that buying and supply management executives may help their CEOs to implement sustainable practices. They also appreciate the need to follow government regulations. The supply chain management remains a top concern for CEOs, purchasing and supply management teams while the strategies and approaches may differ among firms as shown in Fig. 2.8.

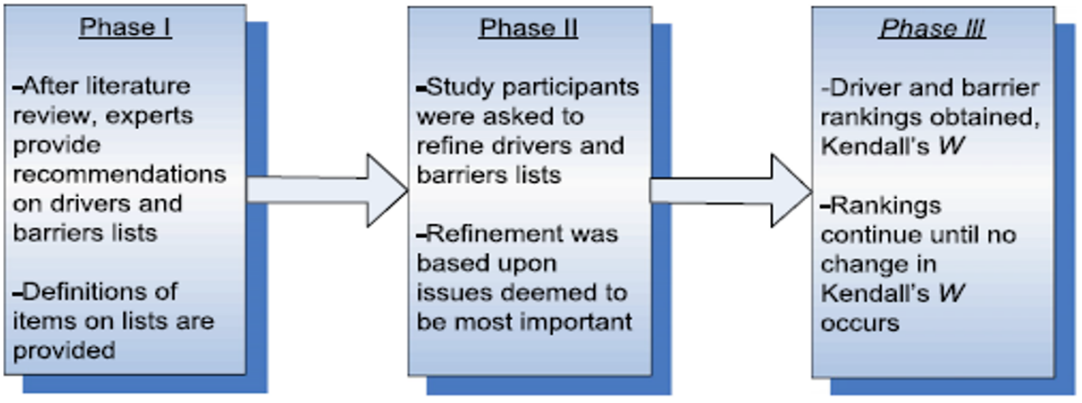

FIGURE 2.8: Various phases of buying and supply management [35].

2.4 The important role of Sustainability in Construction Projects

In construction industry, economic metrics are critical for determining if a project is finished on time, within budget, and meeting other specified scope criteria. A breakthrough paradigm is designed that quantifies the importance of critical success factors (CSFs) for incorporating sustainability into project management methods at each level. The extensive analysis reveals the unique insights on the integration of sustainability into project management techniques, particularly in developing countries. These findings are critical for improving project performance, ensuring sustainability, and fostering economic development in building projects globally [36]. The Triple Bottom Line idea is an important tool for monitoring and improving sustainability throughout the project's life cycle. Furthermore, the notion of green Information modeling for buildings (BIM) is proposed, serves as a link between BIM technology and sustainability in the building sector. It is suggested that Indonesia could focus on BIM education and promote awareness. The BIM technology can be used to cut costs, preserve economic stability, and enhance life-cycle asset management. This comprehensive strategy guarantees that sustainability concerns are included in all phases of development, resulting in long-term environmental, social, and economic advantages [37].

Life cycle costing is an excellent economic tool for determining the durable value of sustainable buildings. However, its usefulness is hampered by a lack of relevant "live" cost data and insufficient expertise with its implementation. To overcome these issues, it is necessary to educate both clients and professional consultants on the advantages of sustainable building.

The Chinese government has extensively supported prefabrication technology as a method of increasing building efficiency and output. The two projects are compared that use distinct building technologies; prefabrication and cast-in-situ. The purpose of this comparison is to assess the efficacy of prefabricated technology in meeting sustainability goals and enhancing overall project outcomes [38].

The ever increasing population of the world and the looming threat of climate change present huge environmental and socio-economic issues. The approaches for incorporating sustainability ideas into building project management are investigated. A survey approach is used to identify and prioritize essential sustainability criteria. These criteria help in analyzing the sustainability of business initiatives as well as guide judgments on project portfolio selection and financial resource allocation. By tackling these difficulties, the research seeks to build a more sustainable built environment [39].

The project success is frequently dependent on adherence to the restrictions such as cost, time, and budget. In a developing country like Pakistan with a thriving infrastructure industry, the stakeholder management is critical to the project success. A quantitative study [40] is conducted to determine the influence of stakeholder's management on project success. The data of 300 respondents from both public and private firms is gathered. The investigation is carried out utilizing structural equation modeling (SEM) and smart PLS software. The findings highlight the necessity of boosting awareness among project teams about the formal implementation of stakeholder management methods. This type of integration is critical for improving project efficiency and success over time. An increased emphasis on stakeholder management can result in more sustainable and meaningful outcomes in construction.

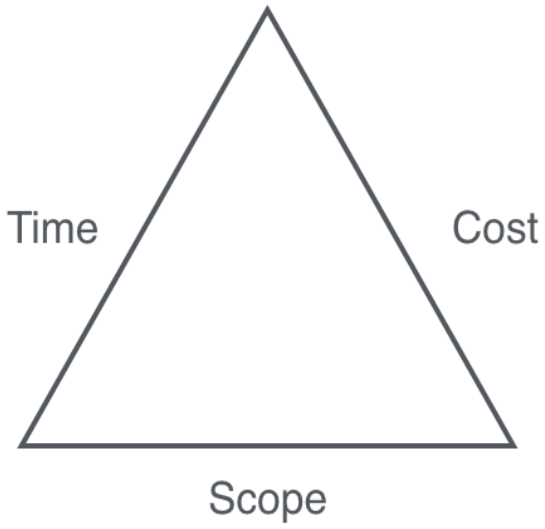

FIGURE 2.9: Sustainable development triangle [40].

2.5 Engaging Stakeholders in Sustainable Construction

Efforts to achieve sustainable growth in China's construction sector need a careful balance of stakeholder's interests and overcoming associated hurdles. The gray theory is used to group expert views into similar and analyzable indices. The findings highlight the key stakeholders (suppliers, businesses, and sustainable communities) whose collaboration may result in mutual benefits. The key contributions include creating a framework for assessing co-benefits among stakeholders and adopting a mixed-method approach to evaluate the building scene. By harnessing co-benefits, both the global and local environmental challenges may be solved simultaneously. To improve precision in the face of information uncertainties, the gray theory and Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS) are used to quantify stakeholder's rankings and criteria, resulting in implementable insights [41]. Stakeholder's relations have a substantial impact on project outcomes for construction projects. Effective stakeholder management (including stakeholder's analysis) is critical to the project success. Prabhu [42] identified the key stakeholders and assessed in terms of their interests, power, and attitudes. An integrated approach is adopted for stakeholder identification and management. Stakeholder's analysis guides choices to improve quality, reduce expenses, and expedite decision-making while protecting human resources. This empirical study provides insight into stakeholder management strategies. Effective stakeholder management enhances project quality, controls costs, and meets timeframes. The findings provide insights applicable to the stakeholder management in varied project situations.

The project management methods are critical at workplace. They serve as key components, driving innovation, adding value, and realizing visions. Despite their relevance, the projects frequently confront problems and have significant failure rates, raising business and academic worries. This study [43] incorporates stakeholder theory into project management by combining quantitative survey analysis with SEM methodologies to uncover six essential stakeholder traits that influence

project success. The two frameworks are devised; TSIA (Total Stakeholder Influence Analysis) and SBPMM (Stakeholder-Based Project Management Model), which make it easier to incorporate stakeholders concepts into projects. Both frameworks (TSIA and SBPMM) emerge as critical tools.

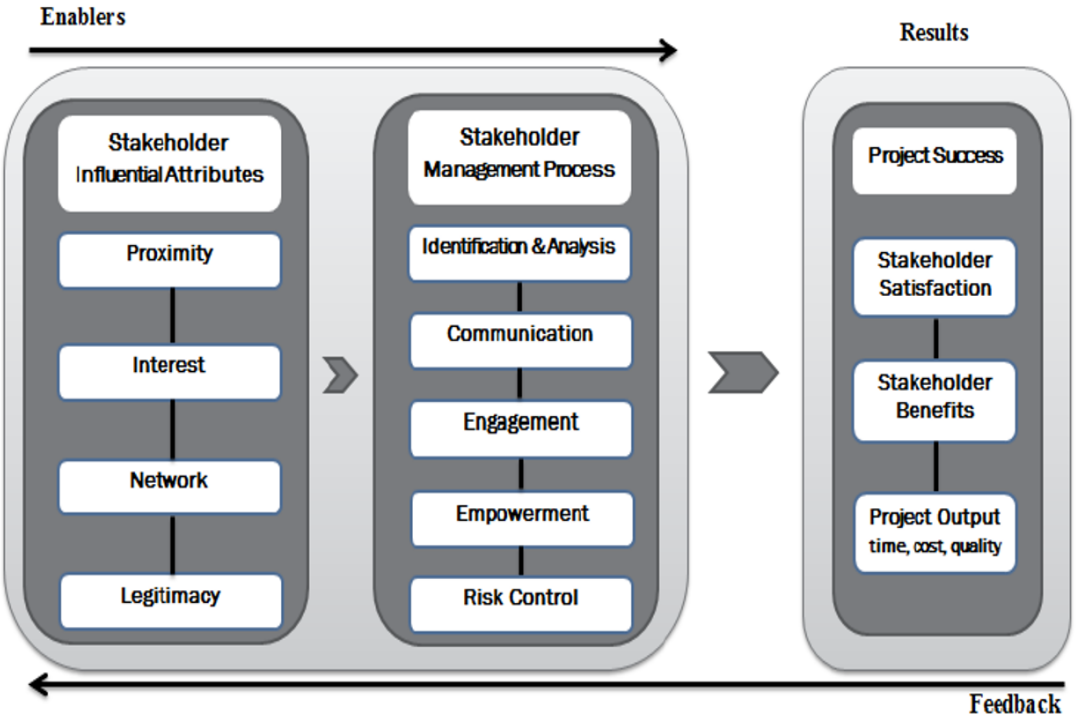

FIGURE 2.10: Project management model centered around stakeholders [43].

An empirical study [44] addresses the social sustainability for construction projects particularly from developing nations perspective. It analyzes feasibility of stakeholders. The feasibility reports from Indian government entities for 61 projects are evaluated. The study demonstrates that the reports do not adequately address social sustainability factors such as occupational health and safety, worker employment practices, and community engagement. Statistical analysis reveals a substantial link between social sustainability considerations, project type, and the delivery system. The findings provide significant information for decision-makers looking to promote social sustainability for projects, which will benefit disadvantaged groups. The research utilizes both quantitative and qualitative tools for analyses.

2.6 Role of Internal Stakeholders in Economic and Social Sustainability

Construction sustainability issues can endanger government decrease of carbon and energy goals. By using a hybrid strategy, the research work [45] emphasizes the importance of shared knowledge and expertise along the supply chain in achieving sustainable building goals.

A web-based tool might improve systematic participation and facilitate adherence to government aims. Organizational hurdles such as knowledge shortages and severe workloads along with industry-wide constraints like insufficient government action and regulatory attention create problems. Overcoming these obstacles necessitates collaborative efforts to emphasize sustainability and expedite engagement procedures.

Sustainable development concepts cover all stages of the construction process from raw material extraction to waste management. This holistic method involves planning, design, and building as well as ultimate deconstruction. Choosing suppliers close to the project is critical when making sustainability selections. Close supplier proximity lowers transportation emissions and increases efficiency. Multi-Criteria Analysis (MCA) is a popular tool for supplier selection that weighs aspects such as environmental effects, economics, and social concerns. Construction projects may align with sustainable aims by choosing close suppliers and implementing MCA, reducing their environmental footprint, and increasing resource efficiency. This integrated strategy guarantees that sustainability stays at the forefront of decision-making processes, propelling the construction sector toward a more environmentally conscious and responsible future [46].

Wagner et al. [47] carried out two types of analyses; simple descriptive analysis and factor analysis. However, this approach has drawbacks when it comes to measuring perception and analyzing efficiency in organizational interactions. The absence of a dynamic model requires ongoing administrative oversight and frequent modifications. Simply categorizing stakeholder significance is insufficient and the

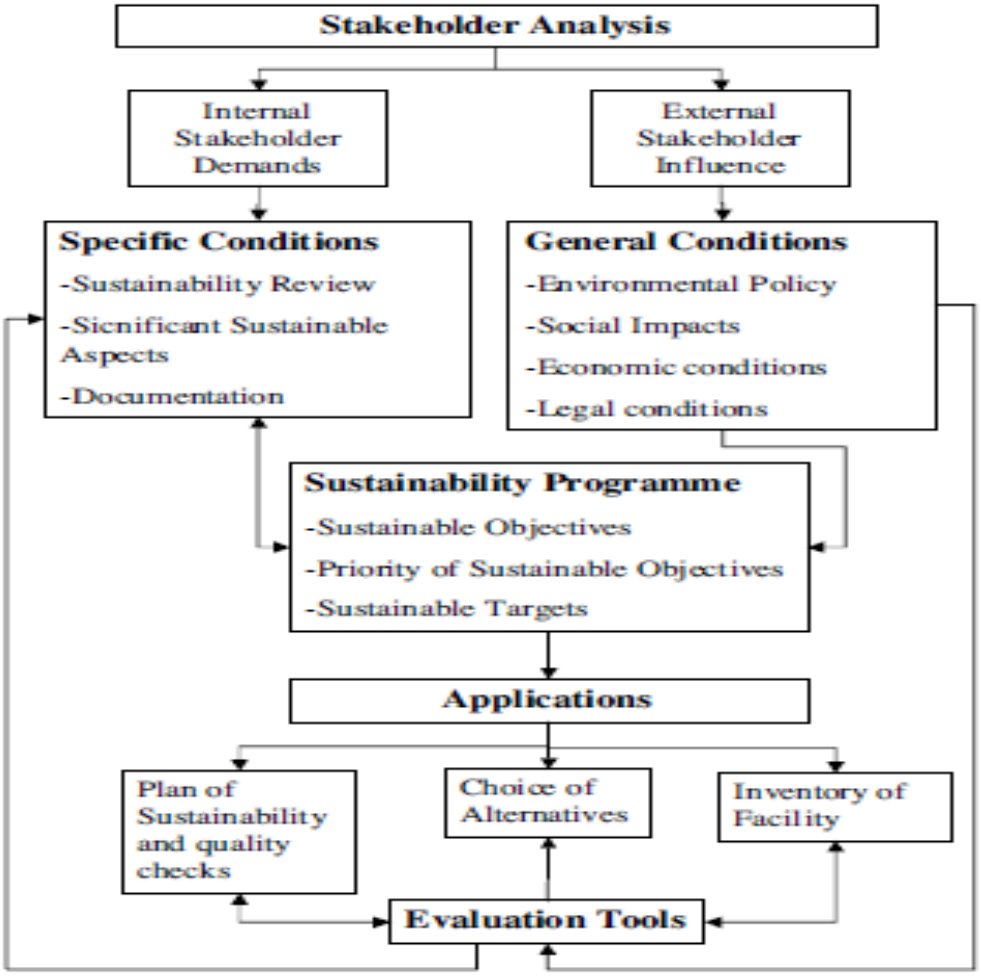

FIGURE 2.11: Model for analyzing stakeholders in a structural manner [46].

linkages are essential for achieving stakeholder's expectations. Managing stakeholder's relationships should also take into account how organizational activities and efforts help to create, establish, and reinforce links with each stakeholder.

