MINISTRY OF EDUCATION AND TRAINING
NATIONAL ECONOMICS UNIVERSITY

DINH THUY DUNG

DEVELOPING A MODEL OF SUSTAINABLE-ORIENTED FACTORS AFFECTING THE PROJECT MANAGEMENT PROCESS OF CONSTRUCTION PROJECTS IN VIETNAM

PHD DISSERTATION IN ECONOMICS

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DECLARATION

The author has read and comprehended the policy on plagiarism and academic integrity violations. With my honor, the author certifies that I carried out the research and that it does not violate regulations of good scholarly practice.

PhD Candidate

Dinh Thuy Dung

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LIST OF ABBREVIATIONS

No.	Abbrevations	Explanation
1	PM	Project management
2	D&B	Design and budget
3	PMP	Project management process
4	TBL	Triple Bottom Line
5	LCA	Life Cycle Assessment
6	CDWM	Construction and demolition waste management
7	PMBOK	Project Management Body of Knowledge
8	PLS-SEM	Partial Least Squares Structural Equation Modeling
9	ANOVA	Analysis of Variance
10	TFP	Total Factor Productivity
11	WCED	World Commission on Environment and Development
12	ISO	International Organization for Standardization
13	LEED	Leadership in Energy & Environmental Design)
14	MCDA	Multi-Criteria Decision Analysis
15	BIM	Building Information Modelling
16	RII	Relative Important Index
17	AHP	Analytic Hierarchy Process
18	PMO	Project management office

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CHAPTER 1. INTRODUCTION

1.1. Research rationales

The construction sector is widely recognized as one of the most dynamic and influential industries in developing economies, as it provides essential infrastructure that underpins economic growth, urbanization, and social development. Construction projects are inherently complex undertakings involving multiple stakeholders—such as investors, contractors, consultants, engineers, regulators, and local communities—whose interests, responsibilities, and expectations must be carefully coordinated. Within this context, project management plays a central role in integrating diverse activities, aligning stakeholder objectives, and ensuring that projects are delivered effectively (Ofori, 2019; Aghimien et al., 2020). Core project management functions—such as scope definition, resource allocation, scheduling, monitoring, and control—have been shown to contribute significantly to improved project transparency, enhanced organizational performance, and higher stakeholder satisfaction (Silvius & Schipper, 2019; Stanitsas et al., 2021).

However, as economic development accelerates, the construction industry has also emerged as one of the largest contributors to environmental degradation and social externalities. Globally, construction activities account for a substantial share of carbon emissions, resource consumption, energy use, water pollution, and waste generation, while also creating social impacts related to labor conditions, community disruption, and public health. At the same time, construction projects generate significant economic and social benefits by providing housing, infrastructure, and employment, contributing approximately 10% of GDP in many countries (Building, 2023). This dual role highlights a fundamental tension between short-term project efficiency and long-term sustainability outcomes. Consequently, sustainability has become a critical concern for construction project management, raising questions not only about what projects deliver, but how they are managed throughout their life cycle.

In response to these challenges, sustainability has increasingly been incorporated into project management research and practice. Prior studies distinguish two complementary dimensions of sustainability in projects: the sustainability of project outcomes (e.g., green buildings, energy efficiency) and the sustainability of project management processes themselves (Silvius & Schipper, 2024). While outcome-oriented sustainability has been widely studied in construction, far less attention has been given to how sustainability considerations are embedded within project management processes such as initiating, planning, executing, monitoring-controlling, and closing.

To address this gap, this study introduces the concept of "Sustainability-Oriented Factors Affecting the Project Management Process of Construction Projects." Although this terminology is not yet standardized in the literature, it is grounded in established theoretical foundations. Specifically, sustainability-oriented factors are defined in this research as managerial, organizational, institutional, and stakeholder-related factors that integrate economic, social, and environmental considerations into project management activities across the project life cycle. This definition aligns with the triple bottom line (Elkington, 1998) and with process-based interpretations of project management standards such as ISO 21500 and PMBOK, which conceptualize project management as a system of interrelated processes rather than isolated techniques.

Rather than treating sustainability as an external constraint or a post-project evaluation criterion, this study positions sustainability as an integral orientation shaping decision-making within each project management process group. From this perspective, sustainability-oriented factors influence how project objectives are defined, how resources are planned and allocated, how execution is carried out, how performance is monitored and controlled, and how project closure contributes to long-term value creation and organizational learning.

Examining sustainability-oriented factors across the entire project management process is theoretically and empirically justified. Existing research demonstrates that project performance problems—such as schedule delays, cost overruns, and quality failures—often originate from early-stage managerial decisions and propagate through later phases (Merrow, 2011; Shen et al., 2017). Focusing on isolated stages, such as execution or monitoring alone, risks overlooking the cumulative and path-dependent nature of project management effectiveness.

Process-based standards, including ISO 21500 and PMBOK, explicitly emphasize that project success emerges from the coordinated functioning of all process groups across the life cycle. Consequently, sustainability-oriented practices introduced at only one stage are unlikely to deliver meaningful or lasting impact if they are not consistently embedded throughout the project. This provides a strong theoretical rationale for adopting a holistic, process-based research model that systematically examines sustainability-oriented factors across all major project management process groups.

The construction sector represents a particularly strong and relevant context for investigating sustainability-oriented project management processes. Construction projects are typically large-scale, resource-intensive, long-duration, and highly visible, with direct implications for environmental quality, social well-being, and economic development. Unlike manufacturing or service projects, construction projects are site-specific, involve temporary organizations, and are subject to complex regulatory and stakeholder environments, making effective and sustainable project management especially challenging.

In Vietnam, sustainability-oriented construction research remains limited, with most existing studies focusing on efficiency, profitability, scheduling, and traditional critical success factors (Le-Hoai et al., 2008; Nguyen et al., 2004). Sustainability considerations—particularly those embedded within project management processes—have received relatively little empirical attention. This gap is particularly significant given Vietnam's ongoing urbanization, infrastructure expansion, and policy commitments to sustainable development, as reflected in Resolution No. 06-NQ/TW (2022). Persistent challenges such as weak coordination among stakeholders, limited institutional capacity, and insufficient guidance on applying sustainability principles at the project level further underscore the need for systematic investigation.

Against this backdrop, this study argues that a process-based, sustainability-oriented approach to construction project management is both theoretically justified and practically necessary. By conceptualizing sustainability-oriented factors as drivers embedded within project management processes and examining their influence across the entire project life cycle, the research responds directly to gaps in existing literature and policy practice. The construction sector in Vietnam provides a highly relevant empirical setting for developing and testing this approach, with implications for project managers, policymakers, and researchers seeking to improve project performance while advancing long-term sustainable development.

1.2. Research objectives and questions

Research Objectives

To accomplish this overarching objective, the research is structured around the following specific objectives:

1. To systematically identify sustainability-oriented factors influencing the project management process in construction projects, based on an extensive review of relevant domestic and international literature.

2. To classify and organize these factors into structured factor groups corresponding to the phases of the project management process—namely initiation, planning, implementation, monitoring and control, and closing—as defined by ISO 21500.
3. To develop a conceptual research model that explicates the relationships between sustainability-oriented factor groups and the effectiveness of project management processes throughout the project life cycle.
4. To formulate research hypotheses and operationalize key variables in order to examine the influence of sustainability-oriented factors on project management performance.
5. To empirically test and validate the proposed research model using data collected from construction projects in Vietnam, thereby assessing the magnitude and significance of the effects of factor groups across different project management phases.
6. To analyze the relative importance and interaction effects of sustainability-oriented factor groups, with the aim of identifying critical mechanisms for integrating sustainability into project execution.
7. To propose evidence-based managerial and policy recommendations that support the effective integration of sustainability principles into construction project management practices in Vietnam.

Following the construction and empirical validation of the model, the study provides practical recommendations for project managers to enhance sustainability integration in project execution.

To achieve this objective, the dissertation addresses the following research questions:

RQ1. What are sustainability-oriented factors in the project management process in the construction industry in the world? Which factors are suitable for the conditions of the Vietnamese construction industry?

RQ2. Whether or not sustainability-oriented factors identified can be grouped into five phases of the project management process in the Vietnamese construction industry?

RQ3. How can the impact level of sustainability-oriented factors be quantified (e.g., regression or cross-tabulation analysis)? Do the hypotheses regarding the influence of these factors on project management processes in the Vietnamese construction industry hold true?

RQ4. What are the latent relationships between sustainability-oriented factors in phases of project management processes to gain insights into the interrelationships among these factors in order to enhance project management processes in the Vietnamese construction industry?

RQ5. What are managerial recommendations to enhance the project management process in the Vietnamese construction industry?

1.3. Subject and scope of the research

The subject of this thesis is construction projects conducted in Vietnam. More specifically, research on construction projects in the form of apartment buildings and the management process of these projects.

This dissertation focuses solely on identifying and examining the factors that influence the effectiveness of project management processes, without addressing or explaining other aspects of project management such as its intrinsic nature, sequence of activities, or procedural characteristics.

The study was conducted in Vietnam, more specifically Hanoi, the capital of Vietnam, and mainly construction projects were conducted by private enterprises with a scale from 200 billion to 500 billion VND.

The research sample was collected in primary form through surveys and interviews with construction businesses operating in Hanoi. Each business will survey 15-20 individuals who have participated in the implementation of a recent construction project, including relevant entities such as investors, supervision consultants, managers, and contractors; main contractor, subcontractors, project support staff. The thesis mainly focuses on assessing the level of impact of factors on the project management process through opinions and practical experiences.

Besides, secondary data is used from 2018-2024 to comment and evaluate with the context of the study. solutions and recommendations for the 2024-2030 period. In addition, secondary data is also provided to management agencies such as the Ministry of Construction, General Statistics Office, and Ministry of Finance (Planning and Investment before).

1.4. Research methods

The thesis follows the basic steps of quantitative research. Based on previous research on construction project management, sustainable construction and factors affecting sustainable construction projects, the thesis explores the research gap based on the construction project management process with sustainable orientation. To fill this gap, based on the research framework and collected data, research hypotheses are formed and verified through the PLS - SEM method. Finally, the reported results for the implications and discussion will be detailed in chapter 3.

Data collection

The thesis conducts an overview and selects a research model to determine research hypotheses by interviewing in-depth domestic and foreign experts at construction agencies and subjects related to implementation a construction project, focusing on high-rise building projects, a narrow-scale survey to evaluate the appropriateness of the selected research model as well as research hypotheses and concepts from the model. model to suit the Vietnamese practical context.

Conducted a survey of construction businesses as individuals participating in construction projects in Hanoi Vietnam according to scale, number of years of work experience, type of project involved and understanding Individuals' knowledge of ISO 21500 theory is applied in the thesis.

Data analysis

In this thesis, quantitative methods are used to test the model of factors affecting the sustainable-oriented construction project management process. Research methods used include desk study, exploratory factor analysis, regression and PLS - SEM. Details of the method to save money are presented in chapter 3.

Desk study

Secondary information collected from domestic and foreign articles, seminars, reports and related documents has been collected, analyzed and synthesized. To discover the research gap of project management process and construction research subject, a review of literature related to construction project, project management and sustainability was delved into to find out concepts, relationships, and influencing factors in different economic contexts.

Exploratory factor analysis

After synthesizing the impact factors, perform exploratory factor analysis to identify and eliminate inappropriate factors in each group of factors related to the project management process. In addition, descriptive statistical analysis also provides information about the research sample, coefficients and statistical significance of those factors.

Regression analysis and PLS - SEM

Regression method to test and evaluate the impact of each factor related to the project management process. The estimation results are used to test the proposed hypotheses. Then, to evaluate the interrelationship between groups of factors, we used the PLS - SEM method to test the interrelationship between groups of factors as proposed by the hypothesis and at the same time test the intermediate variables. Then propose a model of sustainability-oriented factors affecting the construction project management process in Vietnam.

1.5. Contributions of the research

In general, there are many construction projects conducted in Vietnam every year and there are many factors that affect the success of a construction project, including project management. Although there have been a number of studies and proposals related to project management in Vietnam, there are still limitations, especially in the context that projects must aim at sustainability as a criterion of the era. For the construction industry, one of the fields that causes environmental and social impacts, the contributions of the thesis are meaningful in both theory and practice.

Theoretical Contribution

This dissertation makes a substantive theoretical contribution to investment economics, construction economics, and sustainability-oriented project management by conceptualizing construction projects as structured systems for mobilizing, allocating, and transforming investment capital into economic, social, and environmental value. Rather than examining sustainability as an auxiliary objective, the study embeds sustainability-oriented factors directly into the core project management process groups defined by PMBOK and ISO 21500, thereby extending existing project management theory with an explicit economic perspective.

The research addresses a significant theoretical gap in the Vietnamese context, where prior studies have largely examined project management effectiveness or sustainability performance in isolation, without systematically explaining how sustainability-oriented management processes influence investment project efficiency. By developing and empirically validating a comprehensive research model, the study operationalizes abstract management and sustainability concepts into quantifiable economic variables linked to project outcomes.

Furthermore, the process-based classification of sustainability-oriented factors across initiation, planning, implementation, monitoring and control, and closing stages provides a coherent theoretical framework for understanding how interactions among these factors shape project performance over the project life cycle. This framework advances theoretical knowledge by clarifying the mechanisms through which governance quality, stakeholder coordination, and sustainability integration affect the economic performance of construction investments.

Practical Contribution

From a practical perspective, the dissertation delivers strong empirical evidence aimed at improving the economic efficiency and sustainability of construction project investments in Vietnam. The findings enable investors, contractors, and project managers to identify which sustainability-oriented factors exert the greatest influence on cost performance, schedule adherence, quality outcomes, and overall investment efficiency.

The proposed framework supports more effective strategic and operational decision-making by helping construction enterprises optimize resource allocation, enhance project governance, and reduce economic losses associated with cost overruns, delays, and inefficient use of capital. Importantly, the study demonstrates that sustainability-oriented project management is not merely a compliance or ethical concern, but a critical determinant of investment efficiency and long-term economic value creation.

In addition, the policy implications derived from the research offer concrete guidance for improving institutional coordination and regulatory support for sustainability-oriented project management. These recommendations contribute to strengthening transparency, accountability, and stakeholder alignment, thereby facilitating timely project delivery, quality assurance, and sustainable economic outcomes in construction projects within Vietnam's market-oriented economy.

1.6. Structure of the dissertation

This dissertation has been divided into five chapters

Chapter 1 is Introduction. It includes the reason for choosing the topic, scope and subject of the research, research questions, research methods and contributions of the research.

Chapter 2 is Literature review. It includes definitions of project management, sustainable construction and synthesizes previous research related to project management processes according to ISO 21500, factors affecting each process.

Chapter 3 is Theoretical Framework and Research Methodology. This chapter will provide specific information about the theory used in the thesis. It provides the theoretical framework for the research question and the research hypotheses to be tested. This chapter also describes in detail the research method, data, model and variables.

Chapter 4 is Empirical result and discussion. This chapter will discuss the results of the study

Chapter 5 is Conclusion and Policy implication. This final chapter demonstrate main finding and conclusion. Several recommendations are proposed for relevant parties such as managers, businesses and state management agencies.

CHAPTER 2. LITERATURE REVIEW

2.1. Studies on sustainable development

Sustainable development is classically defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). In the context of project management, sustainability refers to managing projects in a way that optimizes the triple interaction among People, Planet, and Prosperity, ensuring that project outcomes deliver long-term environmental, social, and economic value (Silvius & Schipper, 2014; Økland, 2015).

From this definition, three core dimensions of sustainability—economic, social, and environmental—have been widely recognized and incorporated into later research (Sev, 2009; Hall, 2006; Marnewick, 2017; Becker et al., 2015; Martens & Carvalho, 2016). These dimensions form the Triple Bottom Line (TBL) approach, described as follows (Shokouhi & Bachari, 2025):

- Environmental dimension: Focuses on natural resource conservation and responsible resource consumption. Emphasizing the minimization of negative impacts on ecosystems, the management of environmental risks, and the rational use of natural resources. In project management, this aspect relates to conducting environmental impact assessments, managing waste, and adopting green technologies to reduce emissions.
- Economic dimension: Stresses financial stability and value creation. Ensuring that the project utilizes financial resources efficiently, generates long-term value, and minimizes losses and waste. In project management, this dimension is reflected in cost control, the optimization of resources, and the assurance of sustainable economic benefits after the project's completion.
- Social dimension: Aims to strengthen social relationships and promote societal well-being. Focusing on promoting equity, safety, and the harmonization of interests among stakeholders. In project management, this aspect is reflected in transparency, the active participation of communities, ensuring occupational safety, and respecting cultural and social values.

Sustainability is approached holistically, encompassing social responsibilities, environmental obligations, and economic considerations, particularly in response to the challenges of consumer-driven societies. The three sustainability pillars—environmental protection, economic development, and social welfare—are integral to ensuring balanced progress (Yin et al., 2018).

Moreover, sustainability represents a shift in traditional consumption patterns, promoting responsible decision-making without compromising current living standards. A balanced global approach, characterized by self-sufficiency and cooperation, contributes to sustainable outcomes (Moshood, 2022a; Moshood, 2022b; Moshood et al., 2024). However, social and environmental sustainability alone are not appealing to developers unless economic sustainability is also achieved (Carvajal-Arango et al., 2019; Moshood et al., 2024). In modern times, it is difficult to imagine economic progress without simultaneously addressing environmental protection and societal well-being (Amin Khalifeh, 2020). Thus, the three sustainability pillars must be interconnected to ensure long-term success.

2.2. Studies on sustainable development in Construction industry and construction project management (SCPM)

2.2.1. Construction Project and Project Management

A construction project is a complex, one-time effort that requires the coordinated performance of multiple stakeholders to deliver physical infrastructure, residential, or industrial assets within defined constraints of time, budget, and quality (Bakar et al., 2011). It encompasses a sequence of interrelated tasks that transform resources—materials, capital, and labor—into built structures. The nature of construction projects distinguishes them from other forms of project work due to their long lifecycle, high uncertainty, and extensive environmental and social impacts (Chen et al., 2009). Construction projects are typically substantial in value and require detailed information regarding planning, design, scheduling, material quantity, and quality specifications, all of which are managed by various stakeholders (Bansal, 2009). In the construction industry, projects are generally categorized into three main groups:

1. Building construction projects, including residential and commercial buildings, as well as schools.

2. Infrastructure projects, such as highways and bridges.

3. Industrial construction projects, including manufacturing plants and factories (Kiani Mavi et al., 2021).

Project management, in turn, refers to the application of knowledge, skills, tools, and techniques to project activities to meet project requirements (PMI, 2021). It involves initiating, planning, executing, monitoring, controlling, and closing project activities in a structured and integrated manner. In the construction sector, project management is not only a mechanism for achieving operational success but also an enabling system for sustainability performance, as it governs how resources are utilized, how stakeholders interact, and how risks and externalities are managed across the lifecycle of a project.

Within Vietnam's context, project management is guided by national regulations issued by the Ministry of Construction, yet the integration of sustainability criteria remains limited. Therefore, contextualizing global standards such as ISO 21502:2020 and PMBOK 7 for the Vietnamese construction environment provides the theoretical and methodological foundation for this research

The interconnection and overlap among four key areas—project management, sustainable development, the construction industry, and systems thinking—were explored in the study by Eid (2004). The research demonstrated that integrating sustainable development guidelines into project management processes for construction projects enables more effective implementation of sustainable construction practices. Additionally, it provided evidence that sustainable project management processes are achievable and can positively influence policy, strategy, and standard-setting, which typically guide the execution of projects within the construction industry.

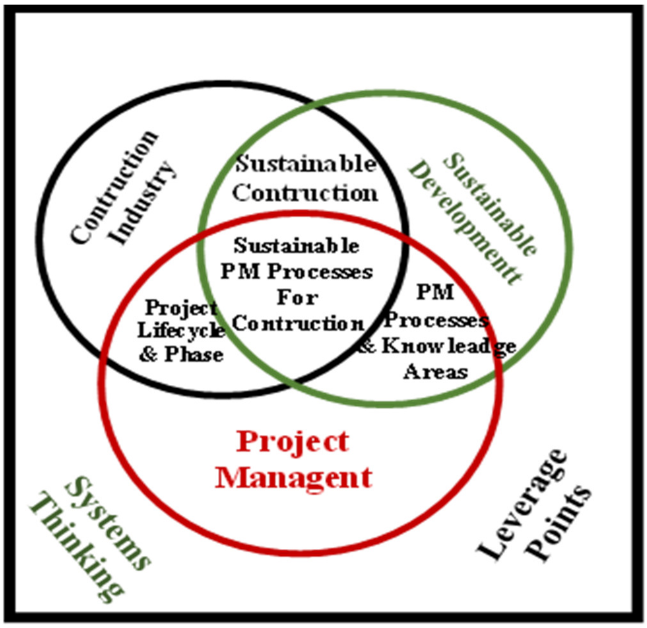


Figure 2.1: Research framework "Relationships in the Construction Industry"

Source: (Eid, 2004)

2.2.2. Sustainable Development in Construction Industry

Sustainability is not a widely experienced practice in the context of developing countries and is therefore considered an innovative concept for the construction industry in these nations (Boons and Lüdeke-Freund, 2013). Environmental sustainability indicators primarily emphasize renewable energy consumption, waste management, water conservation, material preservation, recyclability, and pollution issues (Yilmaz and Bakis, 2015). Minimizing construction waste during the building process not only benefits sustainability but also reduces overall project costs, as a significant portion of construction cost overruns is attributed to waste generation (Ajayi and Oyedele, 2018). It is widely accepted that construction and demolition waste management activities should adhere to the three principles of reduction, reuse, and recycling (Huang et al., 2018). On the other hand, lifecycle costs, quality issues, infrastructure development, construction and maintenance costs, profitability, and employment are considered key economic indicators in the literature (Heravi et al., 2015). Social sustainability dimensions mainly focus on cultural heritage, user security, safety and health, public utilities, and public comfort (Shen et al., 2007).

The construction industry is widely recognized for its impact on sustainability factors and must clearly demonstrate its role within the Triple Bottom Line (TBL) framework. Research on sustainability in the construction sector has gained significant attention and has been explored from various perspectives. These studies can be categorized into three groups: (1) those taking a general perspective, which include synthesizing relevant topics and setting future research directions; (2) studies focused on developing countries; and (3) studies centered on developed nations.

Group 1: General Perspective

From previous research perspectives, industries such as construction, transportation, and agriculture play a crucial role in national development and "have significant potential for achieving sustainable development" (Sev, 2009).

A study by Lima et al. (2021) utilized VOSviewer software to systematize research, synthesizing 443 studies over an 18-year period (2000-2017) that employed qualitative methods in the field of "sustainability in construction." The study revealed a lack of quantitative methods for assessing sustainability in the construction industry. It also found that research primarily focuses on the planning and implementation phases, with the operational and maintenance phases requiring further exploration. These findings highlight research gaps in sustainability studies in construction. More specifically, the study synthesized key research areas, including:

- **Materials:** A significant number of studies focus on materials, with frequent mentions of concrete, steel, cement, and wood, as building materials are central to ecological and environmental concerns. Researchers aim to identify eco-friendly and reusable materials. In Vietnam, a developing country, sustainable material selection has been examined. A set of 18 sustainability criteria was developed based on previous research and a questionnaire survey.

- **Project Management:** Ranked as the second-largest research area, studies in this category address stakeholder management, waste management, contract management, and decision-making in various aspects. Emphasis is placed on the importance of stakeholder management in sustainable projects, as project success is directly linked to participant satisfaction and a shared understanding of project goals, which may conflict with traditional viewpoints.

- **Sustainability Assessment:** Models in this area combine existing environmental assessment methods and factors considered in environmental certifications. These models identify gaps in current frameworks and seek to address them by proposing solutions tailored to specific conditions, such as legal requirements and market demands.

- **Energy:** Given that the construction industry consumes substantial resources and has negative environmental impacts, sustainable tools and methods are integrated to enhance energy efficiency, thermal comfort, and user satisfaction.

Additionally, the study found that among the three sustainability pillars, environmental concerns receive the most attention. The most widely used certifications include LEED and LCA, with the planning and implementation phases being the most studied in the lifecycle of construction projects (Lima et al., 2021).

Through a systematic review, (Salah et al., 2023) found that China has the highest number of sustainability studies, followed by Australia and the United States. "Sustainability" and "sustainable construction" are among the most frequently searched keywords. Based on their findings, the authors proposed a framework for evaluating sustainability in development and construction projects. These studies collectively aim to guide and inspire future research on sustainability in construction.

Group 2: Studies in Developing Countries

The greatest challenge for the construction industry in developing countries lies in finding a comprehensive approach to ensure that its contributions to physical, economic, and human development align with the requirements of sustainable development. These requirements are defined by local needs and value systems, which may differ from those of the economic elite in these nations (Du Plessis, 2007).

