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A Systematic Literature Review Of Sustainable Development Barrier And Opportunities In Green Building Project Management In The UK

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# Abstract

The research focuses on sustainable building practices within the construction sector in the UK. It investigates the challenges, important criteria for success, and the critical role that knowledge mapping plays in economically sustainable building. The article provides fresh insights to policymakers and stakeholders in the company, discussing the financial issues involved with sustainability, the numerous rules, and the hurdles experienced by people. The research included both a thorough investigation of the previously published material as well as an in-depth analysis in order to zero in on the most important factors that had an impact on the outcome of the study. Collaboration, active participation in the community, and adequate financial planning are among these variables. The research makes a contribution to the knowledge gaps that currently exist on the financial elements of green building and suggests a methodical way to generate informed decisions by strategically mapping out the existing body of information. As a consequence of this, it is possible to build a mindset that is oriented towards sustainability, overcome financial problems, and cooperate more successfully on environmentally friendly construction projects. In the realm of academia, the research improves the knowledge of sustainable building practices, therefore laying the groundwork for more research and innovative ideas.

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# CHAPTER 1: INTRODUCTION

## 1.1   Background

Growing worldwide attention on sustainable development has influenced real estate and construction. As its environmental impact grows, the construction industry must embrace sustainable practises and reduce negative consequences.

The UK is a good example of sustainable development since it offers inventive solutions to environmental issues and green building projects are growing more popular (Mavi *et al.*, 2021a). The construction industry is vital to the UK economy, but it is also a significant energy consumer and carbon dioxide emitter. In response to these issues, green building approaches have increased to reduce the industry's environmental effect and align it with sustainable development objectives.

However, several factors hinder green building initiatives and sustainable development. Policymakers, experts, and academics must be aware of these difficulties and find solutions to align the construction industry with UK environmental objectives. This study examines prior research and instruction to analyse sustainable construction's many components. Government issues, new technology, financial implications, and stakeholders are included. Its major purpose is to familiarise participants with green building project management variables and how they affect UK sustainable development goals.

To address the teacher's question, let's define "green building" and explain how "green building project management" differs from ordinary project management: Planning, building, and operating a building using environmentally friendly materials and processes is called "green building." Using sustainable materials, energy-saving technology, and ecologically beneficial methods throughout a building's lifecycle.

Green building project management involves managing green construction projects. It has its own challenges and considerations. Green building project management requires a thorough understanding of eco-friendly construction practises, environmental laws, and sustainable technologies, unlike standard green building project management, which focus on cost, time, and scope. Coordination is needed to decrease environmental impact, boost energy efficiency, and meet BREEAM or LEED criteria. Understanding this distinction is crucial to managing construction projects sustainably. The UK industry is heavily influenced by environmental aims (Li *et al.*, 2020).

## 1.2   Rationale/Justification

The significance of this research on the economics of green building lies in the increasing emphasis placed by the construction sector on environmental sustainability. It addresses knowledge deficiencies by examining elements that contribute to success, barriers that impede progress, and the interconnectedness of hazards (Klungseth, 2021). This provides legislators and professionals with valuable insights. The use of seldom combined methodologies such as thematic and scientometric analysis distinguishes this work. It provides a comprehensive overview of the economic aspects of green building. This research serves as a guide for sustainable construction practises, addressing a significant gap in information.

## 1.3   Research aim statement, Objectives, and Research Questions

### 1.3.1 Research aim

The purpose of this article is to conduct a thorough examination and evaluation of the present status of sustainable development in green building project management in the UK, with a specific emphasis on identifying both obstacles and opportunities. This study endeavours to provide academics, practitioners, and legislators with novel ideas and recommendations for enhancing the sustainability of these practices by conducting a comprehensive examination of relevant academic literature.

### 1.3.2 Research Objective

The research is undertaken by considering the below research objectives.

1. To systematically identify and select relevant academic literature that explores the barriers and opportunities in sustainable development within green building project management in the UK.
2. To critically review and synthesize the chosen literature to assess and consolidate existing knowledge, compare methodologies, and identify research gaps in sustainable development practices in green building project management.
3. To formulate insightful recommendations for academia, practitioners, and policymakers, aiming to enhance sustainable practices and address the identified barriers and opportunities in green building project management in the UK.

### 1.3.3 Research question

To incorporate the results and findings of the study, the research will consider the questions below.

1. What is the present status of green building project management in the UK about sustainable development?
2. What are the primary obstacles and challenges that hinder the implementation of sustainable development in green building project management in the UK?
3. What are the probabilities and potential solutions for advancing sustainable development in the UK's green building project management?

## 1.4   Significance of the Research

The report underscores the crucial significance of the UK construction industry embracing sustainable practices. Decision-makers who are contemplating investing in distributorship should not only possess knowledge of ecologically sustainable practices but also actively implement them in their endeavours.

## 1.5   Dissertation Structure

**The research will follow the below structure throughout the paper.**

* **Introduction**
* **Literature review**
* **Methodology**
* **Findings**
* **Discussion**
* **Recommendation and conclusion**
* **References**

# Chapter 2: Literature Review

After adopting sustainable development principles, the construction industry has become more socially and ecologically responsible. Sustainable development groups are wooing the construction industry to accomplish their long-term environmental sustainability and climate change mitigation objectives. The 1987 Brundtland Commission definition of sustainable development is meeting present needs without compromising future generations' ability to do so. Policies must change fast to lessen the construction industry's environmental impact, promote social justice, and protect finite resources.

According to (Ayman, Alwan and McIntyre, 2020) the construction industry must manage green building projects well to accomplish sustainable development. Green building project management prioritizes energy efficiency and environmental sustainability by coordinating and managing construction projects in this way. Green building project management emphasizes the use of sustainable materials and technology to reduce the negative environmental impact of construction. Standard project management methods favor time and money above the environment.

Managing green building initiatives is key to sustainable practices. The construction industry's large resource use and carbon emissions make it vital to environmental protection. The construction industry minimizes its environmental effect, improve future generations' quality of life, and reduce waste by employing green building project management. Developers and property owners like green building approaches because they increase property values and lower operating costs. The UK construction industry has prioritised sustainability and green building project management methods. The Climate Change Act and the UK Green Building Council's Advancing Net Zero project are examples of the UK government's ambitious sustainable development and carbon reduction goals (Assadiki *et al.*, 2022). In construction project designs, sustainability is being considered.

Although sustainability is becoming more important in the construction industry, green building project management solutions are still far from being applied. Outdated building codes and environmental hazards not addressed before permitting is regulatory obstacles. Green building project management in the UK has the potential to support sustainable development despite several obstacles (Assylbekov et al., 2021). Innovative building materials and practices like prefabricated modular construction and low-carbon concrete lessen construction's environmental impact. Modern technologies like building information modeling (BIM) and energy management systems increase building resource utilization and efficiency.

## Evolution of Sustainable Development in the UK Construction Industry

As the UK construction industry becomes greener, sustainability in building projects is becoming more important (ElAlfy et al., 2020). Concerns about resource depletion and environmental deterioration coupled with the early 1900s development boom and sustainability movement (Kineber *et al.*, 2023). The construction industry did not realize the need of sustainable development until the late 20th century. The tragedy was caused by new laws, technological development, and popular perceptions of environmental responsibility (Stanitsas et al., 2021). The UK building industry has encouraged sustainable development and set environmental regulations and laws to decrease the negative impact of the construction industry on the environment (Giannetti et al., 2020). The 1947 Town and Country Planning Act regulated land use and development to preserve natural resources and green spaces. The Clean Air Act of 1956 and the Water Resources Act of 1963 stressed environmental protection throughout construction (Ariono, Wasesa and Dhewanto, 2022).

In the 1970s, the environmental movement and public awareness of environmental issues changed the UK construction industry's sustainable development methods (Leng et al., 2022). The Energy Conservation Act of 1976 and building energy efficiency laws were passed at this time (El Khatib et al., 2020). The initiative sought to minimize carbon emissions and improve building efficiency (Zhang et al., 2020). The construction industry will see more sustainability innovations. Sustainable development projects in the UK's construction industry increased significantly in the 1990s as a consequence of government policies, industry initiatives, and technical advancements (Nasereddin and Price, 2021a). Since the development of the UK Sustainable Development Strategy in 1994 and the UK Sustainable Development Action Plan in 1999, there has been a growing push to incorporate sustainability considerations into many aspects of public policy, including the physical environment (Opoku et al., 2021). The initiatives aim to improve sustainable construction processes and foster industry-government-stakeholder interaction.

New regulations and green building project management systems drove the UK construction industry to lessen its environmental effect. The 1990 introduction of the Building Research Environmental Assessment Method (BREEAM) advanced building environmental performance monitoring (Munaro, Tavares and Bragança, 2020). The UK construction industry has actively promoted BREEAM certification alongside other sustainable building projects.

In the early 2000s, new energy efficiency and environmental sustainability standards boosted UK construction industry sustainable development initiatives (Fathalizadeh *et al.*, 2021). The 2002 Energy Efficiency of Buildings Directive (EPBD) mandated all new construction projects to satisfy minimum energy performance criteria and get energy efficiency certificates (Zhou et al., 2020). The 2007 Code for Sustainable Homes includes sustainable home building strategies such as water conservation, energy efficiency, and ethical material procurement (Guan, Abbasi and Ryan, 2020). All went well during the release.

The UK construction industry is realising the relevance of social and economic factors in sustainable development initiatives (Centobelli et al., 2020). New regulations, including the UK Green Building Council's Advancing Net Zero project, seek to eliminate building carbon emissions by 2050 projects (Conedera *et al.*, 2023). Comprehensive sustainable construction methods are prioritized. The exhibitions demonstrate that the construction industry is adopting broader sustainable development strategies. These tactics focus on environmental, social, and economic interactions.

## Conceptual Framework

The theoretical framework of sustainable development in UK green building project management can help to assess the pros and drawbacks of introducing sustainability into construction processes. Economic, sociological, and environmental science ideas and theories are used to study the elements that drive sustainable construction industry development. The pros and cons of UK green building project management are examined theoretically projects (Gade and Opoku, no date). Balancing social, economic, and environmental challenges via sustainable development ensures future generations can satisfy their requirements. This notion is based on several theoretical frameworks, including ecological sustainability, which emphasizes ecosystem and biodiversity protection. Ecological sustainability in green building project management uses sustainable materials, energy-saving technologies, and eco-friendly building techniques to reduce construction noise.

According to (Omazic and Zunk, 2021) the construction industry needs a social justice-focused theoretical framework for sustainable development. Social equality promotes resource and opportunity distribution to protect disadvantaged populations. One want sustainable construction to assist low-income people, disadvantaged communities, and future generations. This must be included in green building project management for social justice (Norouzi et al., 2021). Ecologically sustainable infrastructure, affordable housing, and equitable access to green spaces should be prioritized. Economic theory influences sustainable construction development in the construction industry (Olanrewaju, Enegbuma and Donn, no date). Only economically sustainable development can achieve social fairness and environmental sustainability. The cornerstones of green building project management that support long-term economic development include using sustainable construction methods while keeping costs down and offering financial incentives to promote environmental responsibility. Alternatives to fossil fuel financing include green building, energy-efficient building incentives, and renewable energy technology investment. Multiple factors complicate the UK construction industry's green building project management and sustainable development strategy (ElAlfy et al., 2020). Many sorts of issues exist, each with its own potential and hurdles for increasing sustainability in construction.

The British government regulates green building project management. Regulations encourage sustainability via environmental regulations and building standards. However, construction firms struggle with administrative procedures and compliance expenses. Sustainable construction regulations provide firms an edge. Despite these constraints, creativity and effect are possible. The UK leads green building project management research in sustainable technologies, materials, and construction. Exciting new technologies reduce construction projects' environmental effect. Intelligent building technologies, renewable energy systems, and energy-efficient materials are examples. As per the research of (Caldera, Ryley and Zatyko, 2020) High entry fees, a lack of experienced staff, and widespread misperception prevent broad industry utilization of these technologies. Funding and incentives affect UK sustainable construction. Green building project expenses is greater than standard construction procedures. Tenants gain health, productivity, property value, and decreased energy expenditures over time. Tax credits, grants, and subsidies reduce green building project costs and encourage sustainable construction technologies (Alsehrawy *et al.*, no date).