The study conducted by Maier and Aschilean [48] provides 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 organization's ability to achieve its goals.

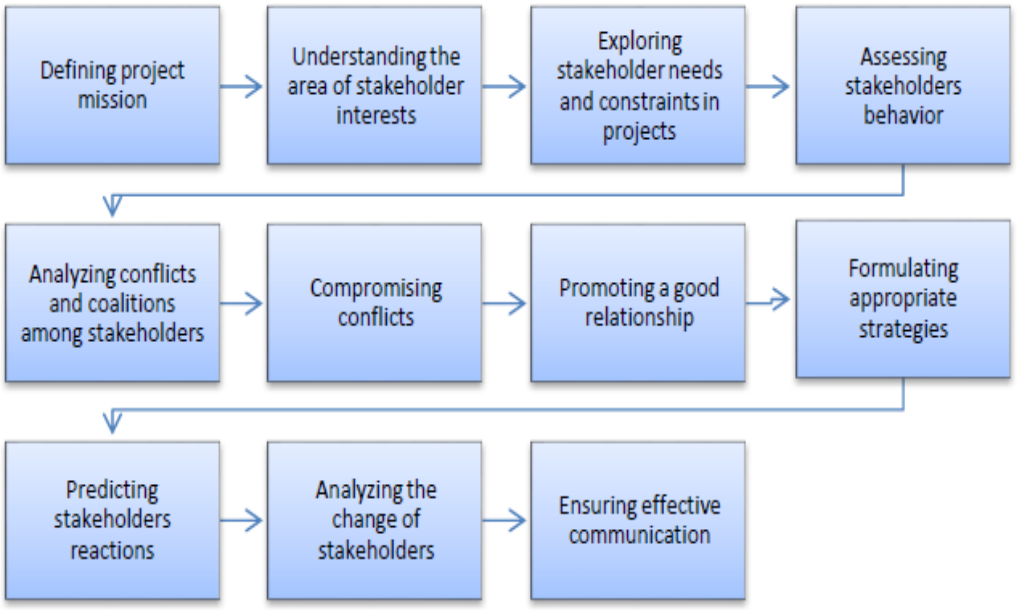

FIGURE 2.12: Construction stakeholders structure; A complete approach [48].

Sometimes owners are unaware of sustainable construction procedures and concepts, especially those pertaining to land. Many people in positions of power and wealth lack fundamental knowledge. The major goal of the project is to identify important stakeholder groups and analyze their responses to changes in initiatives, revealing potential possibilities, and dangers. During construction projects, open conversations and comments should be promoted from construction workers, supporting two-way communication rather than top-down commands in order to maintain greater levels of labor satisfaction [49].

The growth of digitalization, automation, and greater use of information and communication technology (ICT) signal the start of the Fourth Industrial Revolution. However, various hurdles obstruct its implementation in the construction sector. To address these problems, a survey was administered and evaluated. The BIM, cloud computing, and modularization are examples of important advancements in the technology, Although mixed, definite, and augmented reality are still in their infancy and have an impact on the sustainability of the construction industry. Social aspects appear to be crucial with the biggest impact on effective adoption. Embracing the industrial revolution in construction industry promises to improve performance and meet future challenges [50].

Sustainable projects involve a wide range of stakeholders with varying interests, emphasizing the significance of efficient communication among decision-makers and relevant organizations when acquiring resources to avoid failures. The government bodies have a substantial impact on sustainable building projects focusing on the importance of balancing stakeholders interests. Understanding of power relations between stakeholders (such as land sellers, purchasers) and local governments are critical. Local governments working on public land schemes sometimes exercise greater authority than land dealers due to their administrative capabilities. This highlights the complexities of stakeholder interactions for sustainable building projects as well as the need to take into account multiple viewpoints and interests to ensure project success [51].

Innovative technology and concepts play an important role in lowering construction project and product delivery times. These technologies not only save expenses such as labor and material prices but also increase total productivity in the construction business. However, various variables that influence worker productivity rates have been found including communication gaps and skill mismatches among team members. Team members must be able to successfully complete essential duties, work quickly to meet deadlines, and cooperate well with other team members. Both the project manager's competency and team members' talents have a major impact on customer satisfaction and project completion within the stated time period. As a result, investing in novel technology and ensuring excellent communication and talent matching among team members are critical for achieving desirable outcomes in construction projects [52].

The absence of communication with the client in a situation when there is a lack of knowledge can lead to misconceptions and miscommunications. Effective client communication is important for ensuring that client expectations are correctly understood and satisfied. Furthermore, short-term activities rely heavily on working capital management.

Owners train managers on the importance of good operational capital management, which may have a direct influence on profitability. Proper working capital management guarantees that the firm has enough liquidity to meet its short-term

obligations while also increasing profitability and reducing financial risk. As a result, good communication with clients and smart working capital management are both essential components of successful business operations [53].

Capital stability management is a crucial component of a company's overall financial and economic picture. It involves 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 are the foundation for enhancing the average balance of all cash, in addition to keeping an eye on the absolute liquidity level. Customer value consists 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 [54].

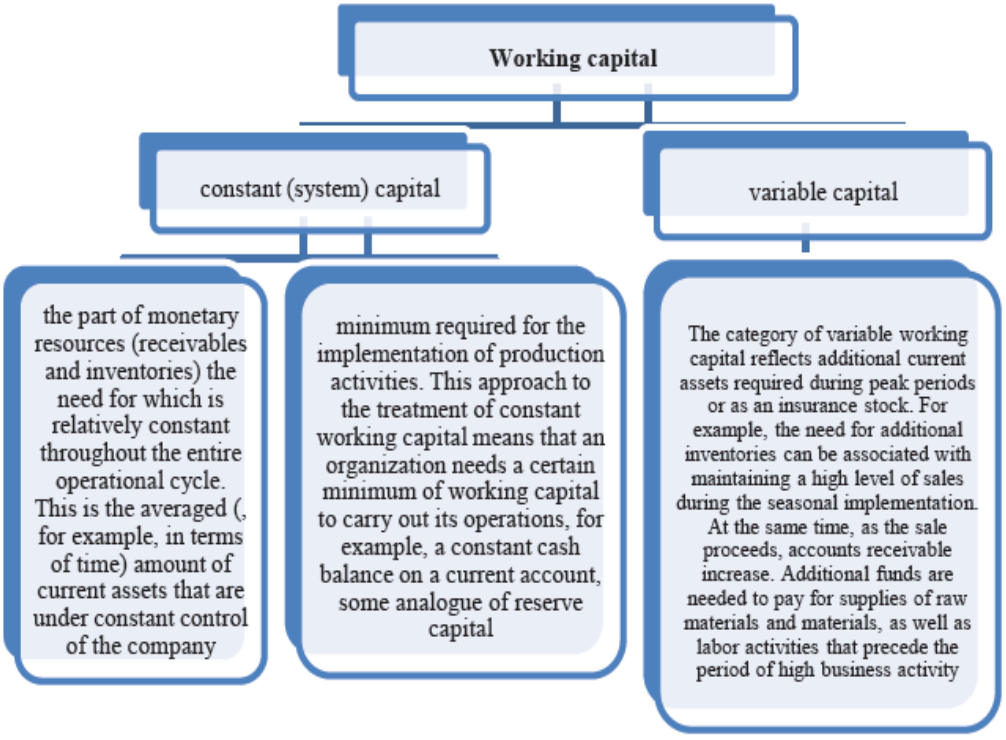

FIGURE 2.13: Analysis of working Capital structure [54].

Supplier development is a purchasing organization's investment in improving the performance of its suppliers. A firm's success is often determined by how well

it's able to create social capital, which may enhance relationship performance. Companies should explain their aims to suppliers in a clear and concise manner, organize their direct supplier development programs carefully, set improvement targets through formal supplier evaluations, and provide suppliers regular feedback on their performance. The interconnection of many factors of supplier development and many sorts of improvements, such as cost and quality, highlights the need for strategic supplier selection to attain desired results efficiently. Firms may enhance their supply chain performance and overall business success by developing strong supplier relationships and implementing targeted growth efforts [55].

Usually, the government handles public money and makes sure that it is properly allocated for development goals. It is expected that development projects will stimulate economic growth by encouraging a variety of local business activities. However, a lot of government resources are typically wasted owing to cost overruns, poor quality, and project delays. This mismanagement delays expected economic development results and impairs the effective use of public expenses. To solve these problems, the government should take steps to increase cost management, strengthen quality assurance methods, and simplify project delivery processes. This allows to optimize the impact of its investments, promote long-term development, and better serve the public interests [56].

The value of innovation is emphasized through three findings; improving technical capabilities, employing fresh graduates, and promoting organizational learning. In today's employment market, when individuals have to choose between steady employment and risky freelance work, financial incentives for freelancers should be adequate to balance the greater risks associated with self-employment.

Certain job categories may not use subcontractors; for example, the corporations may choose to recruit people rather than incur the expenditure of idle time depending on the workload forecasts. This highlights the need for effective workforce planning to balance personnel needs with operational demands. Organizations may better position themselves for success in an ever-changing industry by investing in technological developments, acquiring new people, and establishing a culture of constant learning. This drives innovation and maintains competitiveness [57].

Entrepreneurs and managers actively shape the success or failure of their businesses. Effective information management in entrepreneurial ventures is a crucial competency that has a substantial influence on the success of small firms. However, the businesses should prioritize resolving any concerns before moving forward. This proactive strategy ensures that possible obstacles are resolved quickly allowing for easier project execution and improving the chance of project success [58].

In today's business environment, organizations have to deal and cultivate tight connections with their suppliers. Entrepreneurial orientation is an important component of a company's strategic orientation defined by characteristics such as risk-taking, innovation, and proactive approach. It symbolizes an intangible organizational resource that generates long-term competitive advantage. Firms that embrace an entrepreneurial orientation indicate a commitment to connect in long-term practices that promote innovation and allow for proactive reactions to market dynamics. This strategic approach helps the businesses to handle uncertainty effectively while also capitalizing on emerging opportunities and positioning them for long-term success in competitive marketplaces. As a result, cultivating an entrepreneurial mindset within the corporate culture becomes critical for businesses seeking to create and retain a sustainable competitive advantage [59].

The relationship between market direction and learning orientation shows that when an organization takes a market-focused strategy, it gives priority to three components of consumer value: status, value for money, and reputation for excellence. Usually, marketing has been customer-oriented with an emphasis on addressing customer requirements and increasing profits via customer happiness.

However, the importance and control of client focus and innovation in achieving a competitive edge cannot be overemphasized. These characteristics play substantial roles in improving the organization's market positioning and promoting long-term success. Companies that integrate both market and learning orientations may better react to changing market dynamics, innovate in response to consumer wants, and create a durable competitive advantage. This strategic alignment allows firms to seize new opportunities [60].

The government assistance in crafting policies for entrepreneurs is insufficient for Pakistani entrepreneurial ecosystem. To successfully reduce unemployment, the government should conduct seminars, programs, and workshops to encourage company owners to grow their operations particularly among young people. Fresh graduates have aptitude and promise but little experience in company operations. Furthermore, the rules regulating private enterprises (particularly those relating to business registration and taxation) are extremely complicated and difficult to understand. Simplifying these restrictions will promote company growth and provide chances for entrepreneurship in the country [61].

2.7 Role of External Stakeholders in Economic and Social Sustainability

The International Labor Organization (ILO) defines 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 worker's right to have a safe and healthy workplace. The stakeholder approach to OHS encompasses all areas of corporate social responsibility including protecting worker well-being and encouraging a collaborative approach to the workplace safety [62]. The Bangladesh Readymade Garments Manufacturers and Exporters Association (BGMEA) is a well-known organization that represents woven garment factory owners and other stakeholders. The BGMEA advocates a "zero tolerance" approach to safety concerns. The association routinely audits member factories for compliance, implements social compliance development programs, and arranges training sessions to improve compliance and environmental standards. Owners of construction projects are the key consumers of construction services and frequently supply project finance. Additionally, they have a good impact on project's safety performance [63].

Researchers investigated numerous approaches used by various construction parties to accomplish the goal of zero injuries while intending to minimize and eventually eliminate construction mishaps. Managing the interests and impacts of many project contributors and stakeholders is important in construction projects especially when it comes to the occupational health and safety (OHS). The construction sector has major technical, cultural, and organizational differences, which provide significant issues for OHS management [64]. It is recommended that the government should take the lead in establishing occupational health and safety (OHS) laws. To properly fulfill the sustainability goals, the government should emphasize both economic growth and social conformity. The key steps may include increasing taxes on construction businesses for energy consumption and pollution contributions, giving investment assistance for energy-efficient technology, and improving government enforcement of on-site energy management laws. These measures are vital for the implementation of energy management strategies in Pakistan's building sector [65].

Understanding worker's behavior is vital for increasing production efficiency in the construction sector, which is primarily reliant on human labor. Fluctuations in construction labor productivity have a substantial impact on the national economy and total productivity. Inadequate safety precautions, insufficient skill training, poor material quality, and low salaries all contribute to workers' psychological stress. These aspects are vital and should be addressed for developing a pleasant work atmosphere and increasing productivity in the construction industry [66]. Sustainable development is described as a wholesome to the development that takes into account the happiness of people, animals, plant species, ecosystems, and natural resources. It addresses issues such as poverty alleviation, gender equality, human rights, and universal education. Six sustainability targets have been established by the Construction Confederation Environmental Forums (CCEF), indicating a growing recognition of the significance of sustainability in the construction sector. However, there is still a shortage in environmental education and awareness between the general public and industrial players. Education is critical in tackling sustainability issues because it raises awareness, promotes continual progress, and provides people with the information they need to apply

ecologically friendly activities and procedures. Sustainable development goals and environmental challenges may be successfully pursued by involving stakeholders and harnessing the industrial knowledge [67].