Research in developing countries has primarily focused on identifying the key factors and barriers to integrating sustainability into the construction industry. Studies have affirmed that beyond tools, technology, and technical capacity, a strong commitment and active participation from all stakeholders involved in construction projects are essential. For instance, Pham et al. (2019) investigated these challenges within the Vietnamese context using survey questionnaires and statistical analysis. Their findings highlighted barriers related to human resources, materials, technology, and policies. Based on these identified obstacles, the study proposed solutions to help Vietnamese policymakers and managers overcome difficulties and gradually incorporate the concept of sustainable development into construction practices. Similar research has been conducted in Ghana, emphasizing the necessity of overcoming such barriers.

Efforts to enhance sustainable construction practices have also been a key research area in Malaysia, Iran, and Nigeria. These studies emphasize stakeholder engagement, improved management practices, and stronger government support in transitioning from traditional construction methods to sustainable approaches. Additionally, they explore strategies to increase the reuse and recycling rate of sustainable materials (Ebekozien et al., 2021; Mohammed Hamza Momade, 2018).

Economic growth and infrastructure development are also prominent topics of study in developing countries. The underdevelopment of physical infrastructure compared to other regions worldwide has led to dual challenges in financing and sustainability, particularly in Africa's pursuit of the Sustainable Development Goals (SDGs) (Lopes et al., 2017). Research has demonstrated a strong correlation between domestic GDP growth and the construction of large-scale sustainable infrastructure, which enhances the competitive advantage of businesses, particularly in China and Russia (Zhi-Jiang Liu, 2020). In lower-income countries such as Yemen, sustainability indicators in the construction sector have been declining, necessitating appropriate solutions to address these issues (Sultan & Alaghbari, 2023).

To optimize sustainability in construction across social, economic, and environmental dimensions, the Life Cycle Assessment (LCA) methodology has been widely recognized as a foundational approach. Other methods, such as Multi-Criteria Decision Analysis (MCDA) and Building Information Modeling (BIM), have also been applied to analyze input-output relationships across the three phases of a building’s lifecycle—construction, operation, and decommissioning. These approaches facilitate the selection of materials that align with sustainable ecosystem principles (Barbhuiya, 2023; Erlandsson, 2003)

Overall, research in developing countries focuses on monitoring and evaluating the construction sector's growth in relation to economic development, assessing sustainability indicators using LCA methodology, and identifying barriers to sustainable construction practices. These studies primarily employ surveys, questionnaires, and regression analysis to determine influencing factors. In Vietnam, research on sustainable construction practices remains limited, primarily focusing on general overviews or isolated aspects such as materials rather than a comprehensive framework for sustainable construction integration.

Group 3: Studies in Developed Countries

Research in developed countries reveals that sustainability in construction is widely recognized and integrated into industry practices. However, there remains a need for greater managerial involvement in the early design phase to leverage expertise effectively, as evidenced by studies in South Korea and the United States (Hyojoo Son, 2011).

In contrast, research in the United States and China has focused on construction and demolition waste management (CDWM). These studies address key research questions, including the existing policies and regulations on CDWM in both countries, the market mechanisms governing CDWM, and the primary challenges faced in its implementation (Aslam et al., 2020). Additionally, scholars have examined the extent to which government regulations influence sustainable construction practices (Akadiri et al., 2013).

Findings from developed countries underscore the urgency of sustainability in the construction sector. Sustainable development enhances organizational competitiveness, with firms generating higher revenues demonstrating a more proactive approach to sustainability initiatives (Adetunji et al., 2003).

2.2.3. Sustainable development in construction project management

The integration of sustainability principles into project management has been discussed extensively in academic literature (Silvius & Schipper, 2014; Stanitsas et al., 2021; Misnan et al., 2024). Sustainability in project management is conceptualized as the incorporation of social, environmental, and economic considerations into the management of projects and project portfolios. These considerations influence decision-making, resource allocation, stakeholder engagement, and risk management across all process groups—Initiating, Planning, Implementing, Controlling, and Closing.

Silvius and Schipper (2014) argue that sustainability-oriented project management extends traditional project objectives—scope, time, cost, and quality—to include dimensions such as ethical responsibility, equity, resilience, and long-term value. This integration requires a systemic understanding of interdependencies between project processes and external environmental or societal systems. Økland (2015) further posits that sustainability introduces a "values dimension" into project management, transforming the discipline from a mechanistic process of delivery into a holistic approach to value creation.

In recent years, the integration of sustainability into construction project management (CPM) has emerged as a decisive factor in advancing global development objectives, particularly those articulated in the United Nations' 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs) (Goel, 2019). The construction industry, in particular, holds a critical position in addressing SDGs related to sustainable and resilient infrastructure and sustainable cities and communities, while also influencing broader goals such as poverty alleviation, public health, education, gender equality, access to clean energy, and climate action (Casier, 2015).

Consequently, the adoption of sustainable construction (SC) practices can substantially enhance human well-being while ensuring the preservation of environmental systems. This underscores the imperative that sustainability principles be systematically integrated across all stages of the construction process—from design and planning to implementation and operation (Brandon & Lombardi, 2010; Gunarathne et al., 2020).

For construction projects, integrating sustainability means embedding lifecycle thinking—considering environmental impacts from material selection to post-construction use and demolition—and ensuring inclusive participation of all stakeholders throughout the process (Banihashemi et al., 2017; Takagi & Varajão, 2022). Each process group in the project management cycle contributes uniquely to sustainability outcomes:

- Initiating: Identifying stakeholder needs and setting sustainability-oriented project objectives.

- Planning: Integrating environmental and social impact assessments into procurement, scheduling, and budgeting.

- Implementing: Managing resources and labor practices responsibly to minimize waste and ensure safety.

- Controlling: Monitoring sustainability indicators and ensuring compliance with standards.

- Closing: Capturing lessons learned and institutionalizing sustainable practices for future projects.

By integrating these principles, project management transforms from a performance-centered model to a value-centered model—aligning project goals with sustainable development imperatives.

In construction project management, this means embedding sustainability principles into every process group. The Initiating process integrates feasibility, stakeholder, and community perspectives; Planning incorporates environmental assessments and social safeguards; Implementation ensures responsible resource and labor management; Controlling establishes performance indicators; and Closing emphasizes knowledge transfer and lifecycle responsibility.

This integrated perspective ensures that project success is measured not only by immediate efficiency but also by its contribution to broader sustainable development goals. Therefore, sustainability-oriented project management can be considered a multidimensional construct reflecting the extent to which sustainability principles are systematically embedded in each phase of the project management process

Projects account for over 20% of global economic activity and exceed 30% in some emerging economies. As projects serve as instruments for executing corporate strategies, integrating and assessing sustainability at the operational level is imperative (J. Turner, 2013; Shokouhi & Bachari, 2025). In today's complex and interconnected world, an organization's success depends not only on the tangible execution of projects but also on its long-term environmental and social impact. This necessitates a paradigm shift in which project management and sustainability are no longer treated as separate concepts but are instead seamlessly integrated (Shokouhi & Bachari, 2025). Consequently, sustainable project management practices have gained increasing importance in recent years (Stanitsas et al., 2021).

Integrating sustainability into project management practices within the construction industry in developing countries can be examined through the lens of the diffusion of innovation theory—an approach used to identify key success factors in project management (Banihashemi, 2017). However, sustainability has not been explicitly and systematically incorporated into widely recognized project management frameworks such as PMBOK, ISO 21500:2012, and PRINCE2 (Brones et al., 2014). Perspectives on sustainability in project management vary widely, as it remains a highly debated issue across different contexts, countries, and time periods. Key areas of focus include Critical Success Factors (CSFs), sustainability performance indicators, sustainability assessment metrics in construction project management, evaluation of sustainable construction practices, challenges and barriers to sustainable project management, and strategies for integrating sustainability into project management processes.

A customized CSF model tailored to the context of developing countries has been proposed, leveraging CSFs to integrate sustainability into project management activities across different stages using the diffusion theory framework. Research has identified key stakeholders who influence this process (Banihashemi, 2017). This approach categorizes CSFs into different groups and considers the perspectives of various stakeholders, including project-level, project management-related, company-related, risk management, communication management, client/contractor, and design-related factors. Methods such as Fuzzy DEMATEL, Relative Importance Index (RII), and the traditional Analytic Hierarchy Process (AHP) have been used to evaluate and rank these factors in countries such as Australia, Bangladesh, and Russia (Gunduz & Almuajebh, 2020; Mavi & Standing, 2018). These studies share a common methodological approach in assessing the significance of factors and exhibit no major differences in their analytical frameworks.

In Vietnam, research on success factors (SFs) related to large-scale capital-intensive projects—often deemed difficult to manage successfully—has identified key elements such as comfort, communication, and commitment. These findings provide valuable insights for managing projects in emerging Asian economies (Nguyen et al., 2004).

Furthermore, numerous studies have focused on identifying, quantifying, and ranking sustainability indicators in construction project management. These indicators serve as guiding tools for modern projects striving for sustainability. A well-defined set of sustainability indicators is essential for shaping construction processes and managing sustainable construction projects (Stanitsas & Kirytopoulos, 2021). Surveys, interviews, and various evaluation methods, including the Relative Importance Index (RII), have been employed to assess these indicators. Findings suggest that environmental and economic criteria are considered the most critical, guiding efforts to control these key factors (Stanitsas et al., 2021; Dobrovolskienė & Tamošiūnienė, 2016). Additionally, comprehensive indicator frameworks that account for stakeholder involvement throughout the project lifecycle contribute to achieving a balance between different interests while also serving as a foundation for developing future sustainability indicators (Fernández-Sánchez & Rodríguez-López, 2010).

From a research perspective, studies on barriers to integrating sustainability into project management have primarily employed survey-based methodologies. Notably, research on barriers and challenges has been concentrated in developing countries such as South Africa, Nigeria, Iran, Kenya, and Bangladesh. Key barriers identified include project context, knowledge gaps, investment constraints, community engagement, and strategy formulation (Fathalizadeh et al., 2021). Other challenges include a lack of awareness of potential benefits, inadequate collaboration among practitioners, limited government involvement, complex regulations on green and sustainable construction, and high costs of sustainable building materials (Fathalizadeh et al., 2022). Leadership competencies, managerial qualities, and decision-making abilities have also been found to influence project success in sustainable construction management (Tabassi et al., 2016). The diverse range of barriers and challenges raises questions about the feasibility of establishing a standardized framework for sustainability-oriented project management. However, there is a general consensus that these insights provide a foundation for guiding construction organizations in developing countries (Fathalizadeh et al., 2022; Mashwama et al., 2020).

The concept of integrating sustainability into project management practices has been widely discussed in academic literature. According to Silvius & Schipper (2014) and Banihashemi (2017), this integration involves the comprehensive assimilation of social, economic, and environmental principles into project management. In Vietnam, specific barriers to sustainable project management include technological limitations, managerial capacity, and the availability of government incentives (Pham et al., 2019).

Several studies have examined sustainable construction project management in Vietnam over the years. These studies have explored topics such as the application of Building Information Modeling (BIM) in public construction project management (Dao et al., 2020; Van Tam et al., 2021; Nguyen et al., 2024), risk management in sustainable construction (Nguyen & Macchion, 2022), stakeholder satisfaction with project management effectiveness (Nguyen et al., 2020), as well as quality, cost (Le-Hoai et al., 2008), schedule management (Long et al., 2004), risk management, and managerial skills (Zuo et al., 2018). However, these studies have generally focused on specific aspects of project management knowledge rather than adopting a holistic approach. Given the complexity of construction project management—where multiple stakeholders with diverse objectives operate under structured management processes—a sustainability-oriented approach is essential.

2.3. Theoretical base of research models

To rigorously examine the integration of sustainability within the construction management domain, this dissertation constructs a multi-dimensional theoretical framework. This framework synthesizes four distinct yet interconnecting streams of thought: Project Life Cycle Theory, Process-Based Management Theory, Systems Theory, and the evolving paradigm of Sustainable Project Management. This synthesis provides the epistemological lens necessary to deconstruct the complex mechanisms, causal interdependencies, and strategic evolutions characterizing the Vietnamese construction industry.

2.3.1. Project Life Cycle Theory

Project Life Cycle Theory provides the foundational temporal structure for project analysis, positing that projects are dynamic, finite endeavors evolving through distinct phases rather than static events. The Project Management Institute (PMI, 2017) and the Association for Project Management (APM, 2019) both delineate this evolution through standardized groups: *Initiating, Planning, Executing, Monitoring & Controlling*, and *Closing*.

However, critical scholarship argues that the traditional application of this theory often suffers from a "short-termism" bias. Morris (2013) contends that the conventional life cycle focuses excessively on delivery (execution) while neglecting the "front-end" (strategy/definition) where value is actually created. This is particularly critical for sustainability. Edum-Fotwe and Price (2009) demonstrated that social sustainability parameters must be embedded during the *pre-project planning* phase; otherwise, they are treated as mere constraints during execution.

Expanding on this, Labuschagne and Brent (2005) introduced the *Comprehensive Project Life Cycle Management Framework*, arguing that the project life cycle must align with the *asset life cycle* (operations) and *product life cycle* (manufacturing/supply chain). This theoretical expansion is crucial for construction, as the environmental impact of a building during its 50-year operation far exceeds that of its 2-year construction phase (Kibert, 2016).

Furthermore, empirical studies by Aarseth et al. (2017) and Waly and Thabet (2003) identified a phenomenon known as the "sustainability gap" within the life cycle. They observed that high-level sustainability goals set during *Initiating* often fail to translate into actionable tasks in the *Work Breakdown Structure (WBS)* during *Planning*, leading to poor implementation during *Executing*. This dissertation utilizes Project Life Cycle Theory not merely to describe *when* things happen, but to critically analyze *where the disconnects occur* in the transition of sustainability intent into construction reality within the Vietnamese context.

2.3.2. Process-Based Management Theory

Project management, at its core, embodies the practical application of universal management principles. General Management Theory (GMT), pioneered by foundational thinkers like Henri Fayol (1949), provides the enduring conceptual bedrock for understanding organizational efficiency. Fayol's classic delineation of management function: planning, organizing, commanding, coordinating, and controlling (often summarized as P-O-L-C in later interpretations by Koontz & O'Donnell, 1976) establishes that effective management is a rational, systematic activity focused on the optimal utilization of scarce resources to achieve organizational objectives. This view is echoed by modern management thought, which consistently emphasizes the need for structured approaches to deliver value and sustain organizational viability (Drucker, 2007). Therefore, within this theoretical lineage, the Project Management Process (PMP) emerges as a specialized management process model, directly operationalizing these general management functions within the unique context of temporary, goal-oriented endeavors. It translates the abstract principles of GMT into a concrete sequence of activities designed to navigate the complexities inherent in project delivery.

Global project management standards, such as the Project Management Body of Knowledge (PMBOK® Guide) from the Project Management Institute (PMI) and the ISO 21500/21502 series (International Organization for Standardization), are precisely drawn from these foundational tenets of general management. The PMP's sequential yet iterative process groups—Initiating, Planning, Executing, Monitoring & Controlling, and Closing—directly operationalize Fayol's functions. The Initiating and Planning process groups distinctly embody the 'Planning' function of GMT, establishing objectives, strategy, and detailed roadmaps. The Executing process group reflects the 'Organizing' and 'Commanding/Leading' functions, mobilizing resources and directing activities. The Monitoring & Controlling process group is a direct manifestation of

GMT's 'Controlling' function, ensuring performance alignment and course correction. Finally, the Closing process group, while concluding the project, extends the 'Controlling' function through feedback loops and lessons learned, informing future 'Planning' cycles. PMBOK, particularly its earlier editions, explicitly articulated project management through an array of interconnected processes detailing inputs, tools, techniques, and outputs (PMI, 2017), aligning perfectly with a process-centric view. While the seventh edition shifted towards a principles- and performance-domain orientation (PMI, 2021), the underlying structure of process groups remains critical for organizing project work, reflecting the enduring relevance of a systematic approach. Similarly, the ISO 21500 series fundamentally defines project management as "a set of interrelated actions carried out to achieve a predetermined outcome" (ISO, 2012, 2020), integrating principles of value creation, governance, and sustainability. These standards, therefore, do not merely provide technical guidelines; they institutionalize the core principles of general management within the project context, establishing PMP as a rigorous, systematic tool for the rational application of resources to generate desired value, including sustainable outcomes.

2.4. Studies on the Construction Management Process

The project management process (PMP) refers to the structured set of activities required to achieve project objectives. ISO 21502 (2020) defines it as “a set of interrelated actions carried out to achieve a predetermined outcome,” emphasizing principles of value creation, governance, and sustainability. PMBOK 7 (2021) complements this by shifting from a process-based to a performance domain orientation, focusing on stakeholder, value, and system thinking rather than rigid process compliance.

ISO 21500 is designed to be compatible with established project management standards such as PMBOK and lean construction philosophies. It allows for flexibility in sequencing and process customization, providing freedom in selecting appropriate tools and adapting inputs and outputs to suit specific project contexts, including psychological barriers faced by professionals.

As highlighted by Brioso (2015), project management systems such as PMI’s PMBOK and PRINCE2 are not mutually exclusive or in competition. Instead, they can be initiated and harmonized through ISO 21500, which serves as a common, integrative framework. When applied appropriately, these systems can coexist effectively, fostering consistency, adaptability, and improved management practices in the construction sector.

Additionally, another study has confirmed that when applying ISO standards, the traditional chronological sequence of project execution is not strictly followed. Instead, processes can be reordered based on the requirements of the management system rather than adhering to a fixed, conventional sequence. Furthermore, ISO does not specify particular tools or techniques, allowing experts to select the most appropriate tools based on the project type, which is especially beneficial in construction projects.

Moreover, According to the theory on the role of project management to achieve sustainable development goals (Opoku et al., 2024), a theoretical framework has been built to integrate sustainability factors into project management processes in the construction industry as follows:

1. Project Management as a Tool for Strategic Alignment Modern organizations are increasingly required to ensure that every initiated project contributes—directly or indirectly—to their overarching sustainability commitments. This necessitates that project managers develop a deep understanding of how their projects align with both organizational and global sustainability priorities.

According to Silvius et al. (2017), achieving sustainability alignment begins with the integration of sustainability criteria during the initiating phase of a project. Such criteria include environmental impact assessments, evaluations of long-term social benefits, and life-cycle cost analyses. Embedding these considerations from the outset ensures that fundamental project decisions—such as site selection, technological choices, materials, and construction methods—reflect sustainability principles.

Opoku and Fortune (2022) emphasise that decisions made during the early strategic stages often exert irreversible effects on a project's sustainability performance. For example, inappropriate design choices can result in excessive carbon emissions or elevated operating costs throughout the facility's life cycle. Consequently, incorporating sustainability considerations into the project's initial strategic decision-making process is a critical step in ensuring positive contributions to the United Nations Sustainable Development Goals (SDGs).

2. Planning and Implementation Toward Sustainable Value The planning phase represents the foundation upon which sustainable outcomes are defined and operationalised. Sustainable planning not only involves the efficient allocation of resources but also the identification of Key Performance Indicators (KPIs) encompassing environmental, social, and economic dimensions (Animi and Owusu-Manu, 2021).

In practice, this may include selecting contractors and suppliers certified under environmental management systems such as ISO 14001, adopting energy-efficient design methods, ensuring occupational health and safety, and prioritising the use of recycled or locally sourced materials to reduce emissions associated with transportation.

During the implementation phase, these sustainability-oriented strategies are put into action. Empirical studies suggest that project managers with strong leadership competencies (Turner and Müller, 2019) are more capable of motivating project teams and stakeholders to pursue sustainability goals through effective communication, training, and empowerment. In this respect, project managers act not only as coordinators but also as change agents, facilitating shifts in organisational culture and mindset toward sustainable practices.

3. Controlling and Evaluating Sustainability Performance The controlling phase ensures that project objectives related to time, cost, and quality remain within approved limits while simultaneously meeting sustainability targets.(Heldman 2007) contends that effective control extends beyond technical monitoring; it involves measuring, analysing, and reporting on sustainability performance throughout the project's life cycle.

Various instruments—such as KPI dashboards, environmental performance reports, and carbon emission indices—can be utilised to monitor project progress in relation to SDG benchmarks (Animi and Owusu-Manu, 2021). Transparent and consistent reporting enhances accountability and fosters stakeholder trust (Baker et al., 2011).

From an economic perspective, efficient control contributes to optimising costs across the project life cycle, minimising waste, reducing financial risk, and improving value for money. This aspect is particularly significant in developing contexts such as Vietnam, where construction investments are constrained by limited capital and increasing demands for efficient public expenditure.

4. Project Closure and Long-Term Value Creation The closing phase provides an opportunity to consolidate and transfer the sustainable outcomes achieved during project execution. As argued by (Heldman 2007) and (Turner and Müller 2019), project closure extends beyond the handover of physical deliverables to include the documentation of lessons learned, the assessment of sustainability indicators, and the development of long-term operation and maintenance strategies.

Such measures ensure that the sustainability value of a project continues to deliver benefits long after completion. For instance, a green building project supported by a well-designed maintenance plan can maintain low energy consumption, minimise emissions, and promote healthier living conditions over its operational lifespan.

In essence, sustainable project management represents a holistic approach that embeds sustainability principles across all phases of the project life cycle—from initiation and planning to implementation, control, and closure. Through this integration, project management becomes a strategic mechanism for generating enduring value for people, the planet, and the economy

Despite this shift, the five classical process groups—Initiating, Planning, Implementing (Executing), Controlling (Monitoring and Controlling), and Closing—remain conceptually valuable for structuring project activities and for empirical modeling. In this dissertation, these five process groups serve as the organizing framework, each associated with specific sustainability-oriented attributes identified through literature review and qualitative expert interviews.

The alignment between these standards can be summarized as follows:

Table 2.1. Project management standards

Traditional Process Group	ISO 21502 (2020) Focus	PMBOK 7 (2021) Focus	Sustainability Integration
Initiating	Context, justification, governance	Stakeholder & value domain	Stakeholder participation, early sustainability goals
Planning	Planning and integration management	Planning & adaptability domain	Sustainable resource allocation, environmental risk planning
Implementing	Execution of project work	Delivery performance domain	Ethical labor practices, technology adoption, waste control
Controlling	Monitoring, evaluation, and feedback	Measurement & control domain	Tracking sustainability KPIs, compliance, safety
Closing	Formal completion, knowledge transfer	Value realization domain	Lessons learned, long-term impact, continuous improvement

Source's: Author's compilation

This mapping shows that modern project management standards increasingly emphasize principles and value outcomes, aligning with the sustainability-driven research focus of this study.

The project accounts for approximately one-third of the world's total gross domestic product (GDP) and involves various resources while interacting daily with its surrounding environment. Therefore, it is considered an essential tool for achieving a sustainable future. Widely accepted project management standards, such as PMBOK and ISO 21500, are process-based. When discussing sustainability in project management, key processes include stakeholder management, project lifecycle management, and decision-making and evaluation (Marcelino-Sádaba et al., 2015).

A study proposing an integrated model based on ISO 21500 (ISO, 2012) and successful project management processes by Varajão (2018) described the incorporation of six new processes into the ISO 21500 process groups to enhance project success. This research contributed to defining evaluation criteria and identifying success factors that influence the implementation of project management processes. The importance of these criteria and factors is directly linked to the level of management effort required in different project groups, as it allows planning efforts to be directed toward the areas with the greatest impact on project success (Takagi & Varajão, 2022).

Research on integrating project management processes has also emerged in the construction industry. One study proposed an integrated construction project management model combining traditional, lean, and agile methodologies. This model was analyzed based on the project lifecycle, which includes initiation, planning and design, replanning, execution and control, and closure phases, with each phase incorporating recommended practices for improved management (Lima et al., 2021).

Studies on construction project management processes have been approached from various perspectives. One approach focuses on identifying sustainability factors in different project lifecycle stages, such as the design and planning phases (Spangenberg et al., 2010), integrating sustainability criteria into project management processes (Musa & Bashir, 2019), or evaluating fundamental construction project management processes and identifying the root causes of challenges in each process (Zhong et al., 2018; Shen et al., 2007). Such evaluations help enhance management efficiency, improve overall industry productivity, and mitigate the negative environmental impact of construction.

A study investigating construction projects in Yemen examined the extent to which PMBOK guidelines and project management processes were applied, as well as the factors influencing their adoption. The findings indicated that projects only partially followed the guidelines for the closing process, with the competency of project managers being a critical factor. Implementing structured project management guidelines and processes was found to improve the efficiency of construction projects (Gunduz et al., 2023).

Another research stream focuses on understanding relationships within project management process groups. One study assessed the interrelations between 49 processes across the 10 knowledge areas and 5 process groups outlined in PMBOK. The study found that most processes play similarly important roles in project management. However, planning processes account for nearly half of all PMBOK-specified processes, making them a fundamental aspect of project management. These insights provide project managers with valuable input for prioritizing process groups (Herrera et al., 2020).