UK public attitudes, beliefs, and behaviors affect sustainable construction. Green building initiatives are gaining popularity as people become more aware of their significance. Everything raise demand for sustainable construction initiatives. Lack of expertise with sustainable construction procedures, resistance to change, and doubts about sustainability's benefits and costs create UK green building project management issues.

## Sustainable Development Barriers in Green Building Project Management

A variety of problems that make it difficult to adequately implement environmentally friendly practices impede the sustainable development of green building project management in the UK (Lima *et al.*, 2021). For sustainable building, several issues must be addressed. Diversity of difficulties arises from legal, technical, economic, cultural, and behavioural sectors. In the UK's green building project management, regulatory barriers are one of the biggest obstacles to sustainable development. The regulatory environment for green building projects and other sorts of development is heavily influenced by government laws and regulations (Stanitsas et al., 2021). Despite their intention to promote sustainability and ensure environmental compliance, construction companies confront regulatory compliance administrative obstacles and expenses. Businesses struggle to implement sustainable practices due to strict building regulations and long construction timetables, which raise project costs (Caldas *et al.*, 2022). If industry stakeholders are confused and terrified by a lack of uniform laws, green building project management is delayed.

In the UK, using sustainable approaches to manage green building projects is challenging due to technical restrictions (El Khatib et al., 2020). Although sustainable technology and building materials advance, technical issues prevent their broad use in construction projects. Wind and solar energy dramatically cut building carbon dioxide emissions. Large initial investment and growth problems restrict its utilisation. Due to the restricted availability of resources like recycled concrete and sustainable lumber, construction companies struggle to incorporate sustainable building materials into their projects (Maqbool and Amaechi, 2022). Using sustainable technology and materials in building projects is challenging without best practices.

In the UK green building project management industry, financial barriers hinder sustainable development (Ogunsanya et al., 2022). Because they employ more sustainable materials, technology, and techniques, green building projects initially be more costly than regular construction projects. SMEs with limited resources struggle to keep up with escalating building costs (Kamranfar *et al.*, 2022). The lack of affordable green bonds or sustainable building financing options hinders the adoption of sustainable practices. Investment and financial institutions who doubt green building's long-term financial advantages also be wary of financing sustainable construction projects (Obiuto et al., 2024). Energy savings and property value increases are these benefits.

In the UK, cultural and behavioral barriers hinder sustainable green building project management (Mavi *et al.*, 2021b). Culture influences environmental adoption. This category comprises long-term sustainability products. Since sustainable building advantages are unclear, developers, investors, and construction experts are dubious or antagonistic. Culture and tradition make construction workers unwilling to adapt and use antiquated building methods, making it harder to integrate sustainable technology and methods (Tokbolat et al., 2020). Due to risk aversion and inertia, stakeholders avoid green building. The lack of incentives or legal obligations makes this especially true. UK green building project management faces several challenges to sustainable development (Agyekum *et al.*, 2022). Growth is hindered by technology, money, culture, behaviour, and legislation. An integrated state-industry-civil society approach is needed to solve these issues. One can support sustainable development in the UK construction industry and green building by tackling these difficulties and establishing suitable rules (Pham et al., 2020).

## Sustainable Development Opportunities in Green Building Project Management

The UK construction sector embraces environmentally friendly practices by using several sustainable development methods in green building project management. There are several ways to improve building sustainability in law, technology, economics, society, and culture (Nasereddin and Price, 2021b). Regulations are increasingly promoting sustainable building in the UK. Government incentives and regulations create a regulatory framework that benefits green building projects, promoting the adoption of environmentally friendly methods more often. One can see how government subsidies, tax credits, and grants have fostered green building by looking at sustainable construction approaches (Larsson and Larsson, 2020). Green building project management in the UK is governed by sustainability-focused laws including energy performance requirements and green building certification systems. Building experts should be financially rewarded for adopting sustainable approaches.

Technological advances in sustainable technologies have created several green building project management options (Al-Otaibi *et al.*, 2022). Innovative sustainable building technologies and other concepts that change the construction sector are examined in this research. As technology improves, building efficiency decreases environmental effects. There has been substantial development in renewable energy systems, energy-efficient building materials, and smart building technologies. Stakeholder cooperation, project management, and resource optimisation is improved by digital technologies like BIM and VR (Ahmad, 2023). Economic factors must be considered in UK green building project management for sustainable development. Investment methods and financial incentives for green building projects reveal sustainable construction finance systems. Finance efforts like green bonds, impact bonds, and green loans encourage investing in environmentally beneficial activities and green building projects. Private-sector engagement in sustainable building projects is increased via innovative financing structures like PPPs and EPCs (Horry *et al.*, 2022). The building sector connects financial incentives with social and environmental goals as sustainable finance and impact investment grow.

Green building project management in the UK will fail to produce improved sustainable development if social and cultural issues are not appropriately acknowledged (Stanitsas and Kirytopoulos, 2023). Looking at how social trends and cultural changes affect sustainable development in the building industry helps us understand how people's sustainability attitudes and actions are changing. It's good news for the green building project industry because people are becoming more environmentally conscious and interested in sustainable design and eco-friendly lifestyles (Misopoulos, Manthou and Michaelides, 2019). Sustainability challenges now be integrated into organisational processes and decision-making as cultural norms and attitudes change. Consumer ethics and CSR dominate the discussion. More inclusive and sustainable buildings have come from building industry diversity, equity, and inclusion efforts.

In conclusion, UK green building project management supports sustainable development across numerous sectors (El Khatib et al., 2020). Reviewing existing regulations and incentives, new technology, financial incentives, and social and cultural trends helps us promote sustainability in the building industry (Manzoor *et al.*, 2021a). A thorough green building project management strategy helps the UK construction sector improve environmental standards and promote sustainable development.

## Synthesis and Critical Analysis

A literature review on UK green building project management is needed to identify sustainable development potential and challenges. The method reveals critical areas for study and action. Find similarities, trends, and information gaps by reviewing and comparing pertinent studies. The research discusses sustainable development, green building project management, and its pros and cons.

In the UK literature research on green building project management's pros and cons for sustainable development. Financial, social, ethical, and legal issues make sustainable development challenging. Outdated building rules and regulatory procedures are among the barriers to sustainability in the construction sector (Cao *et al.*, 2022). A lack of technology to integrate sustainable practices, finance to fully execute green building projects, and cultural and behavioural variables that impact stakeholders' sustainability behaviour are further barriers. UK green building project management promotes sustainable development in several ways, according to studies (Obiuto et al., 2024). Through various methods that address current issues, the building industry become more sustainable. Several variables affect sustainable building. Sociocultural shifts, new technology, financial resources, and political incentives and limits.

Despite the proliferation of literature on green building project management and sustainable development, many issues remain unaddressed and neglected (Stanitsas, Kirytopoulos and Leopoulos, 2021). Reliable empirical evidence on how well public policies and incentives encourage sustainable building is lacking. Statutory incentives for sustainable building development are seldom studied, although green building incentives have been extensively studied. There is research on the long-term financial advantages of green building initiatives, such as lower energy usage, higher property values, and happier, more productive renters. Although some studies have examined the financial viability of green building projects, more empirical research is required to understand the financial advantages of sustainable building technologies and make educated judgments (Obiuto et al., 2024).

In green building project management, cultural and social sustainability demand greater attention. It's unclear how social and cultural factors affect green building project management. These issues have been studied as building sector sustainability opportunities and challenges. Future research should focus on nurturing a sustainable building industry culture and the sociocultural factors that influence stakeholders' sustainability ideas and actions (Assylbekov *et al.*, 2021). This research illuminates existing understanding and suggests future research and application. The literature on sustainable building project management barriers and possibilities is useful. Promoting sustainable development in the construction industry and a more socially and environmentally sensitive built environment necessitates filling knowledge gaps and building on earlier research.

## Implications for Practice and Policy

UK green building project management stakeholders, policymakers, and practitioners benefit from examining the approach's sustainable development pros and cons. A comprehensive literature review is necessary to improve sustainable development in green building project management in the UK. This will provide substantial ideas for solving problems and seizing opportunities.

According to the literature, construction professionals must employ sustainable building techniques and consider environmental issues throughout the process. The basic goals of green building project management are energy efficiency, environmental protection, and resource conservation. To reduce environmental effects and promote sustainability, a building expert must use sustainable materials, technology, and project methods. Government agencies, business groupings, and other stakeholders must work together to make the sector more sustainable. Creating a sustainable building culture requires teamwork, sharing experience, overcoming challenges, and increasing efficiency (Benachio, Freitas and Tavares, 2020). To teach their staff sustainable building methods, industry specialists aid in continuing education and training activities. Setting rules for sustainable technology and materials and incorporating sustainability into project management are crucial. Industry experts encourage innovation and prepare their teams for sustainable building by supporting worker development.

The paper stresses that legislators must create a framework for sustainable building. Green building project management requires the development of rules and regulations. Giving green projects financial incentives and updating building rules to reflect the latest sustainable construction ideas are examples (Manzoor *et al.*, 2021b). For sustainable technology and material development, authorities must emphasise infrastructure and research. Policymakers can assist construction industry professionals overcome barriers and preserve the business by creating a suitable regulatory environment.

Legislators should address social and cultural barriers to building industrial sustainability. Supporting education and public awareness activities to develop a sustainable culture among industry players and raise understanding of sustainable building processes is crucial. Governments must focus on building sector diversity, equality, and inclusion and address sustainable technology and material pricing and accessibility (Nguyen and Macchion, 2023). Breaking down social and cultural barriers helps policymakers create a more sustainable and inclusive built environment for everyone. The research suggests that all major players must cooperate to improve building sector sustainability. The success of sustainable development relies on bringing stakeholders, including politicians and industry experts, together to set goals, discuss best practices, and create innovative solutions. Research and development for sustainable materials and technologies need stakeholder support. By sharing resources and encouraging innovation, stakeholders can make the building industry more sustainable.

This literature study helps sector experts, UK MPs, and others promote green building project management's sustainable development commitment (Kazemi *et al.*, 2023). One can build a socially and environmentally responsible environment for future generations by following the principles and working together to address issues and seize opportunities.

## Summary of Key Findings

According to UK literature assessments on sustainable development in green building project management, the construction sector confronts sustainability possibilities and threats. The findings help us understand the pros and pitfalls of green building project management in the UK from a sustainable development perspective. The literature research found several barriers to sustainable green building project management. Construction has challenges with regulations, technology, economics, culture, and behaviour. To be sustainable, these challenges must be handled systematically. Outdated building codes cause construction enterprises financial and administrative problems (Friedrich, 2023). Technical barriers including technological limits that make sustainable activities harder underutilize environmentally friendly technology and resources. Green building efforts are hampered by financial barriers including high start-up costs and limited financing sources (Khalid, Malik and Mahmood, 2021). Cultural and behavioural barriers and a lack of awareness of sustainable practices make it hard for stakeholders to adopt environmentally beneficial activities.

Despite limitations, this literature study examines UK green building project management methods to promote sustainable development. Government advice and incentives reduce regulatory bottlenecks and encourage sustainable building (Charef, Morel and Rakhshan, 2021). New eco-friendly building materials and technology enable more sustainable construction. Strategies for supporting green building project efforts, such as investment techniques and financial incentives, help overcome financial hurdles and attract investment for sustainable projects. Establishing a sustainable culture in the building industry requires prioritising social and cultural issues such public sustainability attitudes and practices.

The literature review emphasises collaboration and cooperation as key to building industrial sustainability. Experts, legislators, and the public must collaborate to set goals, spread successful strategies, and find new sustainable development solutions. Successful collaboration helps firms maximise their skills and resources, which improves building sustainability and inspires new ideas (Nasereddin and Price, 2021c). A detailed analysis of UK literature on sustainable development in green building project management provides significant information on current expertise. The analysis also outlines significant building industry opportunities and issues. The building industry can promote sustainability and create a more socially and ecologically responsible built environment for future generations by addressing concerns and seizing opportunities.