During the last decade, the construction sector has gained an increase in workplace inclusiveness and diversity. Employees who feel involved and appreciated by the organization are more content and productive. Recruiting from a more varied pool (including different races and genders) not only improves talent acquisition but also develops more informed and objective decision-making. Small and large construction businesses focus on distinct traits, abilities, and staff, which influence the entire corporate culture and atmosphere. However, diversification programs may present obstacles such as decreased social cohesiveness, communication hurdles, and greater employee conflicts [68].

Diversity management is widely used in construction organizations across the world, aiming to cultivate employees from origins and regions. In this sense, "diversity" refers to an employment that represents society's diverse demographics and "inclusion" means harnessing these differences in the workplace to engage individuals and improve their performance. Organizational change is also important and it entails addressing issues like senior leadership, organizational environment, a feeling of belonging, communication techniques, transparent recruiting, and possibilities for advancement and growth. Individual-level characteristics such as personality traits, locus of control, and self-confidence, including self-respect and empowerment, all contribute significantly to fostering inclusivity and have to be taken into account when implementing hiring and management procedures [69].

Diversity also improves shareholder returns because the advantages outweigh the expenses, resulting in higher returns for shareholders. During the last few decades, the research on the influence of gender diversity for corporate performance has backed by the Upper Echelon Theory (UET), which holds that diversity should boost firm performance. As a result, diversity programs are likely to provide good status benefits for businesses. However, this study adds more data indicating that the benefits of diversity may not be immediately apparent in financial accounting. But overall diversification initiatives do not appear to reduce shareholder value

and should be encouraged [70]. It may be investigated that how certain actions directly affect disadvantaged people's capacity to access resources and participate in decision-making processes on an equal footing with those who currently hold positions of authority. Efforts to directly improve the participation of different voiceless people are critical. Members of marginalized groups must not be treated into equity, diversity, and inclusion (EDI) committees or task forces but rather actively participate in activities that benefit society from a variety of viewpoints. Societies that incorporate members of disadvantaged groups into their leadership structures become more appealing to new members from those same groups [71].

There are several advantages of technology transfer procedures in the construction sector including advances in goods, manufacturing processes, and the development of new market-demanded products and services. According to a study [72] on worldwide competitiveness in service sectors, advances in construction technology are likely to result in a important improvement in productivity over the next two or three decades. This efficiency improvement is vital for fulfilling the needs of a continually changing market while remaining competitive in a global economy. Construction companies may simplify their processes, decrease costs, and provide higher-quality goods and services to their clients by embracing and using modern technology. As a result, the adoption of technology transfer techniques is critical for generating development and success in the construction industry. As duties become more dependent on technology, many people have lost their jobs.

Effective information and communication technology (ICT) adaptation depends heavily on the project managers, who carry major responsibilities for project management. The continuous up-gradation of ICT tools seeks to discover solutions for improving project management within organizations to fit the industry's changing needs.

Project communication management means that the project information is generated, collected, distributed, stored, and disposed of in a timely and suitable manner. However, due to rapid technological advancements, many businesses have deployed ICT solutions that do not sufficiently suit their goals. Project managers frequently coordinate the work of all organizations engaged in a project. Thus,

providing project managers with the required tools and training, which can improve the efficacy of ICT adaptation and overall project management practices [73].

A supply chain management network based on entities such as construction firms, transportation companies, and product suppliers, who are involved in the upstream and downstream flow of commodities. Common challenges encountered during the order-to-delivery process include a lack of coordination and the participation of subcontractors. Delays in conveying demand to material suppliers might also have an influence on order placement processes. To overcome these difficulties, digital technologies like material tracking tools may be used in order-to-delivery procedures. These technologies enable the creation of information in real time, which improve the traceability of supplies and building sites [74]. Compared to other industries, the construction industry has a significantly higher accident and fatality rate.

Data show an increasing tendency for rural labor migration to metropolitan regions, where the construction and manufacturing sectors are closely intertwined. Technology assessment (TA) is a systematic examination of the social implications of technology introduction, extension, or change, with an emphasis on unintended, indirect, or delayed consequences. Despite the broad spectrum of technological difficulties in building, there are few TA activities in construction industry. TA cannot make accurate forecasts but can reveal vectors of change, emphasizing possible advantages and dangers of technological advancement [75].

2.8 Summary of Literature

The extensive prior academic literature is reviewed to get insights about various aspects of sustainability and stakeholder involvement in the construction sector. It is divided into three phases, each concentrating on a different component of the study topic. In the first step, the major concepts and ideas of sustainability are covered along with improvement factors and how they are applied in the constru-

uction industry. This includes reviewing current literature to better understand how sustainability is defined and applied in construction projects. The key subjects covered include environmental sustainability, social responsibility, and economic feasibility. The literature mostly focuses on the environmental pillar of sustainability, with comparably little study of the social and economic sustainability in Fig 2.14.

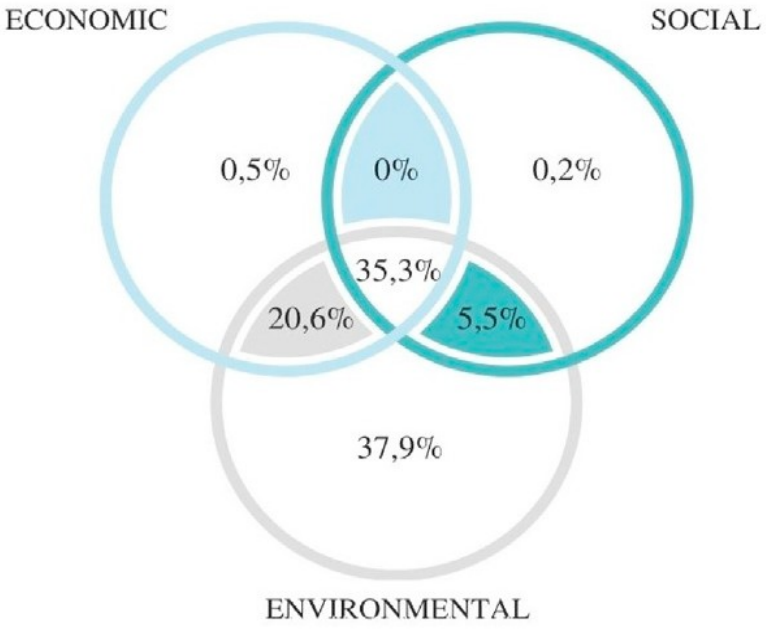

FIGURE 2.14: Logic diagram representing most discussed pillar of sustainability.

By combining data from previous studies, it is attempted to provide a thorough picture of construction sustainability. The second component of the literature review investigates elements that influence social and economic sustainability in construction projects. This includes a careful estimate of topics such as community participation, labor practices, economic growth, and supply chain management. The review aims to identify major drivers and constraints to social and economic sustainability in construction by critically examining previous studies.

Finally, the literature explores the role of both internal and external stakeholders for construction projects. This involves looking into how stakeholders affect project results, decision-making processes, and overall project success. The breakdown of stakeholder is shown in Table 2.1.

TABLE 2.1: Breakdown into internal and external stakeholder.

Internal Stakeholders	**External Stakeholders**
1. Employees	1. Supplier
2. Owners	2. Shareholder
3. Managers	3. Customers
	4. Society
	5. Government
	6. Creditor

The goal is to emphasize the importance of effective stakeholder involvement and management in ensuring sustainable building practices by combining findings from previous research. Overall, the literature review offers an in-depth overview of recent and classical research studies on sustainability and stakeholder involvement in the construction sector. The aim is to help establish successful methods and techniques for improving sustainability in construction projects by integrating conclusions from previous research studies. After reviewing the literature on sustainability; the main variables and sub-variables of are identified and summarized in Table 2.2.

TABLE 2.2: Variables and sub-variables of sustainability for construction industry.

Sustainability	**Variables**	**Subvariables**	**References**
Economic Sustainability	Land	Suppliers	[41]
		Owners	[46–49, 52]
		Government	[41, 51]
	Labours	Owners	[45, 52]
		Managers	[52, 53]
	Capital	Owners	[40, 48]

Table 2.2: (Continued).

Sustainability	**Variables**	**Subvariables**	**References**
		Managers	[8, 36, 54]
		Suppliers	[55]
		Government	[56]
	Entrepreneurship	Employees	[57]
		Managers	[58]
		Suppliers	[59]
		Customers	[60]
		Government	[40, 61]
Social Sustainability	Health and Safety	Employees	[62]
		Managers	[39, 63]
		Owners	[64]
		Government	[65]
	Human rights	Employees	[66]
		Government	[67]
	Diversity and inclusion	Employees	[68]
		Managers	[69]
		Shareholders	[70]
		Society	[31, 71]
	Technology	Employees	[72]
		Managers	[37, 38, 73]
		Supplier	[74]
		Society	[75]

2.9 Research Gap

The research highlights a major gap in the literature within construction industry. Although, the present research focuses primarily on the environmental aspect of sustainability, there is a noticeable lack of attention paid to the social and economic components. Specifically, the integration of these factors with stakeholders is less explored. Stakeholders (such as community members, workers, investors, and lawmakers) play critical roles in achieving sustainability in construction industry. By incorporating them in the research process, variety of ideas can be captured and ensure that the results are relevant and useful for people who make project decisions. To fill this gap, the research proposes an innovative technique. Create a thorough matrix that examines improvement elements related to both the social and economic pillars of sustainability. The incorporation of stakeholder's point of view provides a deeper knowledge and addresses typical environmental issues.

The findings have important practical consequences for construction project designers. The research is a useful reference, offering insights on the significance of addressing social and economic sustainability issues in the project management decisions. Overall, this research adds significant value to the subject of building sustainability. To fill this essential gap, a work delivers actionable insights that may strengthen the future project management procedures.

Chapter 3

Research Methodology

This chapter outlines the process that is used to achieve the goals of the study. It begins with an extensive literature analysis to identify the parameters. A matrix of identified parameters is created by linking sustainability improvement pillar to internal and external stakeholders. Based on this matrix, a questionnaire is designed, which covers the relevant factors of sustainability and stakeholders. The responses are gathered through online survey and the results are examined through statistical tools. Finally, the results are discussed in detail. This chapter provides a thorough description of the research methods used in the current study.

3.1 Research Framework

This research aims to assess how internal and external stakeholders of construction projects contribute in improving the social and economic pillars of sustainability in order to attain overall objective of sustainability. The important study topics are sorted out and the relationship between the stakeholder participation and sustainability pillars is better understood through a thorough review of the literature. A questionnaire is developed and opinions from the respondents are gathered based on the examination of the literature. Following a statistical analysis of the data, the factors impacting sustainability are ranked using the relative importance index method. Following the analysis, the results are discussed. Finally, the conclusions

are drawn based on the tests, results, and analyses. Figure 3.1 displays the flow chart and methodologies used in the current research work.

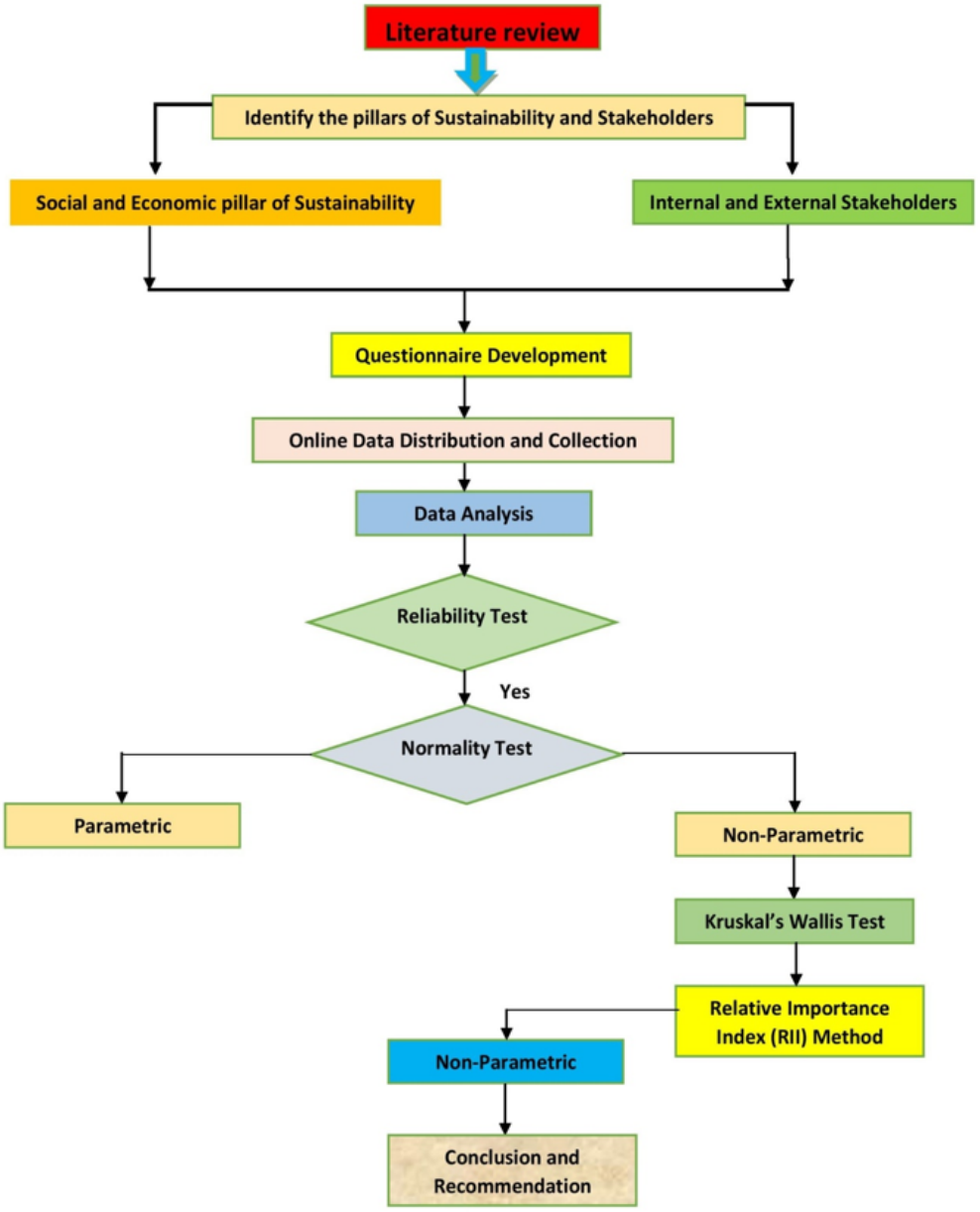

FIGURE 3.1: Research framework flowchart.