In project management, the dynamics of process-related factors are crucial for managers. Identifying causes of project delays based on the five PM process groups allows for assessing the interrelations among these groups. Research has shown that issues arising during the initiation phase have the most significant impact on subsequent processes, thereby affecting overall project performance (Zarei et al., 2017).

Studies on integrating sustainability into project management processes have also focused on mapping sustainability principles within PM process groups. One study aligned sustainability with PMBOK (2000 Edition) knowledge areas and construction knowledge areas listed in the PMBOK Construction Extension. This research evaluated the relevance of sustainability criteria (SD) and the three pillars of sustainability—social, economic, and environmental—using Meadows' efficiency leverage point scale (Eid, 2004).

In the Vietnamese context, most research on project management processes has concentrated on risk factors, project timelines, or cost management in construction and infrastructure projects. However, to enhance holistic project management and improve managers' understanding and accountability regarding sustainable project trends, it is essential to clarify a comprehensive management process and its associated factors with a clear objective toward sustainability.

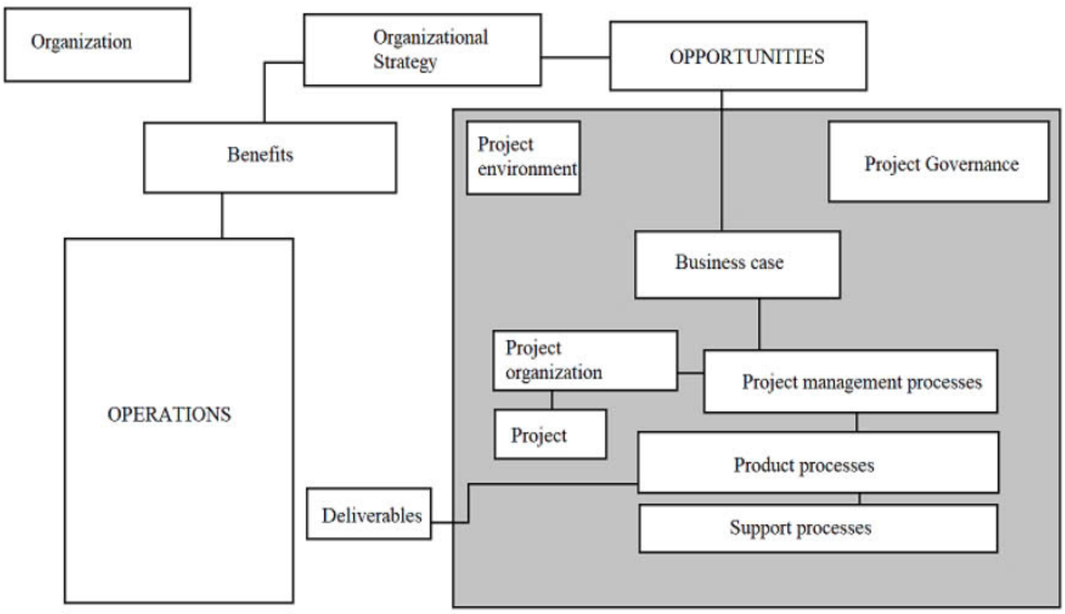


Figure 2.2: ISO 21500:2012 standard integration of processes

Sources: (ISO, 2012)

Effectiveness of the Construction Project Management Process

Early studies on project success predominantly equated project effectiveness with the achievement of final outcomes, typically measured by completion on time, within budget, and to specified quality standards (Morris & Hough, 1987; Pinto & Slevin, 1988). This outcome-oriented perspective treated project effectiveness as a static end state, providing limited insight into the managerial mechanisms through which such outcomes were achieved. In response to these limitations, later scholars began to distinguish between project success and project management effectiveness, arguing that the latter should be understood as a process-based construct reflecting the quality of managerial actions rather than solely final deliverables (Turner, 2014). From this perspective, project management effectiveness is increasingly conceptualized as the degree to which project management processes are systematically initiated, planned, executed, monitored, controlled, and closed in a coherent and disciplined manner. This conceptualization is strongly reinforced by international standards such as PMBOK and ISO 21500, which define project management as a structured system of interrelated process groups, suggesting that effectiveness emerges from the coordinated functioning of these processes across the project life cycle.

A substantial body of literature demonstrates that project outcomes are largely determined by decisions and practices embedded within project management processes. Shen et al. (2017) emphasize that deficiencies in early-stage processes—such as inadequate stakeholder engagement and weak scope definition—often trigger cascading problems in later phases, resulting in schedule delays, cost overruns, and compromised quality. Similarly, Merrow (2011) argues that front-end management decisions account for a significant proportion of project failures, underscoring the primacy of process quality over technical execution. Research grounded in PMBOK-based frameworks further highlights that each process group contributes differently to project management effectiveness: initiating and planning processes establish strategic alignment and resource feasibility; executing processes translate plans into operational actions; monitoring and controlling processes preserve performance by identifying and correcting deviations; and closing processes support value realization and organizational learning (PMI, 2017; Turner, 2014). Despite the growing recognition that project success encompasses broader strategic and sustainability-related dimensions, the iron triangle of time, cost, and quality remains the most widely used and empirically robust framework for assessing project management effectiveness, particularly in construction projects (Atkinson, 1999; Turner, 2014). Atkinson (1999) argues that the iron triangle should not be discarded but reinterpreted as a measure of managerial efficiency, as schedule, cost, and quality performance directly reflect the effectiveness of planning accuracy, resource control, and quality assurance embedded within project management processes.

More recent studies have emphasized the need to integrate process-based perspectives with sustainability-oriented performance measurement frameworks. Silvius and Schipper (2014) argue that project management effectiveness should be assessed by examining how managerial processes translate organizational values—such as sustainability—into operational performance outcomes. From this viewpoint, time, cost, and quality are no longer interpreted solely as short-term delivery metrics, but as indicators of long-term economic efficiency, social responsibility, and environmental stewardship. Sustainable cost management emphasizes life-cycle cost optimization rather than initial investment alone; sustainable quality extends beyond technical compliance to include user safety, social value, and environmental performance; and sustainable scheduling balances timely delivery with responsible use of resources and labor (Marcelino-Sádaba et al., 2015; Martens & Carvalho, 2017). Accordingly, while contemporary definitions of project success incorporate broader criteria such as stakeholder satisfaction, safety, and sustainability outcomes (Demirkesen & Ozorhon, 2017), the iron triangle remains a valid and theoretically grounded foundation for measuring project management effectiveness at the operational level. Therefore, in this dissertation, project management effectiveness (PME) is defined as the dependent variable (Y) and is operationalized through time, cost, and quality performance, reflecting the effectiveness of sustainability-oriented project management processes throughout the project life cycle.

Based on the above synthesis, this study adopts project management effectiveness as the dependent variable, measured through the iron triangle of time, cost, and quality, as these criteria most directly capture the operational effectiveness of sustainability-oriented project management processes in construction projects.

2.5. Studies on sustainability-oriented factors influencing the Construction Project Management Process

Sustainability as a Project Goal and a Characteristic of Project Management Processes: Sustainability in project management refers to both a project goal and a defining characteristic of the processes through which the project is managed (Czuchry & Yasin, 2003). Pursuing sustainability means creating new products, services, and business models designed to generate value for both society and companies (Geradts & Bocken, 2018). It also involves deliberate changes in an organization's values, philosophy, products, processes, or practices (Geradts & Bocken, 2018). Therefore, sustainability-oriented attributes of project management processes (PMP) can be understood as key features or beneficial characteristics that contribute to sustainability-driven project execution.

Project management activities can be classified either by content or by project phase. According to the PMBOK framework, the content of project management encompasses multiple knowledge areas, while the process is divided into three main phases: preparation, implementation, and operation. In this dissertation, the factors under investigation are those related to the investment implementation phase and are categorized in alignment with the process groups described in the PMBOK as well as the guidelines provided in ISO 21500.

In general, integrating sustainability into project management processes means applying structured methodologies, such as those outlined in PMBOK and ISO 21500, which define project management as a five-phase process: initiating, planning, implementing, controlling, and closing. Each phase produces specific outcomes that impact the project's final objectives while also providing continuous information to stakeholders throughout the project lifecycle (Lindahl & Ryd, 2007). Furthermore, various factors influence each phase, potentially altering project outcomes based on evolving expectations and external conditions. In recent years, ISO standards have increasingly emphasized sustainability considerations, leading enterprises to gradually recognize and integrate sustainability factors into the management and implementation of their projects. Within the scope of this study, the factors influencing the project management process are identified based on previous research related to standardized project management process groups, as well as on the criteria outlined in ISO guidelines concerning project management in relation to sustainability.

2.5.1. Initiating group attributes factors - sustainability oriented affecting project management process

The Initiating Process in Project Management

The Initiating Process is defined in PMBOK and ISO guidelines as: *"The initiating processes are used to start a project phase or project, to define the project phase or project objectives, and to authorize the project manager to proceed with the project work"* (ISO, 2012).

The initiating phase in project management is widely recognized as a critical foundation for project success, yet it remains relatively underexplored in the literature. McBride (2016) emphasizes that this phase inherently involves uncertainty and complexity, as it marks the beginning of a new effort where many questions arise. Nevertheless, studies such as Brioso (2015) and Bakator (2017) note that research on this stage in construction projects has been limited, partly because it is often perceived as less complex compared to later phases, and partly due to a lack of accessible data and information from organizations. This gap suggests that while theory acknowledges its importance, empirical evidence in construction contexts is still insufficient.

A dominant theme across existing research is the role of stakeholders. Heldman (2007) stresses that key decisions and resource allocations occur during initiation, making stakeholder engagement indispensable. Numerous studies (Orlander, 2007; Marcelino-Sádaba et al., 2015; Isang et al., 2025) confirm that stakeholders strongly influence the project management process by shaping sustainability perceptions, defining metrics, and ensuring long-term viability. For instance, Bongei et al. (2024) demonstrated that the performance of dam construction projects in Kenya was directly tied to the initiating phase, particularly through feasibility studies, project charters, and stakeholder participation. Similarly, Takagi and Varajao (2022) and Matu et al. (2020) argue that early consensus-building meetings help clarify goals and embed sustainability objectives into formal documents such as feasibility studies and project charters. However, despite this consensus, critical perspectives argue that much of the existing literature remains normative, emphasizing the need for stakeholder involvement without sufficiently addressing how power imbalances and conflicting interests can hinder genuine participation.

Another significant strand of research highlights managerial capabilities as a determining factor in the effectiveness of initiation. Studies by Guinan (2024), Ma (2011), and Zhong et al. (2018) point to resource availability, personnel selection, and strategic alignment as essential managerial skills during this phase. The central output, the project charter, is considered a cornerstone for aligning project objectives with organizational strategy. Empirical evidence supports this: projects with a clearly articulated initiation phase are more likely to succeed in terms of cost, time, and scope (Al-Kuhail et al., 2021; Turner & Müller, 2019). Nonetheless, the literature tends to underplay contextual factors such as institutional frameworks, political influences, and cultural aspects, which may also shape managerial effectiveness in the initiation process.

Taken together, the literature consistently identifies stakeholder engagement and managerial capabilities as the two critical factors shaping the initiating process. While there is strong agreement on their relevance, gaps remain in addressing how these factors interact under real-world constraints such as data scarcity, conflicting stakeholder interests, and institutional limitations. These gaps provide opportunities for further empirical research, particularly in construction project contexts where sustainable outcomes are increasingly prioritized.

Research Perspective	**Key Proponents**	**Core Focus & Arguments**	**Identified Gaps & Limitations**
Nature, Context & Under-exploration	ISO (2012); McBride (2016); Brioso (2015); Bakator (2017)	Focus: Definition and inherent characteristics. Arguments: • Defines initiation as the foundation for authorization and objective setting. • Marks a phase of high uncertainty and complexity. • Often perceived as "less complex," leading to limited academic attention.	• Lack of empirical data: Difficulty in accessing organizational information limits real-world evidence. • Contextual scarcity: Insufficient studies specifically within the construction industry.
Stakeholder Engagement & Sustainability	Heldman (2007); Marcelino-Sádaba et al. (2015); Isang et al. (2025); Takagi & Varajao (2022)	Focus: Influence of actors on project definition. Arguments: • Stakeholders shape sustainability perceptions and define metrics. • Early consensus-building is vital for embedding sustainability into feasibility studies and charters. • Direct link between early engagement and performance (e.g., dam projects).	• Normative bias: Literature prescribes engagement but lacks detail on execution. • Power dynamics: Insufficiently addresses how power imbalances and conflicting interests hinder genuine participation.
Managerial Capabilities & Strategy	Guinan (2024); Zhong et al. (2018); Turner & Müller (2019); Al-Kuhail et al. (2021)	Focus: Technical skills and strategic alignment. Arguments: • The *Project Charter* is the cornerstone for aligning project outputs with organizational strategy. • Resource availability and personnel selection are critical managerial skills. • Clear initiation predicts success in cost, time, and scope.	• Contextual oversight: Tends to underplay external factors. • Institutional void: Neglects how political influences, cultural aspects, and institutional frameworks impact managerial effectiveness.

Source: Author’s compilation based on literature review

2.5.2. Planning group attributes factors - sustainability oriented affecting project management process

Planning Process in Project Management

In the second phase, the "Planning Process," PMBOK and ISO 21500 define it as: *"The planning processes are used to develop planning detail. This detail should be sufficient to establish baselines against which project implementation can be managed and project performance can be measured and controlled" (ISO, 2012).* According to previous studies, project management planning including factors such as the contractor's planning capabilities and site management skills. Project managers rely on well-structured plans to guide implementation and respond to issues arising from the contractor's side. Poor planning can negatively impact subsequent project phases and overall project efficiency (Sambasivan & Soon, 2007).

In developing countries, integrating sustainability into construction projects requires a competitive and transparent bidding process. Proper planning of procurement procedures is essential during the project planning phase to ensure sustainable project execution (Banihashemi et al., 2017b).

In general, the planning phase plays a critical role in setting clear objectives, timelines, cost estimates, and risk assessments. These elements serve as the foundation for establishing baselines that support and control project execution in later stages (Shen et al., 2007).

This phase also presents an opportunity to integrate sustainability into all aspects of project management. Key factors identified in research include planning processes, stakeholder involvement, sustainability policies, and project location (Misnan et al., 2024). Additionally, material selection, design safety, environmental knowledge and experience, and communication between stakeholders are crucial considerations (Shen et al., 2007). To enhance sustainability within the Triple Bottom Line (TBL) framework, factors such as political and legal stability, governance structures, and corporate strategies significantly influence economic sustainability in the planning process. Furthermore, in the planning stage of project management, sustainability-oriented factors influencing project management processes (PMP) can be observed in international standards such as ISO 14001:2015 and the Occupational Health and Safety Assessment Series (OHSAS 18001:2007). These standards establish requirements related to occupational health and safety, environmental management, and the implementation of management systems that enable firms to control risks and challenges associated with workplace safety while simultaneously improving environmental performance (Asah-Kissiedu et al., 2021).

Comprehensive project planning is essential for managing the inherent complexity of construction projects. Detailed planning reduces uncertainty and allows for more effective resource allocation, thereby minimizing cost overruns and delays (Anantatmula & Rad, 2018). Similarly, (Sears et al.2015) emphasize that rigorous planning ensures projects are adequately prepared to address implementation challenges. Moreover, comprehensive planning enables adaptability to changing circumstances, thereby enhancing the overall likelihood of project success (Animi & Owusu-Manu, 2021).

Research Perspective	**Key Proponents**	**Core Focus & Arguments**	**Implications for Sustainability Integration**
Foundational & Operational Efficiency	ISO (2012); PMBOK; Sambasivan & Soon (2007); Sears et al. (2015); Anantatmula & Rad (2018)	Focus: Establishing baselines and reducing uncertainty. Arguments: • Planning creates the detail needed to measure and control performance (baselines for time, cost, scope). • It is a tool for managing complexity and reducing uncertainty. • Poor planning (e.g., inadequate site management) directly causes delays and inefficiencies.	• Foundation for Control: Sustainability targets must be defined here to be measurable later. • Efficiency: Rigorous planning minimizes resource waste (a key sustainability metric) by preventing errors and rework.
Procurement & Strategic Alignment	Banihashemi et al. (2017b); Misnan et al. (2024); Shen et al. (2007)	Focus: Bidding, material selection, and stakeholder involvement. Arguments: • In developing countries, transparent bidding planning is crucial for sustainable execution.	• Gatekeeping Role: Procurement planning acts as a "gatekeeper," ensuring only contractors/suppliers capable of meeting sustainability standards are selected.

Research Perspective	Key Proponents	Core Focus & Arguments	Implications for Sustainability Integration
		• Critical decisions on material selection and design safety occur here. • Strategic alignment with corporate strategies and governance structures influences economic sustainability.	• Strategic Link: Connects high-level corporate sustainability policies with on-the-ground execution.
Standardization & Risk Management	ISO 14001:2015; OHSAS 18001:2007; Asah-Kissiedu et al. (2021); Animi & Owusu-Manu (2021)	Focus: Compliance with international standards and adaptability. Arguments: • Integration of management systems (Environmental & OHS) allows firms to control risks systematically. • Planning enables adaptability to changing circumstances. • Emphasizes political/legal stability as factors influencing economic sustainability.	• Systematic Integration: Sustainability is not ad-hoc but embedded via standardized requirements (ISO 14001/OHSAS). • Risk Mitigation: Proactive planning for environmental and safety risks reduces the likelihood of accidents and non-compliance.

Source: Author's compilation based on literature review.

2.5.3. Implementing group attributes factors - sustainability oriented affecting project management process.

The third phase of this process is the "Implementation Process", defined by ISO 21500 as: *"The implementing processes are used to perform the project management activities and to support the provision of the project's deliverables in accordance with the project plans."* (ISO, 2012). A study on project management implementation in publicly funded infrastructure projects in Kenya, using survey and quantitative methods, identified key challenges in this phase. These challenges include resource allocation, leadership capabilities, technical skills of employees, and lack of financial support, all of which pose risks to project execution (Aghaegbuna et al., 2020). Further research highlights that successful implementation depends on strong leadership, clear communication, and proactive problem-solving (Bhatti & Nazir, 2024).

At this stage, all necessary arrangements for execution must be in place. Zhong et al. (2018) emphasize that essential factors influencing project implementation include selecting appropriate contractors and suppliers, as well as empowering project personnel to fulfill their roles effectively. Additionally, project managers must ensure economic sustainability by carefully managing capital allocation for interest payments, salaries, material costs, and equipment procurement to enhance long-term viability (Shen et al., 2007). Contractors should also be evaluated for their sustainable practices, with monitoring mechanisms in place to assess real-time performance and provide feedback (Banihashemi, 2017).

From a social sustainability perspective, building a strong project team is crucial for improving performance and fostering collaboration. Studies indicate that the team's awareness, knowledge, and perception of sustainability significantly impact the integration of sustainable practices into project management. Without this understanding, incorporating sustainability into decision-making and addressing social challenges becomes difficult (Sang et al., 2018).

The application of modern technology in project execution is also a critical success factor. Research by Banihashemi (2017) highlights the importance of technological advancements in enhancing project management efficiency. Moreover, construction waste management should be planned not only through environmental impact assessments but also by promoting awareness and education among stakeholders (Shen et al., 2007).

During the implementation stage, effective process management ensures that project activities are carried out in alignment with the established plan and within the defined parameters. Osei-Kyei and Chan (2017) emphasize that successful implementation relies on strong leadership, clear communication, and proactive problem-solving. Projects that manage the implementation phase effectively are more likely to maintain schedule adherence and uphold quality standards. Similarly, Walton et al. (1998) highlight that clear communication, decisive leadership, and active problem resolution not only sustain project timelines and quality benchmarks but also enhance stakeholder satisfaction, thereby contributing to overall project success.

Research Perspective	**Key Proponents**	**Core Focus & Arguments**	**Implications for Sustainability Integration**
Operational Execution & Challenges	ISO (2012); Aghaegbuna et al. (2020); Osei-Kyei & Chan (2017); Walton et al. (1998); Bhatti & Nazir (2024)	Focus: Translating plans into deliverables and overcoming execution barriers. Arguments: • Execution is where plans meet reality; success relies heavily on strong leadership, clear communication, and proactive problem-solving. • Key challenges (especially in public projects/developing contexts) include resource constraints, lack of financial support, and skill gaps. • Effective execution maintains schedule and quality, driving stakeholder satisfaction.	• Leadership as Driver: Sustainable practices require strong leadership to enforce new protocols amidst resource constraints. • Process Adherence: Without effective process management, sustainability plans risk being abandoned under pressure.
Resource Management & Economic Viability	Zhong et al. (2018); Shen et al. (2007); Banihashemi (2017)	Focus: Contractor selection, capital allocation, and supply chain management. Arguments: • Selecting appropriate contractors/suppliers and empowering personnel are prerequisites. • Economic sustainability requires careful management of cash flow (salaries, materials, interest payments). • Contractors must be monitored for real-time sustainable performance.	• Supply Chain Control: Implementation is the phase to verify if contractors are actually adhering to the sustainable practices promised in the planning phase. • Financial Discipline: Proper capital allocation ensures the project remains viable long-term, a key component of economic sustainability.

Research Perspective	Key Proponents	Core Focus & Arguments	Implications for Sustainability Integration
Social Factors & Technological Enablers	Sang et al. (2018); Banihashemi (2017); Shen et al. (2007)	Focus: Team dynamics, awareness, and technology adoption. Arguments: • The project team's awareness, knowledge, and perception of sustainability are decisive for integration. • Modern technology application enhances efficiency. • Waste management requires not just technical plans (EIAs) but also soft skills like education and awareness promotion.	• Human-Centric Approach: Social sustainability starts with the project team itself (empowerment, knowledge). • Tech-Driven Efficiency: Technology reduces waste and improves precision, directly contributing to environmental goals.

Source: Author's compilation based on literature review.

2.5.4. Controlling group attributes factors - sustainability oriented affecting project management process.

The control phase is defined as: *"The controlling processes are used to monitor, measure, and control project performance against the project plan. Consequently, preventive and corrective actions may be taken, and change requests made, when necessary, in order to achieve project objectives."* (ISO, 2012). At this stage, the primary focus is ensuring that project objectives are met as planned. Key challenges and considerations include assessing project progress and status in comparison to the initial plan, allocated budget, and available resources. Project managers play a crucial role in making real-time decisions, implementing corrective measures, and utilizing appropriate tools to keep the project aligned with its original objectives (Zhong et al., 2018).

The selection of effective monitoring and control methods is critical. A study on construction projects in Malaysia highlights that project success heavily depends on establishing robust supervision and control mechanisms. Effective oversight helps prevent costly mistakes, safeguard project profitability, and identify challenges early on (Yong & Mustaffa, 2013).

From a social sustainability perspective, sustainable labor practices play a key role in ensuring project longevity. According to Stanitsas et al. (2021), labor sustainability involves monitoring employment conditions, health and safety standards, training opportunities, fair wages, and career development. Additionally, ensuring responsible workforce management and team development is essential for achieving long-term project goals.

Research Perspective	Key Proponents	Core Focus & Arguments	Implications for Sustainability Integration
Performance Monitoring & Corrective Action	ISO (2012); Zhong et al. (2018); Yong & Mustaffa (2013)	**Focus:** Measuring, monitoring, and controlling project performance against baselines. **Arguments:** • Critical for ensuring project objectives are met as planned. • Involves assessing progress vs. plan, budget, and resources. • PMs make real-time decisions, implement corrective measures, and utilize tools. • Robust supervision prevents costly mistakes, safeguards profitability, and identifies challenges early.	• **Accountability:** Control ensures sustainability commitments are not just planned but actively achieved and maintained. • **Early Warning:** Timely identification of deviations from sustainable practices prevents costly rework and larger environmental/social impacts.
Social Sustainability & Long-term Viability	Stanitsas et al. (2021)	**Focus:** Integrating human-centric aspects into monitoring. **Arguments:** • Labor sustainability is crucial for project longevity. • Monitoring extends to employment conditions, health & safety, training, fair wages, and career development. • Responsible workforce management ensures long-term project goals are met.	• **Holistic Monitoring:** Shifts focus beyond traditional cost/schedule to include social metrics. • **Human Capital:** Ensures ethical treatment of workers, which is fundamental for social sustainability and long-term project success. • **Risk Mitigation:** Proactive monitoring of labor practices reduces social risks and enhances reputation.