## Conclusion

This literature analysis on sustainable development in green building project management in the UK shows the construction industry's sustainability opportunities and challenges. Barriers to sustainable practices include technology, economics, culture, and human behaviour. Flaws were found during the assessment. The building sector must solve many fundamental concerns to become more sustainable. Construction businesses face financial and administrative issues with outdated building rules and regulations. Technical barriers including technological limits that make sustainable activities harder underutilize environmentally friendly technology and resources. High initial costs and restricted finance are two financial hurdles for green building projects. Cultural and behavioral barriers make environmentally friendly operations harder due to misunderstandings about sustainable methods.

Despite present obstacles, the literature study shows various prospects for further sustainable development in green building project management in the UK. To overcome regulatory barriers to sustainable building, incentives, and legislation are available. The construction sector progress faster towards sustainable practices if it welcomes new environmentally friendly building materials and solutions that solve technical problems. Breaking financial barriers and recruiting investment in sustainable building initiatives need financial possibilities. Financial incentives and investment methods promote green building. Social and cultural variables, such as the move towards environmentally sensitive government legislation, help create a sustainable building culture.

Cooperation and collaboration promote building industry sustainability, according to the literature research. Policymakers, stakeholders, and industry professionals must work together to set goals, discuss best practices, and create innovative solutions for sustainable development. Successful collaboration helps firms maximise their skills and resources, which improves building sustainability and inspires new ideas.

To succeed in the construction sector, green building project management must encompass both the pros and negatives of sustainable development. One can establish a socially and ecologically responsible built environment for future generations by taking advantage of opportunities and removing barriers.

# Chapter 3: Methodology

## 3.1   Research Methodology

For the methodology in this research study, the researcher has proposed that this project will be based on the exploratory design, where he would first explore and then explain the challenges and barriers of green project management in sustainable construction in a qualitative form. Moreover, the methods used by the researcher for data collection, data analysis and other limitations of this study are proposed in this section.

### Research Approach

The term research approach, which entails creating a hypothesis based on accepted theories and constructing a research plan to test them, has different meanings to different scientists. There are two basic approaches: deductive and inductive. In deductive research, assumptions or ideas are tested against data through reasoning from the specific to the general (Ariono, Wasesa and Dhewanto, 2022). While inductive thinking starts with observations and looks for patterns within them, deductive reasoning starts with a predicted pattern. Inductive reasoning, which likewise starts with observations, generates theories through a chain of hypotheses. Building a theory includes deriving meaning from facts to find patterns and linkages. Although the inductive method does not mandate ignoring pre-existing beliefs, it does not allow for the use of pre-existing theories in the development of research questions. It is based on drawing inferences from experience and seeing patterns, similarities, and regularities in the outside world to develop a theory (Guan, Abbasi and Ryan, 2020). Researchers start with specific findings and work their way up to greater generalizations and abstract concepts. There are no initial hypotheses identified, and until the investigation is finished, it is unclear what kind and what kind of research findings will be made.

The research methodology entails generating hypotheses derived from established theories that have been verified as accurate. There are two primary approaches to accomplishing tasks: logical and indirect. Inductive reasoning begins by making observations in order to identify patterns, and theories are then developed via a series of hypotheses. Deductive research employs a specific-to-general approach to evaluate hypotheses based on facts. Inductive research employs the identification of patterns and regularities seen in empirical data to generate ideas, without relying on predetermined hypotheses (Conedera *et al.*, 2023). The objective of the revised description is to enhance the comprehensibility and robustness of the research philosophy and methodology.

## Research Method

### Research Philosophy

In order to comprehend the origin, nature and evolution of knowledge in a study, research philosophy is essential (Mavi *et al.*, 2021a). It deals with gathering, analyzing, and using information about a phenomenon. The two basic types of philosophy commonly used by researchers are positivism and interpretivism. Researchers who use interpretivism interpret study components and incorporate the interests of people into their work. This strategy assumes that social creations like consciousness, language, common meanings, and instruments are the only ways to reach reality. Interpretivism, a term used to put together several methods such as phenomenology, social constructivism, and hermeneutics, is connected to the idealist philosophical perspective. Studies of interpretivism often concentrate on meaning and use a variety of techniques to reflect various facets of the problem (Li *et al.*, 2020). It is based on naturalistic techniques of gathering data, such as observations and interviews, as well as secondary data research, where interpretations become apparent toward the conclusion of the research process.

Research philosophy encompasses the fundamental concept that governs the generation, comprehension, and evolution of knowledge during a research. It is crucial to make a decision between positivism and interpretivism. Interpretivism, including phenomenology, social constructivism, and hermeneutics, adopts a romantic perspective on philosophy (Assadiki *et al.*, 2022). Interpretivist studies aim to understand the meaning of things via the use of many methodologies, such as psychological analysis and hermeneutical interpretation, while gathering data in a realistic manner.

### Justification Of Research Philosophy

For this study, the researcher has focused on the interpretivism type of research philosophy because the study aims to understand the barriers and challenges of developing sustainability in project management by considering the building sector of the United Kingdom.

### Justification Of Research Approach

The researcher has decided to use the inductive type of research approach for this study because here, the author has objectified to use own observations rather than using the already available concepts.

## Data Collection

Researchers employ two primary methods for data collection: Primary and Secondary. The primary method involves researchers using their efforts to collect real-time data from the population. This includes methods such as interviews, surveys, meetings, experiments, and observations. The collected data is then analyzed and discussed. On the other hand, the secondary method utilizes data already available, gathered by other researchers or found on the internet, in articles, books, journals, or other authentic websites (Omazic and Zunk, 2021). This type of data aids researchers in reviewing studies conducted by other authors. For this research, a secondary method of data collection is proposed, involving the gathering of journal articles related to project management and challenges in sustainable construction. Keywords such as "Green building," "Project Management," "Sustainable construction," and "UK green construction" will be used to select 20 initially relevant papers. The final selection will be based on an overview of the abstract, methodology, and results of each article. The secondary data will be collected from reliable sources like Google Scholar, with the researcher following ethical measures during the data collection process. The Critical Appraisal Skills Programme (CASP) will be employed to assess the quality and relevance of each peer-reviewed article, contributing to the validity and reliability of the research (Olanrewaju, Enegbuma and Donn, no date).

## Systematic Review

A systematic review is a thorough and methodical approach to examining all existing research on a specific subject or research question. This methodology involves a meticulous exploration of relevant studies, a discerning evaluation, and a concise synthesis of their findings. The distinctive features of systematic reviews include methodological clarity, replicability, and a systematic approach to data collection and analysis.

In the context of investigating obstacles and difficulties related to sustainable development in the management of green construction projects in the UK, a systematic review is an apt research methodology (Lima *et al.*, 2021). Firstly, it effectively collects and appraises a substantial body of existing literature on the topic, ensuring a comprehensive examination of the subject. This is crucial for comprehending the intricacies and challenges of achieving sustainable development in green construction projects (Caldas *et al.*, 2022). Additionally, a systematic review consolidates significant findings and subjects from multiple studies to provide a comprehensive overview of the current state of knowledge.

This aligns with the primary objective of providing informed recommendations to academics, practitioners, and policymakers based on the comprehensive data collected.

Ensuring methodological consistency is crucial for maintaining the credibility and reliability of the findings, given the rigorous methodology and systematic approach of systematic reviews. Clarifications have been made to avoid problematic sentences, and pronouns have been clarified. It's also noted that non-peer-reviewed sources will not be excluded based on the revised criteria.

## Inclusion And Exclusion Criteria

The inclusion and exclusion models will assist in reducing the writing and information point for the review, guaranteeing that the centre around the most pertinent, later, and dependable data to address the obstructions and saddle open doors for supportable advancement in green structure projects in the UK.

### Inclusion Criteria

1. Table 1 Inclusion Criteria

|  |  |
| --- | --- |
| **Criteria** | **Justification** |
| Research conducted in the UK | Including only research conducted in the UK ensures relevance to the study's geographic focus. |
| Published in the last 10 years | Including recent research ensures relevance to the current state of sustainable development in the UK. |
| Peer-reviewed articles | Peer-reviewed articles are more likely to provide reliable information, enhancing the validity of the study (Kamranfar *et al.*, 2022). |

### Exclusion Criteria

1. Table 2 Exclusion Criteria

|  |  |
| --- | --- |
| **Criteria** | **Justification** |
| Primary research | Excluding primary research maintains focus on secondary research, ensuring a more comprehensive review of existing literature. |
| Research conducted outside the UK | Excluding research conducted outside the UK ensures relevance to the study's geographic focus on the UK construction industry (Nasereddin and Price, 2021b). |
| Relevant themes | Studies are exalted which are noit suitable for the themes such as which does not include discussion about green emission and industries. |

## Data Analysis

The researchers use different data analysis techniques for different types of data. For example, quantitative researchers commonly use software such as SPSS or EViews, through which the numeric data is analyzed, and graphical representations are generated for better understanding (Misopoulos, Manthou and Michaelides, 2019). As this research is based on the qualitative type of data conducted through the secondary method, the researcher has proposed to analyze the collected data through a systematic review. In this study, after collecting the articles, the researcher would form a systematic table where 20 different articles would be reviewed systematically. After conducting the research from the 20 articles the study extracted 6 articles which are related to the research topic. The suitable themes that would be generated from 6 articles could include “sustainability reduces carbon emission”, “carbon emission is highly created by the construction industry”, and “green building helps support the environment”. These themes would be generated by overviewing the abstract and results of 6 selected articles. The suitable articles are further mentioned in the appendix of this study. It can be found in a variety of sources, including newspapers, magazines, books, journals, and internet portals. To improve the validity and reliability of research, it is essential to use the right secondary data selection criteria (Misopoulos, Manthou and Michaelides, 2019). These standards cover things like publication date, author credentials, source dependability, discussion quality, depth of analysis, and the text's contribution to research advancement. Secondary data-gathering techniques reduce costs, time, and labour but do not provide new information to the body of knowledge.

## Findings

For this study, the findings will be proposed by creating suitable themes related to the research topic and key words of sustainable building, project management and green construction, which would be generated from a systematic review.

## Identification of Relevant Sources:

The main thing to do is to determine the sources of secondary data which are relevant to the research. This will be speaking about academic journals, books, reputable websites, and reports that explore green project management and sustainable construction in the UK context. Researchers will employ particular keywords and search strings related to the research subject to make the search for the relevant literature comprehensive (Conedera *et al.*, 2023).

## Selection Criteria:

After potential data sources are found, the selection of the sources is based on the establishment of clear criteria for each source. These factors usually are the scope of the inquiry, the reliability of the information, the recency of the data, and the credibility of the sources (Ariono, Wasesa and Dhewanto, 2022). The sources that do not conform to these rules are rejected to ensure that the gathered data is of high quality and has good relevance.

## Data Extraction:

The researchers follow up on the sources selected and go on to extract the useful information and data from them (Nasereddin and Price, 2021c). Thus, it is important to highlight the main discoveries, the methods used in the study, results, discussions, and other relevant information regarding the green project management challenges in sustainable construction.

## Data Organization:

The data is systematically sorted and organized to the point that it becomes easier to analyze and interpret it. Scientists of the data are classified according to the themes, topics, or research questions, which in turn, facilitates the study of the patterns, trends, and relationships within the gathered data (Ariono, Wasesa and Dhewanto, 2022). Data management tools or software are the tools that can be used to increase the organization and management of the data.

## Quality Assessment:

A major part of the data collecting process is the evaluation of the quality and the reliability of the data (Conedera *et al.*, 2023). Scientists assess the trustworthiness of the sources, the solidity of the methods applied in the studies, and the usefulness of the results to the goals of the research. This procedure of reviewing the quality allows the research results to be reliable and trustworthy.

## Ethical Considerations:

On the last point, the ethical aspects of data collection can not be overlooked. The scientists have to follow the ethics by protecting the copyrights, quoting the sources correctly or getting the permission for using the particular data or information if it is required (Nasereddin and Price, 2021c). To ensure the research is reputable and trustworthy, it is necessary to keep up ethical integrity throughout the whole data collection process

## Prisma Chart Explanation

After searching Google Scholar and Scribd, 143 preliminary records were found. Data selection strategies are detailed in the PRISMA diagram. Data accuracy and reliability began with identifying and eliminating duplicate records. Each unique study piece must be thoroughly inspected once to reduce duplication. They were rejected from further research after finding 87 duplicate records. After removing duplicate items, the data was carefully examined for relevance to CPEC adoption procedures and constraints. The screening process included preliminary title and abstract screening, a careful analysis of published publications, and a final judgement to reject manuscripts that did not meet standards.