3.1.1 Literature Review

The initial step in the research process is to perform a complete literature review. This stage is important because it gives a basic grasp of the issue at hand and helps to locate the research question within the current body of knowledge. This descriptive examination assisted in developing the issue statement and establishing the research objectives.

3.1.2 Identify the Pillars of Sustainability and Stakeholder

From the literature review, identify the pillars of sustainability and factors of stakeholders.

3.1.3 Pillars of Sustainability and Factors of Stakeholders

The study tries to determine how internal and external stakeholders contribute to enhancing the social and economic pillars of sustainability in construction projects. It undertakes a comprehensive literature review to investigate relevant factors of sustainability and stakeholders.

3.1.4 Questionnaire Development

A questionnaire is developed using the identified factors to gather data from respondents. The data was gathered online. Statistical methods are used to examine the collected data and to determine the important factors impacting sustainability and stakeholders.

3.2 Development of Research Hypotheses

This study evaluates the construction industry's motivation to implement the social and economic pillars of sustainability. Based on the objective of the research, three viable hypotheses are generated to investigate various elements of stakeholder's participation and perception in the construction business. These assumptions are based on claims reported in the literature about the internal and external stakeholders and their influence on social and economic pillars of sustainability. The hypotheses try to examine the link between stakeholder involvement and sustainability, the variations between internal and external stakeholders, and the relationship between improvement pillars and sustainability results in construction industry.

1. **Null Hypothesis (H_0)**: There is no significant relationship between stakeholder's participation and (social and economic) pillars of sustainability in the construction industry.

   Alternative Hypothesis (H_1): The involvement of stakeholders has an important beneficial association with the social and economic sustainability in the construction industry.

2. **Null Hypothesis (H_0)**: Internal stakeholder's opinions on the improvement pillars are not significantly different from those of external stakeholders in the construction sector.

   Alternative Hypothesis (H_1): Internal stakeholder's perspectives on improvement pillars vary significantly from those of external stakeholders in the construction industry.

3. **Null Hypothesis (H_0)**: There is no significant relationship between the importance of the improvement pillars and how much social and economic sustainability we achieve in construction projects.

   Alternative Hypothesis (H_1): There is a specific positive relationship between the importance of the improvement pillars and the level of social and economic sustainability achieved in construction projects.

3.3 Measurement and Data Collection

A thorough literature is covered to find out and assess measurable issues relevant to the current research. The sustainability factors are further classified into sub-factors and relationships are developed with both internal and external stakeholders.

This entire approach improves the understanding of issues that influence sustainability in the construction sector and help in building successful strategies for

meeting sustainability targets. Based on the literature findings, a matrix is developed that integrates the improvement pillars of sustainability and stakeholders as shown in figure 3.2.

	Internal Stakeholder			External Stakeholder					
Stakeholder / Improvement Pillars of Economy Sustainability	1. Employees	2. Owners	3. Manager	4. Suppliers	5. Shareholder	6. Customers	7. Society	8. Government	9. Creditor
1. Land	×	✓	×	✓	×	×	×	✓	×
2.Labor	×	✓	✓	×	×	×	×	×	×
3. Capital	×	✓	✓	✓	×	×	×	✓	×
4. Entrepreneurship	✓	×	✓	✓	×	✓	×	✓	×
Improvement Pillars of Social Sustainability									
5. Health and safety	✓	✓	✓	×	×	×	×	✓	×
6. Human Rights	✓	×	×	×	×	×	×	✓	×
7.Diversity and inclusion	✓	×	✓	×	✓	✓	×	×	×
8.Technology	✓	×	✓	✓	×	×	✓	×	×

FIGURE 3.2: Matrix the Pillars of Sustainability and Factors of Stakeholders.

3.3.1 Research Philosophy

This study utilizes different factors sorted out from various research studies to justify and explain the assumptions, which are analyzed through different tests. The quantitative approach is used as research methodology to evaluate the data.

To address the goals and research questions, as well as to look into correlations, the variables are assessed and quantified. In order to determine if the decisions meet the success or failure criteria, the hypotheses are tested and compared to the data's test results.

3.3.2 Data Analysis

The gathered data through questionnaire responses are analyzed as detailed below:

3.3.2.1 Unit of Analysis

The units of analysis consist of persons, organizations, and important geographic areas. Participants in this study came from technical backgrounds and have comprehensive knowledge of the selected improvement factors. This research focuses on the construction projects and examines the involvement of internal and external stakeholders such as employees, managers, suppliers, and government agencies. The study aims to identify patterns and variables impacting the sustainability results by investigating stakeholder interactions throughout project phases such as planning, design, construction, and post-construction. The online Google Form is a simple, rapid, and cost-effective method of data collection [76]. Different tests are performed in the current research work are;

1. Normality test
2. Descriptive statistics
3. Reliability test
4. Hypothesis testing

3.3.2.2 Number of Samples

An appropriate number of samples are critical to accomplish research objectives and statistical needs. This decision was made based on Rawalpindi and Islamabad's population along with the desired level of accuracy. Better sample sizes produce more reliable results but they also require more resources and time. The probability sampling is used to ensure equal representation and giving each individual an equal chance of being chosen. Taro Yamane formula is used to calculate the sample size with a 0.05 margin of error [77].

Sampling strategies in research are essential for effectively measuring stakeholder viewpoints on social and economic scales of sustainability. The sampling methodologies are vital in getting data from stakeholders to understand their perspectives and preferences about sustainability projects. The data are gathered using proper sampling methods and divided people into groups for full population representation. Respondents had two parts to complete. Part one gathers personal details like age, gender, and experience while part two contains questions on the chosen parameters for the current study. The Likert scale measures views on knowledge, beliefs, actions, and experience of the respondent related to topic under study. This study used a five-point Likert scale from "strongly agree" 1, "agree 2, "neutral 3, "disagree 4," and "strongly disagree" 5 to properly evaluate [78]. N. Mujere [79] used selective sampling, which is a type of non-probability sampling. This strategy requires choosing people from the community who are thought to be best suited to give accurate and relevant information. Therefore, the non-probability sampling technique is adopted used for the current study. The sample group for the study includes both internal and external stakeholders who are important relevant to the sustainability initiatives. This provides an insight into how stakeholders think and prioritize social and economic aspects of sustainability. Demographics refer to audience-related data and are a necessary aspect of research [80].

According to the latest data updated on the PEC website, there are 1,680 registered contractors in categories C-A through C-5 in Azad Kashmir, Rawalpindi, and Islamabad [81]. The responses are collected from the registered construction firms in Islamabad, Rawalpindi, and Azad Kashmir by emailing a Google Form questionnaire. Approximately 400 construction companies from these locations took part in the survey. In addition to the online survey, the data are directly collected from experts at various organizations. The required sample sizes have various degrees of accuracy, confidence, and variability. The sample size is computed to achieve $\pm 5\%$ accuracy with 95% confidence and 0.5 of variability, similar computations might exist at $\pm 7\%$ and $\pm 10\%$ accuracy levels. These sample size calculations are vital for ensuring the quality and reliability of the data acquired for research investigations. They allow researchers to establish the proper sample size depending on their desired degree of precision and reliability.

In order to ensure that enough data for current study, the right sample size should be selected. The maximum variability (p = 0.5) is assumed because the population of firms in Islamabad, Rawalpindi, and Azad Kashmir is huge, and the adoption rate of the new practice is unknown (it may be anywhere from 0% to 100%). It is aimed to achieve 95% confidence in findings with a margin of error of no more than ±5% [82].

To calculate the sample size, Equation 3.1 is used, which allows to determine the optimal sample size depending on the required levels of precision and confidence.

$$n_0 = \frac{z^2 \times p \times q}{e^2} \tag{3.1}$$

Where,

n_0 = Sample size

z = Number of standard deviation from mean use z=1.96 for a confidence level of 95%

e= Standard error 5%

p = q = 50%

$$n_0 = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2}$$
$$n_0 = \frac{0.9604}{0.0025}$$
$$n_0 = 385$$

In research with a small population, the sample size will change to account for the fact that each sample unit yields more information than a larger population. This adjustment is frequently calculated using Equation 3.2, in which "n" denotes the sample size and "N" indicates the population size. Equation 3.2 assures that the specified sample size offers adequate information while retaining statistical validity in the setting of a smaller population.

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}} \tag{3.2}$$

$$n = \frac{385}{1+\frac{385-1}{1680}}$$

n=313

The chosen sample size of 313 may be regarded as appropriate to attain the specified degree of accuracy since it is determined using probability sampling, which ensures that every individual has an equal chance of being represented.

3.3.2.3 Response Collection

The current study focuses on enhancing sustainability in the construction industry in the Azad Kashmir, Rawalpindi, and Islamabad regions of Pakistan. Initially, the pilot test is run on 33 responses and then collected the rest of the replies. Total 300 valid responses are gathered for the current research study. The participants include professionals of construction industry such as engineers, stakeholders, supervisors, staff members, team leaders, and others experts. The methodology is applicable to diverse types of construction companies/firms. The data are collected via a Google Form questionnaire, which respondents have completed and submitted [83].

The first section of the questionnaire focuses on collecting personal information from participants including age, gender, profession, and education level. This section seeks to create a detailed demographic profile of the respondents providing critical background for the following study. In the second part of the questionnaire, the respondents are asked to answer various facets of sustainability improvement including economic and social variables. This section seeks replies that will enable the spreading of these fundamentals to both internal and external stakeholders.

The participants are asked to answer questions and statements aimed at assessing their perspectives, knowledge, and experiences relevant to the economic and social sustainability in their specific project environment. They are knowledgeable about the tricky technology, which is critical for global competitiveness and have experience with sustainable building procedures. Selected members are actively involved in construction projects inside their organizations providing direct information.

The methodology aims people who fit certain criteria and allows targeted research on sustainability in construction. Participants should complete and submit the questionnaire online via Google Form and share their views and perspectives. The subsequent responses are gathered and compiled from the chosen demographic for further treatment. This includes arranging and preparing data for analyses in line with the study objectives and methodology.

3.3.2.4 Data Reliability

The purpose of the reliability test is to evaluate the internal consistency of research constructs. Typically, Cronbach's alpha, a statistic with values ranging from 0.0 to 1.0, is used to describe it. A score of 1.0 denotes that the measurements are very uniform or dependable, whereas a value of 0.0 suggests that the data is entirely inconsistent. When applied, a Cronbach's alpha score of more than 0.7 indicates that the research measures' data is reliable enough for additional examination. This criterion provides assurance that the study's findings are reliable and robust, fostering confidence in the conclusions derived from the data.

Researchers frequently utilize reliability tests (such as Cronbach's alpha) to assess the consistency and dependability of their research tools, ensuring the validity and reliability of their study findings [17]. In the current study, social and economic sustainability improvement aspects are linked to both internal and external stakeholders collectively as well as each stakeholder group individually.

3.3.2.5 Normality Test

The normality test, also known as the Kolmogorov-Smirnov or Shapiro-Wilk test, is used to determine whether the obtained data has a normal distribution. This test is most effective when working with small to medium-sized samples often containing up to 5000 observations. If the significance level of the data is more than 0.05, it can be chosen as regularly distributed (parametric data). The data distribution pattern is not normal and should be regarded as (non-parametric) when the significance level is less than 0.05 [84].

3.3.2.6 Evaluation of Parametric and Non-parametric Data

When the data do not meet the test assumptions, the choice between parametric and non-parametric testing is made after statistical tests have been completed. Selecting an appropriate test is crucial, taking into account the characteristics of the data, including distribution, sample size, and measurement scale (ranked, continuous, or ordinal). For continuous, normally distributed data that exhibits a uniform distribution among groups and shows a linear relationship, parametric tests are appropriate. When analyzing data that is ranked or ordinal, deviates from a predetermined distribution, or shows non-linear behavior, non-parametric tests are not required. These tests are strong and applicable to wide range of conditions by providing accurate and reliable statistical analysis even when tight data distribution assumptions are not fully satisfied [85].

A significance level (also known as alpha) of 0.05 is frequently employed as a threshold for statistical significance. The present research used a non-parametric test since the significance threshold was less than 0.05. A statistical test may reject the null hypothesis if the p-value is less than 0.05, indicating that it is improbable that the observed findings were the product of pure chance. A Kolmogorov-Smirnov or Shapiro-Wilk test with a p-value of less than 0.05, so the data is significantly deviates from the normal distribution. Hence, non-parametric tests that do not satisfy presumptions on the data's underlying distribution may be selected by researchers. Since the significance level in the normality test was less than 0.05, a non-parametric test is conducted. The non-parametric approach is utilized as an acceptable replacement for statistical analysis since the data do not meet the requirements of normality.

3.3.2.7 Relative Importance Index

A research study [86] explores the sustainable development in Ghana's construction sector with an emphasis on hurdles to long-term project feasibility. Cultural, financial, professional, and direction-finding obstacles are investigated using a questionnaire survey.

The Relative Importance Index (RII) is used to evaluate the relevance of each barrier. The findings emphasize the need for government-led measures to solve environmental challenges through policy and legislation. This emphasizes on the necessity of coordinated efforts to promote sustainable practices in the construction sector, which is critical for Ghana's sustainable development.

$$RII = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{5n} \tag{3.3}$$

Where:

n_1 shows the quantity of respondents who strongly disagreed or "very low."

n_2 shows the quantity of respondents who is choose "disagree" or "low."

n_3 shows the quantity of respondents who counts "neutral" or "medium" responses.

n_4 shows the quantity of respondents who the responses are "agree" or "high."