Source: Author's compilation based on literature review

2.5.5. Closing group attributes factors - sustainability oriented affecting project management process.

According to ISO 21500, this phase is defined as: *"The closing processes are used to formally establish that the project phase or project is finished, and to provide lessons learned to be considered and implemented as necessary."* Project closure encompasses all aspects of the project and serves as an integrated, cross-cutting process that ensures stakeholder alignment on success criteria and project completion (Dinsmore & Cabanis-Brewin, 2018). Despite its strategic importance, this phase is often overlooked or undervalued. Key factors influencing project closure effectiveness among stakeholders include risk perception, finalizing contractual relationships, assisting employees in career planning, engaging in project closure decisions, and obtaining support from other departments (Wen & Qiang, 2019). Additionally, stakeholder commitment extends to project lifecycle development, delegating authority, and ensuring ongoing management when needed throughout the Project Life Cycle (PLC) (Bashir, 2019).

Social Sustainability in Project Closure

From a social sustainability perspective, the closure phase involves labor practices and relationships with the local community. Key social considerations include:

- Workplace safety
- Prevention of child labor
- Ensuring fair working conditions

Moreover, societal and governmental acceptance of the project outcomes plays a crucial role. Public approval ensures that the project's results and benefits align with broader stakeholder interests, serving as a foundation for formal project closure (Stanitsas et al., 2021).

As emphasized by PMBOK 2017 and Institute 2016, documenting lessons learned is a critical aspect of project closure, providing valuable references for future projects.

In Vietnam, research has predominantly focused on specific knowledge areas rather than a comprehensive evaluation of all project management processes. Studies typically target only one or a few specific processes rather than examining the entire project lifecycle. For a more holistic approach to project management, it is essential to explore factors and attributes that influence different project management process groups to establish a more structured and effective project management framework

Research Perspective	Key Proponents	Core Focus & Arguments	Implications for Sustainability Integration
Formal Completion & Strategic Importance	ISO (2012); Dinsmore & Cabanis-Brewin (2018); Wen & Qiang (2019)	Focus: Formalizing project completion and stakeholder alignment. Arguments: • The closing phase formally concludes a project/phase. • It integrates all project aspects, ensuring stakeholder consensus on completion criteria. • Despite strategic importance, it's often overlooked/undervalued. • Key factors include risk perception, finalizing contracts, and gaining inter-departmental support.	• Ensuring Value Capture: A formal closure ensures that sustainability benefits (e.g., certification, operational efficiencies) are documented and transferred. • Future Projects: Lessons learned are crucial for continuous improvement in sustainable practices.
Social Sustainability & Community/ Labor Relations	Stanitsas et al. (2021); Bashir (2019)	Focus: Ethical labor practices and community engagement. Arguments: • Involves evaluating workplace safety, preventing child labor, and ensuring fair working conditions. • Societal and governmental acceptance of project outcomes is foundational for formal closure. • Stakeholder commitment extends to long-term lifecycle development and ongoing management.	• Ethical Legacy: Guarantees that the project's social impact aligns with ethical standards, preventing negative long-term consequences. • Community Acceptance: Public approval of project outcomes (e.g., infrastructure) ensures long-term social sustainability and legitimacy. • Long-term Stewardship: Consideration for post-completion management ensures benefits persist and negative impacts are managed.

Research Perspective	Key Proponents	Core Focus & Arguments	Implications for Sustainability Integration
Knowledge Transfer & Continuous Improvement	PMBOK 2017; Institute 2016	Focus: Documenting lessons learned for future projects. Arguments: • Documenting lessons learned is a critical aspect for organizational learning. • Provides valuable references and best practices for future projects.	• Sustainable Learning Cycle: Capturing successes and failures in sustainability efforts allows future projects to improve and avoid past mistakes. • Knowledge Building: Fosters institutional knowledge on how to effectively integrate sustainability into PMP.

Source: Author's compilation based on literature review.

2.5.6. Synthesis of sustainability - oriented factors and economic aspects within project management processes (PMP).

Project Management (PM) is increasingly recognized not merely as a collection of techniques but as a distinct field of applied economics, where economic principles are leveraged to optimize the allocation and utilization of scarce resources towards achieving specific objectives. Projects, by their very nature, represent investments of resources—capital, labor, materials, and time—with an expectation of future benefits. Decisions made throughout the project lifecycle—from project selection and budget allocation to risk management and performance evaluation—are fundamentally economic in nature, revolving around maximizing value under constraints. Kerzner (2017), in his seminal work on project management, emphasizes projects as "systems" designed to transform scarce resources into products or services, a perspective that distinctly reflects its economic underpinning. Similarly, Morris (2013) argues that PM is, at its core, about value creation, which is inextricably linked to economic factors such as profitability, cost-efficiency, and optimal resource deployment. This perspective firmly places PM within the realm of applied economics, where the theory of choice under scarcity drives operational strategies.

Within this framework, the Project Management Process (PMP) serves as the core instrument of applied economics. Standardized by organizations like PMI (PMBOK Guide) and ISO (ISO 21500/21502), the PMP provides a structured methodological framework for decision-making and actions aimed at optimizing project outcomes. Each phase of the PMP—from Initiating, Planning, Executing, Monitoring & Controlling, to Closing—is intimately tied to economic principles. The Initiating phase involves project selection, a pure applied economics problem concerning economic feasibility, cost-benefit analysis, and selecting investments that yield the highest value under capital constraints (Mishan & Quah, 2020). The Planning phase is fundamentally about optimal resource allocation, detailed budgeting, and financial risk management, aiming to create the most resource-efficient roadmap to project goals (Bentley, 2010). During Executing, effective cost and schedule management are crucial for maintaining profitability and performance while minimizing resource waste (Sambasivan & Soon, 2007). The Monitoring & Controlling phase utilizes variance analysis—an economic tool—to assess investment efficiency and make corrective decisions to maximize remaining project value (PMI, 2017). Finally, the Closing phase involves assessing the final economic performance, including Return on Investment (ROI) and lessons learned on resource management, to inform future investment decisions (Dinsmore & Cabanis-Brewin, 2018). Thus, the PMP is not merely a checklist of activities but a structured sequence of economic decisions designed to ensure the most efficient use of an organization's limited resources to generate desired value. Disregarding economic principles at any PMP stage can lead to inefficiencies, resource wastage, and ultimately, a failure to achieve project objectives, be they financial or sustainable.

The factors explored in this study are all related to economic elements and economic sustainability indicators. The summary table below selects and analyzes more specific points demonstrating the relationship between these factors and sustainable economic development.

Table 2.2. Factors oriented sustainability relate to economics

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
Initiating	Proper human resource selection	Human selection is considered applied economics because it solves the optimization problem within a business, using cost-benefit analysis and human capital theory to efficiently allocate scarce labor resources. Through this, businesses maximize organizational value by carefully considering the balance between recruitment costs and expected marginal productivity.	Personnel selection plays a crucial role in helping businesses screen individuals who meet professional criteria and possess ethical values and environmental awareness, thereby easily conveying sustainability principles into all daily operational decisions. This process optimizes long-term socio-economic costs by minimizing risks and employee turnover, while also building a team that meets criteria and innovates to realize shared development goals.	(Al-Swidi et al., 2021) (Sypniewska et al., 2023) (Aftab et al., 2022)
	Long-term efficiency considered in early stages of construction projects	Focusing on initial costs, investors are willing to accept higher investments to reduce future operating expenses. Calculating long-term efficiency helps the project achieve sustainable positive cash flow over many years, ensuring real profits after	When calculating long-term efficiency, investors are compelled to choose durable materials and energy-saving technologies to reduce operating costs. This directly reduces carbon emissions (carbon footprint) and construction waste throughout the 50-70 year lifespan of the building. A project with low operating costs will be more resilient to economic shocks (e.g., rising electricity prices, inflation). It will not become a	(Khan et al., 2019) (Ouellet-Plamondon & Habert, 2016)

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
		deducting depreciation and currency inflation.	"financial burden" for future generations to pay for maintenance or demolition.	
	Having a clear connection between project objectives and benefits of stakeholders	Stakeholders voluntarily strive for a common goal because they see a direct financial benefit in that success. Consensus on the interests of the parties helps eliminate costly "expenses" such as legal dispute costs, compensation costs due to project delays, and management costs caused by conflicts of interest.	When citizens, the government, and investors all see their interests in a project, the project will avoid protests, lawsuits, and conflicts of interest. This harmony ensures the project is socially accepted and protected in the long term. Transparency in benefits helps prevent corruption and vested interests. A project built on a foundation of fair benefit distribution will create a healthy business ecosystem where trust is the catalyst for sustainable economic development.	(Moffat & Zhang, 2013) (Ahsan et al., 2013)
Planning	Clear and transparent procurement and bidding processes (P1)	Transparent bidding is a method for investors to determine the "market equilibrium price." A lack of transparency leads to "asymmetric information," creating opportunities for price collusion or oligopolies. Transparency also helps eliminate "Corruption Tax"—a type of	In a fair bidding process, contractors are forced to compete based on technological capabilities and management solutions rather than "connections." This fosters innovation throughout the construction industry. Transparency ensures that investment capital (from the state or private sector) flows to the right places, creating truly high-quality projects instead of substandard ones due to	(Sohail & Cavill, 2008) (Chan & Owusu, 2017)

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
		hidden cost that doesn't add value to the product but inflates investment costs. Therefore, it is the most powerful tool for minimizing input costs.	resource waste. This is the most sustainable way to protect national capital.	
	Effective procurement management plan (P2)	Buying too early will tie up capital (opportunity cost of capital) and incur warehousing costs. Buying too late leads to production delays and penalties for delays. This plan is a tool to balance the optimal point between capital costs and supply chain risks. An effective plan helps match cash outflows with actual progress.	Precise (Just-in-Time) planning helps avoid over-purchasing materials (leading to damage and waste) or excessive inventory (occupying space and capital). In sustainable economics, reducing waste increases revenue. Good planning helps build long-term partnerships with suppliers, rather than making quick, opportunistic purchases. This makes the project more resilient to market price fluctuations, ensures financial stability, and increases supply chain stability.	(Meehan & Bryde, 2011) (Varnas et al., 2009)
	Accurate estimating activity resources and durations to develop schedule (P3)	Accurate resource estimation is fundamental to successful pricing in the production function. Inaccurate estimates of timeframes will lead to shortfalls in the actual budget. In project finance, this	Accurate cost estimates help prevent "cost overruns"—a leading cause of bad debt for banks and a burden of public debt for society. When time and resources are accurately projected, society avoids wasting resources on protracted projects. Those resources can	(Flyvbjerg, 2014) (Love et al., 2013)

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
		inaccuracy in forecasting forces investors to set aside large "Contingency Reserves," reducing the efficiency of capital utilization.	then be freed up to invest in other profitable opportunities (opportunity cost).	
	Clear definitions of project scope and constraints (P5)	In economics, it's impossible to optimize profits without defining the limits of the output. The "Scope" is the economic boundary of a project. If the scope is unclear, the project will incur unpaid work or unexpected costs. This disrupts the approved cost-benefit analysis, turning a profitable project into a loss-making one.	Once the scope is clearly defined, the investor can accurately calculate the return on investment. This ensures the project is truly profitable and self-sustaining in the future. Clearly defining the scope helps us consume only the necessary resources for the defined objectives. This avoids over-reliance on resources and financial waste on meaningless projects.	(Mirza et al., 2013) (Project Management Institute, 2017, Chapter 5)
Implementing	Applying modern technologies and methods to the implementation stage	Modern technologies (e.g., BIM, automation) help reduce construction time, minimize errors, and increase labor productivity. This leads to more efficient use of capital, reduced cost per unit, and increased return on investment.	Modern technology is often accompanied by environmentally friendly solutions (green materials, energy-efficient design). Their application not only reduces emissions and resource consumption during construction but also lowers long-term operating costs, creating sustainable value for the asset.	(Chen & Chen, 2019) (Love & Irani, 2016)

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
		Modern methods offer better predictability and control, helping to avoid technical errors, rework, and disputes. This risk reduction directly protects the project budget and profit margin.	Continuous application and innovation in technology helps businesses build a solid "knowledge capital," enhancing competitiveness and adaptability in a changing market. This is a key factor in ensuring the organization's survival and sustainable development.	
	Competent contractors and vendors	A competent contractor/supplier ensures the quality of work and materials, minimizing the risk of defects and delays. This avoids huge "hidden costs" such as warranty repairs, compensation for damages, or litigation that may arise later. Choosing a reliable partner helps ensure a stable, timely, and high-quality supply. This minimizes the risk of material shortages, price fluctuations, or operational disruptions, helping the project maintain its planned schedule and budget.	Competent partners typically adhere to ethical and environmental standards, minimizing risks related to social issues (child labor, poor working conditions) or environmental problems (illegal resource exploitation). This builds a transparent and sustainable supply chain, protecting the reputation and long-term value of the business. Collaborating with quality partners ensures a long lifespan for the project, reducing the need for major maintenance and repairs. This helps maintain asset value over time, reduces lifecycle costs, and provides long-term value to the community.	(Jain et al., 2020) (Shen et al., 2007)

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
	Effective managing construction waste during the construction phase	Effective waste management includes sorting, recycling, and reuse. This transforms waste (an expense that must be processed) into a resource that can generate revenue (selling recycled materials) or save on the cost of purchasing new materials. Ineffective waste management leads to high processing costs (transportation fees, landfill fees) and the risk of administrative penalties for violating environmental regulations. Good management helps save on these direct costs and avoids financial risks due to legal violations.	Effective waste management is the foundation of a circular economy model. It reduces landfill waste, saves natural resources and energy used to produce new materials. This contributes to reducing the burden on the ecosystem and creating valuable secondary raw materials. Compliance with waste management regulations helps projects avoid penalties, legal disputes, and reputational issues. An environmentally friendly project will obtain a "social license to operate," building trust and long-term support from the community and investors.	(Shen et al., 2007) (Zou et al., 2021)
Controlling	Having enough project budget to pay for remaining tasks	This is crucial for maintaining operations and avoiding project disruption. A budget shortfall will lead to additional borrowing (at higher interest rates), increased capital costs, and the risk of	Projects that fall short of budget and are not completed represent a serious waste of social resources (land, materials, and labor already invested). Ensuring sufficient budget helps complete the project, put it into use, create sustainable value, and avoid becoming an	(Almeida et al., 2022)

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
		bankruptcy, reducing or completely eliminating expected profits. Ensuring sufficient budget helps maintain an uninterrupted workflow. Every day of project delay incurs indirect costs (management, equipment rental, contract penalties) and wasted resources, eroding economic efficiency.	economic burden for the future. The ability to complete the project according to the financial plan builds confidence among investors, banks, and the community. This encourages future investments and contributes to the stability and sustainable development of the economy.	
	Having competent project managers	Good project managers make optimal decisions regarding the allocation of materials, labor, and equipment, minimizing waste and maximizing productivity. They also effectively control management costs and other incidental expenses, thereby protecting the project's profit margin. Project management capabilities directly impact whether a project is completed on time, within budget, and to the required quality standards. This is a	A competent project manager not only completes a project but also builds capacity for the team, develops efficient work processes, and transfers knowledge. This is an investment in human capital and intellect, creating a competitive advantage and sustainable adaptability for the organization in the long term. Continuously completing successful projects under the leadership of a skilled manager will build a solid reputation for the company. This reputation attracts new projects, strategic partners, and customers, ensuring a sustainable revenue and profit stream for the business.	(Drouin et al., 2020) (Kloppenborg et al., 2020; Müller & Turner, 2020) (Siddique & Khan, 2021)

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
		key factor in ensuring the committed return on investment (ROI).		
	Periodic monitoring and controlling the project progress and reporting to stakeholders	Periodic monitoring helps quickly identify deviations from the plan (in terms of time, cost, and quality). Early detection allows for timely adjustments, preventing minor issues from escalating into major crises with significantly higher remediation costs. Transparent reporting to stakeholders creates accountability for work teams, boosting performance. Simultaneously, accurate information helps investors and stakeholders make informed financial decisions, minimizing investment risks.	Strict control of progress and quality optimizes the use of materials, equipment, and labor, minimizing material and energy waste. This demonstrates environmental responsibility and is a crucial element in sustainable resource management. Transparent and regular reporting builds trust and mutual understanding among stakeholders. This "social capital" helps reduce transaction costs, enhance cooperation, and create a stable, sustainable investment environment with less conflict and easier access to "social permits to operate."	(Geraldi & Lechter, 2022) (Kloppenborg et al., 2020) (Yin & Liu, 2020)
Closing	Careful considering long-term effects when	Solving problems with a temporary, inexpensive short-term solution can lead to much higher	Long-term solutions often prioritize environmentally sustainable options (e.g., eco-friendly materials, energy-saving	(Shao et al., 2022) (Geraldi & Lechter, 2022)

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
	troubleshooting issues	maintenance, operating, and repair costs in the future. This mindset ensures that each corrective decision is geared towards minimizing the overall cost of the project. Unresolved issues can become potential risks, causing major failures or impacting the operational performance of the facility, reducing asset value and the project's profitability in the long term.	technologies) to reduce operating costs and negative environmental impacts throughout the project's lifecycle. This is an investment in "green resources" for the future. Decisions based on long-term effectiveness ensure that the structure does not become a huge maintenance burden for future generations, preserving the value and profitability of the asset for society for decades.	
	Long-term commitments of stakeholders to project objectives	Long-term commitment creates stability and confidence, minimizing costs arising from renegotiations, disputes, or changes in objectives midway. This protects investment capital and optimizes resource utilization throughout the project's lifecycle. Large projects often require a continuous flow of capital and policy support. Long-term commitment from stakeholders	Long-term commitment creates a stable collaborative environment, minimizing social conflicts or political instability that could stall or destroy the project. This helps the project obtain a "Social License to Operate" and maintain the necessary support from the community and government. Continuous commitment from stakeholders ensures a stable flow of capital, which is especially important for large infrastructure projects. This stability encourages long-term investment, creates sustainable business	(Sadegh et al., 2021) (Müller & Turner, 2020) (Drouin et al., 2020) (Drouin et al., 2020)

Process	Sustainablity-oriented factors	The economic aspect of each factor	The sustainable feature of each factor	References
		(investors, government, community) is crucial to ensuring the project doesn't stall due to lack of funding or legal obstacles, protecting expected returns.	opportunities, and contributes to stable economic growth for the region.	
	Documenting lessons learned at the project closure	Lessons learned are invaluable "knowledge capital." Documentation helps avoid repeating costly mistakes, optimize processes, and reduce costs for subsequent projects, creating a cost-competitive advantage. Analyzing lessons learned helps organizations improve risk management capabilities, enhance decision-making skills, and develop best practices. This creates a solid foundation for achieving sustainable economic success.	Systematizing and sharing lessons learned creates an accumulated "knowledge capital." This capital is a driving force for innovation, helping the organization and the construction industry continuously improve, adapt to new challenges, and maintain a sustainable competitive advantage. By learning from the past, future projects can be implemented more efficiently, minimizing wasted resources (time, materials, manpower) and costs due to errors. This contributes to the sustainable development of the industry by optimizing the use of scarce resources.	(Kasapoğlu & Günay, 2019) (Love & Sing, 2013) (Love & Sing, 2013)

Sources: Author's research

2.6. Research gap

Extensive prior research has rigorously investigated various critical aspects of construction project management (CPM), often focusing on key performance indicators such as risk management, cost control, schedule adherence, and quality assurance. However, a notable knowledge gap persists in the literature concerning a comprehensive, process-oriented understanding of Construction Project Management Processes (CPMPs) themselves. This deficiency is observed even within developed nations, and it is particularly pronounced in emerging economies like Vietnam. Existing literature, as noted by Brioso (2015) and Bakator (2017), often exhibits a "fragmented" focus while neglecting the integrated, interlinked nature of the entire process lifecycle. This scarcity stems from several systemic barriers: the "black box" phenomenon, where organizations are reluctant to share internal decision-making workflows; a methodological bias toward "hard" metrics (cost, time) over complex, "soft" process variables; and a pervasive misconception that foundational phases like Initiating and Closing are merely administrative formalities rather than strategic drivers (McBride, 2016; Wen & Qiang, 2019). Consequently, research in developing contexts like Vietnam—has remained largely "factor-centric," identifying external inputs affecting success without explaining how the rigorous application of the full PMP framework actually functions. This creates a significant research gap: moving beyond a static analysis of isolated factors to a dynamic understanding of the integrated PMP is not merely an academic exercise, but an urgent necessity for advancing sustainable effectiveness in construction management.

It is paramount to recognize that enhancing these underlying project management processes is fundamental to achieving sustained improvement across all aforementioned project performance indicators. Conversely, neglecting the systematic optimization of CPMPs inevitably hinders the consistent achievement of project objectives. This causality is particularly pertinent in the Vietnamese context, where documented inefficiencies in overall project management practices underscore the urgent need for process-level intervention rather than merely addressing symptomatic issues.

While numerous studies have explored various 'factors' impacting specific aspects of project management (e.g., factors influencing project risk, cost overruns, or quality deviations), much of this research tends to be factor-centric rather than process-centric. Such approaches often yield fragmented, short-term recommendations that fail to address the systemic and sustainability improvement of project management processes over the long term. Consequently, these studies frequently fall short in proposing actionable, enduring strategies for enhancing overall CPM performance.

Therefore, a significant research gap exists regarding the development and validation of holistic, process-driven frameworks for optimizing CPMP effectiveness, particularly in contexts like the Vietnamese construction industry. This proposed research aims to directly address this critical gap by developing a framework of sustainable orientation factors affecting to project management process. Such a process-centric framework is anticipated to offer sustainable, long-term improvements in project management efficiency and effectiveness within the Vietnamese construction industry, ultimately contributing to enhanced project success rates and providing a valuable model for similar developing economies.

CHAPTER 3. RESEARCH METHODOLOGIES

3.1. Research process

The research process applied in this thesis strictly adheres to international scientific standards in the field of sustainable construction economics and management, demonstrating strong similarities with cited research works worldwide. Specifically, the use of a mixed-method approach, starting with qualitative screening of factors and continuing with quantitative testing of the model, is an optimal approach successfully applied by (Banihashemi et al, 2017) in building a model of key success factors (CSFs) for sustainable project management in developing countries. This study also uses in-depth interviews to contextualize variables before conducting a large-scale survey, similar to the approach used in this thesis in Vietnam.

In particular, the use of partial least squares linear structural modeling (PLS-SEM) to handle latent variables and complex relationships between project management process groups has proven to be the most modern and appropriate method currently available, as seen in the studies by (Martens & Carvalho, 2017) and (Stanitsas et al, 2021). These authors both used PLS-SEM to quantify the impact of sustainable practices on project success, confirming the superiority of this method in handling non-standard data and small samples - a common characteristic in construction industry surveys. Furthermore, the reliability testing process using Cronbach's Alpha and exploratory factor analysis (EFA) before running the structural model also perfectly matches the standard process in the study by (Gunduz & Almuajebh, 2020) when evaluating sustainable success factors.

The research methods used in the thesis include: qualitative methods and quantitative methods. This section outlines the research process, detailing the steps undertaken to fulfill the study's objectives. The research process is structured into three main stages:

Stage 1: Theoretical Overview

This stage begins with the research idea centered on project management processes in construction projects in Vietnam. The author conducted an extensive literature review, consulting various sources such as academic journals, doctoral theses, and scientific research projects. Priority was given to peer-reviewed international journals of high repute.

Based on the specific research context in Vietnam—particularly within construction enterprises frequently involved in residential, high-rise, and commercial building projects—the scope was narrowed to identify research gaps. These findings guided the formulation of research objectives and research questions. The outcome of this phase is the development of a preliminary research model, presented in Section 3.1.

Stage 2: Preliminary Research

Both qualitative and quantitative research methods were applied in this phase. The qualitative research primarily served to explore and validate the relevant sustainability-oriented factors influencing project management effectiveness. Insights from this phase were used to refine the survey instrument and conduct a pilot study.

The qualitative phase involved semi-structured interviews and expert interview (Skulmoski et al., 2007) with experts and stakeholders directly involved in project management within construction projects in Vietnam. These interviews provided a foundation for comparison with quantitative results and helped capture the current status of project management practices in the industry.

Stage 3: Main Quantitative Study

In this stage, quantitative methods were the primary approach. The purpose was to empirically test the hypotheses developed earlier. The study employed various statistical techniques to assess and refine measurement scales, including Exploratory Factor Analysis (EFA). The Ordinary Least Squares (OLS) regression method was applied to test the hypothesized relationships between sustainability-oriented factors and project management effectiveness, using SPSS 22 software.

To reinforce the empirical validity of the study and provide deeper insights into the Vietnamese context, Chapter 4 presents a proposed model that illustrates the interaction between the factor groups related to project management processes. This model is tailored to the Vietnamese construction industry and integrates sustainability dimensions. It represents an important step in confirming the practical applicability of the project management process model and offers both researchers and construction enterprises a comprehensive view of sustainability-oriented factor groups.