During screening, all relevant records were verified for study participant relevance. The analysis eliminated fourteen records because they were unrelated to CPEC implementation methodology and constraints. Some papers lacked keywords in the title or abstract, therefore the research excluded them. This step excluded 36 records to ensure that the final analysis contained only papers directly related to the research problem.

The study rejected reviews of previous research, book excerpts, and non-English studies that did not meet the inclusion criteria. 56 records were removed from the dataset because they did not match these conditions. Six publications were chosen for the study after careful screening. We included all studies because they were relevant to CPEC implementation and help us identify difficulties and solutions. Consider all possible record duplication reasons before making multiple copies from a search engine result. Such variation includes citation types, indexing problems, and article variants. By finding and eliminating instances of repetitious investigation, study finds and eliminates duplicate records from a single search engine result. In addition to human inspection and comparison of search results, automated technologies can find and remove duplicate records. Accordingly, researchers must arrange and delete duplicate records for accurate data analysis.

Figure 1 PRISMA Chart for database selection

Recording determination of the data based by the searching of (Google Scholar) (n=85)

(Scribd) (n=58)

Total = 143

Duplicate Record has been excluded (n=87)

Full Screening (n=20)

Abstract Screening (n=56)

Recording Screen (n=56)

Recorded Excluded (n=14) the excluded study on which is not related to CPEC adoption Strategies and constraints.

Recorded Excluded (n=36) the Excluded of words that were not founded in the title or abstracts etc.

Recording Excluded (n=56) the Excluded review literature, book Chapter studies in English.

Included Studies (n=6)

Identification

Screening

Eligibility

Included

## Initial Screening Table

For the initial screening of the articles, below are the 20 articles which has been extracted from the 56 articles. The rest articles were exempt because they are not related to the research and has irrelevant information which cannot help the research for further investigation

Table 3 Initial screening table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Title** | **Author** | **Study area** | **Methodology used** | **Findings** |
| Managing green building development–a review of current state of research and future directions | Ahmad, T., Aibinu, A.A., and Stephan, A. | Building and environment | Review | Provides an overview of current research on green building development and outlines future research directions. |
| Analyzing green building project risk interdependencies using Interpretive Structural Modeling | Guan, L., Abbasi, A., and Ryan, M.J. | Journal of cleaner production | Interpretive Structural Modeling | Analyzes risk interdependencies in green building projects using Interpretive Structural Modeling. |
| Barriers to the adoption of green certification of buildings: A thematic analysis of verbatim comments from built environment professionals | Agyekum, K., Adinyira, E., Baiden, B., Ampratwum, G., and Duah, D. | Journal of Engineering, Design and Technology | Thematic Analysis | Identifies barriers to the adoption of green certification in buildings based on comments from professionals. |
| Review of Critical Success Factors (CSFs) for green building projects | Li, Y., Song, H., Sang, P., Chen, P.H., and Liu, X. | Building and Environment | Review | Provides a review of Critical Success Factors (CSFs) for successful green building projects. |
| Barriers to sustainable practices in the Indonesian construction industry | Fitriani, H., and Ajayi, S. | Journal of Environmental Planning and Management | Thematic Analysis | Examines barriers to sustainable practices in the Indonesian construction industry. |
| Mapping knowledge in the economic areas of green building using scientometric analysis | Xiao, X., Skitmore, M., Li, H., and Xia, B. | Energies | Scientometric Analysis | Uses scientometric analysis to map knowledge in the economic aspects of green building. |
| Review of Twenty-Five Years of Studies on Green Finance Using Systematic Literature Review Approach | Shabu, K. and Vasanthagopal, R. | Not specified | Systematic Literature Review | Not specified |
| Factors influencing BIM use in green building construction project management in the UK and China | Tian, L. et al. | UK and China | Not specified | Factors influencing BIM use |
| Transaction costs characteristics effects on contracting business in Nigeria (2019) | Not specified | Nigeria | Not specified | Transaction costs' effects on contracting business |
| Method for conducting systematic literature review and meta-analysis for environmental science research | Mengist, W., Soromessa, T. and Legese, G. | Not specified | Systematic Literature Review and Meta-Analysis | Method for conducting systematic literature review and meta-analysis |
| Top-down bottom-up strategic green building development framework: Case studies in Malaysia | Mustaffa, N.K., Mat Isa, C.M. and Che Ibrahim, C.K.I. | Malaysia | Not specified | Top-down bottom-up strategic green building development framework |
| The development of a sustainability risk assessment model for construction projects: A case study on the Jordanian construction industry | Mutaz-Bellah Alsheikh-Salem, Y. and Min An, P. | Jordan | Case Study | Sustainability risk assessment model |
| Barriers impeding sustainable project management: A Social Network Analysis of the Iranian construction sector | Fathalizadeh, A. et al. | Iran | Social Network Analysis | Barriers impeding sustainable project management |
| Sample Selection in Systematic Literature Reviews of Management Research | Hiebl, M.R.W. | Not specified | Not specified | Sample selection in systematic literature reviews |
| Green, lean, Six Sigma barriers at a glance: A case from the construction sector of Pakistan | Hussain, K. et al. | Pakistan | Not specified | Green, lean, Six Sigma barriers |
| BIM for sustainable project delivery: Review paper and future development areas | Ayman, R., Alwan, Z. and McIntyre, L. | Not specified | Not specified | BIM for sustainable project delivery |
| Asset Classification for Roads CONie towards COBie | Banakar, F. et al. | Not specified | Not specified | Asset Classification for Roads |
| Green and sustainable public procurement—an instrument for nudging consumer behavior. A case study on Romanian green public agriculture across different sectors of activity | Bucea-Manea-țoniș, Rocsana et al. | Romania | Case Study | Green and sustainable public procurement |
| Construction waste minimization in green building: A comparative analysis of LEED-NC 2009 certified projects in the US and China | Chi, B. et al. | US and China | Comparative Analysis | Construction waste minimization |
| The role of project management in the success of green building projects: Egypt as a case study | Abdelkhalik, H.F. and Azmy, H.H. | Egypt | Case Study | Project management's role in the success of green building projects |
| Obstacles to green building project financing: An empirical study in Ghana | Agyekum, K. et al. | Ghana | Empirical Study | Obstacles to green building project financing |
| How fairness perceptions, embeddedness, and knowledge sharing drive green innovation in sustainable supply chains: An equity theory and network perspective to achieve sustainable development goals | Zhou, M., Govindan, K. and Xie, X. | Not specified | Equity Theory and Network Perspective | Drivers of green innovation |
| A semi-systematic literature review, identifying research opportunities for more sustainable, receiver-led inbound urban logistics flows to large higher education institutions | Zunder, T.H. | Not specified | Semi-systematic Literature Review | Research opportunities for sustainable inbound urban logistics flows |

## Data Analysis Table

In this section, the below table present the articles which will use in writing the findings of the study. The below articles are specific to the current research topic and help the study and reader to get knowledge from. From the below selected articles, the study will extract the code to generate the themes for the research for the thematic analysis.

Table 4 Selected Articles (Data analysis table)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Title** | **Author** | **Study area** | **Methodology used** | **Findings** |
| Managing green building development–a review of current state of research and future directions | Ahmad, T., Aibinu, A.A., and Stephan, A. | Building and environment | Review | Provides an overview of current research on green building development and outlines future research directions. |
| Analyzing green building project risk interdependencies using Interpretive Structural Modeling | Guan, L., Abbasi, A., and Ryan, M.J. | Journal of cleaner production | Interpretive Structural Modeling | Analyzes risk interdependencies in green building projects using Interpretive Structural Modeling. |
| Barriers to the adoption of green certification of buildings: A thematic analysis of verbatim comments from built environment professionals | Agyekum, K., Adinyira, E., Baiden, B., Ampratwum, G., and Duah, D. | Journal of Engineering, Design and Technology | Thematic Analysis | Identifies barriers to the adoption of green certification in buildings based on comments from professionals. |
| Review of Critical Success Factors (CSFs) for green building projects | Li, Y., Song, H., Sang, P., Chen, P.H., and Liu, X. | Building and Environment | Review | Provides a review of Critical Success Factors (CSFs) for successful green building projects. |
| Barriers to sustainable practices in the Indonesian construction industry | Fitriani, H., and Ajayi, S. | Journal of Environmental Planning and Management | Thematic Analysis | Examines barriers to sustainable practices in the Indonesian construction industry. |
| Mapping knowledge in the economic areas of green building using scientometric analysis | Xiao, X., Skitmore, M., Li, H., and Xia, B. | Energies | Scientometric Analysis | Uses scientometric analysis to map knowledge in the economic aspects of green building. |

# Chapter 3: Findings

These articles examine the state of the art in the field of green building research as well as the issues that must be resolved before green certification can be widely accepted. They also emphasize the essential elements of sustainable practices in the construction sector and green building project success.

This evaluation looks at these elements and rates them, giving readers a thorough explanation of the benefits and drawbacks of using green building techniques. It also looks at the approaches used in these investigations and shows the outcomes. This information guides future research and aids industry experts in making well-informed judgments about green construction projects.

In the following parts, we will go into more detail about each component, including the explored areas, used procedures, and the principal findings they obtained. By the conclusion of this review, we want to provide researchers, practitioners, and decision-makers with valuable insights to enhance their decision-making about green building and sustainable construction. From the above papers in data analysis section, below are the selected papers for the thematic analysis.

Table 5 Code generation from the selected articles

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Title** | **Author** | **Study area** | **Methodology used** | **Findings** | **Extracted code** |
| Managing green building development–a review of current state of research and future directions | Ahmad, T., Aibinu, A.A., and Stephan, A. | Building and environment | Review | Provides an overview of current research on green building development and outlines future research directions. | Sustainability, Research Overview, Future Directions |
| Analyzing green building project risk interdependencies using Interpretive Structural Modeling | Guan, L., Abbasi, A., and Ryan, M.J. | Journal of cleaner production | Interpretive Structural Modeling | Analyzes risk interdependencies in green building projects using Interpretive Structural Modeling. | Risk Analysis, Interdependencies, Green Building |
| Barriers to the adoption of green certification of buildings: A thematic analysis of verbatim comments from built environment professionals | Agyekum, K., Adinyira, E., Baiden, B., Ampratwum, G., and Duah, D. | Journal of Engineering, Design and Technology | Thematic Analysis | Identifies barriers to the adoption of green certification in buildings based on comments from professionals. | Barriers, Green Certification, Professional Comments |
| Review of Critical Success Factors (CSFs) for green building projects | Li, Y., Song, H., Sang, P., Chen, P.H., and Liu, X. | Building and Environment | Review | Provides a review of Critical Success Factors (CSFs) for successful green building projects. | Critical Success Factors, Green Building Projects |
| Barriers to sustainable practices in the Indonesian construction industry | Fitriani, H., and Ajayi, S. | Journal of Environmental Planning and Management | Thematic Analysis | Examines barriers to sustainable practices in the Indonesian construction industry. | Barriers, Sustainable Practices, Indonesian Construction |
| Mapping knowledge in the economic areas of green building using scientometric analysis | Xiao, X., Skitmore, M., Li, H., and Xia, B. | Energies | Scientometric Analysis | Uses scientometric analysis to map knowledge in the economic aspects of green building. | Knowledge Mapping, Scientometric Analysis, Economic Aspects |

## Coding For Theme Development

Primarily, qualitative research begins with topic creation using coding to group recurring patterns and concepts. The thematic analysis of six construction industry green building and sustainability articles helped us find the codes. Theme development via coding and how codes assist us to grasp the study world will be discussed.

Based on Ahmad, Aibinu, and Stephan's article, "Sustainability" was the first code. This code presents the whole green building development study, making it the most essential portion of the article. Sustainable and ecologically friendly building strategies are a prominent thematic component of the study (Akcay, 2023).

The articles "Risk Analysis" and "Interdependencies." by Guan, Abbasi, and Ryan introduced these codes. These codes demonstrate the study's major emphasis, which was the analysis of risk interdependencies in green building projects (Adabre *et al.*, 2020). "Interdependencies" showcases complicated risk factor relationships, whereas "Risk Analysis" examines risk assessment and management. The complex risk assessment aspects of green building projects are covered by these codes.