Finally, n_5 shows that individuals who choose "strongly agree" or "very high."

The RII is often used by researchers to assess the importance of issues as assessed through surveys. It is a non-parametric approach used to estimate the relative value of several factors based on the survey results. The data from a questionnaire survey is analyzed using the RII approach, which is aided by Microsoft Excel®. The RII scores are calculated and presented in graphical forms like pie and bar charts. These responses provide useful insights on the perceived importance of elements among participants by allowing a thorough overview of their priorities and viewpoints. The RII approach and subsequent analysis allowed researchers to draw relevant results and consequences from the survey data [87]. The RII is determined to be the most useful method of analyzing the data received from the questionnaire surveys. The method is to calculate the RII of all 28 questions then ranking all of them for social and economic improvement elements along with internal and external stakeholders. By identifying which factors are the most important for project success in terms of social and economic sustainability accompanied with stakeholders in the construction sector (Eq 3.4).

$$RII = \frac{\sum W}{A \times N} \tag{3.4}$$

Chapter 4

Results and Discussion

In this chapter describes the data collection method, including surveys and statistical analysis. Purposive sampling is used in this study to choose individuals based on important features. Subsequently, the demographic data of participants is being presented. Likert scale methodology is used to evaluate respondent's attitudes about numerous issues. The data is analyzed through statistical approaches and thoroughly discussed the results, emphasizing major findings and consequences.

4.1 Demographic Results of Data

The demographic data contained in this research includes gender, experience, education, and designations as shown in Table 4.1.

Table 4.1: Demographic data.

Gender	Age (years)	Experience (years)	Qualification/ Education
Male	Below 25	1 - 5	Matriculation / O-Level
Female	25 - 30	5 - 10	Intermediate / A-Level
	30 - 35	10 - 15	Bachelor/ Equivalent
	35 - 40	15 - 20	Master/ M.Phil./ Equivalent

Table 4.1: (Continued).

Gender	Age (years)	Experience (years)	Qualification Education
	40 - 45	20 - 25	PhD
	45 - 50	25 - 30	
	50 Above	30 Above	

4.1.1 Characteristics of Respondents

4.1.1.1 Gender

As per response data, out of 300 respondents, males are 76.3% and females are 23.7%. The frequency and percentage of gender data are shown in Fig 4.1.

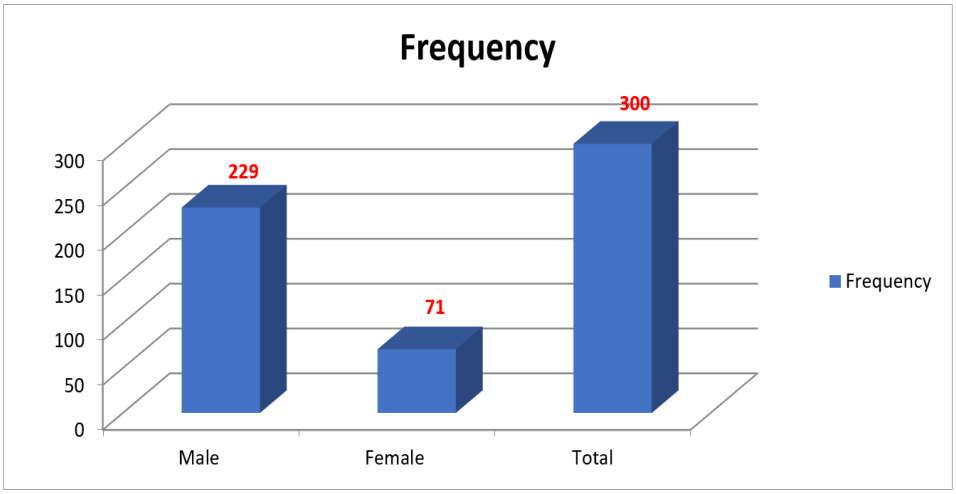

FIGURE 4.1: Gender Distribution.

4.1.1.2 Age

The age frequency of respondent is categorized as follows: below 25 years, 25 - 30 years, 30 - 35 years, 35 - 40 years, and above 40 years. Fig 4.2 shows these results. The data shows that the frequency of each age group is 70, 146, 53, 19, 9, 2, 1, and their percentages are 23.1%, 48.2%, 17.5%, 6.3%, 3.0%, 0.7%, and 0.3%, respectively.

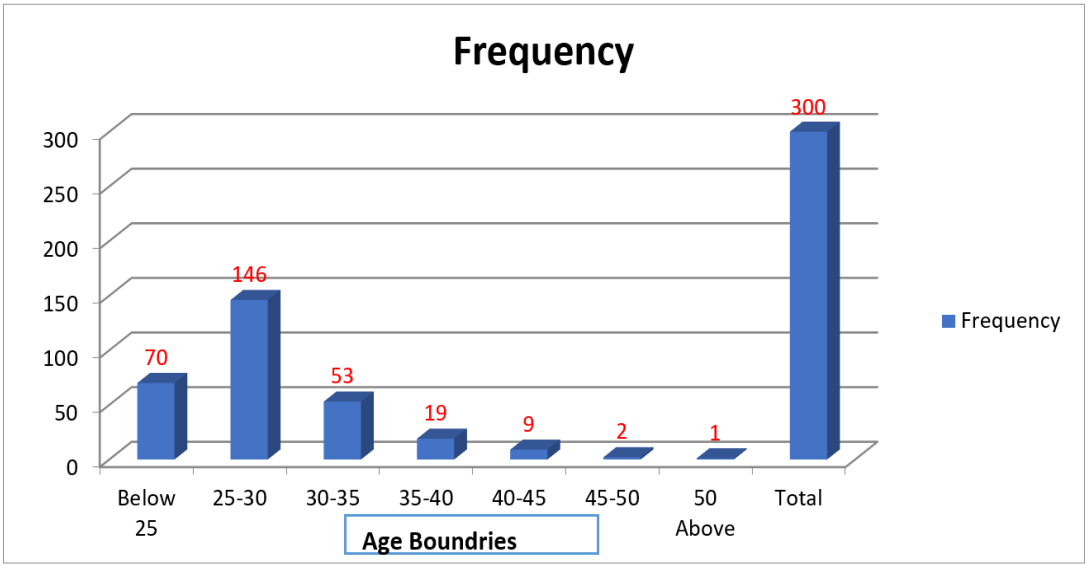

FIGURE 4.2: Ages of Responders.

4.1.1.3 Experience

This research considers professionals' experience levels to better understand their opinions. Experience categories present delicate insight and provide better data interpretation. The results are shown in Fig 4.3. Approximately, 59.67% have less than 5 years of experience, 26.67% have 5 to 10 years of experience, 8.33% have 10 to 15 years of experience, 3.67% have 15 to 20 years of experience, 0.33% has a range of 20–25 years, and 0.67% has a range of 25–30 years of experience.

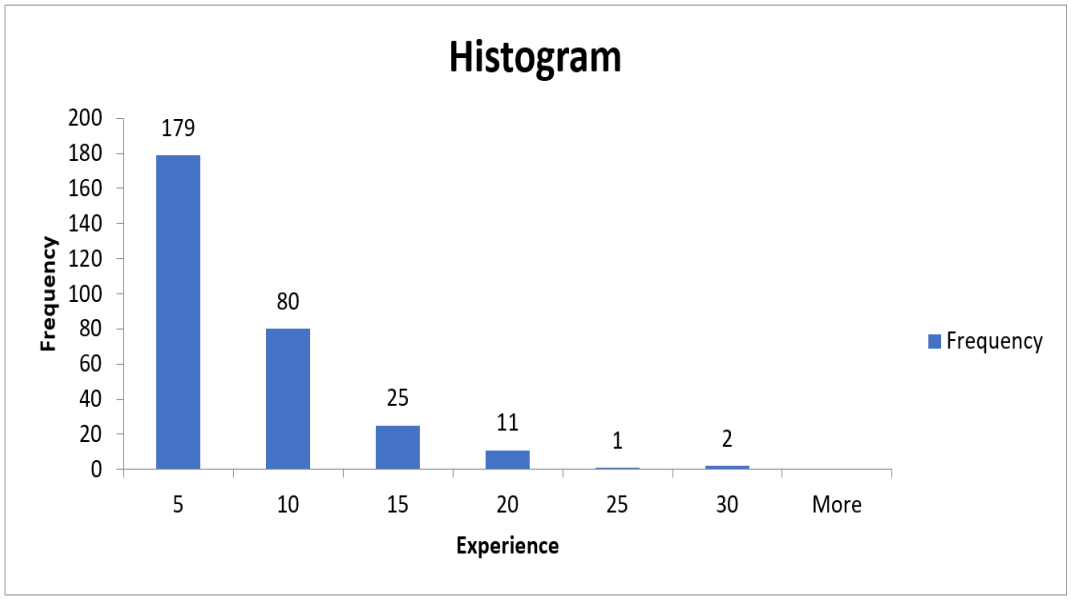

FIGURE 4.3: Experience of expertises.

4.2 Examining Statistics

The gathered information is examined statistically in efficient way using Excel® and SPSS statistical tools.

4.2.1 Reliability Test

When collecting data, especially when using a Likert scale, a reliability test known as the Cronbach's alpha technique is common for assessment of internal consistency of the data. If the alpha value is more than 0.7, the data are consistent and need more investigation [88]. The outcomes of the various improvement factors' reliability test can be noted in Table 4.2.

TABLE 4.2: Reliability test.

Improvement Factors	**No. of items**	**Cronbach's Alpha**
1. Land	3	0.842
2. Labor	2	0.844
3. Capital	4	0.840
4. Entrepreneurship	5	0.836
5. Health & Safety	4	0.835
6. Human Rights	2	0.789
7. Diversity & Inclusion	4	0.837
8. Technology	4	0.839

Using Cronbach's alpha to assess the reliability of the improvement elements, the study examined a variety of parameters related to sustainability and the results of building projects. With a Cronbach's alpha of 0.842, the land factor which includes variables like availability, location, and regulatory compliance showed a high level of dependability. With an even higher dependability score of 0.844, labor which includes workforce availability, skills, and efficiency showed great internal consistency in this area.

With a Cronbach's alpha of 0.840, "capital," or financial resources and investment in the project, also demonstrated a high level of dependability. Despite having a slightly lower score (0.836), entrepreneurship—which requires creativity, risk-taking, and management skills—maintained solid dependability. Cronbach's alpha for health and safety, which is important for guaranteeing employee welfare and adherence to safety regulations, was 0.835 in the research, indicating its dependability.

The human rights category, which includes labor rights, ethical behavior, and fair treatment, received a lower reliability score (0.789), indicating potential for improvement in measuring consistency. Diversity & Inclusion received a solid 0.837, highlighting the significance of having a diverse and inclusive workforce. Finally, with a Cronbach's alpha of 0.839, technology—which includes the use of new tools, techniques, and digital solutions—showed a high degree of reliability.

The majority of the components have high Cronbach's alpha values, which suggests that these improvement factors are consistently measured and emphasizes their significance in evaluating the sustainability and project results of construction projects. Ensuring strong and trustworthy results through reliable measurement is crucial for informing choices and devising strategies targeted at enhancing building practices. A greater understanding and improvement of many elements of building projects by stakeholders may result in more efficient, safe, and sustainable outcomes. This can be achieved by recognizing and concentrating on five key improvement factors.

4.2.2 Descriptive Statistics

All values like the total respondents are shown in Table 4.3. Analyzing the improvement factors indicates that "technology" stands out as most in need of development, with the highest mean score of 3.993. On the other hand, "diversity and inclusion" has the lowest mean score (3.917), indicating that it is an area that needs greater attention. However, the standard deviation, a measure of data distribution, provides a distinct perspective. Here, "capital" has the highest value

(0.7918), reflecting a broader variety of viewpoints on its improvement than the other elements. In comparison, "Land" has the lowest standard deviation (0.6621), which represents that the respondents are more in agreement on the need for change. Finally, the "technology" is the main concern based on the mean scores and the opinion on "capital" improvement are the most varied while remarks on "land" are more consistent.

Table 4.3: Descriptive statistics analysis.

	Descriptive Statistics				
Improvement Factors	**N**	**Min**	**Max**	**Mean**	**Std. Deviation**
1. Land	300	1.0	5.0	3.938	0.6621
2. Labor	300	1.0	5.0	3.954	0.7799
3. Capital	300	1.0	5.0	3.933	0.7918
4. Entrepreneurship	300	1.0	5.0	3.974	0.7499
5. Health and Safety	300	1.0	5.0	3.965	0.7357
6. Human Rights	300	1.0	5.0	3.957	0.7320
7. Diversity and Inclusion	300	1.0	5.0	3.917	0.7084
8. Technology	300	1.0	5.0	3.993	0.6991

4.2.3 Normality Test

4.2.3.1 Kolmogorov-Smirnov Test (K-S)

The K-S test contrasts the distribution of the sample with that of the reference, or normal, distribution. The largest difference between the sample and reference cumulative distribution functions is the test statistic. A smaller difference in distance between the two distributions is indicated by a lower statistic value. But according to your findings, the data does not follow a normal distribution, and the significance (p-value) is less than 0.001 for every test, meaning that the differences are statistically significant.

The sample distribution is more similar to the normal distribution when the K-S statistic has lower values. While there may be some variation from normalcy

in your data, all K-S statistics are less than 0.5, and the significance (p-value < 0.001) suggests that these deviations are statistically significant [89].

4.2.3.2 Shapiro-Wilk (S-W) Test

The S-W test compares the sample data to a normal distribution with the same mean and variance in order to explicitly test for normality. A score closer to 1 in the test statistic implies that the sample distribution is more similar to a normal distribution, which has a range of 0 to 1. Values significantly deviating from normalcy are indicated by values substantially lower than 1, particularly those below 0.05. Once more, the statistical significance of this departure is indicated by the p-values <0.001. The sample distribution may be closer to normal if the S-W statistic has higher values (nearer to 1). Significant departures from normality are indicated by values substantially less than 1. Even if the S-W statistics are closer to normality (higher than 0.05), the statistical importance of these deviations is still shown by the significance (p-value < 0.001) [90].