A diagram illustrating the full research process is presented as follows:

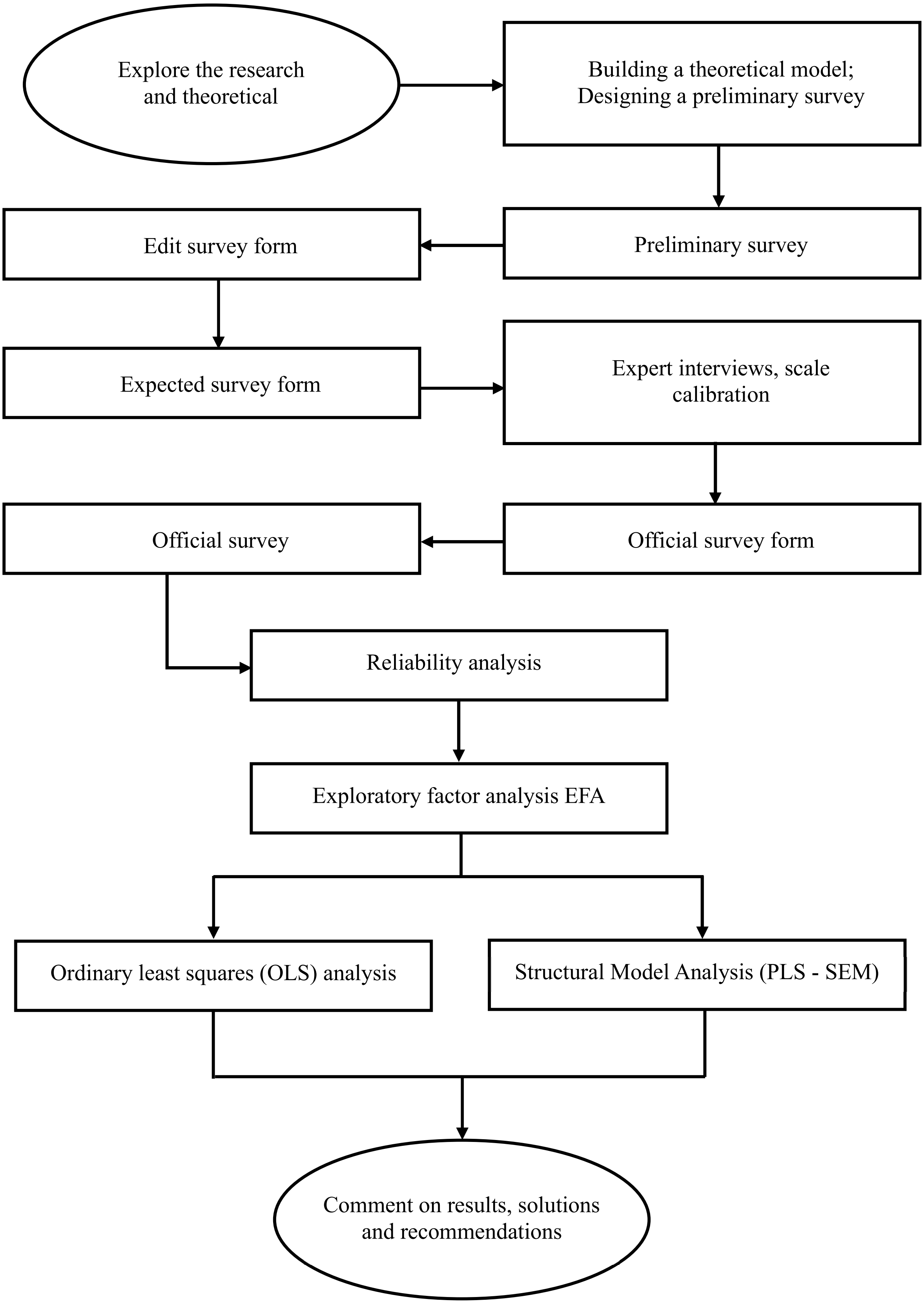


Diagram 3.1. Method process

3.2. Research model

3.2.1. research model for stage 1

On the basis of reviewing and synthesizing prior research as well as relevant theoretical models, the author developed a preliminary questionnaire that incorporated measurement scales of factors influencing the effectiveness of construction project management processes. In order to ensure that these measurement scales captured the full range of influential factors, the researcher conducted in-depth interviews with nine experts, all of whom were senior leaders directly responsible for managing construction investment projects. The main purpose of this stage was to refine, validate, and eliminate factors deemed inappropriate.

The qualitative interviews were designed to address the following key aspects: (i) Evaluation of the comprehensiveness of the measurement scales for factors affecting the effectiveness of construction project management processes.

(ii) Assessment of the suitability of the proposed model in relation to the current conditions and characteristics of construction projects in practice.

(iii) Revision and refinement of wording and measurement items in the preliminary questionnaire.

Beyond these core objectives, the qualitative phase was also intended to provide a deeper understanding of the current state of project management and management processes in construction investment projects. Accordingly, the interview protocol included additional questions concerning project outcomes, existing limitations, and the underlying causes of challenges in project management processes. More specifically, the experts were asked to reflect on:

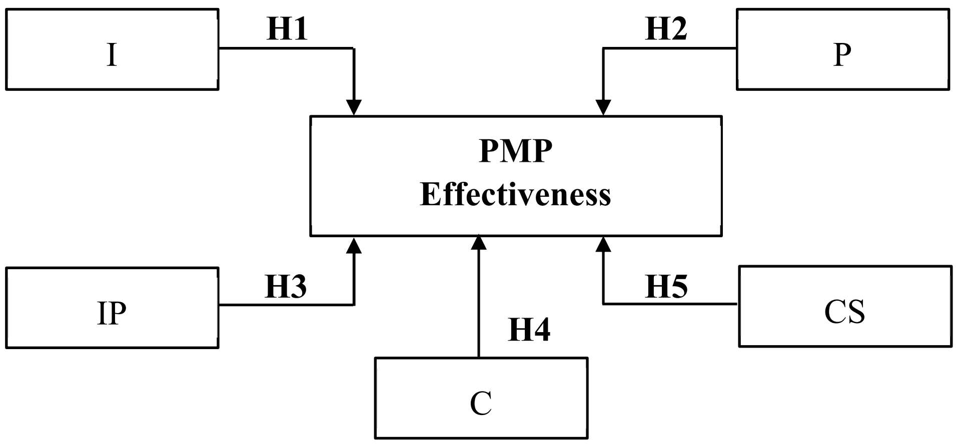
- Their perceptions of sustainability within project management, and the extent to which sustainability factors influence managerial practices.
- The degree to which sustainability requirements are consistently addressed within project management processes.
- Their experience with sustainability-related factors in project management, including references to ISO standards or relevant legal documents issued in Vietnam.
- Recommendations on necessary measures to ensure sustainability in the management of construction projects.

The selection of experts for the interview stage was based on their professional specialization, years of experience, and, most importantly, their direct involvement in project execution or their role as representatives of investors managing and implementing construction projects. This ensured that the perspectives obtained were both practical and representative of the realities of construction project management in Vietnam.

To determine the factors and assess the extent of their influence on the effectiveness of construction project management processes, the author employed Ordinary Least Squares (OLS) regression analysis. The regression model in this study is expressed as follows:

$$EPMP_i = \alpha + \beta_1 I_i + \beta_2 P_i + \beta_3 IP_i + \beta_4 C_i + \beta_5 CS_i + \varepsilon_i$$

In this study, the effectiveness of project management processes (EPMP) is treated as the dependent variable (Y) in the regression model. EPMP is operationalized through performance indicators reflecting project management effectiveness, measured by the average score of three dimensions: time, quality, and cost.



Firgue 3.1. Model of factors affecting PMP (stage 1)

The assessment of project management process effectiveness was conducted using a five-point Likert scale (ranging from 1 = the least influential to 5 = the most influential), based on respondents' perceptions of the extent to which project outcomes meet expected performance standards.

Independent Variables

The independent variables in the research model include:

- I: Initiating process group
- P: Planning process group
- IP: Implementing process group
- C: Controlling process group
- CS: Closing process group

3.2.2. Hypothesis of the research model of stage 1

ISO 21500 proposes that project management consists of five process groups: *initiating, planning, implementing, controlling,* and *closing.* Each group encompasses associated factors that, when sustainability-oriented, can influence the effectiveness of the entire project management lifecycle.

Previous studies have emphasized that both corporations and governments should embed sustainability into their long-term strategies to address today's most pressing global challenges. Project work and project management are essential vehicles through which sustainability objectives can be achieved (Marcelino-Sádaba et al., 2015). According to the Project Management Institute (PMI, 2018), sustainability—covering social, economic, and environmental dimensions—should be integrated into all areas of project management through knowledge, skills, tools, and techniques.

As discussed above, sustainability-oriented factors are embedded across the five process groups of project management and are expected to affect the overall effectiveness of the project management process (Chou & Yang, 2012). This structured framework is considered applicable to all types of projects across industries and organizations.

In this study, to construct appropriate hypotheses, the research builds upon prior factor exploration studies, drawing on the theoretical and applied foundations of PMBOK and ISO 21500. Specifically, the sustainable-oriented factors identified in Chapter 1 are mapped to the five process groups to evaluate how they influence project performance, effectiveness, and ultimately, project success—understood as the fulfillment of initial project objectives.

Before grouping factors into their corresponding process categories, the researcher conducted interviews with experts to determine the relationships between identified factors and the five process groups of PMBOK and ISO 21500. Through three rounds of interviewing, a comprehensive list of 40 sustainability-oriented factors was generated. Experts were asked to assign each factor to its relevant process group. The finalized mapping is presented in Table 3.8.

Initiating and Planning: Foundation of Sustainable Project Management

As noted in Chapter 1, there is limited literature explicitly linking the *initiating process group* to project management effectiveness. This research examines how sustainability-oriented factors related to initiating and planning influence project management effectiveness.

In this regard, activities such as early stakeholder engagement, joint meetings to clarify project goals and deliverables, and establishing shared definitions of success are considered essential. The project plan serves as the foundation that outlines how results will be achieved, how key stakeholders will be managed, and how risks, procedures, and performance indicators will be identified and monitored.

In a study on delay factors in Malaysian construction projects, Sambasivan and Soon (2007) highlighted that poor planning in the early stages of a project tends to persist throughout, resulting in delays at multiple points. Hence, effective execution is highly dependent on sound planning.

H1: Factors relating to the Initiating process affect project management effectiveness.

Table 3.1. Factors of Initiating group relate to effectiveness project management (EPM)

Factor code	Sustainability -oriented factor	Time (Schedule Performance)	Cost (Cost Performance)	Quality (Quality Performance)
I1	Proper human resource selection	Reduces early-stage delays caused by capability mismatch	Avoids costs related to rework and replacement	Improves initial quality planning and decision-making
I2	Active participation of stakeholders in the early stage	Minimizes late changes and schedule disruptions	Reduces costs arising from conflicts and objections	Enhances acceptance of quality requirements
I3	Positive awareness of stakeholders about project management	Improves coordination speed in early phases	Limits inefficiencies and transaction costs	Supports consistent quality expectations
I4	Having a clear connection between project objectives and benefits of stakeholders	Prevents scope ambiguity affecting schedule	Avoids unnecessary cost increases due to misaligned objectives	Ensures quality objectives reflect stakeholder benefits
I5	Long-term efficiency considered in early stages of construction projects	Reduces future schedule disruptions	Optimizes life-cycle costs rather than short-term savings	Enhances long-term quality and durability
I6	Active exchanging between stakeholders in the initial stage	Accelerates decision-making and approvals	Reduces coordination and communication costs	Improves shared understanding of quality standards

H2: Factors relating to the Planning process affect project management effectiveness.

Table 3.2. Factors of Planning group relate to effectiveness project management (EPM)

Factor code	Sustainability-oriented factor	Time (Schedule Performance)	Cost (Cost Performance)	Quality (Quality Performance)
P1	Clear and transparent procurement and bidding processes	Reduces delays caused by procurement disputes	Prevents hidden and transaction costs	Ensures procurement quality and compliance
P2	Effective procurement management plan	Improves coordination of procurement schedules	Controls procurement-related cost overruns	Ensures quality of procured materials and services
P3	Accurate estimating activity resources and durations to develop schedule	Enhances schedule accuracy and feasibility	Avoids cost overruns due to underestimation	Prevents quality degradation due to schedule pressure
P4	Paying attention to project requirements when creating WBS	Improves logical sequencing and task clarity	Reduces rework and unnecessary costs	Ensures quality requirements are embedded in tasks
P5	Clear definitions of project scope and constraints	Minimizes scope creep and schedule slippage	Prevents uncontrolled cost growth	Maintains consistency of quality objectives
P6	Long-term stability of the political system and legislation	Reduces schedule uncertainty caused by regulatory changes	Minimizes compliance-related cost risks	Ensures sustained quality standards
P7	Good communication between stakeholders to develop various project plans	Accelerates planning decisions and approvals	Reduces coordination and transaction costs	Aligns quality expectations across stakeholders
P8	Active implementing environmental assessments to develop project management plan	Prevents delays caused by environmental issues	Avoids mitigation and penalty costs	Enhances environmental and functional quality
P9	Clear project specifications to define project scope and activities	Improves schedule realism	Prevents cost escalation due to unclear specifications	Ensures technical quality compliance

Implementing: Executing Sustainability in Practice

The *implementing* process group encompasses sustainability-oriented actions that directly influence project management effectiveness. This phase includes the execution of project activities and delivery of project outputs. It also involves managing performance through preventive or corrective measures (Varajão, 2021).

Project success during implementation is typically measured in terms of timely delivery, budget compliance, and quality of outputs. A successful project not only fulfills contractual obligations but also creates future value for the organization. This value is shaped, in part, by how well the project is managed.

H3: Factors relating to the Implementing process affect project management effectiveness.

Table 3.3. Factors of Implementing group relate to effectiveness project management (EPM)

Factor code	Sustainability-oriented factor	Time (Schedule Performance)	Cost (Cost Performance)	Quality (Quality Performance)
IP1	Applying modern technologies and methods to the implementation stage	Improves execution efficiency and reduces delays	Optimizes resource utilization and reduces waste-related costs	Enhances construction accuracy and performance
IP2	Competent contractors and vendors	Minimizes schedule disruptions caused by poor performance	Prevents cost overruns due to errors and rework	Ensures workmanship quality
IP3	Effectively using project resources	Maintains stable execution pace	Reduces inefficiencies and unnecessary costs	Supports consistent quality outcomes
IP4	Thorough understanding of project team members about construction projects	Reduces misunderstandings and execution delays	Avoids cost increases caused by mistakes	Improves compliance with quality requirements
IP5	Active mitigating environmental impacts of construction projects to stakeholders	Prevents work stoppages due to environmental complaints	Avoids mitigation and penalty costs	Enhances environmental and social quality
IP6	Effective managing construction waste during the construction phase	Improves workflow efficiency on site	Reduces disposal and material costs	Supports clean and organized construction quality

Controlling: Monitoring with a Sustainability Lens

According to PMBOK (2017), *controlling* refers to monitoring, reviewing, and reporting project progress to meet the goals outlined in the project management plan. In sustainability-oriented projects, controlling processes help stakeholders understand the project's current state, identify performance gaps, and recommend corrective actions (PMI, 2016).

Kivilä et al. (2017) argue that achieving sustainable project management and value creation requires comprehensive project control mechanisms. This includes evaluating whether organizations currently apply integrated control tools to ensure sustainability and how such tools are implemented in practice.

H4: Factors relating to the Controlling process affect project management effectiveness.

Table 3.4. Factors of Controlling group relate to effectiveness project management (EPM)

Factor code	Sustainability-oriented factor	Time (Schedule Performance)	Cost (Cost Performance)	Quality (Quality Performance)
C1	Selecting proper methods to control construction projects	Enables timely detection of schedule deviations	Prevents uncontrolled cost escalation	Maintains quality compliance
C2	Periodic monitoring and controlling the project progress and reporting to stakeholders	Reduces delays through early corrective actions	Avoids cost overruns due to late interventions	Ensures transparency in quality performance
C3	Having enough project budget to pay for remaining tasks	Prevents schedule disruption due to cash flow shortages	Secures financial continuity	Avoids quality compromises caused by budget pressure
C4	Having competent project managers	Improves decision-making speed	Enhances cost control effectiveness	Ensures consistent quality management
C5	Using proper methods to monitor construction projects	Improves schedule tracking accuracy	Reduces inefficiencies and rework costs	Maintains construction quality standards
C6	Practicing project human resource management under a long-term view	Stabilizes workforce availability	Reduces turnover-related costs	Sustains skill-based quality performance
C7	Effective coordinating project stakeholders to solve problems	Accelerates issue resolution	Reduces costs related to disputes	Preserves agreed quality objectives

Closing: Formalizing Completion and Capturing Lessons

The *closing* phase involves formally documenting project results, archiving relevant information, and releasing resources for future initiatives. A project is not considered fully complete until all closing activities are finalized. Sustainability-oriented factors play a critical role in this process, as closure requires thorough follow-through on all objectives—a task prone to being overlooked or poorly executed if not carefully managed.

Effective project closure ensures proper documentation of procedures and outcomes, especially in cases where activities are prematurely terminated. When closure is conducted with attention to sustainability, it strengthens organizational learning and future project readiness (PMI, 2016).

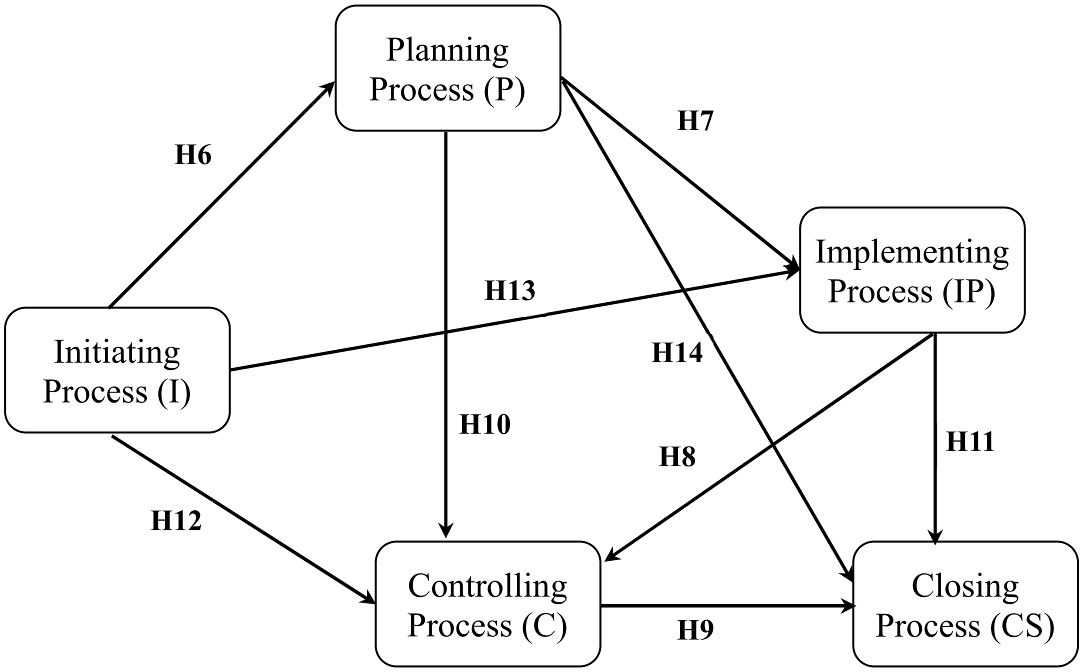
H5: Factors relating to the Closing process affect project management effectiveness

Table 3.5. Factors of Closing group relate to effectiveness project management (EPM)

Factor code	Sustainability-oriented factor	Time (Schedule Performance)	Cost (Cost Performance)	Quality (Quality Performance)
CS1	Careful considering long-term effects when troubleshooting issues	Prevents delays caused by repeated problem-solving	Avoids additional costs due to short-term fixes	Ensures durable and sustainable quality outcomes
CS2	Good coordination between stakeholders in the project closure	Accelerates handover and close-out procedures	Reduces administrative and coordination costs	Confirms quality acceptance among stakeholders
CS3	Long-term commitments of stakeholders to project objectives	Prevents delays in final approvals	Avoids post-project cost claims	Ensures quality aligns with long-term objectives
CS4	Acceptance of government agencies for the project completion	Prevents schedule delays in final certification	Avoids penalties and compliance-related costs	Confirms regulatory and technical quality compliance
CS5	Documenting lessons learned at the project closure	Improves schedule performance of future projects	Enhances long-term cost efficiency	Improves future quality management practices

3.2.3. Research model for stage 2

This section examines the interrelationships among the process groups to determine the extent to which they influence one another in contributing to the overall effectiveness of construction project management. By analyzing the mutual dependencies between the independent variables, the study aims to provide a more comprehensive understanding of how project management processes interact, thereby offering insights into both their direct and indirect effects on project performance.



Firgue 3.2. Model of interrelationships among the process groups (stage 2)

Each of the five independent variable groups (X) is treated as a latent construct, measured through multiple indicators based on validated items from prior studies and expert consultation. The detailed list of observed variables for each construct is presented in Table 3.1

3.2.4. Hypothesis of interrelationship between Project Management Processs.

To provide a more comprehensive evaluation of the project management process, this dissertation extends its scope by examining an interrelationship model between groups of factors associated with each phase of the project management lifecycle. The hypotheses are developed in accordance with the sequential structure outlined in internationally recognized frameworks such as *PMBOK* and *ISO 21500*, with several additional hypotheses introduced to assess whether there are distinctive characteristics or variations in the Vietnamese context. This extended empirical study utilizes the same survey dataset as the main research. The objective is to test, in greater depth, the practical applicability of the project management process and explore potential interdependencies or causal impacts among the factor groups representing different management phases. By doing so, the study seeks to verify how closely real-world practices in Vietnam align with international standards and to what extent localized factors influence the project management lifecycle.

The *Initiating process group* plays a foundational role in the success of construction projects as it defines the project's strategic purpose, scope, and stakeholder framework. According to the *PMBOK® Guide* (Project Management Institute, 2021), this process formalises the *project charter* and *business case*, which serve as guiding instruments for subsequent planning, executing, and controlling processes. A weak or ambiguous initiating process often leads to unclear objectives, insufficient stakeholder alignment, and inaccurate estimates, creating significant downstream challenges (Williams, 2017).

In the planning process, effective initiation establishes the basis for developing the Work Breakdown Structure (WBS), defining milestones, and estimating costs and risks. Empirical evidence from the construction sector demonstrates that robust *Front-End Loading (FEL)*—that is, detailed planning and feasibility assessment at the early stage—strongly correlates with higher project performance. Bakke and Johansen (2025) found that projects with high FEL maturity levels achieved improved cost predictability and resource utilization. Conversely, inadequate initiation can result in "lock-in" effects, where early commitments to flawed technical or financial decisions limit flexibility and lead to cost overruns and schedule delays (Cantarelli et al., 2010).

During the implementing process, the initiating group sets the governance structure, defines authority lines, and ensures the early engagement of stakeholders. Such early involvement strengthens communication and reduces conflicts during project delivery (Prebanic, Pavic and Stanic, 2023). In large-scale construction projects, where coordination among contractors, investors, and regulators is complex, early stakeholder alignment has been shown to enhance efficiency and trust (University of Massachusetts Boston, 2022).

Moreover, in the **controlling process**, the reliability of scope, schedule, and cost baselines—established during initiation—directly determines the quality of project monitoring and variance analysis. Flyvbjerg (2013) argues that the early definition of project goals and evaluation criteria is a key predictor of economic and operational success in capital-intensive projects. Therefore, a well-structured initiating process not only provides strategic direction but also ensures measurable parameters for control and continuous improvement throughout the project lifecycle.

In summary, the initiating process group creates a logical and economic foundation for effective planning, executing, and controlling processes. Its influence extends beyond procedural alignment, shaping the efficiency, adaptability, and sustainability of construction projects. Consequently, improving the quality of project initiation is essential for achieving both managerial effectiveness and economic resilience (Bakke and Johansen, 2025; Cantarelli et al., 2010; Flyvbjerg, 2013).

H6: Initiating has positive influence on Planning

H12: Initiating has positive influence on Controlling

H13: Initiating has positive influence on Implementing

The *Planning process* forms the analytical and procedural foundation for both the *Controlling* and *Closing* processes in project management. As outlined in the *PMBOK® Guide* (Project Management Institute, 2021), project planning defines baselines for scope, schedule, cost, quality, and risk, which later serve as reference points for monitoring and controlling project performance. Without a comprehensive planning framework, it becomes impossible to measure deviations, evaluate variances, or apply corrective actions effectively (Kerzner, 2019). Thus, planning establishes the logical and quantitative benchmarks upon which control mechanisms operate.