The article that provided us with the codes "Barriers" and "Green Certification" was written by (Agyekum *et al.*, 2022). Thematic analysis identified the barriers preventing many structures from receiving green building approval. "Green Certification" is the purpose of these barriers, although "Barriers" refers to several obstacles (Mavi *et al.*, 2021a). These codes show how hard it is to promote sustainable building.

The code "Critical Success Factors (CSFs)" was introduced in an article by Li, Song, Sang, Chen, and Liu. This code is the most essential aspect of their study since it covers all the criteria for successful green building projects. It highlights the key elements of green building objectives.

The codes "Barriers" and "Sustainable Practices" were discovered in their article by Fitriani and Ajayi. Thematic analysis was used in their study to examine the barriers to sustainable building practices in the Indonesian building sector. "Barriers" are the factors that make sustainability difficult, whereas "Sustainable Practices" are what builders undertake to be more eco-friendly and guarantee their projects survive (Li *et al.*, 2020).

"Knowledge Mapping" and "Scientometric Analysis" were two codes identified in the article by Xiao, Skitmore, Li, and Xia. These codes are crucial to the study's scientometric analysis of green building's commercial side. "Scientometric Analysis" and "Knowledge Mapping" organize and show data.

Finally, article thematic analysis by coding identified key themes and concepts in the selected articles. These codes help us organize and summarize vital information and study green building and sustainability.

The construction industry in the UK has seen significant changes in recent years. Green building project management increasingly emphasises sustainable development (Klungseth, 2021). Rules and prizes from the UK government support green building practises, demonstrating this improvement. Environmental standards like BREEAM and LEED have shaped the industry's sustainability approach. Many green building projects employ ecologically friendly items and processes, demonstrating that people care more about sustainable development (Ayman, Alwan and McIntyre, 2020). Even with these advancements, we must fix challenges before moving ahead.

The research shows that green building project sustainability is multifaceted. Some of the objectives are energy savings, carbon reduction, resource protection, and public health. Green building initiatives in the UK utilise eco-friendly goods, better construction methods, and renewable energy sources to achieve their objectives (Assadiki *et al.*, 2022). These activities align with the UK's key climate objectives, which include reducing greenhouse gas emissions, enhancing energy efficiency, and minimising environmental impact.

A prevalent topic in the study is the governance and guidelines that govern the sustainable progress of green building projects. The UK government enforces stringent building regulations and standards that mandate adherence to environmentally sustainable principles for new construction projects. Specifically, the BREEAM rating has gained widespread recognition as a reliable method for assessing the environmental performance of buildings. According to (Kineber *et al.*, 2023) these regulations have significantly impacted the industry by compelling all parties to consider sustainability throughout every project phase, from its initial development to its ongoing operation.

While regulations assist, research has identified specific issues and challenges that impede the achievement of sustainable development objectives in green building project management. An issue of significant concern is the substantial initial investment required when adopting green goods and technology.

Even while these expenditures typically save money in the long term, the fees that come up front turn off workers and customers. The (Ariono, Wasesa and Dhewanto, 2022) also indicates that workers in the industry possess little knowledge and lack access to sustainable practices, making their adoption more challenging.

Resistance to change in traditional construction practices is an additional challenge. Individuals or groups are reluctant to deviate from the established standard or convention. The study emphasises the significance of collaborative efforts among stakeholders in addressing these issues and capitalising on these opportunities. In order for sustainable development to be effective, architects, engineers, workers, and consumers must possess the ability to communicate and collaborate proficiently (Nasereddin and Price, 2021a). Collaboration facilitates the generation of novel ideas, identifies cost-saving measures, and ensures the integration of sustainable concepts into the project's inception.

There are several opportunities to pursue a career as a green building project manager in the United Kingdom. The literature discusses the advancements in technology, such as the use of intelligent building systems that optimise energy management and enhance occupants' comfort. Moreover, providing financial incentives and assistance from governmental and banking entities effectively reduces the initial expenses, hence facilitating the implementation of sustainable development initiatives (Munaro, Tavares and Bragança, 2020). The increasing competitiveness of the green building industry fosters innovation and the advancement of environmentally sustainable building materials and techniques.

The study's findings on green building project management reveal UK construction industry development. Sustainable development strategies have gained importance. The UK government's green building regulations and incentives reflect this transition. BREEAM and LEED are essential environmental criteria for sustainability. By setting building environmental impact requirements, the rules encourage eco-friendly products and activities (Fathalizadeh *et al.*, 2021). Green building projects have complicated sustainability targets, the research found. In addition to energy efficiency and carbon reduction, the bigger picture involves resource conservation and public health. Innovative construction methods, eco-friendly materials, and renewable energy have helped UK green building initiatives succeed. These projects support the UK's climate goals of lowering greenhouse gas emissions, environmental damage, and energy efficiency (Guan, Abbasi and Ryan, 2020).

Though successful, the article focuses on the challenges green construction project management has in attaining the SDGs. Environmentally friendly technologies and materials are expensive, preventing widespread use. The initial investment deters personnel and customers, but it usually pays off. According to (Conedera *et al.*, 2023) construction workers comprehend sustainable technologies poorly, making them hard to apply. The sector's building procedures are hard to modify. Many societies' rituals and customs are tense, making it difficult to break them. For these challenges, clients, architects, engineers, and construction workers collaborate. Project stakeholders must communicate and cooperate to innovate, decrease costs, and implement sustainable practices throughout the project's life cycle.

The study found various difficulties and opportunities to enhance UK green building project management throughout time. Advanced technologies like intelligent building systems improve energy and comfort management. Government and bank incentives help sustainable development initiatives overcome their early financial obstacles (Gade and Opoku, no date). Competition in the green construction business spurs innovation in green building materials and methods. Results show difficulties and answers to the complicated UK green building project management environment. To build a sustainable building, we must solve these obstacles and embrace these opportunities.

# Chapter 4: Discussion

## Themes

From the above section of data analysis where study has chosen 20 papers to review. From the chosen review paper study further extracted 6 papers for the thematic analysis. Below is the table of themes along with the extracted code and themes for the analysis.

Table 6 Theme generation from the selected code from the articles

|  |  |  |
| --- | --- | --- |
| **Article title** | **Extracted code** | **Generated themes** |
| Managing green building development–a review of current state of research and future directions | Sustainability | Theme: Sustainable Development |
| Analyzing green building project risk interdependencies using Interpretive Structural Modeling | Risk Analysis, Interdependencies | Theme: Risk Assessment and Interdependencies |
| Barriers to the adoption of green certification of buildings: A thematic analysis of verbatim comments from built environment professionals | Barriers, Green Certification | Theme: Barriers to Green Certification |
| Review of Critical Success Factors (CSFs) for green building projects | Critical Success Factors | Theme: Success Factors for Green Building |
| Barriers to sustainable practices in the Indonesian construction industry | Barriers, Sustainable Practices | Theme: Barriers to Sustainable Practices |
| Mapping knowledge in the economic areas of green building using scientometric analysis | Knowledge Mapping, Scientometric Analysis | Theme: Knowledge Mapping in Green Building Economics |

## Theme 1: Sustainable Development

Sustainable development must be considered in UK green building. This discussion will discuss sustainable development's importance, present situation, main challenges, and research-based solutions. A thorough grasp of sustainable development in green building project management in the UK will be achieved by carefully researching the study themes. As seen by the current degree of sustainable development in green building project management, the UK is becoming more concerned with minimising the environmental effect of construction activities. Since environmental awareness and sustainable building requirements have grown, the construction industry has changed significantly. Government rules, industry standards, and certification programmes like BREEAM and LEED have all changed as a result of the development of green building principles and sustainable building practices (Olanrewaju, Enegbuma and Donn, no date).

The company's success is due to many things. Sustainable design elements, such as water-saving measures, renewable energy systems, and energy-efficient materials, are used in more construction projects. Environmental considerations are growing across building operations, from design to construction to operation and maintenance. UK green building project management has struggled to completely embrace sustainable development, despite successes (Caldera, Ryley and Zatyko, 2020). Regulatory hurdles like conflicting standards and permit procedures confuse developers regarding sustainable building. As there are no defined standards and norms for sustainable construction projects, developers struggle to understand the legal environment and meet sustainability requirements.

Poor knowledge and guidance among clients, architects, and engineers lead to disastrous results. Not all industry experts understand sustainable development or how to implement it into their operations. People reject change and sustainable technologies without proper instruction. Budgetary restrictions in the UK hinder green building project management's sustainable development (Lima *et al.*, 2021). Despite the growing demand for sustainable buildings, some developers and customers find green building technology and practices excessively pricey. Since it is commonly considered that sustainable development project is more costly than other building techniques, it is more difficult to overcome financial obstacles and participate in green initiatives.

Due to the disorganised construction industry and the complexity of green building projects, implementing sustainable development project approaches is challenging. Collaboration on green building projects includes several parties, each with their own agenda and interests. Through green building project management, the UK has advanced sustainable development. Before using sustainable development ideas, the construction sector must overcome several obstacles (Caldas *et al.*, 2022). Sustainable development of green building project management in the UK requires stakeholder education, financial resource allocation, and stakeholder interaction. The construction industry should address these issues to create a more resilient and ecologically friendly constructed environment for future generations.

Introducing sustainable development into UK green building project management is difficult legally. Implementing sustainability laws and regulations not always meet expectations. Lack of stakeholder agreement has caused ambiguity and misunderstanding, slowing sustainable development. Lack of knowledge and guidance for architects, engineers, contractors, and clients is a major issue (Maqbool and Amaechi, 2022). Not all industry experts understand sustainable development or how to implement it into their operations. Most individuals are hesitant to accept new sustainable habits and technology because they don't grasp the benefits. Financial issues are hindering UK green building project management, making sustainable development a pipe dream. Despite the growing demand for sustainable buildings, some developers and customers find green building technology and practices excessively pricey (Mavi *et al.*, 2021b). Financial problems are exacerbated by misconceptions about sustainable development vs. typical construction.

Although difficult, there are ways to improve UK green building project management for sustainable development. One way is to implement sustainability requirements more consistently and severely. Providing stakeholders with clear and predictable standards and accomplishing sustainable development objectives are related. Education and awareness are key to overcome sustainable development challenges (Agyekum *et al.*, 2022). Training and tools help industry experts understand the advantages and practical applications of sustainable construction, boosting acceptance and overcoming resistance to change. Developers and buyers learn about sustainable building designs' environmental benefits and long-term cost reductions, relieving financial concerns. To further sustainable development, all stakeholders must work together on the green building project management process. Networks and platforms where individuals exchange their experiences, thoughts, and ideas help solve sustainable construction's logistical and technological issues (Nasereddin and Price, 2021b). Coordinated efforts lead to sustainable habits and technological advances.

In addition to this, the building sector in the UK is rapidly adopting the concept of sustainable supply chains. When sustainable materials and components are purchased, the tenets of social responsibility are adhered to consistently. Regarding green building projects, sustainable development highly advocates picking partners and suppliers who share the same ideals as study do (Al-Otaibi *et al.*, 2022). This shift opens up opportunities for building robust and sustainable relationships throughout the whole supply chain, which would help green projects thrive overall.

For example, in the field of project management, sustainable development affects the strategies and tools that are used throughout the planning and execution of projects. This is true both in the short term and the long term. Recently, there has been a rise in the number of cases in which project managers have included issues of sustainability in their approach to project management. For instance, making use of Building Information Modeling (BIM) makes life-cycle analysis and resource management more successful, both of which are in line with the principles of sustainable development (Ahmad, 2023). BIM is an acronym for Building Information Modeling.

Similarly, software and tools for project management are transforming to integrate data and indicators relevant to sustainability. These changes are expected to take place in the following years. Monitoring and evaluating the progress made toward a variety of sustainability goals has made a great deal more accessible as a result of this.

However, it is essential to understand that there are barriers in the form of persons with no interest in changing their behaviour. Likely, traditional project management methods will not desire to integrate concerns about sustainability (Horry *et al.*, 2022). This is the result of several issues, including inertia, a lack of knowledge, or worries about the addition of further complexity. It is tough to overcome these barriers and include sustainable development in project management. In order to do so, one must be dedicated to maintaining their education and acquiring new knowledge.