Analyzing the data's distribution pattern is crucial after establishing the data's dependability. The Shapiro-Wilk and Kolmogorov-Smirnov tests are used to asses if the data is normally distributed or parametric. The standard criteria for the test are given in the following hypothesis [91]. The conditions are;

$\mathbf{H_0}$; if p > alpha level (p is greater than alpha), retain H1 (the distribution sample is standard).

$\mathbf{H_1}$; if p < alpha level (p is less than alpha), reject H0 (the distribution sample does not have a standard distribution).

Whereas, alpha is equal 0.05, based on the findings of Kolmogorov-Smirnov and Shapiro-Wilk, the significance values for both the social and economic pillars of sustainability improvement factors could be noted.

The procedures below are used to do normality testing in SPSS®: Run SPSS® and open the data set first. Next, select Explore after selecting Analyze and then Descriptive Statistics. Move the variables of interest into the Dependent List box

in the Explore dialog box. Choose normality plots with tests by clicking Plots. To begin the analysis, go back to the Explore window, choose the required statistical settings under Statistics, and then click OK. Examine the K-S and S-W test statistics and their associated p-values (Sig.) to interpret the findings in the Tests of Normality table. An indication of a considerable departure from normality is a p-value less than 0.05 for K-S but greater than 0.05 for S-W. Based on these conclusions, modify the analytic strategy so that it is consistent with the distribution properties of data.

The SPSS® software is used to verify that the data distribution and the outcomes of the normality test are normal are shown in Table 4.4.

TABLE 4.4: Normality test results.

Tests of Normality						
	Kolmogorov-Smirnova			**Shapiro-Wilk**		
	Statistic	**Df**	**Sig.**	**Statistic**	**Df**	**Sig.**
1. H_{12}	.450	300	<.001	.511	300	<.001
2. H_{14}	.437	300	<.001	.547	300	<.001
3. H_{18}	.408	300	<.001	.696	300	<.001
4. H_{22}	.385	300	<.001	.704	300	<.001
5. H_{23}	.420	300	<.001	.644	300	<.001
6. H_{32}	.388	300	<.001	.677	300	<.001
7. H_{33}	.393	300	<.001	.703	300	<.001
8. H_{34}	.401	300	<.001	.671	300	<.001
9. H_{38}	.388	300	<.001	.747	300	<.001
10. H_{41}	.406	300	<.001	.667	300	<.001
11. H_{43}	.413	300	<.001	.627	300	<.001
12. H_{44}	.417	300	<.001	.639	300	<.001
13. H_{46}	.416	300	<.001	.619	300	<.001
14. H_{48}	.398	300	<.001	.673	300	<.001
15. H_{51}	.417	300	<.001	.645	300	<.001
16. H_{52}	.393	300	<.001	.660	300	<.001

Table 4.4: (Continued).

Tests of Normality						
	Kolmogorov-Smirnova			**Shapiro-Wilk**		
	Statistic	**Df**	**Sig.**	**Statistic**	**Df**	**Sig.**
17. H_{53}	.406	300	<.001	.669	300	<.001
18. H_{58}	.392	300	<.001	.710	300	<.001
19. H_{61}	.408	300	<.001	.678	300	<.001
20. H_{68}	.395	300	<.001	.663	300	<.001
21. H_{71}	.443	300	<.001	.605	300	<.001
22. H_{73}	.436	300	<.001	.620	300	<.001
23. H_{75}	.405	300	<.001	.687	300	<.001
24. H_{77}	.386	300	<.001	.693	300	<.001
25. H_{81}	.398	300	<.001	.578	300	<.001
26. H_{83}	.424	300	<.001	.629	300	<.001
27. H_{84}	.406	300	<.001	.639	300	<.001
28. H_{87}	.397	300	<.001	.687	300	<.001

The K-S and S-W test findings for the different hypotheses (H12 to H87) with a sample size of 300 individuals are shown in the table. These tests look at how much the data deviates from a normal distribution. Regarding H12, the significance approach for both the K-S and S-W test statistics is < 0.001, at 0.450 and 0.511, respectively. H14 has a 0.001 significance level for the K-S test statistic of 0.437 and a 0.001 significance level for the S-W test statistic of 0.547. For H18, the significance approach is less than 0.001 for both the K-S and S-W test statistics, which are 0.408 and 0.696, respectively. With a significance level of less than 0.001, H22 displays a K-S test statistic of 0.385 and an S-W test statistic of 0.704. Regarding H23, the significance apporach for both the K-S and S-W test statistics is less than 0.001, at 0.420 and 0.644, respectively.

Furthermore, H32 has an S-W test statistic of 0.677 and a K-S test statistic of 0.388 at a significance level of less than 0.001. H33 has a significance level of less than 0.001 for both the S-W test statistic of 0.703 and the K-S test statistic of

0.393. A significance level of less than 0.001 is indicated by a K-S test statistic of 0.401 and an S-W test statistic of 0.671 in H34. With a significance level of less than 0.001, the K-S test statistic for H38 is 0.388, and the S-W test statistic is 0.747. H41 exhibits a significance level of less than 0.001 for both the K-S and S-W test statistics, which are 0.406 and 0.667, respectively. With a significance level of less than 0.001, H43 has a K-S test statistic of 0.413 and an S-W test statistic of 0.627.

H44 has a significance level of less than 0.001 for both the K-S and S-W test statistics, which are 0.417 and 0.639, respectively. With a significance level of less than 0.001, the K-S test statistic for H46 is 0.416, and the S-W test statistic is 0.619. A significance level of less than 0.001 is shown by a K-S test statistic of 0.398 and an S-W test statistic of 0.673 in H48. For H51, the significance level of the K-S test statistic is ¡0.001, and the S-W test statistic is ¡0.001, both having a significance level of <0.001. With a significance level of less than 0.001, the K-S test statistic for H52 is 0.393, and the S-W test statistic is 0.660. A significance level of less than 0.001 is shown by the K-S test statistic of 0.406 and the S-W test statistic of 0.669 in H53.

A significance level of less than 0.001 is shown by the K-S test statistic of 0.392 and the S-W test statistic of 0.710 on H58. H61 has a significance level of less than 0.001 for both the S-W test statistic of 0.678 and the K-S test statistic of 0.408. For H68, the significance threshold is less than 0.001 for both the K-S and S-W test statistics, which are 0.395 and 0.663, respectively. H71 displays a significance level of less than 0.001 for both the S-W test statistic of 0.605 and the K-S test statistic of 0.443. H73 shows a significance level of less than 0.001 for both the K-S and S-W test statistics, which are 0.436 and 0.620, respectively. With a significance level of less than 0.001, the K-S test statistic for H75 is 0.405, and the S-W test statistic is 0.687. With a significance level of less than 0.001, H77 has a K-S test statistic of 0.386 and an S-W test statistic of 0.693.

H81 has an S-W test statistic of 0.578 and a K-S test statistic of 0.398, with a significance level of less than 0.001. For H83, the significance approach is less than 0.001 for both the K-S and S-W test statistics, which are 0.424 and 0.629,

respectively. H84 displays a significance level of less than 0.001 for both the S-W test statistic of 0.639 and the K-S test statistic of 0.406. With a significance level of less than 0.001, the K-S test statistic for H87 is 0.397, and the S-W test statistic is 0.687. The data consistently deviates considerably from a normal distribution, as shown by the significance values of less than 0.001 obtained from the Kolmogorov-Smirnov and Shapiro-Wilk tests.

The normality test indicates that the null hypothesis (H0) is rejected since all of the significance values it yields are more than 0.05 for the S-W test and less than 0.05 for the K-S test. It concludes that the alternative hypothesis (H1) is accepted. Therefore, this represents that the data distribution pattern is not uniformly distributed, which means that the data is non-parametric. Hence, non-parametric tests should be performed for further analysis.

4.2.4 Wallis Test (H test) Proposed by Kruskal

The data is non-parametric; hence it is crucial to assess the respondents' level of sensitivity. The Kruskal-Wallis test is used in this case to quantify such a level. The purpose of this test is to ascertain if respondents' attitudes toward each element were similar or different. Determine if there are statistically significant differences in the replies from the different categories by doing the Kruskal-Wallis test. This helps in determining the extent of opinion diversity and, as a result the respondents' level of sensitivity. The following hypotheses establishes the standard criteria to observe respondents sensitivity [92]. When examining a single category variable with two categories, such as construction project success vs. failure, the Chi-square goodness-of-fit test's degree of freedom is computed as follows: Df = k-1, where K is the number of categories. The degree of freedom in this scenario, with two categories (success and failure), Df is 2 - 1 = 1. The test is used to examine if the observed and predicted proportions of success and failure in a binary outcome scenario match.

For example, if you have 100 total projects, 60 of which are successful and 40 of which are unsuccessful, and you expect the distribution to be equal (50 successes

and 50 failures), the Chi-square goodness-of-fit test with one degree of freedom can be used to determine whether the observed distribution deviates significantly from the expected distribution [93].

H_0: if p > alpha level, every median is the same. (Identical sensitivity)
H_1: If p < alpha level rejects H0, More than one difference in median (Variation in Sensitivity).

Use the Analyze option in SPSS® to do this test. Next, choose Nonparametric Tests, then Legacy Dialogs, and finally one sample Chi-Square. Add your category variable to the list of test variables, and if necessary, provide predictable values. After running the test, examine the results, which include the p-value, degrees of freedom, and Chi-Square statistic. If the observed and predicted frequencies differ significantly, as shown by a p-value of less than 0.05, it can be inferred that the data does not match to the expected distribution.

Whereas, 0.05 is the alpha level, and the findings of a one sample chi-square test are shown in Table 4.5:

TABLE 4.5: Kruskal's Wallis (H-test) result (One-Sample Chi-Square Test where null hpothesis (H0) was rejected).

Sr. No.	**Null hypothesis**	**Sig.[a]**
1	H_{12}	<0.001
2	H_{14}	<0.001
3	H_{18}	<0.001
4	H_{22}	<0.001
5	H_{23}	<0.001
6	H_{32}	<0.001
7	H_{33}	<0.001
8	H_{34}	<0.001
9	H_{38}	<0.001
10	H_{41}	<0.001
11	H_{43}	<0.001

Table 4.5: (Continued).

Sr. No.	**Null hypothesis**	**Sig.[a]**
12	H_{44}	<0.001
13	H_{46}	<0.001
14	H_{48}	<0.001
15	H_{51}	<0.001
16	H_{52}	<0.001
17	H_{53}	<0.001
18	H_{58}	<0.001
19	H_{61}	<0.001
20	H_{68}	<0.001
21	H_{71}	<0.001
22	H_{73}	<0.001
23	H_{75}	<0.001
24	H_{77}	<0.001
25	H_{81}	<0.001
26	H_{83}	<0.001
27	H_{84}	<0.001
28	H_{87}	<0.001

(a). Represents significance level is .050

The findings of the one-sample chi-square tests performed on the different hypotheses (H12 through H87) are shown in the test summary. The null hypothesis (H0) for each hypothesis asserts that the observed and predicted frequencies do not differ significantly from one another.

All of the hypotheses have p-values less than 0.001 according to the tests, suggesting very significant outcomes. As mentioned in the footnote, 0.050 is the significance level applied to these tests. So the test rejects the null hypothesis as the p-value is less than the significance criterion. For every component under test, this shows compelling evidence both in favor of the alternative hypothesis and against the null hypothesis.

The results indicate that respondents are generally in agreement on the importance of sustainability's social and economic elements. Such constant sensitivity means that their thoughts do not differ that much. With this consistency in mind, the non-parametric data will be examined using the Relative Importance Index (RII). Ranking and assessing the importance of different aspects may be done with the RII technique when dealing with ordinal or non-parametric data. The elements for social and economic sustainability that respondents value most highly will be easier to identify according to this technique.

4.2.5 Relative Importance Index

4.2.5.1 RII for all Improvement Factors

The data are analyzed to calculate the relative importance index for each improvement pillar of social and economic sustainability by using eq 3.3 which was ranked on the basis of the improvement factor with stakeholders in the construction industry. The questionnaire is distributed among respondents to obtain their opinions about the most important factors for social and economic sustainability. Effectively analyzing survey data requires accessing the data manipulation and computing features of SPSS® in order to calculate the Relative Importance Index (RII). Start by inputting the survey responses into SPSS®, making sure that the answers are categorized according to comparable ordinal scales, such as "strongly disagree" (ranked 1) to "strongly agree" (ranked 5). Next, add up all of the response categories' frequencies to find the total number of respondents (N) for each question. The responses frequencies from respondents are enlisted in the table 4.6:

TABLE 4.6: Frequencies from Responses (Using SPSS).

	Code	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	H_{12}	8	6	8	242	34

Table 4.6: (Continued).

	Code	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
2	H_{14}	1	8	14	245	27
3	H_{18}	1	29	18	207	40
4	H_{22}	5	18	17	201	56
5	H_{23}	6	15	12	218	45
6	H_{32}	4	14	16	204	56
7	H_{33}	6	15	23	201	50
8	H_{34}	3	15	14	211	52
9	H_{38}	7	30	22	190	46
10	H_{41}	4	17	13	208	52
11	H_{43}	6	11	15	216	46
12	H_{44}	6	13	12	218	45
13	H_{46}	6	11	10	218	49
14	H_{48}	6	15	13	210	51
15	H_{51}	6	14	15	217	42
16	H_{52}	5	9	15	212	53
17	H_{53}	6	13	16	211	48
18	H_{58}	2	16	23	206	46
19	H_{61}	5	15	23	207	43
20	H_{68}	3	13	15	211	50
21	H_{71}	8	14	21	222	25
22	H_{73}	3	19	13	223	33
23	H_{75}	3	16	21	210	41
24	H_{77}	2	7	27	209	47
25	H_{81}	4	8	4	211	56
26	H_{83}	3	12	19	223	35
27	H_{84}	2	12	14	219	46
28	H_{87}	8	14	17	202	52

Based on respondents' ratings from agree to disagree, the frequency data presented allow for the computation of each factor's weight. As an example, consider a question H12:

To calculate the weight score for factor H12, multiplying each response category by its corresponding frequency.