In the context of construction projects, where uncertainty and complexity are high, a well-structured planning process significantly enhances the accuracy of performance measurement. According to Ika, Diallo and Thuillier (2012), construction projects that employed detailed planning methods—such as *earned value management (EVM)* and *critical path analysis*—were able to achieve superior cost efficiency and schedule adherence. The existence of robust planning documents enables project managers to detect early warning signs of delays, cost overruns, or quality deviations, thereby improving decision-making in the controlling process (Williams, 2017). Furthermore, integrating risk management into planning provides contingency reserves that strengthen project resilience against disruptions, particularly in developing countries' construction sectors (Ofori, 2015).

From an economic perspective, the planning process has a multiplier effect on control efficiency. Precise estimation of resources and budgets during planning reduces rework, material wastage, and idle labor costs during execution and control. As noted by Flyvbjerg (2023), “poor planning is the single most consistent predictor of cost overruns in megaprojects.” This assertion underlines that effective control cannot compensate for planning deficiencies; instead, proactive planning minimizes the need for corrective interventions and safeguards financial sustainability throughout the project lifecycle.

Regarding the *Closing process*, the planning stage predefines the criteria for project completion, deliverable acceptance, and performance evaluation. As identified by Nicholas and Steyn (2020), well-articulated project management plans—including quality assurance and documentation systems—facilitate a smoother handover, post-project audits, and lessons-learned integration. When the planning process establishes clear success metrics and closeout requirements, the closing phase becomes a structured, knowledge-driven process rather than a reactive administrative task

H7: Planning has positive influence in Implementing

H10: Planning has positive influence on Controlling

H14: Planning has positive influence on Closing

The *Implementing process* (also referred to as the *Executing process*) represents the stage where project plans are transformed into tangible results through coordinated resource utilization, stakeholder collaboration, and task execution. According to the *PMBOK® Guide* (Project Management Institute, 2021), the effectiveness of implementation determines how accurately the project adheres to the predefined baselines established during the planning process. Therefore, the implementing process serves as the operational foundation that directly influences the accuracy, relevance, and responsiveness of subsequent controlling and closing processes.

During the controlling process, performance monitoring and variance analysis depend heavily on the quality of data generated throughout implementation. Inadequate execution—such as delayed reporting, poor documentation, or inefficient communication—can distort performance indicators, leading to ineffective control actions (Kerzner, 2019). In contrast, a disciplined implementing process that applies standardized tools—such as *Earned Value Management (EVM)*, *Building Information Modeling (BIM)*, and digital reporting platforms—enhances transparency and enables real-time decision-making (Zhao, 2017). Empirical research in the construction sector indicates that effective execution practices improve cost efficiency by up to 20% through better monitoring of on-site activities (Hwang, Zhao and Goh, 2014). Thus, implementation provides the empirical foundation upon which control measures can function objectively and economically.

Moreover, *human resource management* and *stakeholder coordination*—core elements of implementation—play decisive roles in enabling the controlling process. Well-trained project teams that communicate effectively help minimize rework, accelerate problem resolution, and provide accurate data for control evaluation (Jarkas, 2020). The implementing process also establishes the feedback loops necessary for adaptive control, allowing managers to identify deviations early and adjust resource allocations dynamically (Williams, 2017).

With regard to the closing process, the implementing process determines the completeness and quality of project deliverables, documentation, and contractual compliance—all prerequisites for formal closure. According to Nicholas and Steyn (2020), successful project closure requires not only the completion of technical work but also evidence of compliance with scope, schedule, and cost objectives, all of which are achieved through systematic implementation. Furthermore, effective implementation ensures the creation of accurate records and lessons-learned reports, facilitating knowledge transfer and organizational learning during closure (Ofori, 2015).

In economic terms, a well-managed implementing process minimizes resource waste, optimizes labor productivity, and reduces corrective costs during control and closeout. As Flyvbjerg (2023) emphasizes, implementation is the "economic engine" of project management, translating plans into measurable financial and operational outcomes. Thus, the quality of implementation is both a predictor and a driver of success in controlling and closing processes, making it an essential determinant of project sustainability and economic value.

H8: Implementing has positive on Controlling

H11: Implementing has positive influence on Closing.

The control process within project management is deemed pivotal and independent, as it not only oversees the entire course of the project but also regulates individual groups of processes. Moreover, a study on the integration of the Iso 21500 project management model suggests that the control process interacts with initiating, planning, and implementing stages. In this context, the theory of "gate control between process group" is frequently employed, with a "gate" signifying a decision point at the conclusion of each stage. These decision points serve to evaluate whether the project can progress to the subsequent stage or group of processes (Takagi & Varajao, 2022). Building upon these insights, the following relevant theory are proposed:

H9: Controlling has positive influence on Closing

3.2.5. Operationalization of Key Variables and Hypotheses Framework

Based on the theoretical framework, sustainability-oriented factors are operationalized as latent variables corresponding to each process group. Each construct contains multiple indicators derived from ISO 21502, PMBOK 7, and prior empirical studies (Banihashemi et al., 2017; Stanitsas et al., 2021; Misnan et al., 2024).

Construct	Conceptual Definition	Example Indicators	Source
Initiating (I)	Embedding sustainability during initiation, emphasizing stakeholder engagement and goal alignment.	Stakeholder participation, sustainability objectives in project charter, feasibility assessment	Orlander (2007); Marcelino-Sádaba et al. (2015) Opoku et al., 2024
Planning (P)	Integration of sustainability considerations in planning, design, procurement, and risk management.	Sustainable procurement plan, environmental risk assessment, resource allocation efficiency	Shen et al. (2007); Banihashemi (2017) Opoku et al., 2024
Implementing (IP)	Operationalization of sustainability during execution, including ethical practices and efficient resource use.	Green technology adoption, labor safety management, waste reduction measures	Zhong et al. (2018); Ferreira et al. (2024) Opoku et al., 2024
Controlling (C)	Monitoring and corrective mechanisms ensuring sustainability KPIs are achieved.	Compliance audits, performance tracking, safety monitoring	Yong & Mustaffa (2013); Stanitsas et al. (2021) Opoku et al., 2024
Closing (CS)	Sustainable closure, knowledge transfer, and long-term impact evaluation.	Lessons learned documentation, post-project acceptance, lifecycle feedback	Wen & Qiang (2019); Dinsmore & Cabanis-Brewin (2018) Opoku et al., 2024
Project Management Effectiveness (PME)	Overall success of project management in time, cost, quality, and sustainability outcomes.	Timeliness, cost control, stakeholder satisfaction, sustainability achievement	Yong & Mustaffa (2013); Takagi & Varajão (2022)

Each construct was measured using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Exploratory and confirmatory analyses ensured internal consistency, convergent validity, and discriminant validity.

Linkage Between Hypotheses and Theoretical Foundations

The study formulates a series of hypotheses reflecting both direct and inter-process relationships among process groups and their effects on PME. Each hypothesis is theoretically grounded in sustainability-oriented project management literature, consistent with the 3Ps model.

Table 3.6. Hypothesis proposal

Hypothesis	Theoretical Basis	Expected Relationship
H1-H5	Systems theory & sustainability integration (Silvius & Schipper, 2014; Stanitsas et al., 2021)	Positive direct effect
H6-H14	Process interdependence and lifecycle learning (Takagi & Varajão, 2022; Økland, 2015)	Positive indirect or mediated effects
H15	3Ps value creation model (UN SDG Framework; PMBOK 7, 2021)	Mediated relationship

These hypotheses collectively test whether higher levels of sustainability integration across process groups enhance the overall effectiveness of construction project management, both directly and through inter-process linkages.

3.3. Questionnaire Design

The questionnaire is one of the most widely used instruments for data collection in empirical research, serving as a medium between the researcher and the respondents (Murray, 1999; Rajiv Grover, 2006). It is often considered a time- and effort-intensive task, with significant influence on both the response rate and the quality of information collected (Murray, 1999).

The structure of the questionnaire in this study consists of two main parts:

- Part I: This section comprises demographic questions capturing respondent characteristics, such as their role in a project, years of professional experience, knowledge of sustainability in construction, type of project, scale of project, and sources of project funding they have previously been involved in. The results from this section are primarily intended for descriptive statistical analysis in the dissertation (Rajiv Grover, 2006).

- Part II: This section includes questions related to the factors influencing sustainability-oriented project management processes. The questions were developed on the basis of a synthesis of prior literature, expert discussions, and in-depth interviews, and were subsequently refined for suitability. A five-point Likert scale was employed for the survey, which is a widely adopted method for measuring levels of agreement. In this study, the scale was adapted as follows: (1) no influence, (2) low influence, (3) moderate influence, (4) high influence, and (5) very high influence.

The research was conducted in three stages:

Stage 1: The researcher applied the expert consultation method, drawing on expert opinions and pilot testing in order to refine the measurement scales and finalize the questionnaire design.

Stage 2: The reliability of the measurement scales was examined using Cronbach's Alpha, followed by exploratory factor analysis (EFA).

Stage 3: The researcher carried out (i) regression model testing using Ordinary Least Squares (OLS), and (ii) structural model testing using Partial Least Squares - Structural Equation Modeling (PLS-SEM) to evaluate the interrelationships among the groups of influencing factors.

3.4. Data collection

The factors selected for this study were derived from a synthesis of previous research. Although numerous additional factors have been identified in the literature, the author narrowed the scope in accordance with the specific context of this research, the scale of the projects under investigation, and the characteristics of the construction industry in Vietnam. Furthermore, the selection also took into account the internal management capacities of organizations currently implementing construction investment projects.

a. The data collection process in this study was conducted in two stages:

Stage 1 - Secondary Data for Contextual Overview:

To evaluate the research context and practical background, secondary data were collected from sources such as the General Statistics Office of Vietnam (GSO), the Ministry of Construction, the Ministry of Planning and Investment, and other relevant governmental agencies. Additionally, prior academic studies, scientific publications, and reports summarizing the implementation, progress, and effectiveness of construction projects were reviewed to support contextual analysis.

Stage 2 - Qualitative Research:

Objectives and Content of the Qualitative Study

On the basis of reviewing and synthesizing prior research as well as relevant theoretical models, the author developed a preliminary questionnaire that incorporated measurement scales of factors influencing the effectiveness of construction project management processes. In order to ensure that these measurement scales captured the full range of influential factors, the researcher conducted in-depth interviews with nine experts, all of whom were senior leaders directly responsible for managing construction investment projects. The main purpose of this stage was to refine, validate, and eliminate factors deemed inappropriate.

The qualitative interviews were designed to address the following key aspects: (i) Evaluation of the comprehensiveness of the measurement scales for factors affecting the effectiveness of construction project management processes.

(ii) Assessment of the suitability of the proposed model in relation to the current conditions and characteristics of construction projects in practice.

(iii) Revision and refinement of wording and measurement items in the preliminary questionnaire.

Beyond these core objectives, the qualitative phase was also intended to provide a deeper understanding of the current state of project management and management processes in construction investment projects. Accordingly, the interview protocol included additional questions concerning project outcomes, existing limitations, and the underlying causes of challenges in project management processes. More specifically, the experts were asked to reflect on:

- Their perceptions of sustainability within project management, and the extent to which sustainability factors influence managerial practices.
- The degree to which sustainability requirements are consistently addressed within project management processes.
- Their experience with sustainability-related factors in project management, including references to ISO standards or relevant legal documents issued in Vietnam.
- Recommendations on necessary measures to ensure sustainability in the management of construction projects.

The selection of experts for the interview stage was based on their professional specialization, years of experience, and, most importantly, their direct involvement in project execution or their role as representatives of investors managing and implementing construction projects. This ensured that the perspectives obtained were both practical and representative of the realities of construction project management in Vietnam.

The qualitative phase consisted of two rounds of expert interviews with a sample size of 9 participants. These included experienced professionals and project management experts. The interviews were conducted primarily directly.

- Round 1 aimed to confirm the practical relevance and importance of the proposed constructs and hypotheses.
- Round 2 involved more interactive and in-depth discussions with both experts and firms to refine the measurement scales and finalize the questionnaire. This phase emphasized clarification, cultural relevance, and logical structure tailored to the Vietnamese context. The interaction in this round was more two-way and dialogical, in contrast to the more listening-focused nature of the first round.

The experts participating in the interviews unanimously emphasized that raising awareness and improving management practices in construction investment projects plays a critical role in fostering national economic development as well as ensuring sustainable growth for the country. They highlighted that numerous factors influence project management practices and the effectiveness of project management processes during the implementation of investment projects. Through consultation and consensus, the experts agreed to classify these influencing factors into five groups corresponding to the stages of the project management process: initiating, planning, implementing, controlling, and closing.

However, the experts also noted that the measurement scales require refinement in order to better reflect the specific characteristics of the construction industry and to align with sustainability-oriented project management. Their comments and recommendations on revisions related to the measurement scales, content presentation, and wording are summarized as follows:

(i) Initiating process: The experts agreed to eliminate the item *"Recruiting capable individuals to work for the project management board (PMB)"* because project stakeholders often underestimate the crucial role of human resource management in construction projects.

(ii) Controlling process: The experts also recommended removing the item *"Applying EVM in the controlling process"*, since *"many project personnel are not familiar with Earned Value Management (EVM)"*.

(iii) Planning process: The experts emphasized the importance of clarifying the necessity of project preparation and project management preparation. In particular, they highlighted the need to explicitly account for political and legal factors that significantly influence project outcomes.

(iv) Other groups: For the remaining process groups, the experts generally agreed with the existing measurement scales and their ability to evaluate the impacts of these factors on the dependent variables.

(v) Additional suggestions: The experts further proposed incorporating open-ended questions to evaluate and reflect upon the current state of project management practices in construction investment projects. These questions should also allow respondents to propose ways to enhance management activities, improve process control, and strengthen schedule and workload management in future projects.

Based on both the synthesis of previous studies and the results of expert interviews, the variables and measurement scales adopted in this dissertation are presented in *Table 3.7.*

Table 3.7. Sustainable-oriented factors of the project management process

PMP	Coding	Attributes of project management process	References
Initiating	I1	Proper human resource selection	Marcelino-Sádaba et al. (2015), Guinan (2024), Ma (2011) (Opoku et al., 2024b)
	I2	Active participation of stakeholders in the early stage	
	I3	Positive awareness of stakeholders about project management	
	I4	Having a clear connection between project objectives and benefits of stakeholders	
	I5	Long-term efficiency considered in early stages of construction projects	
	I6	Active exchanging between stakeholders in the initial stage	
Planning	P1	- Clear and transparent procurement and bidding processes	Misnan et al. (2024), Shen et al. (2007), Zhong et al. (2018), Banihashemi (2017). (Opoku et al., 2024b)
	P2	- Effective procurement management plan	
	P3	- Accurate estimating activity resources and durations to develop schedule	
	P4	- Paying attention to project requirements when creating work breakdown structure (WBS)	
	P5	- Clear definitions of project scope and constraints	
	P6	- Long-term stability of the political system and legislation	

PMP	Coding	Attributes of project management process	References
	P7 P8 P9	- Good communication between stakeholders to develop various project plans - Active implementing environmental assessments to develop project management plan - Clear project specifications to define project scope and activities	
Implementing	IP1 IP2 IP3 IP4 IP5 IP6	- 1	Shen et al. (2007), Banihashemi (2017), Ferreira et al. (2024) (Opoku et al., 2024b)
Controlling	C1 C2 C3 C4 C5 C6 C7	- Selecting proper methods to control construction projects. - Periodic monitoring and controlling the project progress and reporting to stakeholders - Having enough project budget to pay for remaining tasks - Having competent project managers - Using proper methods to monitor construction projects - Practicing project human resource management under a long-term view. - Effective coordinating project stakeholders to solve problems	Zhong et al. (2018), Yong & Mustaffa (2013), Banihashemi (2017) (Opoku et al., 2024b)
Closing	CS1 CS2 CS3 CS4 CS5	- Careful considering long-term effects when troubleshooting issues - Good coordination between stakeholders in the project closure - Long-term commitments of stakeholders to project objectives - Acceptance of government agencies for the project completion - Documenting lessons learned at the project closure	Dinsmore & Cabanis-Brewin (2018), Mavi & Standing (2018), Cerne & Jansson (2019), Stanitsas et al. (2021), Moolngearn & Kraiwanit (2024) (Opoku et al., 2024b)

Source: Author's research

(a) Initiating Group

The selection of human resources (I1) plays a pivotal role in fostering sustainability by ensuring that skilled labor is equipped with the knowledge to implement sustainable practices. From an economic perspective, this reduces inefficiencies and potential rework, leading to cost savings (Shen et al., 2007). Socially, it promotes employment opportunities and supports workforce development. Environmentally, skilled workers are better positioned to adopt green technologies and minimize resource consumption (Banihashemi, 2017). Additionally, the active participation of stakeholders in the early stages (I2) ensures that the social needs of the community are addressed, while the connection between project objectives and stakeholder benefits (I4) ensures alignment between project goals and the long-term interests of the stakeholders, fostering economic stability and social value (Gareis et al., 2013). Long-term considerations in the efficiency of construction (I5) are integral in reducing both operational costs and the environmental footprint, promoting energy-efficient designs and resource conservation (Marcelino-Sádaba et al., 2015).

(b) Planning Group

Project planning plays a pivotal role in determining the effectiveness of project implementation. The measurement variables within the Planning group, as highlighted in prior studies, include: The procurement and bidding processes (P1) are vital for ensuring that sustainable materials are sourced and costs are managed effectively. This aligns with economic sustainability by ensuring cost-effective procurement while supporting fair trade and local sourcing practices, contributing to social equity (Misnan et al., 2024). Furthermore, incorporating environmental assessments (P8) during planning helps identify potential environmental impacts early, ensuring that construction processes minimize waste and energy consumption, thus contributing to the environmental goals of sustainability (Zhong et al., 2018). Transparent stakeholder communication (P7) ensures that social interests are considered, promoting inclusivity and equitable decision-making, which positively affects the social fabric of the local community.

(c) Implementing Group

The measurement variables within the Implementing group, as referenced in the literature, include: During the implementation stage (IP1), the adoption of modern technologies and methods enables more efficient resource utilization and waste management, which reduces both costs and environmental impacts (Bocchini et al., 2014). Contractors and vendors who are experienced in sustainable practices ensure that both economic and environmental goals are met through the use of eco-friendly materials and efficient construction methods (Shen et al., 2007). Furthermore, ensuring that the project team has a thorough understanding of sustainable practices (IP4) ensures that project implementation is consistent with sustainability principles, aligning the economic goals with socially responsible and environmentally conscious outcomes (Ferreira et al., 2024).

(d) Controlling Group

In the controlling phase, the identified factors influence not only the effectiveness of project management processes but also have potential impacts on earlier and subsequent stages of the project. The measurement variables in this group include: In the controlling phase (C4), the competency of project managers and the ability to monitor project progress effectively are crucial for managing resources efficiently and mitigating potential negative impacts on the environment (Yong & Mustaffa, 2013). Regular monitoring ensures that environmental guidelines are adhered to, reducing waste and emissions. Furthermore, human resource management (C6) from a long-term perspective ensures that the project team remains committed to sustainability goals, while fostering an environment of continuous improvement (Banihashemi, 2017).

(e) Closing Group

The closing stage requires careful consideration, as it marks both the conclusion of the project and the finalization of outstanding tasks. The measurement variables for this group include: effective coordination between stakeholders ensures that the final project outcomes align with both social and environmental sustainability goals. Stakeholder commitment to long-term objectives ensures that the project has a lasting positive impact on the community and the environment (Stanitsas et al., 2021). By documenting lessons learned (CS5), future projects can benefit from the sustainability practices that were successfully implemented, facilitating a continual improvement loop in the industry.

b. Sample Design and Sampling Method

This study adopts a quantitative sampling strategy for the purpose of conducting empirical data analysis. Specifically, regression analysis, Exploratory Factor Analysis (EFA), and Partial Least Squares Structural Equation Modeling (PLS-SEM) are employed to test the proposed hypotheses and evaluate the research model.

In quantitative research, sample size plays a crucial role in parameter estimation and the interpretation of SEM results (Hair et al., 2014). However, there is no universally agreed-upon number that defines an “adequate” sample size (Raykov & Marcoulides, 2000). Scholars have long debated the question of how large a sample should be, and a precise answer remains elusive (Jackson, 2003).

For EFA, the recommended minimum sample size is 50, while a sample of 100 or more is considered preferable. The commonly accepted subject-to-variable ratio ranges from 5:1 to 10:1, although some researchers advocate for a more conservative ratio of 20:1. In this context, the term "observations" refers to the number of valid survey responses, and "measured variables" refers to individual items or indicators in the questionnaire (Hair Jr., 1998; Yeh & Huang, 2009).

Kline (2005) suggests that a sample size under 100 can still yield meaningful results in SEM, a view shared by Hoyle (1995), who proposes a typical sample size between 100 and 200 for structural modeling

In this study, the sample size was determined as follows:

N = k $\sum_{j=1}^{m} Pj$

Where:

k=10 (the minimum multiplier for observed variables),

P j = number of observed variables in the $j\ t\ h$ j th measurement scale,

m = total number of measurement scales (from 1 to m m).

The research model includes five measurement scales with a total of 33 observed variables. By selecting k=10, the minimum required sample size is:

m = 5(33) = 165 (minimum). This study collected 214 valid observations, which exceeds the minimum threshold required for reliable analysis.

Due to the lack of publicly available, enterprise-level survey datasets specific to small- and medium-sized construction firms in Hanoi and the northern provinces of Vietnam, this study employs a non-probability, convenience sampling technique. Under this approach, research participants are intentionally selected based on their relevance and accessibility, rather than through randomization. The survey subjects of this study are directors, managers and employees working in departments/offices and specialized units in the construction sector in Hanoi city.

The decision to conduct the survey in Hanoi is grounded in the following considerations:

To ensure the generalizability and reliability of the research findings on factors sustainability - oriented affect to project management process in Vietnam, the sample selection must be rigorously scientifically grounded. Statistical data over the past decade indicate a primary concentration of construction projects in Vietnam's northern region, encompassing both civil and infrastructure developments. Notably, the 2024-2025 period is projected to witness a significant surge in the implementation of social housing, affordable housing programs, and initiatives aimed at eliminating temporary or substandard housing across the North, signaling robust and coordinated investment within the construction sector (Thanglong.Chinhphu.vn, 2025)

Within this context, Hanoi, as Vietnam's capital and one of the country's most dynamic construction hubs, presents a high number of ongoing and newly initiated construction projects, reflecting rapid growth. Among Vietnam’s five centrally governed cities (Hanoi, Ho Chi Minh City, Da Nang, Hai Phong, and Can Tho), Hanoi consistently ranks among the top in terms of construction density, urbanization rate, and population growth, which translates into a strong demand for high-rise buildings and residential apartments. Therefore, conducting a survey in Hanoi is highly appropriate for this study, as it effectively typifies the construction dynamics and practical realities prevalent in northern Vietnam

Scale and Sustained Economic Contribution

The selection of construction enterprises in Hanoi as the research sample is scientifically robust, ensuring high representativeness of the broader Vietnamese construction industry. This is substantiated by consistent statistical data from 2021 to 2023 across several key dimensions:

Hanoi, as a pivotal economic and political center in Northern Vietnam, consistently maintains a substantial construction sector that significantly contributes to both its Gross Regional Domestic Product (GRDP) and, indirectly, the national GDP.

- GRDP and Growth: Hanoi's GRDP demonstrated strong growth over the period, with increases of 2.92% in 2021, 8.89% in 2022, and 6.27% in 2023 (Hanoi Statistics Department, 2023), often exceeding or matching the national average. The construction sector consistently contributed significantly to Hanoi's economic structure, maintaining an estimated share of approximately 8.5% - 8.8% of the city's GRDP during 2021-2023 (Hanoi Statistics Department).
- Number of Enterprises: The number of construction enterprises in Hanoi steadily increased, from approximately 14,500 in 2021, to 15,200 in 2022, reaching 16,500 in 2023. This figure consistently represented about 12.6% - 13.2% of the total construction enterprises nationwide (GSO), solidifying its position as a major construction hub.

Diversity in Business Structure and Project Types

As a major urban center, Hanoi attracts a diverse range of enterprise types and construction projects, comprehensively reflecting the national construction industry's structure.

Throughout 2021-2023, Small and Medium-sized Enterprises (SMEs) consistently dominated Hanoi's construction sector, estimated at 97-98% of all construction enterprises, a proportion consistent with the national average (GSO, VCCI). This ensures the sample's representativeness across various enterprise scales.

Hanoi has been a focal point for diverse projects, including high-rise residential buildings, urban development areas, commercial and service structures, and critical infrastructure projects such as the Ring Road 4 and ongoing urban railway lines (Hanoi City People's Committee). This breadth of project experience mirrors the overall Vietnamese construction landscape.

Hanoi consistently ranked among the top destinations for FDI. Over 2021-2023, registered FDI into Hanoi reached $1.6 billion (2021), $2.2 billion (2022), and $3.17 billion (2023) (Foreign Investment Agency), with real estate and construction sectors consistently attracting a significant share, enriching the industry's characteristics.