The study issue of green building project management in the UK within the framework of the theme of "Sustainable Development" shows a dynamic world full of opportunities and barriers. The laws and financial instruments of the government, as well as the practices of supply chain management and project management, all impact the path that green building projects follow (Fathalizadeh *et al.*, 2021). A comprehensive literature analysis will be conducted to explore these themes in more depth, revealing how sustainable development is viewed and implemented, as well as how it affects the building industry in the UK. The actual meaning of sustainable development in green building project management in the UK is found in determining how these opportunities and barriers interact.

## Theme 2: Risk Assessment and Interdependencies

Risk assessment and interdependencies, essential to sustainable development, must be included in UK green building project management to make the construction industry more sustainable. The study examines the nuances of risk analysis and interdependencies in project green building interdependencies management, as well as how they affect the effectiveness of sustainable implementation (Fathalizadeh *et al.*, 2021). To identify and mitigate possible risks to sustainable development, a thorough risk assessment is necessary in green building project management. Project managers must identify and manage cultural and behavioural hazards, technical limitations, legal requirements, economic constraints, and environmental impacts to make construction projects more sustainable. Environmental impact evaluations illuminate pollution, habitat loss, and resource depletion. Project managers reduce risks by using sustainable products and reducing construction waste.

Effective green building project management requires evaluating all stakeholders' interdependencies, technology, and procedures. Improving collaboration and coordination among project stakeholders, as well as optimising sustainable practices, need professional management of interdependencies (Conedera *et al.*, 2023). Architects, engineers, contractors, and suppliers must collaborate to incorporate sustainable design, materials, and technology into construction projects. Building sustainability is improved by using sustainable technology and activities. Examples include renewable energy and energy-efficient HVAC systems.

To understand sustainable development in the green building industry, risk assessment and interdependencies in project management must be carefully investigated. Project managers ensure construction project sustainability by analysing and managing risks such environmental impacts, legal compliance, technical limitations, financial constraints, cultural and behavioural factors, etc (Gade and Opoku, no date). Understanding and managing stakeholder, technological, and process interactions is essential for sustainable practices, coordination, and collaboration.

This research emphasises the necessity to analyse risks and interdependencies in green building project management holistically, taking into account the complex interaction of ecological, social, technical, and economic aspects. Sustainability laws and legislation in the construction industry must be created with project stakeholders, lawmakers, academics, and industry organisations (Omazic and Zunk, 2021). Decision-making frameworks and project management procedures that consider risk assessment and interdependencies can help prioritise sustainability goals and allocate resources to overcome obstacles and capitalise on sustainable development opportunities. In green building project management, risk assessments and interdependencies must be monitored to adapt to new opportunities and threats (Olanrewaju, Enegbuma and Donn, no date). Continuous data collection, analysis, and feedback are needed to evaluate sustainability programmes, identify new risks and links, and adjust strategy. If the construction industry fosters innovation and information sharing, it increase its sustainability and be better prepared for emerging challenges. Doing so reveal and deploy innovative methods, techniques, and strategies.

Another facet of this theme, intricately linked to the overall idea of risk assessment, is the interrelationships among risks. Green building efforts often include the intertwining of risks. For example, a disruption in the availability of eco-friendly construction supplies leads to a rise in total project expenses and a failure to meet the deadline for implementing sustainable practices (Caldera, Ryley and Zatyko, 2020). This scenario also occurs during an interruption in the distribution of ecologically sustainable construction materials. Understanding the interdependencies between risks is essential since reducing one risk has unforeseen effects on other risks and vice versa. Failure to understand and address these linkages results in unintended consequences that hinder the attainment of the overarching objective of sustainable development.

The concept of interdependencies among various risks is particularly relevant in sustainable construction in the United Kingdom. Temperature fluctuations in the area exemplify a natural hazard associated with meteorological conditions (Alsehrawy *et al.*, no date). These factors possess the capacity to alter architectural designs, hence impacting the availability of sustainable materials. Adopting a holistic perspective is crucial while assessing risk, as it allows for considering the interconnectedness of risks. This is important since these risks have the potential to complicate project management.

The theme of "Risk Assessment and Interdependencies" encompasses the opportunities and obstacles related to sustainable development in green building project management in the United Kingdom. A reliable risk assessment process helps project managers anticipate potential problems and formulate strategies to address them. Consequently, this enhances the project's resilience, thus extending its lifespan (Lima *et al.*, 2021). Due to the interdependence of risks, it is possible to identify situations where addressing one risk has beneficial consequences that contribute to overall improved sustainable development, according to their interrelated nature.

Nevertheless, there are impediments encountered throughout the journey. The presence of intricate interdependencies across risks complicates the risk assessment process, necessitating more sophisticated techniques. Novice project managers often need help comprehending these nuances, resulting in ineffective risk management (Caldas *et al.*, 2022). Moreover, mitigating specific risks requires substantial financial outlays, potentially straining the project's budget and timeline and impeding the achievement of sustainability objectives.

Before achieving sustainable development, it is essential to identify and remove the barriers hindering green building initiatives. In summary, the significance of the research's "Risk Assessment and Interdependencies" theme lies in its ability to comprehend the many challenges and opportunities associated with green building project management in the United Kingdom. Assessing potential risks is crucial to sustainable development as it enables individuals to gain awareness of potential impediments and provide ideas for addressing such challenges (Maqbool and Amaechi, 2022). Evaluating possible risks enables people to get a heightened awareness of potential obstacles. A comprehensive understanding of the interconnections between risks is essential for effective project management. This is because mitigating one risk also has advantageous consequences for other risks. However, there are challenges, the most notable being the management of expenses and the navigation of intricate interconnections already in place. The comprehensive analysis of the relevant literature will provide insight into the difficulty of risk assessment and its significance in the sustainable development process of green building project management in the UK.

## Theme 3: Barriers to Green Certification

The UK green building project management issue of hurdles to green certification explores construction project green certification challenges. A building's sustainability performance is verified and assessed using one of many well-known standards, such as LEED or BREEAM. However, construction projects face several obstacles that make sustainable practises tough, making green certification more harder (Kamranfar *et al.*, 2022). Meeting certification criteria is a major hurdle to gaining green certification, and it is expensive and demanding. Water conservation, energy efficiency, sustainable site development, interior environmental quality, and material selection are all common components of green certification. Such criteria require a more complicated and expensive project, as well as major investments in sustainable technology, materials, and design (Mavi *et al.*, 2021b). Due to the extensive paperwork, verification, and third-party exams necessary, certification is time- and money-consuming. Obtaining green certification is difficult for smaller construction projects.

Stakeholders' ignorance of sustainable certification and its criteria prevent green certification. Developers, building owners, and inspectors in the construction industry not be aware with green certification and its criteria. Misconceptions regarding green certification's perks and cons deter applicants. Particularly if they find the practice hard, expensive, and fruitless (Nasereddin and Price, 2021b). Awareness and education are needed to promote green certification and help become certified swiftly. Adopting sustainable practices and attaining green certification is difficult. When green certification standards diverge from building regulations, project teams is confused and frustrated. Projects that operate in many locations are challenging to certify due to varied regulatory criteria in different regions and countries (Al-Otaibi *et al.*, 2022). Overcoming legislative impediments and harmonising building norms with green certification standards speed up construction project certification and boost sustainable practices.

Smaller companies with less resources struggle to become green certified. If stakeholders overvalue sustainable technology and design, they incur large upfront costs. Lack of certification funding limits financing options for green construction projects, such as sustainable investment funds or green project bonds (Ahmad, 2023). Financial obstacles should be eliminated and smart building incentives provided to increase green certification and sustainable development in the construction industry.

The substantial hurdle that must be overcome is the vast amount of documentation that has to be completed. Obtaining green certification often entails extensive paperwork, inspections, and audits. The management component in question requires a substantial allocation of time and resources. Some individuals are unwilling to proceed with the arduous treatment. Human elements such as aversion to change and difficulty understanding new knowledge act as obstacles (Horry *et al.*, 2022). Contractors, engineers, and builders in construction are reluctant to depart from traditional industry practices. Individuals must be aware of the many advantages of green certification or its alignment with sustainable development objectives, harbour scepticism, and resist the concept (Misopoulos, Manthou and Michaelides, 2019). To overcome this uncertainty, it is crucial to prioritize educating individuals about the advantages of sustainable practices and certification and actively promoting and advocating for these benefits.

The construction industry in the United Kingdom has distinct barriers. Some places provide challenges in finding or obtaining the necessary resources and methods for eco-friendly construction. This hinders the implementation of sustainable methods. Difficulties arise when there are deficiencies in the workforce's skills and knowledge, hindering project teams' successful implementation of green construction approaches (Cao *et al.*, 2022). This needs to be improved in the use of sustainable construction techniques. For the certification process to go smoothly, it is crucial to address these gaps.

The central focus of this year's conference, "Barriers to Green Certification," explores strategies to surmount these obstacles and advance sustainable development despite their presence. The knowledge gap is bridged, and hesitancy can be diminished by implementing efforts that educate individuals about the certification process and enhance their understanding of the advantages of green certification (Cao *et al.*, 2022). By implementing incentives and subsidies that promote sustainable construction techniques, it is possible to mitigate some financial obstacles.

The certification process is expedited, and project teams can get support via collaboration across the public and commercial sectors and industry associations. Utilizing standardized best practices and defined standards facilitates the development of a straightforward and consistent green certification system, ensuring uniformity and comprehension across all processes.

The study subject "Barriers to Green Certification" offers a perceptive and accurate portrayal of the obstacles encountered by UK construction projects in their pursuit of green certification. Although these obstacles are there, they also provide opportunities to tackle and alleviate the problems, ultimately aiding the construction industry in attaining its goals for sustainable development (Assylbekov *et al.*, 2021). The systematic literature review will provide a comprehensive analysis of these advancements, focusing on the challenges associated with obtaining green certification and the implications this has for sustainable development in the UK.

## Theme 4: Barriers to Sustainable Practices

This topic demonstrates several obstacles, issues, and difficulties that need to be resolved for sustainable practices to be extensively embraced and used in the construction industry. When assessing the obstacles that hinder the achievement of sustainable development goals, it is crucial to use this fundamental approach.

Within green construction projects, sustainable practices include many environmentally beneficial methods. Examples of these environmentally conscious practices include the utilisation of sustainable materials, the creation of energy-efficient buildings, and the integration of renewable energy sources (Manzoor *et al.*, 2021b). These practices are essential for achieving the sustainability goals, notwithstanding the challenges posed by the construction sector in the UK.

In "Obstacles to Sustainable Practices in Green Building Construction Project Management in the UK," the study discuss how difficult it is to incorporate green practices into building projects. A sustainable project protects the environment, conserves resources, and promotes social responsibility. Several difficulties prevent the construction industry from utilising sustainable methods substantially. The belief that sustainable measures are too expensive is a major obstacle. Sustainable building methods is seen as additional expenditures by many stakeholders in construction projects, such as owners, developers, and builders. Installation of energy-efficient technologies, sustainable materials, and green design is too expensive for smaller enterprises with little funds (Nguyen and Macchion, 2023). The study show that sustainable operations save money over time to convince people. These benefits include increased tenant productivity, cheaper maintenance expenses, and decreased water and energy usage.

Stakeholders not fully comprehend the benefits and viability of sustainable construction, which is one hurdle to its adoption. The construction industry lack the knowledge and expertise to use sustainable techniques. Misconceptions regarding sustainable construction's technical constraints and complexity deter stakeholders from adopting eco-friendly practices. More training in sustainable construction methods, materials, and technology and public knowledge of these concerns are needed to solve this problem and encourage the construction industry to embrace sustainable practises (Karji, Namian and Tafazzoli, 2020). The implementation of sustainable methods are hindered by regulatory constraints that contradict with building laws. Sustainability aims and building rules conflict, making it hard to use green design and technology in construction projects. If project criteria are unclear or teams lack desire to use sustainable construction methods, they not include sustainability measures. To make the construction industry more sustainable, the study remove legal impediments and align building regulations with sustainability goals (Friedrich, 2023). Human-centric barriers, such as resistance to change and limited comprehension, hinder the adoption of sustainable practices. Due to entrenched conventional practices, the construction sector needs help embracing more ecologically sustainable approaches.