Weighted score H12= (8×1)+(6×2)+(8×3)+(242×4)+(34×5)
Weighted score H12= (8+12+24+968+170)
Weighted score H12= 1182

Now, it is required to calculate similarly the weight ($\sum$W) of other factors using Excel®. For this purpose, multiply each variable with its weights. The results are shown in Table 4.7:

TABLE 4.7: Multiplication of each response with its Weight (Each coloumn multiplies with it's given score).

	Code	**Strongly Disagree (1)**	**Disagree (2)**	**Neutral (3)**	**Agree (4)**	**Strongly Agree (5)**
1	H_{12}	8	12	24	968	170
2	H_{14}	1	16	42	980	135
3	H_{18}	1	58	54	828	200
4	H_{22}	5	36	51	804	280
5	H_{23}	6	30	36	872	225
6	H_{32}	4	28	48	816	280
7	H_{33}	6	30	69	804	250
8	H_{34}	3	30	42	844	260
9	H_{38}	7	60	66	760	230
10	H_{41}	4	34	39	832	260
11	H_{43}	6	22	45	864	230
12	H_{44}	6	26	36	872	225
13	H_{46}	6	22	30	872	245
14	H_{48}	6	30	39	840	255

Table 4.7: (Continued).

	Code	**Strongly Disagree (1)**	Disagree (2)	**Neutral (3)**	**Agree (4)**	**Strongly Agree (5)**
15	H_{51}	6	28	45	868	210
16	H_{52}	5	18	45	848	265
17	H_{53}	6	26	48	844	240
18	H_{58}	2	32	69	824	230
19	H_{61}	5	30	69	828	215
20	H_{68}	3	26	45	844	250
21	H_{71}	8	28	63	888	125
22	H_{73}	3	38	39	892	165
23	H_{75}	3	32	63	840	205
24	H_{77}	2	14	81	836	235
25	H_{81}	4	16	12	844	280
26	H_{83}	3	24	57	892	175
27	H_{84}	2	24	42	876	230
28	H_{87}	8	28	51	808	260

In these findings, the weighted scores for questions labeled H12 to H87 are displayed. These values are obtained by multiplying the frequency of each response category by its respective score. A rating scale used by survey participants is shown: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).

The numbers in each column show the part of respondents who chose that particular rating for each question. For H12, 8 respondents selected disagree strongly (1), 12 disagree selected (2), 24 neutral selected (3), 968 are agree (4), and 170 agree strongly (5) for question H12. The above mentioned data depict the overall attitude and significance assigned to distinct response groups within each category. Weighted ratings obtained from the survey offer valuable insights into the amount of concurrence or real importance of certain factors among the participants.

Survey responses are used to determine the priority of variables using the Relative Importance Index (RII). The RII ratings are determined for each variable to see which one is consider more socially and economically beneficial and which one is prioritized first in the building industry for a successful project. Higher RII ratings represent respondents' perceptions of increased relevance or priority.

Similarly, adding all the values of H12 to H87 row wise from table 4.10 and multiplying highest weight (A) is 5 with the total number of respondents (N) 300 to obtain the RII of all variables from H12 to H87 and rank all these variables out of 5 as shown in Table 4.9 and reference table for relative importance index are shown in Table 4.8.

TABLE 4.8: Ranking Criteria for Relative Importance Index (RII).

Rank	**RII Range**	**Importance Level**
1st Rank	RII ≥ 0.78	Highest Importance
2nd Rank	$0.77 \leq$ RII < 0.78	High Importance
3rd Rank	$0.76 \leq$ RII < 0.77	Moderate-High Importance
4th Rank	$0.75 \leq$ RII < 0.76	Moderate Importance
5th Rank	RII < 0.75	Low-Moderate Importance

TABLE 4.9: Results of Relative Importance Index (RII)).

		Total Sum ∑W	**Total response (N)**	**Highest weight (A)**	**A × N**	**Relative Importance Index ($RII = \frac{\sum W}{A \times N}$)**	**Ranks**
1	H_{12}	1182	300	5	1500	0.788	1
2	H_{14}	1174	300	5	1500	0.78266667	
3	H_{18}	1141	300	5	1500	0.76066667	2
4	H_{22}	1176	300	5	1500	0.784	1
5	H_{23}	1169	300	5	1500	0.77933333	2
6	H_{32}	1176	300	5	1500	0.784	1

Table 4.9: (Continued).

		Total Sum ∑W	**Total response (N)**	**Highest weight (A)**	**A × N**	**Relative Importance Index ($RII = \frac{\sum W}{A \times N}$)**	**Ranks**
7	H_{33}	1159	300	5	1500	0.77266667	2
8	H_{34}	1179	300	5	1500	0.786	1
9	H_{38}	1123	300	5	1500	0.74866667	5
10	H_{41}	1169	300	5	1500	0.77933333	2
11	H_{43}	1167	300	5	1500	0.778	
12	H_{44}	1165	300	5	1500	0.77666667	
13	H_{46}	1175	300	5	1500	0.78333333	1
14	H_{48}	1170	300	5	1500	0.78	
15	H_{51}	1157	300	5	1500	0.77133333	2
16	H_{52}	1181	300	5	1500	0.78733333	1
17	H_{53}	1164	300	5	1500	0.776	2
18	H_{58}	1157	300	5	1500	0.77133333	
19	H_{61}	1147	300	5	1500	0.76466667	3
20	H_{68}	1168	300	5	1500	0.77866667	2
21	H_{71}	1112	300	5	1500	0.74133333	5
22	H_{73}	1137	300	5	1500	0.758	4
23	H_{75}	1143	300	5	1500	0.762	3
24	H_{77}	1168	300	5	1500	0.77866667	2
25	H_{81}	1156	300	5	1500	0.77066667	
26	H_{83}	1151	300	5	1500	0.76733333	3
27	H_{84}	1174	300	5	1500	0.78266667	1
28	H_{87}	1155	300	5	1500	0.77	2

The factors results in the construction industry with stakeholders are ranked according to their Relative Importance Index (RII) scores, which indicate their perceived significance for project success. The factors with the highest rank are H12,

H14, H22, H32, H34, H46, H48, H52, and H84, which have a RII score of 0.78, which indicates that respondents agree that these factors are critically important.H18, H23, H33, H41, H43, H44, H51, H53, H58, H68, H77, H81, and H87, which are ranked second with a RII score of 0.77, indicating that they are significant but somewhat less important than the first rank. With a RII score of 0.76 in the third rank, H61, H75, and H83 are significant but not as important as those in higher ranks. With a RII of 0.75, H73 is placed fourth in the construction perspective, while H38 and H71 are ranked fifth, indicating that they are consideration to be the least important elements. This RII-based ranking system provides information on the aspects that should be given priority in the construction industry in order to achieve effective project outcomes. These results are properly arranged in Table 4.10:

TABLE 4.10: Individual Ranking Results According to RII.

Improvement Variables	**Rankings**
1. Land and Owners	1
2. Land and Suppliers	
4. Labor and Owners	
6. Capital and Owners	
8. Capital and Suppliers	
13. Entrepreneur and Customers	
14. Entrepreneur and Government	
16. Health & Safety and Owner	
27. Technology and Suppliers	
3. Land and Government	2
5. Labor and Manager	
7. Capital and Manager	
10. Entrepreneur and Employees	
11. Entrepreneur and Manager	
12. Entrepreneur and Supplier	
15. Health & Safety and Employees	
17. Health & Safety and Manager	

Table 4.10: (Continued).

Improvement Variables	**Rankings**
18. Health & Safety and Government	
20. Human Rights and Government	
24. Diversity & Inclusion and Customer	
25. Technology and Employees	
28. Technology and Society	
19. Human Rights and Employees	3
23. Diversity & Inclusion and Shareholder	
26. Technology and Manager	
22. Diversity & Inclusion and Manager	4
9. Capital and Government	5
21. Diversity & Inclusion and Employees	

The construction industry's social and economic sustainability aspects are ranked from 1 to 5 in proper way and results are same as Table 4.10. Social sustainability issues frequently include things like stakeholder involvement, community involvement, and labor practices. Strong community ties, safe and healthy work conditions, and equitable labor practices are a few examples of high-ranked variables like H12, H14, H22, and H34. These elements are essential for preserving a good social effect and guaranteeing that initiatives benefit the community and employees in addition to the business.

Factors pertaining to economic sustainability include cost control, economic growth, and financial success. A number of factors, including H32, H46, H48, and H52, probably deal with financial planning, economic impact, and cost effectiveness. Projects must be financially beneficial, cost-effective, and promote economic development in order to be considered economically sustainable.

Table 4.10 provides a full ranking of the main eight factors, which are arranged according to their Relative Importance Index (RII) rankings.

4.2.6 Social and Economic Improvement Matrix with Stakeholders

A rectangular 8×9 matrix is developed for social and economic sustainability with stakeholders in the construction industry. The relative importance index values are calculated for all factors of social and economic sustainability and identified which factors are most important with internal and external stakeholders in the construction industry. The results of individual factors with stakeholders are shown in Table 4.11.

The results are the Relative Importance Index (RII) scores for the major economic and social sustainability improvement variables in the construction sector, broken down by internal and external stakeholders. Table 4.12, which was previously computed, is the source of all the findings in the matrix. The respondents' assessed overall relevance of eight criteria connected with both internal and external stakeholders was further ranked using these data in order to achieve social and economic sustainability. The 300 total responses are multiplied by the highest score of 5, and the resulting number is the ranking of each element that has to be determined as the most significant factor in Table 4.12 using the RII technique.

According to stakeholders in the construction sector, the table presents the Relative Importance Index (RII) results for several improvement pillars connected to social and economic sustainability. With a RII of 3.89, the highest priority among the pillars of economic sustainability, entrepreneurship is clearly recognized by stakeholders as being extremely important. With a RII of 3.09, capital comes in second, while labor and land are placed lower with RIIs of 1.56 and 2.33, respectively. Health and Safety has the highest RII of 3.10 among social sustainability categories, indicating its primary significance. With relative strengths of 3.09 and 3.04, respectively, diversity, inclusion, and technology also demonstrate their significant importance. With a RII of 1.54, on the other hand, stakeholders view human rights as the least important. These data offer perspectives on the priorities of stakeholders and their understanding of the major drivers of sustainable practices in the construction industry. The results are shown in Figure 4.4.

Table 4.11: RII Matrix Results of Improvement Factors.

	Internal Stakeholders					Extrenal Stakeholders			
Sustainability/ Stakeholder	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
	Employees	**Owners**	**Manager**	**Suppliers**	**Shareholder**	**Customers**	**Society**	**Govt**	**Creditor**
Improvement Pillars of Economy Sustainability									
1. Land	×	1182	×	1174	×	×	×	1141	×
2. Labor	×	1176	1169	×	×	×	×	×	×
3. Capital	×	1176	1159	1179	×	×	×	1123	×
4. Entrepreneurship	1169	×	1167	1165	×	1175	×	1170	×
Improvement Pillars of Social Sustainability									
5. Health and safety	1157	1181	1164	×	×	×	×	1157	×
6. Human Rights	1147	×	×	×	×	×	×	1168	×
7. Diversity and inclusion	1112	×	1137	×	1143	1168	×	×	×
8. Technology	1156	×	1151	1174	×	×	1155	×	×

TABLE 4.12: Results of Relative Importance Index (RII)).

Stakeholders with	**Total Sum ∑W**	**Total response (N)**	**Highest A**	**× N weight (A)**	**Relative Importance Index ($RII = \frac{\sum W}{A \times N}$)**	**Ranks**
Improvement Pillars of Economy Sustainability						
1. Land	3497	300	5	1500	2.33	6
2. Labor	2345	300	5	1500	1.56	7
3. Capital	4637	300	5	1500	3.09	4
4. Entrepreneurship	5846	300	5	1500	3.89	1
Improvement Pillars of Social Sustainability						
5. Health and Safety	4659	300	5	1500	3.10	2
6. Human Rights	2315	300	5	1500	1.54	8
7. Diversity and inclusion	4560	300	5	1500	3.04	5
8. Technology	4636	300	5	1500	3.09	3

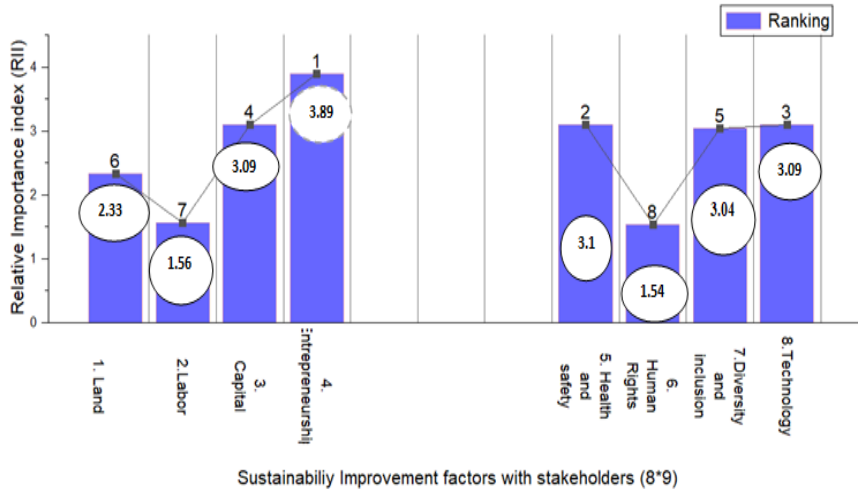

FIGURE 4.4: Relative importance index.

4.3 Summary of Results and Discussion

In Chapter Four of the study, data was collected from experts in the construction industry using the Likert scale methodology, with an emphasis on evaluating factors related to social and economic sustainability. The respondents' demographic characteristics were explained in detail to ensure transparency and clarity in understanding the sample composition. The data was rigorously analyzed using SPSS software, confirming its validity and reliability.

Using the relevant statistical tests, the normality of the data distribution was first evaluated. A conjecture was developed:

- Null Hypothesis (H_0): There is a normal distribution of the data. (Rejected)
- Alternative Hypothesis (H_1): There is no normal distribution of the data. (Accepted)

After the normalcy tests were performed, the findings showed departures from normalcy, which led to the alternative hypothesis being accepted and the null hypothesis being rejected. After determining that the data did not have a normal distribution, non-parametric tests more particularly, the H-test used to continue the research.