Pioneering Legal and Policy Environment

Given its status as the national capital, Hanoi often serves as the initial testing ground for new policies and regulations concerning urban management, planning, investment, and construction.

The period 2021-2023 saw significant legal developments, including amendments to the Land Law, Housing Law, and Real Estate Business Law. Hanoi actively engaged in the detailed discussions and preparation of guiding decrees, serving as a model for other localities. Experiences with policy implementation in Hanoi are thus highly indicative of broader national trends and challenges facing the construction industry.

Market Dynamics and Common Industry Challenges

The market dynamics and challenges faced by construction enterprises in Hanoi are broadly representative of those encountered across the entire Vietnamese construction industry.

- **Market Fluctuations:** From 2021-2023, Hanoi's construction market experienced significant fluctuations in material costs (influenced by global supply chains and inflation), labor costs, and capital access challenges (due to tightened credit policies). Demands for quality and timely project completion also intensified (Ministry of construction, State bank, 2021-2023). These issues are universally experienced by construction firms across Vietnam.

- The market dynamics and challenges observed in Hanoi's construction sector over the past three years accurately mirror those of the wider Vietnamese construction industry, ensuring the research findings possess broad applicability.

Based on the detailed arguments and consistent statistical evidence from 2021-2023, the selection of construction enterprises in Hanoi as the research sample is scientifically well-founded for achieving high representativeness of the entire Vietnamese construction industry. Hanoi's substantial economic contribution, diverse enterprise structure and project types, pioneering legal environment, and exposure to common market dynamics and challenges provide a comprehensive and in-depth reflection of the industry

c. Data Collection Procedure

In this phase, a structured questionnaire was distributed using both in-person. The target sample size was determined based on the principle that the number of responses should be 4 to 5 times greater than the number of items in the questionnaire. The questionnaire included:

- Demographic questions, and
- Items related to the research topic on sustainability-oriented project management processes.

A list of potential respondents was obtained from the Ministry of Construction and reputable project owners. A total of 640 questionnaires were distributed. 230 responses were returned, and 216 valid responses were used for analysis. Reliability and validity were assessed using Cronbach's Alpha and Exploratory Factor Analysis (EFA). Model fit was tested using Ordinary Least Squares (OLS) and Partial Least Squares Structural Equation Modeling (PLS-SEM).

3.5. Data analysis

To test the measurement models, evaluate the practical applicability of the proposed framework, and analyze the impact of influencing factors on the effectiveness of construction project management processes, this dissertation employs factor analysis, which is conducted through the following steps:

Step 1. Descriptive Statistical Analysis

Descriptive statistics are used to characterize the dataset and the research sample by analyzing frequencies and percentages, as well as by presenting the overall status of project management performance in construction investment projects (CIPs) within enterprises. Descriptive statistics are also applied to calculate the mean values and standard deviations of each measurement scale in the research model. These results serve as complementary evidence to support subsequent analytical methods.

Step 2. Factor Analysis

a. Reliability Testing using Cronbach's Alpha

Cronbach's Alpha is employed to assess the internal consistency of the observed variables within each measurement scale, thereby reflecting the degree of homogeneity and coherence of responses. Although the measurement scales were developed based on prior research, it remains necessary to conduct reliability testing in the specific context of this study to ensure the quality and accuracy of the measurement.

Cronbach's Alpha coefficient is used as the primary indicator of scale reliability. According to Hair et al. (2014), a unidimensional and reliable measurement scale should achieve a Cronbach's Alpha value of at least 0.70. A higher value of Cronbach's Alpha indicates stronger reliability of the scale.

Another important indicator is the Corrected Item-Total Correlation, which measures the correlation between each observed variable and the remaining variables within the same scale. The stronger the correlation, the higher the value of the Corrected Item-Total Correlation, and the better the quality of the observed variable. Cristobal et al. (2007) suggest that a measurement scale is considered satisfactory if all observed variables have Corrected Item-Total Correlation values of 0.30 or above. Consequently, any observed variable with a value below 0.30 should be considered for elimination.

Furthermore, if the value of "Cronbach's Alpha if Item Deleted" for a particular indicator is greater than the overall Cronbach's Alpha of the scale, that indicator should also be considered for removal in order to enhance the reliability of the measurement scale.

b. Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) is a statistical technique used to reduce a set of correlated indicators into a smaller number of latent factors that are more meaningful while still retaining most of the original information. EFA is also essential for evaluating the convergent validity of indicators when measuring latent constructs and the discriminant validity between indicators belonging to different constructs.

Following the reliability testing of the measurement scales, EFA was conducted. In this dissertation, the extraction method applied was Principal Component Analysis (PCA) with Promax rotation.

The set of influencing factors on the effectiveness of construction project management processes consisted of 33 observed indicators, all of which satisfied the reliability requirements of the measurement scales in the research model.

According to Hair et al. (2014), once the scales demonstrate reliability, the observed variables may be included in EFA provided that the following conditions are met:

- The Kaiser-Meyer-Olkin (KMO) coefficient ≥ 0.50, with the significance level of Bartlett's Test ≤ 0.05.
- Factor loadings ≥ 0.50.
- The measurement scale is acceptable when the total variance explained ≥ 50% and the Eigenvalue > 1.

The difference in factor loadings of an observed variable across different factors must be greater than 0.30 to ensure discriminant validity

c. PLS - SEM

Structural equation modeling (SEM) is particularly well suited to research on sustainability-oriented project management, where theoretical frameworks typically involve multiple interrelated dimensions and latent constructs. In sustainability and project management studies, key concepts—such as economic, social, and environmental sustainability; governance quality; stakeholder coordination; and project performance—are inherently abstract and cannot be directly observed. SEM enables these latent constructs to be rigorously operationalized through observed indicators, while simultaneously modeling the complex relationships among them. By estimating both the measurement model and the structural model within a unified framework, SEM allows for comprehensive testing of sustainability-oriented project management theories and significantly reduces measurement errors compared to traditional regression techniques (Hair et al., 2019).

SEM has become a widely accepted and robust analytical approach in empirical research on project management and sustainable development. Since its introduction in the early 1980s, SEM has been extensively applied to validate theoretical models that seek to explain how managerial processes, governance mechanisms, and sustainability factors jointly influence project outcomes. Its proven ability to capture multidimensional interactions across different stages of the project life cycle makes SEM particularly appropriate for analyzing sustainability integration in construction project management, thereby reinforcing its methodological relevance and scientific rigor in this research context (Zeng et al., 2021).

CHAPTER 4. EMPIRICAL RESULT AND DISCUSSION

4.1. Project Management and Sustainable Construction in Vietnam

4.1.1. Research Context: The Construction Sector and Sustainable Development in Vietnam

Hanoi is the central hub of the Red River Delta region and holds a position of strategic importance in Vietnam's political, economic, cultural, social, defense, security, and diplomatic spheres. With a population of approximately 10 million as of 2023, Hanoi is also home to the country's leading research institutes, universities, and hospitals. It is Vietnam's largest cultural center and plays a key role in driving regional economic growth, with a Gross Regional Domestic Product (GRDP) exceeding VND 1,000 trillion, accounting for 43% of the Red River Delta's GRDP and 16.2% of the national GDP (Trần Sỹ Thanh, 2023).

Hanoi functions as a growth engine and a regional nucleus with strong spillover effects across the Northern provinces. It also benefits from a geographically advantageous position as a commercial and logistical gateway, linking the capital to other provinces, cities, and international markets. As a special urban area and the political and administrative center of the country, Hanoi gathers historical, cultural, and architectural values. It possesses notable strengths in attracting high-quality human resources and investment capital. As such, urban economic development in Hanoi plays a vital role—not only for the city itself but also for the sustainable development trajectory of the entire nation.

In recent years, the Government of Vietnam has prioritized investment in nationally significant construction projects, recognizing the sector as a key driver of socio-economic growth, infrastructure modernization, and improved living standards. According to the *Vietnam Construction Industry Report 2024-2028*, the construction industry is projected to reach a total value of VND 695.6 trillion in 2024, marking an increase of 9.8 percent compared to the previous year, and is expected to maintain an average annual growth rate of 8.4 percent during the period 2024-2028 (Research And Markets, 2024). This indicates the sector's substantial potential and continued role in national development.

In 2025, the Ministry of Construction has directed the acceleration of several strategic infrastructure and housing projects, including the North-South Expressway, metro systems in Hanoi and Ho Chi Minh City, and particularly, the National Social Housing Program. As reported by *VnEconomy* (2025), as of early 2025, approximately 43,681 out of 100,275 planned social housing units (equivalent to 43.6 percent) had been completed, and an additional 39,245 units are expected to be delivered by the end of the year—raising the overall completion rate to nearly 83 percent.

The construction industry also represents a major contributor to Vietnam's GDP. Data from the *General Statistics Office* (as cited in Vietcap, 2024) show that construction has accounted for 6-7 percent of the national GDP annually over the past decade. In 2023 alone, the sector contributed approximately VND 641 trillion to nominal GDP, reflecting a growth of around 8 percent year-on-year. These figures underscore the sector's strategic importance as one of the pillars of the national economy.

However, alongside rapid expansion, there is a growing recognition that sustainability must become an integral dimension of Vietnam's construction development agenda. To ensure long-term value creation, the sector must align with environmental and social sustainability criteria, including energy efficiency, resource optimization, adoption of green technologies such as Building Information Modeling (BIM), sustainable supply-chain management, and compliance with international environmental and safety standards throughout all stages of project life cycles. Thus, the recent surge in national construction projects not only reflects the government's determination to modernize infrastructure but also highlights Vietnam's commitment to sustainable, technology-driven, and inclusive development in the global context.

Between 2010 and 2020, there was a significant increase in the number of enterprises in general, with construction firms rising by approximately 8.2%. The growth in firm quantity was seen across nearly all economic sectors, except for the state-owned sector, due to ongoing privatization and equitization reforms. During this period, micro, small, and medium-sized enterprises (MSMEs) dominated the construction sector, accounting for about 98% of all construction firms nationwide (GSO, General Statistics Office of Vietnam).

Table 4.1: Regional Gross Product Structure in Hanoi, 2021-2022 (Current Prices)

Unit: %

	Year 2021	Year 2022
TOTAL	**100,00**	**100,00**
1. Agriculture, forestry and fisheries	2,27	2,08
2. Industry and construction	24,31	24,04
- Industry	*16,40*	*15,95*
- Construction	***7,91***	***8,09***
3. Service	62,46	63,22
4. Product taxes minus product subsidies	10,96	10,66

Source: GSO

Number of Operating Construction Enterprises (as of December 31 annually)

Table 4.2. Number of businesses operating in the construction sector

	2015	2016	2017	2018	2019	2020
Construction of all kinds of houses	30.292	30.569	35.358	39.827	44.056	40.290
Construction of civil engineering works	17.728	19.087	20.716	21.828	25.186	27.774
Specialized construction activities	13.244	15.650	17.627	18.829	22.163	26.115
Total	61.264	65.306	73.701	80.484	91.405	94.179

Source: GSO

Construction Enterprises and the Shift Toward Sustainability in Vietnam

It can be observed that the number of active construction enterprises in Vietnam remains consistently high year after year, with a majority focusing on residential building projects (civil construction). Overall, the number of firms has steadily increased, and most Vietnamese construction companies today maintain a dedicated project management board responsible for ensuring proper project execution. This institutional structure underscores the relevance of researching and developing a sustainability-oriented factor model for project management, providing firms with a more scientific and practical framework for improving their operations.

Currently, there are no comprehensive statistics on how many construction enterprises in Vietnam are actively pursuing sustainable development goals (SDGs). However, according to the Ministry of Planning and Investment, Vietnam achieved a score of 73.3 on the 2023 Sustainable Development Goals Index, ranking 56th out of 166 countries—a sign of national progress toward sustainability commitments.

Vietnam’s construction sector is undergoing a notable transition toward sustainable building practices, largely driven by rising energy costs and increased environmental awareness. At present, there are 381 green building projects underway across the country, with this number projected to reach 582 by 2030, reflecting a strong commitment to sustainable development.

This transformation is supported by proactive initiatives from the Ministry of Construction, including the issuance of comprehensive guidelines for green building certification, which encourage investors to adopt environmentally responsible practices and advanced sustainable technologies.

In addition to regulatory support, the push for sustainable construction is bolstered by economic considerations. Building owners and operators are increasingly seeking to reduce operational costs through energy-efficient design and systems. Government support extends beyond legal frameworks and includes practical incentives for energy-saving buildings and environmentally conscious construction activities.

This commitment is evident in the growing number of developers incorporating sustainable features into their projects, such as:

- Proper insulation,
- Energy-efficient appliances,
- Smart building systems.

These practices are establishing a new benchmark for construction in Vietnam, striking a balance between environmental responsibility and economic feasibility. The trend also fosters innovation in construction materials and technologies, driving the development of eco-friendly, resource-efficient building solutions (Mordor Intelligence, 2023).

Vietnam's national Sustainable Development Index (VNSI), first introduced in 2017, reflects the country’s growing attention to global sustainability goals. While this index has helped attract investors, it also highlights challenges in areas such as corporate social responsibility and the broader implementation of sustainability practices. According to the VNSI rankings in 2020, 20 Vietnamese companies were recognized for their contributions to sustainable development. Among them was Coteccons

Construction Joint Stock Company, one of the largest contractors in Vietnam. This demonstrates rising awareness and commitment to sustainability in both construction project implementation and project management.

4.1.2. Construction Project Management Practices in Vietnam

At present, Vietnam does not have a unified, legally binding document that explicitly defines a standardized construction project management (CPM) process. Instead, project management is governed by various laws and regulations, with each aspect of management outlined and guided through specific documents or ministerial guidance.

In 2017, Vietnam issued the national standard TCVN 11866:2017 on project management, which was translated and adapted from ISO 21500:2012. However, practical evidence suggests that awareness and adoption of ISO 21500, PMBOK, or even TCVN 11866 remain limited among construction enterprises, project managers, and executives.

In reality, most project management tasks in Vietnam are still conducted based on experience, personal skills, habitual practices, or informal legacy guidelines. For example, when asked about ISO 21500, several directors from different construction firms in Hanoi admitted to being unfamiliar with the standard. Despite this, they were still able to break down projects into work packages and tasks based on repeated processes from past projects. However, this reliance on tacit knowledge and personal judgment often leads to subjective decision-making and doubts about the objectivity and accuracy of the project outcomes.

Lack of Unified Understanding and the Need for Standardization

In-depth interviews with enterprise leaders and project management teams revealed a consistent gap between theoretical knowledge and practical application. While most managers are aware of project management concepts, their interpretations and implementations vary greatly, leading to inconsistencies across projects. These insights emphasize the urgent need for a unified standard to formalize project management practices in Vietnam and promote collaborative, team-based management structures.

In non-ISO-certified companies, project management is typically carried out based on the internal roles and responsibilities assigned to different departments. For example, the Project Management Office (PMO) is tasked with reporting project progress during weekly executive meetings. If delays or bottlenecks are identified, corrective action plans must be proposed. Meeting minutes include detailed activity schedules, start and end dates, and the responsibilities of all stakeholders involved.

4.1.3. Policies Related to Construction Project Management and Sustainable Development Orientation in Vietnam

On May 10, 2017, the Prime Minister of Vietnam issued Decision No. 622/QĐ-TTg, approving the *National Action Plan for the Implementation of the 2030 Agenda for Sustainable Development*. This decision serves as Vietnam's legal foundation for fulfilling its international commitments and contributing to global efforts toward sustainable development.

The Action Plan is regarded as a *crucial tool for promoting balanced economic growth, social inclusion, and environmental protection in Vietnam*. It also underscores the strategic partnership between the Vietnamese and German governments, particularly through Germany's support in implementing the 2030 Agenda within the framework of the *Vietnam-Germany Macroeconomic Reform/Green Growth Program* and the execution of the *Paris Agreement on Climate Change*.

The Action Plan outlines 17 overarching goals and 115 specific targets for Vietnam, divided into two implementation phases: 2017-2020 and 2021-2030. It emphasizes that *sustainable development is essential for the nation's progress*, calling for the harmonious integration of economic development, social advancement, resource and environmental protection, proactive climate change response, national defense, public security, and the safeguarding of national independence and sovereignty.

The Plan advocates for the active involvement of the Communist Party, the people, all levels of government, ministries, sectors, and localities, with science and technology positioned as the driving force behind sustainable development.

Currently, as Vietnam enters the 2021-2030 implementation phase, the key tasks include:

- Mobilizing all available resources to achieve the Sustainable Development Goals (SDGs);

- Developing a comprehensive database to support the monitoring and evaluation of these goals;

- Fostering high-quality human resources across all sectors;

- Enhancing scientific research and technological innovation, including technology transfer, with a focus on environmental technologies, clean technologies, and new energy solutions.

4.1.4. Forms of Construction Project Management Organization in Vietnam

The forms of construction project management in Vietnam are governed by Article 62 of the 2014 Construction Law, as amended by Clause 19, Article 1 of the 2020 Amended Construction Law. Based on the scale, nature, funding source, and specific implementation conditions of a project, the investment decision-maker is authorized to select one of the following organizational models for project management:

1. Specialized or Regional Project Management Units (PMUs):

2. Applied to projects financed by the state budget or state-invested projects within specific sectors funded by state-owned economic groups or general corporations.

3. Single-Project Management Unit:

4. Applied to large-scale Group A projects using state capital, especially those involving:

o Nationally significant works;

o High technology as confirmed in writing by the Ministry of Science and Technology;

o National defense and security projects requiring confidentiality.

5. Engaging a Project Management Consultancy:

6. Suitable for projects using non-budget state capital, private capital, or projects of unique, specialized nature that do not follow standardized models.

7. Investor's Internal Management Unit:

8. The investor may use their internal qualified technical staff to directly manage projects involving small-scale renovations or community-based participatory development.

9. Qualification Requirements: The PMUs and consultancy firms mentioned in Items 1, 2, and 3 must meet the necessary capacity and professional qualifications as stipulated by law.

10. Government Regulations: The Government of Vietnam provides detailed regulations regarding the structure, functions, and operations of construction investment project management units.

Scope of Construction Project Management

According to the 2014 Construction Law, the scope of construction project management includes:

- Scope and work planning;
- Work quantity control;

- Quality assurance of construction activities;
- Implementation schedule management;
- Investment cost control;
- Safety management during construction;
- Environmental protection during construction;
- Contractor selection and contract management;
- Risk management;
- Information system management related to the construction works;
- And other necessary tasks in accordance with the Construction Law and relevant legal provisions.

The project owner (investor) is responsible for directly performing or delegating the above tasks—either fully or partially—to a Project Management Unit (PMU), project management consultant, or general contractor, where applicable.

4.2. Management Orientation Perspective for Construction Projects Based on Sustainability factors in Vietnam in the Coming Period

4.2.1. Developing a Construction Project Management Process in Vietnam

Currently in Vietnam, there is no unified project management process specifically designed for the construction sector. Most project-related activities are conducted in accordance with state-issued legal frameworks. For example, Decree No. 15/2021 issued by the Government regulates several aspects of construction project investment management. Section 2 of this decree outlines the organization of construction investment management; however, it does not define or mandate a standardized project management process, especially across different sources of funding. As a result, project management in Vietnam primarily focuses on the management of individual aspects such as investment procedures, design approval, construction permits, and contractor supervision.

To support project implementation, government agencies have issued circulars providing guidance on construction investment management, building permits, licensing of individuals and organizations for design and construction, and the regulation of both domestic and foreign contractors. This demonstrates state-level recognition of the importance of project and investment management. For national key projects, there has been increasing coordination among state agencies, including the Department of Construction Management, ministerial leaders, technical staff, and external experts.

These bodies play advisory roles to the National Steering Committee and propose special mechanisms tailored for the execution of critical infrastructure projects, addressing implementation challenges, and accelerating progress.

In response to global demand for standardized project management practices, the International Organization for Standardization (ISO) issued ISO 21500:2012 - Guidance on Project Management after five years of collaboration among leading international experts (Vuong, 2023). Notably, Prof. Dr. Nguyen Minh Nghi, a Vietnamese-Canadian expert, contributed to its development. ISO 21500:2012 was built upon three foundational documents: BSI 6079 (UK), DIN 69901 (Germany, Part 2), and the PMBOK Guide (USA) developed by PMI. Generally, ISO categorizes projects into three levels based on scale and complexity: project, program, and portfolio—with "project" being the most basic and least complex unit.

In 2020, ISO 21502:2020 was introduced as a replacement for ISO 21500:2012 (Vuong, 2023). Although there are updates, the core content regarding project management processes (PMP) remains largely similar between the two standards. ISO 21500:2012 provides a general guide applicable to all types of organizations and projects, regardless of their complexity, size, or duration. Meanwhile, ISO 21502:2020 focuses on key concepts and practices but does not offer guidance on program and portfolio management (Vuong, 2023).

In alignment with international standards, Vietnam introduced TCVN 11866:2017 - Project Management Guidelines, published in 2017 (Vuong, 2023). This national standard is essentially a Vietnamese translation and equivalent of ISO 21500:2012. As of October 2024, there is no Vietnamese equivalent of ISO 21502:2020. The scope and content of TCVN 11866:2017 closely mirror ISO 21500:2012, offering a framework applicable to public, private, and community organizations and any type of project. The standard outlines project management concepts and processes that promote best practices. While it recognizes the context of programs and portfolios, it does not provide detailed guidance on their management. General management topics are only discussed as they relate to project management.

4.2.2. Developing Project Management Orientation to Ensure Sustainability Criteria

In the Prime Minister’s decision approving the Construction Sector Development Strategy to 2030, with a vision to 2045, the strategic directions clearly emphasize the Government's role in guiding both the construction and building materials industries toward sustainable development. Moreover, urban planning and architectural practices are being comprehensively reformed in terms of methodologies, processes, content, and planning products. The new planning approach requires a multidisciplinary, inclusive, long-term strategic vision that respects market principles and adheres to the core values of sustainable development.

The 2011-2020 Socio-Economic Development Strategy also highlighted that rapid growth must be coupled with sustainable development, positioning sustainability as a central and enduring requirement. Sustainable development has since become a core directive of the Communist Party and a central policy of the Vietnamese Government. To achieve this national goal, the Government issued the Strategic Orientation for Sustainable Development in Vietnam (Vietnam Agenda 21), as well as Decision No. 1658/QĐ-TTg dated October 1, 2021, approving the National Green Growth Strategy for 2021-2030, with a vision to 2050.

In the context of the construction sector, Vietnam Agenda 21 identifies construction as a high-impact industry on the environment and prioritizes it in the national sustainable development agenda. Furthermore, the Government's Action Program to implement Resolution No. 06-NQ/TW outlines 15 specific targets aimed at developing green urban areas, ensuring environmental sanitation, reducing greenhouse gas emissions, enhancing climate change resilience, and promoting smart and sustainable urbanization. These targets are ambitious and will require new approaches, systemic thinking, and strong implementation efforts.

Following the guidance of Resolutions No. 06-NQ/TW and No. 148/NQ-CP, the Prime Minister has instructed ministries, local authorities, and advisory bodies to focus on several key strategic orientations when implementing sustainable development initiatives.

In response to these national strategies, the Ministry of Construction approved a program promoting the efficient and sustainable use of energy and natural resources in the construction sector, recognizing both the opportunities and challenges posed by international integration. Efficient use of raw materials and energy is deemed essential to reduce production costs and enhance the competitiveness of construction organizations.

This program identifies four major action areas:

1. Efficient energy use in high-rise and commercial buildings, including:

- Capacity building for project stakeholders;
- Development of model buildings;
- Retrofitting existing operational buildings;
- Advocacy for green buildings and eco-architecture villages.

2. Development of planning and architectural design guidelines to promote energy efficiency.

3. Waste and emission recycling and reuse, including:

- Utilizing waste as raw materials for building materials production;
- Researching alternative materials;
- Converting waste into fuel.

4. Water conservation initiatives, with programs to promote sustainable water use in construction.

One of the most significant achievements in promoting sustainable construction in recent years is the growing adoption and development of green buildings. The rise of green architecture is considered a vital trend in Vietnam's construction sector. It aligns closely with the country's sustainable development objectives and delivers tangible economic, social, and environmental benefits not only for project investors but also for communities and the nation as a whole.

4.2.3. Harmonizing the Relationship Between Project Management Process and Ensuring Stakeholder Participation and Coordination

In construction project implementation, multiple stakeholders are involved, including project owners, consultants, and contractors. The project owner may directly manage the project through internal arrangements, such as using in-house specialized staff or establishing dedicated project management units (PMUs). However, in Vietnam, it is common for project owners to delegate project management responsibilities to a third-party consultancy, depending on the scope of work. This approach aims to ensure objectivity, proactiveness, and a higher degree of specialization in project management processes.