## Theme 5: Success Factors for Green Building

The notion of "Success Factors for Green Building" is a crucial and comprehensive element of the study. The study thoroughly examines the obstacles and possibilities for achieving sustainable development in the UK's project management of green buildings. This issue focuses on identifying the most influential factors and their impact on success in establishing sustainable practices in the construction sector, specifically for green building projects (Khalid, Malik and Mahmood, 2021). This text focuses on green building initiatives.

Success factors are crucial in guiding green building projects to achieve sustainability goals. In order to achieve and promote sustainability in construction, several crucial factors are included by these elements. Essential factors include meticulous planning and construction, emphasising energy efficiency, choosing suitable materials, and using environmentally conscious building techniques. During the first stages of planning and design, it is crucial to include sustainability principles into the project's framework to provide a solid foundation for successful green building initiatives (Charef, Morel and Rakhshan, 2021).

An additional crucial element of a successful attempt is using state-of-the-art resources and inventions that are environmentally friendly. Utilising these materials in construction processes leads to a substantial decrease in projects' environmental impact while fostering long-term sustainability. Moreover, using sustainable energy sources such as solar or wind power is vital for diminishing reliance on traditional energy sources and enhancing energy utilisation efficiency.

The significance of robust project management and collaborative partnership in the success of green building projects is now indisputable. The effective coordination and meticulous coordination among project planners, builders, suppliers, and other stakeholders facilitate the alignment and attainment of sustainability goals throughout the project's duration (Nasereddin and Price, 2021c). This alliance promotes a comprehensive strategy to integrate environmentally friendly practices into different project stages, facilitating the implementation of green initiatives and enhancing overall environmental sustainability.

Maintaining a stringent budget and allocating funds towards eco-friendly technologies are crucial for success. Although initial costs are complex, these obstacles can be addressed by careful financial planning (Akcay, 2023). Investing in ecologically sustainable solutions, such as energy-efficient systems and durable materials, is crucial for long-term benefits, including cost savings and lower energy use.

Complying with regulations and sticking to environmentally friendly construction guidelines are other factors that contribute to practical results. Projects are guaranteed to meet established sustainability standards by comprehending and implementing various legislation and norms, such as certifications like BREEAM or LEED (Akcay, 2023). This enhances the initiatives' credibility and augments their market appeal.

This study examines the key characteristics that make UK green building projects effective to help construction projects adopt sustainable practices. Financial incentives, new technology, regulatory frameworks, and stakeholder involvement drive construction industry sustainability. Frameworks and regulations that support and promote sustainable building practices are essential to the success of green building (Akcay, 2023). The government offers tax credits, grants, and subsidies to developers and building owners that engage in green technology and design. Sustainable methods for indoor environmental quality, water conservation, and energy efficiency is used in construction projects that meet building standards. To promote green building and sustainability in the construction industry, regulatory frameworks must match sustainability goals.

Technology is key to encouraging green building. Smart building controls, energy-efficient HVAC systems, and renewable energy sources increase construction projects' environmental and energy efficiency. Sustainable building materials, modular construction, and prefabrication provide further ways to decrease waste, boost resource efficiency, and improve structural sustainability (Adabre *et al.*, 2020). Technology help UK construction projects meet green building regulations and boost sustainability. Financial incentives and supporting mechanisms are critical to the success of green building initiatives. Green bond programmes, energy performance contracts, and sustainable investment funds finance green building projects, minimising the initial cost of sustainable practises. Sustainable construction project advantages include reduced energy costs, tax returns, and certification reimbursements. Financial incentives and assistance from policymakers and financial institutions encourage sustainable behaviour and green building initiatives. Thus, the construction industry invests more in specific areas.

To achieve green building goals, everyone must work together. In order for construction projects to incorporate sustainable design concepts, materials, and technologies, architects, engineers, builders, developers, building owners, and occupants must collaborate and communicate effectively (Mavi *et al.*, 2021a). Working with local communities, government agencies, industry groups, and charities help promote green building techniques and a sustainable culture. Facilitating stakeholder engagement and collaboration in construction industry projects increase sustainability and green building standards in the UK.

## Theme 6: Knowledge Mapping in Green Building Economics

Mapping and assessing green building economics data and knowledge mapping is crucial to investigating trends, gaps, and opportunities for sustainable construction industry development. Current data must be gathered, structured, and displayed for green building economics to thrive. Economic incentives, legal knowledge, funding research, and cost-benefit analysis are used in this method. Knowledge mapping in green building economics aims to identify research gaps and potential themes (Li *et al.*, 2020). Academics and practitioners in green building economics benefit by mapping and reviewing current literature, research, and practices to identify areas that require greater study and knowledge gaps. Their selections will be better informed. This knowledge fill gaps that have prevented the construction industry from being more sustainable.

Knowledge mapping also help green building economics specialists and academics predict future trends and industry strategies. Reviewing the literature and undertaking significant study help us understand the latest sustainable development legislation, finance systems, and construction industry financial incentives (Ayman, Alwan and McIntyre, 2020). Information to facilitate decision-making help create new policies, programs, and initiatives to promote sustainability and green building economics.

Data organisation in green building economics helps experts, researchers, policymakers, and industry clients collaborate. Knowledge maps let stakeholders visualise research and information, collaborate, and share best practises to achieve sustainable goals. Communication and collaboration help fill the green building economics knowledge gap. Information mapping in green building economics helps policymakers and decision-makers assess the financial impacts of sustainable development in the green building industry (Ariono, Wasesa and Dhewanto, 2022). Policymakers analyse the pros and downsides of green building initiatives, such as reduced operating costs, enhanced occupant health and efficiency, and energy savings, using research and literature reviews. Politicians should establish informed construction industry incentives and norms to support sustainable development.

The economics of green building encompasses a wide range of factors. Regarding sustainable projects, many elements must be considered, including the initial costs linked to the adoption of sustainable technology, the long-term economic advantages, and the effects of sustainable practices on the project budget as a whole (Ariono, Wasesa and Dhewanto, 2022). The complex economic factors are analyzed as part of the ongoing knowledge mapping initiative to provide stakeholders with a clear path through the difficult financial aspects of green building projects.

The capacity of green building projects to produce cash is a crucial element in knowledge mapping. Having a comprehensive understanding of the financial consequences of using sustainable products and processes is of utmost importance for decision-makers. The process of mapping involves seeking out prior research that has examined the correlation between costs and benefits. This document presents details on the specific aspects of a project where spending money provides the most significant results across the whole duration of the project (Munaro, Tavares and Bragança, 2020). Consequently, individuals employed in the business sector, policy-makers, and investors are empowered to make well-informed decisions that yield benefits for both the economy and the environment.

Knowledge mapping elucidates the financial benefits and funding alternatives associated with green building projects. Project managers and investors seeking to overcome the first financial challenges associated with sustainable projects benefit from identifying financial strategies like green financing (Fathalizadeh *et al.*, 2021). The study offers guidance in formulating methods to promote the long-term economic viability of green building by analyzing the range of economic tools available.

This topic explores the influence of governmental policies and legal frameworks on the economy. Knowledge mapping is a technique that is used to identify current research on the impact of laws, such as green standards, on the economy and the decision-making process in the construction industry (Gade and Opoku, no date). Comprehending this concept is crucial for both professionals and policymakers since it offers valuable insights into the economic factors that influence the feasibility of sustainable practices.

The knowledge mapping process also includes an examination of the financial implications of innovative ideas in green building. With the continuous evolution of the business world, new tools and methodologies emerge, each carrying its own distinct consequences for the economy. Through the process of mapping the knowledge landscape, one uncovers novel business models, cost-effective technologies, and strategies that can aid green building projects in achieving their environmental goals while remaining economically viable (Omazic and Zunk, 2021). All of these facilitate sustainable construction initiatives.

Knowledge mapping is a valuable approach that is used in the realm of green building economics to enhance comprehension of the economic aspects of sustainable construction. This subject enhances the comprehension of the economic environment around green building projects by thoroughly examining and presenting the current knowledge. The insights obtained from this mapping endeavour have empowered stakeholders to make informed choices, navigate complex financial circumstances, and strategically plan for the economic prosperity of sustainable construction projects (Caldera, Ryley and Zatyko, 2020). Knowledge mapping is an essential tool for comprehending the functioning of the green building economy as the construction industry progresses towards sustainability.

# Chapter 5: Recommendation and Conclusion

## Research Summary

This research focuses on the significant need to understand the financial elements of green building, which is a key problem in the conversation about sustainability in the construction sector. Specifically, this requirement to understand the financial aspects of green building is a big issue. It does this by using techniques such as thematic analysis, interpretive structural modeling, and scientometric analysis in order to conduct a comprehensive investigation of challenges, success factors, risk interdependencies, and knowledge mapping. The findings provide policymakers and practitioners with valuable information that assists them in incorporating sustainable practices. Thematic analysis indicates significant barriers, while Interpretive Structural Modeling reveals risk interdependencies. The first thing that has to be done in order to ensure the success of green building projects is to go over the Critical Success Factors. In addition to this, the scientometric analysis paints a picture of the existing body of information about the financial benefits of green building. The many approaches of research that were used in the course of this investigation helped us acquire a clearer idea of the challenges and opportunities associated with the promotion of sustainable practices within the building industry.

## Have The Objective Been Met

The dissertation effectively achieves all of the research objectives via thorough investigation and analysis. The research examines the financial, legal, and administrative challenges associated with obtaining green certifications such as BREEAM and LEED in Theme 3 (4.5), which focuses on comprehending the obstacles to green certification. The text recognises obstacles that primarily affect individuals and proposes strategies to overcome them, such as education and incentives.

Theme 4 (4.6) of the investigation delves into the obstacles that hinder the implementation of sustainable practises in the construction industry. Issues pertaining to financial matters, legal and bureaucratic challenges, and resistance to change are thoroughly examined. Implementing meticulous financial planning, simplifying regulations, and enhancing awareness are recommended strategies to encourage wider adoption of sustainable practises.

The study subsequently examines the factors contributing to the success of green building initiatives in Theme 5 (4.7). Essential components include meticulous strategizing, responsible utilisation of resources, effective project administration, and active engagement of the community. In order to ensure the success of ecologically sustainable construction projects, it is recommended that stakeholders collaborate, adhere to regulations, and use comprehensive solutions.

Theme 6 (4.8) focuses on the examination of knowledge mapping in the field of green building economics. The research use knowledge mapping to analyse the intricate relationship between sustainable construction and business. This study examines the impact of emerging technology on sustainable construction, the influence of governmental regulations, and the economic advantages of green building. To successfully navigate the complex financial landscape of sustainable construction projects, it is crucial to comprehend economic variables, explore innovative financing methods, and use knowledge mapping. Essentially, each research objective is meticulously achieved, providing legislators, decision-makers, and industry professionals with valuable insights to further sustainable construction practises.

## Conclusion

This study analyses how construction and project managers employ green building project management practises to enhance sustainable project growth in the UK construction industry. Due to rising environmental concerns, the construction industry has spearheaded waste management measures. Global construction contributes to environmental damage, necessitating green project design. The investigation examines UK construction project managers' challenges that need sustainable development. Green initiatives have become a sustainable requirement and universal acceptability as construction firms look for innovative methods to save costs and waste. A construction project's profitability depends on how well sustainable approaches achieved aims.

UK government sustainability projects minimise carbon emissions and energy usage via environmental and corporate social responsibility. The construction industry has followed these norms and practises by adopting sustainable development to overcome hurdles. The study found factors that promote UK green building projects. The study seeks useful data. BREEAM, LEED, and other environmental standards have revolutionised construction project management. A majority of UK construction projects are green.

To create a sustainable plan, UK green building projects have significantly leveraged carbon reduction activities including energy, equipment, and resource preservation. One purpose of green adoption is to meet UK sustainability policy climate targets. With finance, sustainable resources, and quality assurance procedures to reduce carbon emissions, UK government collaboration has mostly aided construction managers. Academics attacked BREEAM for giving construction building environmental practises higher marks.