Another set of hypotheses was created for the H-test:

- Null Hypothesis (H_0): There isn't a discernible variation between the groups. (Rejected)
- Alternative Hypothesis (H_1): The groups differ significantly from one another. (Accepted)

As with the normality test, the null hypothesis was rejected since the H-test findings demonstrated statistical significance. This supported the conclusion that there was considerable variation between the groups' responses regarding respondents' attitudes toward sustainability considerations.

The study used the Relative Importance Index (RII), a non-parametric approach, to rank the components according to respondents' perceptions of their significance. This method made it possible to rank the importance of elements that were determined to be essential for accomplishing sustainability objectives in the construction sector, including technology, capital, health and safety, and entrepreneurship. The RII rankings offered practical insights into the elements that stakeholders consider most important, which helped to shape future plans and interventions meant to improve sustainability outcomes in construction projects. The RII technique was used to gather and evaluate the data, which showed an organized process from hypothesis testing to real-world implementation. The discipline benefits greatly from these results, which provide practitioners and decision-makers with useful information on how to encourage sustainability in construction industry

According to the relative importance index (RII), entrepreneurship, health and safety, and technology are the highest priorities for enhancing sustainability in the construction sector. Entrepreneurship is ranked first and is highly appreciated for its capacity to stimulate innovation, introduce new technology, and promote corporate development, all of which contribute considerably to the sector's growth and sustainability. Health and safety, ranked second, are critical because they have a direct influence on worker well-being and job satisfaction, especially in the high-risk industry of construction. This emphasis emphasizes the need for strong safety and health regulations in protecting workers and ensuring a sustainable workforce.

Technology, ranked third, is acknowledged for its role in increasing efficiency and cost-effectiveness, with internal stakeholders benefiting from better operational procedures and external stakeholders enjoying the greater transparency and service quality.

Capital, rated fourth, is critical for financial viability and sustaining both current and future projects, emphasizing its relevance in economic sustainability. Diversity and inclusion, rated sixth, are critical for increasing employee engagement and productivity while also supporting social equality. This score demonstrates the industry's commitment to fostering a diverse and inclusive workplace.

Land management, rated sixth, is critical to sustainable development, with internal stakeholders concentrating on responsible land use and external parties worried about the economic consequences of land management. Labor-related concerns, which rank eighth, underline the need of addressing equitable opportunities, safe working conditions, and job security in order to achieve social and economic sustainability. Finally, human rights (ranked seventh) remain a critical concern, emphasizing the necessity of ethical methods and fair treatment in building projects.

Overall, while entrepreneurship, health and safety, and technology are promoted, labor standards, land management, and human rights all require improvement. Addressing these issues would help to develop more balanced and complete sustainability plans in the construction sector, improving overall performance and stakeholder satisfaction.

Chapter 5

Conclusion and Recommendations

In this chapter, provides the conclusions after examining the results and discussion along with the recommendations for further studies. It is split into two parts: the first one highlight the conclusions of the present study while emphasizing on major findings and consequences. The second part outlines recommendations for future directions by pointing out areas for additional exploration and development. The main focus is on addressing and highlighting the key findings of the current study and providing guidance for future studies.

5.1 Conclusions

The prime focus of this research is to better understand the influence of internal and external stakeholders on social and economic sustainability in building projects. The influence of internal and external stakeholders in construction projects is a major challenge in attaining social and economic sustainability. The aim of current research is to identify social and economic aspects of stakeholders, which are accomplished through a critical literature review. The second goal is to integrate the internal and external stakeholders to create a matrix of social and economic sustainability indicators. This is achieved through a detailed literature

review and it is noted that some improvement variables were significantly corresponding to the internal and external stakeholders; however, some of them were not aligning. The identified significant improvement variables were organized into categories based on their extent of contribution and a questionnaire is designed to address and evaluate them. A field questionnaire survey was conducted and 300 responses were obtained, which were adequate as reported by [94–96].

Using statistical analysis methods, the data is examined and it is discovered that:

1) The improvement factors data have a reliability analysis score of 0.843, which is higher than 0.5. This provides evidence that the record is consistent.

2) By applying the Kruskal-Wallis test (H-test) to the improvement factors and stakeholder data, it is possible to determine respondents' perceptions of the factors' existence and improvement. The findings showed that most factors occurred significantly and had a significant impact on both internal and external stakeholders' perceptions of social and economic sustainability during construction projects.

According to the Kruskal-Wallis test, all variables with values ranging from 1 to 28 have less than 0.05, indicating that the null hypothesis must be rejected and the alternative hypothesis should be accepted.

The relevance of certain sustainability improvement pillars for social and economic sustainability, as well as how they may be applied to a wide range of construction industry stakeholders, There are two categories of stakeholders: internal (managers, owners, and workers) and external (suppliers, shareholders, customers, society, and government). Every intersection between a sustainability pillar and a stakeholder highlights the components consider important. Because of their interdependence, all parties involved must have their viewpoints and interests taken into account in a holistic approach to sustainability.

Based on the information obtained from the replies, each group's improvement matrix is created, and the ranking pattern emphasizes that:

- The construction business relies heavily on the relationships between land owners, labor owners, capital owners, capital suppliers, entrepreneurs, custo-

mers, the government, health and safety owners, and technology providers. This group is ranked first.

- Land and Government, Labor and Manager, Capital and Manager, Entrepreneur and Employees, Entrepreneur and Manager, Entrepreneur and Supplier, Health & Safety and Employees, Health & Safety and Manager, Health & Safety and Government, Human Rights and Government, Diversity & Inclusion and Customer, Technology and Employees, Technology and Society are ranked second.
- The Human Rights and Employees, Diversity and Inclusion with Shareholders, Technology, and Manager are ranked third.
- Only one group, Diversity and Inclusion and Manager, is ranked or prioritized at number four.
- Capital and Government, Diversity and Inclusion with employees are the last priorities; hence, they are ranked fifth.

Finally, the relative importance index (RII) of the complete matrix containing eight improvement factors is calculated with respect to stakeholders and rated for each factor, indicating which one is most significant from one to eight for the construction sector. The highest value of the relative importance index has more relevance.

- Entrepreneurship (Rank 1)

  Entrepreneurs and construction project owners value entrepreneurship because it may result in novel construction processes, new technology, and business development. They also contribute to the organization's growth and sustainability by fostering economic development among stakeholders.
- Health and Safety (Rank 2)

  Employees and their representatives, such as trade unions and regulatory authorities, would prioritize health and safety. As it has a direct impact on their well-being and job satisfaction. Because of the high-risk nature of construction labor, it is important to emphasize on health and safety.

- Technology (Rank 3)

  Internal stakeholder management and IT departments supply evolving technology because of its potential to increase efficiency and cost effectiveness. External stakeholders appreciate that using technology may lead to improved service, more transparency, and long-term growth.

- Capital (Rank 4)

  Project financiers, investors, and construction corporations often prioritize capital since it is necessary for economic or financial viability.

- Diversity and Inclusion (Rank 5)

  Internal stakeholders such as workers and the human resource department frequently promote diversity and inclusion, since it may lead to a more engagement and productive workforce. External stakeholders encourage diversity and inclusion in order to represent the larger demography and promote social equality.

- Land (Rank 6)

  Depending on the sector, internal stakeholders prioritize land management for sustainable usage and development. External parties concerned with land-related issues, which contribute to economic sustainability.

- Labor (Rank 7)

  The labor movement emphasizes on the importance of labor-related aspects such as equal opportunities, safe working conditions, and job security in the construction sector. Recognizing and addressing these concerns makes it easier to achieve social and economic sustainability.

- Human Rights (Rank 8)

  Internal and external stakeholders are concerned about human rights in project organizations such as fair treatment and non-discrimination. They concentrate on ethical construction approaches that promote social sustainability.

To summarize, overall entrepreneurship, health and safety, and technology are major objectives, but labor, land, and human rights require improvement.

The study contributed to the early identification, understanding, and awareness of improvements to the social and economic matrix. If these factors exist, they may have an impact on the social and economic well-being of building projects, making it more difficult to achieve both pillars of sustainability. The study's overall conclusions demonstrate that all identified parameters occur considerably and are appropriately ranked based on statistical analyses for construction projects. The study has devised and reported a significant milestone in improving the social and economic sustainability matrix, which may be used to guide the stakeholders involved in the projects. Based on this study, appropriate corrective measures might be implemented by an industry or organization at the planning and strategy levels to achieve social and economic sustainability in the construction sector.

5.2 Recommendations

Developing or strengthening the social and economic pillars of sustainability with construction industry stakeholders is the goal of the current study, which also ranks these improvement aspects. The following is advised in light of the findings:

1. Adopting this study matrix as an improvement element with stakeholders fosters a better understanding and awareness of the aspects that need to be managed with stakeholders both individually and as a team in order for the project to be completed successfully.

2. The goal of the study is to offer a quantitative analysis of social and economic development in the early stages of planning. This would play a big part in creating a solid management plan that could be used later on in the project and aid to finish a sustainable project.

3. Create policies to promote entrepreneurship, diversity and inclusion, financial management, technology adoption, land management, human rights, and labor practices to ensure the long-term sustainability of construction projects that follow best practices.

5.3 Future Directions

It is recommended in light of the research findings, analysis, and conclusions that;

- The scope of the current study is restricted to the social and economic pillars of sustainability with stakeholders; subsequent research can examine the social, economic, and environmental pillars of sustainability in phases of operation and maintenance.
- A further investigation may explore the effects of time management and quality control factors on the sustainability of the construction projects.
- Another future direction may be to determine how technology integration such as BIM and IOT might improve the sustainability in construction by emphasizing on efficiency and resource optimization.

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Appendix A

Questionnaire

Impact of Internal and External stakeholders on social and economic pillar of sustainability for construction Industry

The construction sector is essential to regional, social, and economic growth. It affects biodiversity on a social and economic level, involves stakeholders, and is the primary user of natural resources. Thus, we can only attain sustainability by developing and putting into action efficient programs that enhance social and economic aspects.

But day by day, there is progress, particularly in the social and economic aspects of construction projects, which is one of the most important aspects of sustainable development, along with the use of social and economic management strategies in construction practices. Project budget, performance, and completion are all directly impacted by an effective and efficient social and economic stakeholder management system, including both internal and external parties.

In order to create a matrix for sustainable building, the present project seeks to examine and enhance the social and economic pillars of sustainability in collaboration with stakeholders. As you would all agree, getting input from business experts is essential to enhancing the social and economic pillars of the sustainability matrix in collaboration with stakeholders. Your cooperation is much appreciated.

Improvement Matrix Part I

	Internal Stakeholder			External Stakeholder					
Stakeholder / Improvement Pillars of Economy Sustainability	1. Employees	2. Owners	3. Manager	4. Suppliers	5. Shareholder	6. Customers	7. Society	8. Government	9. Creditor
1. Land									
2.Labor									
3. Capital									
4. Entrepreneurship									
Improvement Pillars of Social Sustainability									
5. Health and safety									
6. Human Rights									
7.Diversity and inclusion									
8.Technology									

Demographic Part II:

Section-I

Please tick (✓) in the box for the appropriate answer.

1. **Gender**

Male ☐

Female ☐

2. **Age:**

Below 25 ☐ 25-30 ☐ 30-35 ☐ 35-40 ☐

40-45 ☐ 45-50 ☐ Above 50 ☐

3. **Education:** ☐Matric ☐ Intermediate ☐ Graduation ☐ Master ☐ PhD

4. **Experience** (in years): _____

1 = Strongly Disagree **2 = Disagree** **3 = Neutral**
4 = Agree **5 = Strongly Agree**

Section-II

Please mark each statement on a five-point scale the extent to which you find the following statements important and you agree or do not agree with the statement.

Sr	**Questions**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1.	The selection of a construction project on a particular land/site/location plays an important role in achieving the economic stability for the project owner.					
2.	The choice of supplier significantly influences the economic conditions of a construction project on a particular land/site.					
3.	The economic stability of the construction companies is reduced due to tax collection by the government agencies.					
4.	The owner can improve the financial conditions of the construction company by providing incentives and benefits to the labor/employees.					

5. The manager's decision to adopt expensive latest technology machines and/or innovative methods instead of relying only on labor influences the economic status of the company.
6. The top management support/interest is crucial for aligning a project with organizational goals and objectives.
7. The manager's focus on enforcing daily or weekly task completion deadlines contributes significantly to the economic stability of the company.
8. The supplier selection affects the economic status of a construction project.
9. The increased costs, low quality, and late completions of the construction projects are the problems caused by the government policies.

10. The entrepreneur has a higher risk of project failure and financial loss when he hires layman workers as compared to the trained/experienced workers for construction projects.
11. Effective project management helps in achieving rapid growth rates while completing the projects within the assigned limit of budgets for entrepreneurs.
12. Effective supplier management and relations can help to improve the performance of the business.
13. In any project, prioritizing the customer's needs and customer's involvement contributes to an entrepreneur's success in business.
14. Government policies and rules play an important role in the decision to start a new business by the entrepreneur.

15. The level of safe working conditions and support provided by the employer in case of any accident has significant contribution in employee retention and satisfaction.
16. The owner's interest to provide health and safety insurance for any project/organization contributes in achieving social well-being.
17. The proactive approach of identification, prioritization, and monitoring of workplace risks by managers helps in achieving employees' trust and social security.
18. The government policy, commitment, effective coordination, and continuous monitoring of project performing organization can influence and promote health and safety.
19. The major reason for most project failures is unequal chances for promotion along with discrimination and favoritism by the top management.

20. The presence of a governmental regulatory body can considerably enforce human rights and could be helpful in maintaining social sustainability.
21. Although diversity in the workforce reduces discrimination in the workplace; however, it can also lead to weak social cohesion, poor communication, and increased conflicts.
22. Diversity in the workforce can reduce work efficiency and create problems for project managers and top management.
23. Diversity in a company can increase the financial load and could reduce the shareholder's return.
24. The availability and accessibility of resources for social participation influence the promotion of diversity and inclusion in project teams.
25. The productivity of a company is increased when employees are empowered to use new technology.

26. A construction firm can achieve social well-being when a project manager decides to adopt new technology machines despite employees' resistance and acceptance to adopt it.
27. A better communication could be developed with suppliers, which may contribute to achieving social sustainability.
28. The innovations in technology have a meaningful influence on society and can be directly linked to social sustainability.