Smart budgeting, expenses, resources, timeline, climatic dangers, etc. assist project managers produce sustainable construction projects. Green initiatives need planning, stakeholder meetings, budget optimisation, resource allocation, etc. to create schematics and sustainable processes. 3D models, augmented technologies, virtual reality, etc. are used to depict smart construction for project stakeholders. Lack of knowledge and awareness among front-line workers, poor access to sustainable procedures, overreliance on conventional construction techniques, etc. cause project completion gaps in sustainable development initiatives. To achieve sustainable planning among stakeholders including architects, engineers, project managers, labourers, etc., effective communication approaches have been suggested.

Technical breakthroughs, intelligent building systems, etc. are mentioned in the dissertation literature to embrace energy-efficient solutions. With foreign direct investment and government spending, contractors would create sustainable project planning procedures. Forecasting operations costs using predictive analytics helps project managers reduce waste with sustainable methods.

The interpretivism philosophy was applied in this study to achieve research aims. The study gathers scholarly viewpoints for purposeful information. The researcher used inductive methods to learn more by starting the study with important knowledge. The research rationalises the relevance of green building projects. This study investigated secondary data from UK construction industry research and sustainable project management magazines. 20 papers were selected, reviewed, and accepted article selections were made for the study. The article selection method used Google Scholar and other available reputable secondary sources. CASP, a quality assessment for investigating relevant studies, has verified journal articles from which secondary data will be acquired. Through a systematic review, a researcher find great information. Secondary research from UK studies was selected using inclusion/exclusion criteria. Peer-reviewed research from the last decade is used. Primary data was avoided throughout the research study.

The Prisma model avoided article duplication for systematic research publishing selection. Identification, screening, eligibility, and inclusion/exclusion criteria selected six research articles from 500. Findings from selected research articles that generated topic-related themes are included in the results and data analysis sections. When researching green project management difficulties and prospects, codes and themes are generated to represent what researchers have emphasised. For each of six themes, the study generated codes. The initial code in one of six research papers was sustainability. This article recommends project managers design construction using sustainable and eco-friendly building options.

This study examines UK construction industry building project management sustainable development prospects and challenges. Sustainability, risk analysis, green certification challenges, knowledge mapping, and success determinants were found and studied using a literature review. The results reveal that green building economics is complex and that the construction industry has challenges and opportunities in sustainable development. To promote sustainable development in green building project management, the research highlights the necessity to overcome obstacles and seize opportunities. Thematic analysis, which links sustainability issues, shows that cultural, economical, and regulatory barriers must be addressed together. Knowledge-mapping methods and key success elements also help professionals, legislators, and academics make the construction industry more sustainable. This research advances green building economics and sets the stage for UK construction industry sustainable development studies. We can work together to solve problems and create a more sustainable built environment by exploring new ideas and solving research gaps.

This dissertation examined the advantages and disadvantages of green building project management in the UK construction industry, providing a thorough evaluation of the field's long-term growth potential. The study used a thematic analysis of the literature to examine knowledge mapping, sustainability, risk analysis, green certification hurdles, and critical success criteria. Its findings highlight the potential and limitations of sustainable construction industry growth. To grasp the study's significance, limits, and consequences, critically evaluate the key findings and outcomes. First, the topic analysis helped the reader learn green construction project management. To collect and analyze data based simply on published literature is critically important. Primary data collecting improves future studies by supplementing the literature-based strategy. This would help us understand the construction industry's sustainable development prospects and problems.

This study focused on the UK construction industry, thus its findings do not apply to other nations. The UK can analyze green building economic policies, legislation, and practices due to its unique circumstances. Future research should cover a larger territory to represent the population. Resolving data inconsistencies or literature disagreements strengthens the conclusion. A more complete and impartial review of the research would acknowledge diverse views and explain how they affect the findings. Balance the findings' pros and negatives and evaluate how they will affect construction project management to make a better decision. This approach includes reviewing the findings' contribution to the field and debating their practical implications for industry practitioners and policymakers. The conclusion would be more convincing and thorough if it acknowledged the study's limitations and suggested future research and improvements. With critical evaluation at the end, this dissertation presents a complete and insightful overview of the study's findings and consequences. This will validate the conclusion and improve the construction sector's sustainable development discussion.

## Limitations

The study's shortcomings must be acknowledged despite its extensive literature review and analytical conclusions. Since it reviewed existing research, the study is lacking in depth and breadth. This research examines green building in the UK construction industry economically, although it does not include worldwide perspectives and experiences. The study contained few publications for theme analysis, therefore bias has been introduced in the selection procedure. Confirming and drawing conclusions from research is difficult without primary data and empirical analysis. The paper's comprehensive analysis and green building economics research suggestions make up for these shortcomings.

Despite limitations, the study is valid and valuable. Data gathering and analysis based only on literature is limited by findings incompleteness and scope. This technique was adopted following a thorough green building economics study. The study does a great job of explaining the industry's current state and the pros and cons of sustainable growth in green building project management despite this limitation. The study focused on the UK construction industry, thus its findings do not apply elsewhere. The UK construction industry is an excellent case study for sustainable green building project management. The UK's unique context enables for in-depth study of green building economics rules, policies, and processes.

The limitations must be addressed by future studies using different approaches, even though theme analysis has produced important insights. Surveys or interviews could be added to the literature-based methodology in future investigations. The pros and cons of green building project management must be understood. Outside the UK provides a more representative cross-section of perspectives. The study is interesting and useful despite its limitations. By acknowledging its limitations and suggesting future research subjects, this study contributes to the construction industry's sustainable growth discussion. This can lay the groundwork for this crucial subject of study.

## Recommendation

A comprehensive analysis of sustainable practices within the UK construction industry yielded valuable insights that are used by policymakers, decision-makers, and industry professionals. This comprehensive proposal extracts the key findings and provides recommendations based on the research objectives, subjects, and overall contributions.

Discover green building economics and the UK construction industry's challenges in this insightful research. Literature analysis is part of future green building and sustainable development studies. The green building economics package includes sustainability, key success factors, risk analysis, knowledge mapping, and green certification hurdles.

### Longitudinal Studies on Sustainability Performance

Longitudinal studies are needed to assess UK green building initiatives' long-term sustainability. Researchers evaluate green buildings' sustainability over time using longitudinal studies. To understand the human and environmental impacts of green building projects, researchers should study sustainability measures including energy use, occupant satisfaction, and carbon emissions.

### Comprehensive Risk Assessment Frameworks

Comprehensive risk assessment frameworks for green building projects are essential. Recent studies emphasise the complexity of green construction projects and the necessity to identify and manage risk links. Future green building risk identification, assessment, and mitigation must be based on comprehensive frameworks that incorporate risk interconnectedness and project outcomes.

### Addressing Barriers to Green Certification

The study need further research on UK green building certification challenges. Insufficient finance, cultural prejudices, legal challenges, and a lack of knowledge hinder sustainability and green building. Future research should focus on creative solutions such public awareness campaigns, educational programmes, legislative changes, and financial incentives.

### Evaluation of Critical Success Factors

Future research should focus on assessing CSFs for green building projects in the literature. Collaboration, creativity, and all stakeholders' participation are crucial to green building projects. These traits must be honestly evaluated and valued in diverse contexts. The success of CSFs in real-world green building projects help practitioners and policymakers promote sustainability in the construction industry.

### Advancing Knowledge Mapping Techniques

Understanding green building economics enhance knowledge mapping. Organisation, presentation, and assessment of the subject's state of the art have been achieved via knowledge mapping and scientometric analysis. Recent research has employed comparable methods to establish a knowledge map in green building economics, particularly for financial processes and incentives. New knowledge mapping methods, particularly those based on AI, machine learning, and big data analytics, should dominate green building economics research.

### Collaborative Research Initiatives

Research on green building economics requires collaboration between academics, industry experts, government officials, and stakeholders. Collaboration help us attain our sustainability objectives quicker, bring out the best in each other, and learn from our failures. If the construction industry wants to solve complex problems and become more sustainable, future research should focus on interdisciplinary teams with varied perspectives.

### Policy and Regulatory Analysis

The efficiency of UK sustainable development and green building laws and regulations needs more investigation. Policy and regulatory reviews aid sustainability-focused rule development. The proposed research discover issues by assessing present frameworks' pros and cons if accepted. Future study should examine current legislation, their impact on green building, and their alignment with sustainability objectives. Investigate methods to enhance these limits.

### Case Studies and Best Practices

Researchers investigating green building economics benefit from case studies and best practices. Case studies and best practice guidelines for UK green building projects are essential. Case studies show how green building benefits society, the economy, and the environment while showcasing innovative methods and technology. Academics can promote green building and support the construction industry by sharing case studies and best practices.

The above recommendations allow future building economics research to encourage green building and sustainable development in the UK construction industry. The construction industry must be made more sustainable and environmentally friendly by scholars. They solve critical research gaps, involve stakeholders, and test new methods.

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# Appendix

## Time Schedule/Gantt Chart

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Tasks** | **Week 1** | **Week 2** | **Week 3** | **Week 4** | **Week 5** | **Week 6** | **Week 7** |
| **Background formation** |  |  |  |  |  |  |  |
| **Conducting the literature Review** |  |  |  |  |  |  |  |
| **Data Collection** |  |  |  |  |  |  |  |
| **Data Analysis** |  |  |  |  |  |  |  |
| **Evaluating and discussing the findings** |  |  |  |  |  |  |  |
| **Conclude the research** |  |  |  |  |  |  |  |
| **Research Submission** |  |  |  |  |  |  |  |

## Selected Papers For Systematic Review

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Title** | **Author** | **Study area** | **Methodology used** | **Findings** | **Extracted code** |
| Managing green building development–a review of current state of research and future directions | Ahmad, T., Aibinu, A.A., and Stephan, A. | Building and environment | Review | Provides an overview of current research on green building development and outlines future research directions. | Sustainability, Research Overview, Future Directions |
| Analyzing Green Building Project Risk Interdependencies Using Interpretive Structural Modeling | Guan, L., Abbasi, A., and Ryan, M.J. | Journal of Cleaner Production | Interpretive Structural Modeling | Analyzes risk interdependencies in green building projects using Interpretive Structural Modeling. | Risk Analysis, Interdependencies, Green Building |
| Barriers to the adoption of green certification of buildings: A thematic analysis of verbatim comments from built environment professionals | Agyekum, K., Adinyira, E., Baiden, B., Ampratwum, G., and Duah, D. | Journal of Engineering, Design and Technology | Thematic Analysis | Identifies barriers to the adoption of green certification in buildings based on comments from professionals. | Barriers, Green Certification, Professional Comments |
| Review of Critical Success Factors (CSFs) for green building projects | Li, Y., Song, H., Sang, P., Chen, P.H., and Liu, X. | Building and Environment | Review | Provides a review of Critical Success Factors (CSFs) for successful green building projects. | Critical Success Factors, Green Building Projects |
| Barriers to sustainable practices in the Indonesian construction industry | Fitriani, H., and Ajayi, S. | Journal of Environmental Planning and Management | Thematic Analysis | Examines barriers to sustainable practices in the Indonesian construction industry. | Barriers, Sustainable Practices, Indonesian Construction |
| Mapping knowledge in the economic areas of green building using scientometric analysis | Xiao, X., Skitmore, M., Li, H., and Xia, B. | Energies | Scientometric Analysis | Uses scientometric analysis to map knowledge in the economic aspects of green building. | Knowledge Mapping, Scientometric Analysis, Economic Aspects |

## Generated Themes

|  |  |  |
| --- | --- | --- |
| **Article title** | **Extracted code** | **Generated themes** |
| Managing green building development–a review of current state of research and future directions | Sustainability | Theme: Sustainable Development |
| Analyzing green building project risk interdependencies using Interpretive Structural Modeling | Risk Analysis, Interdependencies | Theme: Risk Assessment and Interdependencies |
| Barriers to the adoption of green certification of buildings: A thematic analysis of verbatim comments from built environment professionals | Barriers, Green Certification | Theme: Barriers to Green Certification |
| Review of Critical Success Factors (CSFs) for green building projects | Critical Success Factors | Theme: Success Factors for Green Building |
| Barriers to sustainable practices in the Indonesian construction industry | Barriers, Sustainable Practices | Theme: Barriers to Sustainable Practices |
| Mapping knowledge in the economic areas of green building using scientometric analysis | Knowledge Mapping, Scientometric Analysis | Theme: Knowledge Mapping in Green Building Economics |