For public investment projects, Vietnam primarily applies the specialized or regional PMU model. These PMUs can take on various roles within the project management framework:

- As the project owner, the PMU possesses full authority and responsibility as defined by law.
- As the owner's representative, the PMU executes project management duties based on the delegated powers granted by the investor.
- As a project management unit (PMU) assigned specific tasks, the unit shares responsibilities with the investor to fulfill legal project management requirements.
- As a project management consultant, the PMU's roles, responsibilities, and powers are defined contractually.

Each role entails distinct responsibilities, but all contribute to a common goal: ensuring the consistency and integration of tasks across all phases of the project management lifecycle—from initiation and planning to execution, monitoring, and closing. The flexible assignment of duties allows for adaptive management and enhances the capacity to address the unique requirements and constraints of each project.

By aligning the contributions of various parties—whether internal teams, PMUs, or consultants—with specific phases of the project management process, Vietnam can better synchronize project activities, improve communication, and minimize delays or conflicts. Effective coordination also enables early detection of issues, timely adjustments, and more efficient resource utilization, thereby enhancing the overall performance and sustainability of construction projects.

4.2.4. Comprehensively Addressing Shortcomings in the Project Management Process

In construction investment projects involving multiple stakeholders and intersecting processes, inconsistencies and obstacles are often unavoidable. To ensure that project management processes are smooth and efficient, it is crucial to acknowledge existing problems and identify targeted solutions. These issues may arise at different stages of project implementation and reflect the diverse perspectives and responsibilities of the actors involved.

One major challenge lies in legal and regulatory inconsistencies. Several provisions across relevant laws remain fragmented and lack systemic coherence. Given that construction projects typically span long periods, evolving legal frameworks and transitional regulations often cause confusion and compliance difficulties. Legal ambiguity and overlapping rules hinder implementation, prompting project officials to delay, avoid, or even refuse to process legitimate procedures despite strong technical justifications.

To resolve these challenges, it is essential to:

- Improve the legal and policy framework governing public investment construction projects;

- Align state management policies, such as those related to taxation, interest rates, labor, and land, with the realities of project implementation;

- Restructure project management units and consulting organizations to meet professional capacity standards as set forth in the Construction Law.

There is also a pressing need to issue binding legal documents aimed at preventing waste and corruption in public investment, which should serve as foundations for transparency and accountability. Communication and awareness campaigns should be conducted at all administrative levels to foster integrity in project governance. Ministries and local authorities must restore discipline in project implementation through action plans and post-project evaluations. Specialized anti-corruption and anti-waste units should be established within infrastructure investment authorities.

In terms of urban and infrastructure planning, several regulatory gaps still exist—for instance, unclear provisions regarding underground infrastructure or zoning regulations for functional areas. These deficiencies complicate project conformity assessments and delay approvals. Therefore, planning and capital allocation for public investment projects must be timely, synchronized, and harmonized across institutions, with clear demarcation of responsibilities and streamlined procedures.

Regarding project preparation, prolonged delays are often blamed on multi-stage appraisals and approvals. However, outdated or conflicting regulations, poor understanding of updated standards, and insufficient capacity among project owners, PMUs, and consultants frequently result in low-quality feasibility studies and repeated revisions, further impeding timelines. The limited use of digital tools in project preparation, management, and implementation—on the part of investors, contractors, and regulators—remains a major hindrance to efficiency and transparency.

Construction permitting is another area of concern, especially for multi-unit, multi-story residential projects initiated by individual households. Some localities still struggle with enforcement, while others exploit loopholes to circumvent formal procedures, risking safety and legal compliance. It is thus essential to streamline administrative procedures, delegate responsibilities clearly, and eliminate unnecessary requirements to reduce procedural bottlenecks.

In the implementation phase, many projects lack coordination and suffer from fragmented development, leading to overburdened infrastructure, underutilized facilities, and wasted resources. To overcome this, project management must undergo a fundamental transformation—in terms of mindset, operational models, management capacity, and legal literacy. The ultimate goal is to eliminate inefficiencies, misallocation, and corruption in public investment construction, and to minimize adjustments to total investment and project timelines.

A priority area for reform is the development of professional, capable project management consultancy organizations equipped to handle not only technical and financial aspects but also legal, environmental, and social dimensions. This requires building a qualified pool of project managers and technical experts, capable of managing large-scale, high-rise buildings, public works, and complex infrastructure projects. In parallel, such organizations must be equipped to manage growing project complexity and integrate modern tools and technologies.

In summary, both current challenges and future trends in Vietnam's construction sector—especially in public investment project management—demand:

- Organizational restructuring;
- Policy reform for transitioning project management models;
- Application of advanced technologies, particularly information systems and data platforms;
- Alignment with sustainable development goals.

It is noteworthy that, for public-funded projects, institutional change is often dependent on official policies and legal mandates. In the absence of enabling regulations, most public projects are unable to adapt to global best practices or emerging trends, underlining the critical role of a proactive and responsive regulatory environment

4.3. Evaluation of Sustainability-Oriented Factors Affecting Project Management Processes in the Vietnamese Construction Industry

4.3.1. Descriptive statistical analysis

The quantitative analysis in this study is based on 216 valid survey responses, selected according to the following inclusion criteria: respondent's role in the project, years of professional experience, knowledge of project management processes and ISO 21500 standards, understanding of sustainability concepts, type of project, total investment capital, and funding source.

Findings from Descriptive Statistics

Table 4.3. Distribution of Respondents by Role

No.	Category	Quantity	Percentage (%)
1	Project Owners	120	55.6%
2	Construction Contractors	36	16.7%
3	Design Consultants	31	14.4%
4	Project Management / Supervision Consultants	23	10.6%
5	Suppliers	6	2.8%

The majority of respondents participated from the perspective of project investors, with 120 investors, accounting for 55.6% of the sample. Additionally, 36 respondents identified as construction contractors (16.7%), 6 were suppliers (2.8%), and 23 were project management or supervision consultants (10.6%). These data indicate that most projects involve direct participation from investors and essential stakeholders. Project management activities must therefore be consistent and integrated throughout the lifecycle, from the investor level down to contractors and supervising units.

While project owners bear the ultimate responsibility for overall project success and profitability, contractors also possess a profound and strategic interest in the effective management of both the Controlling and Closing phases of construction investment projects. This engagement extends beyond mere contractual obligation, directly influencing their profitability, reputation, and long-term viability in a competitive market.

For contractors, the Controlling phase is paramount for safeguarding daily operational efficiency and protecting profit margins. Robust control mechanisms enable contractors to closely monitor costs, schedules, and quality, ensuring optimal utilization of resources (labor, materials, equipment), minimizing waste, and preventing cost overruns (Shen et al., 2007). Early detection of deviations from the project plan allows for timely corrective actions, preventing minor issues from escalating into costly crises. As Khan, Sharma, & Pathak (2021) empirically demonstrated, projects employing well-developed control systems, such as Earned Value Management (EVM), experience fewer cost overruns and more efficient resource utilization. Effective control also plays a crucial role in managing operational risks, from technical failures and safety hazards to environmental non-compliance. Prompt identification and mitigation of these risks protect contractors from legal penalties, claims, and reputational damage, which are vital for maintaining solvency and securing future contracts (Yong & Mustaffa, 2013). The ability to deliver projects on time, within budget, and to high-quality standards, driven by effective control, directly enhances a contractor's reputation and their likelihood of winning future bids.

Similarly, the Closing phase, though often undervalued, holds strategic importance for contractors as it represents the final gateway to secure benefits, transfer knowledge, and solidify reputation. Professionally executed project closure is essential for fulfilling contractual obligations, including final deliverables, financial settlements, and the release of retention monies and guarantees (Dinsmore & Cabanis-Brewin, 2018). Inefficient or contentious closure can lead to costly post-project disputes, legal claims, and delayed final payments, significantly eroding profitability. Crucially, the Closing phase is a prime opportunity for organizational learning. Through meticulous documentation of lessons learned, contractors can capture invaluable insights into what worked and what failed regarding construction processes, risk mitigation, and, significantly, sustainability practices. This knowledge transfer is vital for internal process improvement, enhancing future project efficiency, and fostering a competitive advantage. For instance, documenting successful waste management strategies or innovative green material applications can directly inform future projects, contributing to sustainable development and reducing costs (Stanitsas et al., 2021). Finally, a professional and thorough project closure reinforces a contractor's image as a reliable and competent partner. This includes ensuring smooth handover, addressing all stakeholder concerns, and, from a social sustainability perspective, managing workforce transitions ethically (Wen & Qiang, 2019). Such positive closure experiences cultivate client loyalty, strengthen industry reputation, and enhance the contractor's "social license to operate," thereby securing future business and long-term viability

Table 4.4. Survey Data on Years of Experience in the Construction Industry

No.	Years of Experience	Quantity	Percentage (%)
1	From 1 to less than 3 years	9	4.2%
2	From 3 to less than 5 years	10	4.6%
3	From 5 to less than 10 years	53	24.5%
4	More than 10 years	144	66.7%

The largest group of respondents has more than 10 years of experience (144 responses, or 66.7%). Those with 5-10 years of experience accounted for 24.5% (53 respondents), while the remaining 4.3% (10 respondents) and 4.2% (9 respondents) have 3-5 years and 1-3 years of experience, respectively. These figures suggest that the majority of participants are highly experienced in construction. In practice, experience is one of the most critical criteria for assigning responsibility, awarding contracts, or forming partnerships. Conversely, respondents with limited experience may face difficulties in overseeing or comprehensively managing a project.

Table 4.5. Survey on Knowledge of Sustainability in Project Management

No.	Content	Quantity	Percentage (%)

1	Never heard of it	15	6.9%
2	Slightly aware	75	34.7%
3	Aware but never applied it in practice	77	35.6%
4	Clearly understood and already applied in practice	49	22.7%

35.6% of respondents stated that they were *aware of sustainability concepts but had never applied them in practice*. This highlights the reality that sustainability integration remains limited in Vietnam. Multiple factors may explain the lack of implementation, including project goals that do not explicitly incorporate sustainability, or various institutional and practical barriers that hinder its adoption.

Table 4.6. Survey on Knowledge of Project Management According to PMBOK and ISO 21500:2012

No.	Content	Quantity	Percentage (%)
1	Never heard of it	59	27.3%
2	Slightly aware	67	31.0%
3	Aware but never applied in practice	69	31.9%
4	Clearly understood and already applied in real projects	21	9.7%

31.9% of respondents indicated that they *knew about the ISO 21500:2012 standard but had never applied it*. This suggests that while the standard is not unfamiliar to professionals, its implementation in Vietnam remains limited. One possible explanation is that many enterprises and projects do not face strict requirements for formalized project management processes. Organizations often focus primarily on outcomes such as quality, cost, and schedule, while overlooking standardized procedural frameworks. Moreover, for many stakeholders, ISO 21500 is still seen as a theoretical guideline that is difficult to implement in practice, particularly in the context of local construction projects.

Table 4.7. Types of Projects Participated in by Survey Respondents

No.	Project Type	Quantity	Percentage (%)
1	Apartment Building Projects	103	47.7%
2	Commercial Center Projects	4	1.9%

3	Office Building Projects	22	10.2%
4	Mixed-Use Development Projects	30	13.9%

The majority of respondents had been involved in residential apartment building projects, which accounted for 47.7% of all projects surveyed. This reflects the current development trend in Hanoi, where apartment construction projects are growing rapidly. It also indicates that many firms are actively engaged in this segment. Other project types—such as high-rise office buildings and mixed-use developments—also accounted for a noteworthy proportion of responses

Table 4.8. Total Investment Capital of Projects Participated in by Survey Respondents

No.	Investment Scale	Quantity	Percentage (%)
1	Less than or equal to VND 250 billion	69	31.9%
2	From VND 250 billion to VND 500 billion	60	27.1%
3	From VND 500 billion to VND 750 billion	17	7.9%
4	From VND 750 billion to VND 1,000 billion	14	6.5%
5	More than VND 1,000 billion	56	26.6%

Most projects had a total investment capital of less than VND 250 billion, followed by those in the VND 250-500 billion range. This reflects that most respondents are involved in small to medium-sized projects, which is consistent with the market structure of many Vietnamese construction enterprises

Table 4.9. Sources of Project Funding Used in Surveyed Projects

No.	Funding Source	Quantity	Percentage (%)
1	State Budget	54	24.0%
2	Private Capital	146	66.0%
3	Foreign Capital	6	10.0%

The majority of projects were financed by private capital, indicating that many construction projects are profit-driven and funded by non-state entities. This underscores growing interest from individuals and private enterprises in the sustainable development of the construction sector in Vietnam.

4.3.2. Reliability test results of the measurement scales

After data collection, the study conducted a reliability analysis of the measurement scales in the model using Cronbach's alpha (Tables 4.11-4.15). Items that were unsuitable for inclusion in the scales were removed if they had an item-total correlation less than 0.3 and/or if the Cronbach's alpha value would increase upon deletion of the item compared to the overall scale's Cronbach's alpha. The remaining items in the scales demonstrated high reliability, with item-total correlations greater than 0.3 and Cronbach's alpha values ≥ 0.8.

Table 4.10. Reliability coefficient of Initiating group (I)

Cronbach's Alpha = 0.799				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
I2	16.6574	11.677	0.439	0.804
I3	16.5972	10.484	0.660	0.736
I4	16.6435	9.923	0.658	0.735
I5	16.5278	11.069	0.574	0.763
I6	16.5000	11.060	0.585	0.760

Table 4.11. Reliability coefficient of Planning group (P)

Cronbach's Alpha = 0.911				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
P1	30.99	49.712	0.601	0.908
P2	30.98	48.088	0.708	0.900
P3	30.95	46.519	0.789	0.894
P4	30.92	46.002	0.812	0.892

P5	30.83	47.423	0.752	0.897
P6	30.80	48.207	0.681	0.902
P7	30.68	49.262	0.709	0.900
P8	30.55	51.718	0.602	0.907
P9	30.63	50.568	0.582	0.909

Table 4.12. Reliability coefficient of Implementing group (IP)

Cronbach's Alpha = 0.875				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
IP1	19.9583	23.584	0.545	0.875
IP2	20.1713	20.245	0.749	0.842
IP3	20.1806	20.446	0.704	0.850
IP4	20.0602	21.052	0.733	0.845
IP5	20.0370	21.264	0.712	0.849
IP6	20.0324	21.948	0.635	0.861

Table 4.13. Reliability coefficient of Controlling group (C)

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
C1	24.69	24.989	0.584	0.859
C2	24.90	22.715	0.703	0.843
C3	24.74	23.470	0.736	0.838
C4	24.70	23.326	0.722	0.840
C5	24.60	24.436	0.660	0.849
C6	24.56	25.420	0.597	0.857
C7	24.59	25.926	0.512	0.868

Table 4.14. Reliability coefficient of Closing group (CS)

Cronbach's Alpha = 0.843				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CS1	16.5324	11.618	0.604	0.823
CS2	16.6204	10.702	0.751	0.781
CS3	16.5417	11.998	0.602	0.823
CS4	16.5231	11.739	0.627	0.816
CS5	16.5417	11.431	0.657	0.808

Cronbach's Alpha coefficient has been used to validate the reliability of the 5-point scale (Hair et al., 2014). Hair et al. (2017) argued that a scale ensuring unidirectionality and achieving reliability should reach Cronbach's Alpha threshold of 0.7 or higher. A higher coefficient indicates greater reliability. Additionally, another indicator utilized to evaluate the scale's reliability is the Corrected Item-Total Correlation. This value represents the correlation between each observed variable and the rest of the scale. A stronger correlation indicates better reliability. Moreover, Cristobal et al. (2007) suggests removing elements with a Corrected Item-Total Correlation less than 0.3. Consequently, factor I1 "Human resource selection" in the Initiating group is eliminated due to a Corrected Item-Total Correlation of 0.262. The Cronbach's Alpha coefficient results are 0.799, 0.911, 0.875, 0.869, and 0.843 for attributes in the Initiating, Planning, Implementing, Controlling, and Closing sub-process, respectively. These results confirm the reliability of the measurement scale in questionnaires. The remaining attributes are thirty-two (32).

4.3.3. Exploratory Factor Analysis (EFA) results

EFAs are utilized to estimate the remaining attributes, with the reliability of each factor checked through communality. During this evaluation, three attributes, namely "Active participation of stakeholders (I2)," "Troubleshooting, effective coordination of supervision (C7)," and "Responsible labor practices for sustainable development (C6)," are eliminated due to communalities <0.5 or loading attributes >0.5 out of 2 attributes. Therefore, there are only twenty-nine (29) attributes to perform EFA. The communalities of the remaining attributes are all greater than 0.5, indicating the reliability of the construction model in this study. EFAs are conducted using principal component analysis and Promax rotation. The significance of Bartlett's test (p=0.000) and a Kaiser-Meyer-Olkin (KMO) index value of 0.798 confirm that the data is suitable for factor analysis.

All attributes with loadings greater than 0.5 are considered to contribute to the explanation of factor groups. These five factor groups collectively explain 63.7% of the total variance in the data, surpassing the recommended threshold suggested by Hair et al. (2017).

Based on twenty-nine sustainable-oriented attributes associated with the construction PMP, five sub-processes are identified: Initiating (I), Planning (P), Implementing (IP), Controlling (C), and Closing (CS).

Table 4.15. Results of exploratory factor analysis

Variable	Content	Component				
		1	2	3	4	5
P3	Planning resources and materials	0.840				
P4	Develop products/services that pay attention to social sustainability	0.833				
P2	Efficiency of bidding	0.823				
P5	Scope of work, constraints	0.772				
P1	Procurement and bidding process	0.753				
P7	Communicate with parties in social reporting	0.743				
P6	Political and legal stability	0.701				
P8	Environmental assessment	0.643				
P9	Design project specifications and techniques	0.563				
IP4	Knowledge and awareness		0.809			
IP2	Contractor's right to perform		0.790			
IP5	Minimize water and noise pollution		0.773			
IP1	Modern technology and methods		0.760			
IP3	Project resources (people, machinery, capital)		0.730			
IP6	Waste management		0.653			

Variable	Content	Component				
		1	2	3	4	5
CS4	Public acceptance			0.760		
CS2	Coordination between parties			0.752		
CS3	Committed to meeting sustainable development goals			0.708		
CS5	Experience in sustainable management			0.651		
CS1	Troubleshooting issues related to sustainable development			0.555		
C3	Status of expenses				0.851	
C2	Progress status				0.823	
C1	Control methods				0.783	
C4	Powers and abilities of managers				0.708	
C5	Monitoring methods				0.606	
I6	Exchange in environmental reporting on sustainability					0.786
I5	Scope of work, constraints					0.771
I3	Knowledge and awareness					0.714
I4	The connection between strategies and sustainable management					0.693

4.3.4. Regression analysis results (stage 1)

To assess the overall suitability of the regression model and test the proposed hypotheses, an F-test was conducted. The result yielded an F-value with a significance level of 0.000, which is less than the threshold value of 0.005. This indicates that the regression model is statistically significant and appropriate for explaining the relationship between the independent variables and the construction project management process.

In other words, the set of independent variables included in the model jointly has a meaningful impact on the dependent variable representing the effectiveness of construction project management. This result provides a solid foundation for further interpretation of the estimated coefficients and hypothesis testing in subsequent sections.

Table 4.16. ANOVA test

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41.477	5	8.295	55.490	.000b
	Residual	31.394	210	0.149		
	Total	72.870	215			
a. Dependent Variable: HQ						
b. Predictors: (Constant), CS, C, IP, P, I						

Table 4.17. Model summary

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.754a	0.569	0.559	0.38664	1.617
a. Predictors: (Constant), CS, C, IP, P, I					
b. Dependent Variable: Effectiveness of PMP					

In Table 4.17, the R Square and Adjusted R Square values are used to assess the goodness-of-fit of the regression model. The Adjusted R Square value of 0.559 indicates that approximately 55.9% of the variation in the dependent variable can be explained by the independent variables included in the model. The remaining 44.1% is attributed to factors outside the model, including omitted variables and random errors.

Both the R^2 and Adjusted R^2 values range from 0 to 1. The closer the R^2 value is to 1, the greater the explanatory power of the independent variables with respect to the dependent variable. Conversely, a value closer to 0 implies a weaker explanatory power. It is important to note that there is no absolute threshold for R^2 that universally defines a model as satisfactory or unsatisfactory. A high R^2 does not necessarily imply that a study has high academic value, nor does a low R^2 imply a lack of significance. The appropriateness of the R^2 value must be interpreted in the context of the research objectives, the nature of the data, and the theoretical framework of the study. Moreover, the explanatory power of the model does not determine the overall value or contribution of the research.

Table 4.18. Regression Results

Coefficientsa										
Model		Unstandardized Coefficients		Standardized Coefficients	t	Mr.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	4.620	0.026		175.628	0.000			
	I	0.14***	0.026	0.240	5.295	0.000	0.240	0.343	0.240
	P	0.177***	0.026	0.305	6.727	0.000	0.305	0.421	0.305
	IP	0.178***	0.026	0.305	6.741	0.000	0.305	0.422	0.305
	C	0.279***	0.026	0.479	10.581	0.000	0.479	0.590	0.479
	CS	0.18***	0.026	0.310	6.838	0.000	0.310	0.427	0.310
a. Dependent Variable: Effectiveness of PMP									

Notes: *, **, *** 90%, 95% and 99% confidence levels.

The results of quantitative analysis show that the regression coefficients (B) are all positive, reflecting that all factors have a positive influence on the efficiency of the project management process of the construction industry in Vietnam, supporting the positive relationship for the H1 hypothesis. H2, H3, H4, H5. The Sig. value of the factors is less than 0.005, so with a significance of 5%, the influence of the factors on the project management process is statistically significant. The linear regression model looks like:

$$\widehat{\boldsymbol{EPMP}_i} = 4.620 + 0.14 * I_i + 0.177 * P_i + 0.178 * IP_i + 0.279 * C_i + 0.18 * CS_i$$

The specific influence of groups of factors on the effectiveness of the construction project management process is reflected as follows:

When factor I (Initiating) increases by 1 point, the efficiency of the construction project management process increases to 0.14 points, supporting the H1 hypothesis

When the P factor (Planning) increases by 1 point, the efficiency of the construction project management process increases to 0.177 points, supporting the H2 hypothesis

When the IP (Implementing) factor increases by 1 point, the efficiency of the construction project management process increases to 0.178 points, supporting the H3 hypothesis

When factor C (controlling) increases by 1 point, the efficiency of the construction project management process increases to 0.279 points, supporting the H4 hypothesis

When the CS (Closing) factor increases by 1 point, the efficiency of the construction project management process increases to 0.18 points, supporting the H5 hypothesis

4.3.5. Result of PLS - SEM

a. Evaluation of the convergence value of the scale

To assess the convergence value of attributes, the outer loading weight should ideally exceed 0.7 and converge on the factor represented by the scale (Henseler et al., 2009). Additionally, the Average Extracted Variance (AVE) should be greater than 0.5 to ensure satisfactory convergence values for attributes (Hair et al., 2014).

Table 4.19. Outer loading and Average Extracted Variance (AVE)

Items	AVE	C	CS	I	IP	P
C1		0.689				
C2		0.821				
C3	0.632	0.846				
C4		0.846				
C5		0.762				
CS1			0.768			
CS2			0.859			
CS3	0.614		0.735			
CS4			0.762			
CS5			0.788			
I3				0.783		
I4				0.83		
I5	0.872			0.775		
I6				0.786		
IP1					0.555	
IP2					0.824	
IP3					0.827	
IP4	0.606				0.811	
IP5					0.823	
IP6					0.795	

Items	AVE	C	CS	I	IP	P
P1						0.572
P2						0.688
P3						0.812
P4						0.86
P5	0.573					0.825
P6						0.804
P7						0.787
P8						0.679
P9						0.743

The results in Table 4.19 indicate that items C1, IP1, P1, P2, and P8 have outer loadings below 0.7, which does not meet the criterion for satisfactory convergence according to Henseler et al. (2009). Therefore, these attributes should be excluded from the model in subsequent analyses. However, the remaining items exhibit outer loadings greater than 0.7, indicating satisfactory convergence. Furthermore, the extracted average variance of the attributes is greater than 0.5, meeting the criterion for convergence of attributes as per Hair et al. (2014).

b. Discriminant validity

After removing elements C1, IP1, P1, P2, and P8, further tests are conducted. The discriminant validity of the factor scale in the model is evaluated based on the Heterotrait-Monotrait Ratio of Correlations (HTMT) proposed by Henseler (2015). When the HTMT coefficients are less than 0.85, it indicates that the two attributes are different from each other (Henseler et al., 2015).

Table 4.20. Heterotrait-monotrait Ratio (HTMT matrix)

	P2	CS	I	IP	P
C					
CS	0.649				
I	0.378	0.587			
IP	0.298	0.498	0.517		
P	0.335	0.489	0.369	0.395	

The results in Table 4.20 indicate that all HTMT coefficients are less than 0.85, meeting the criterion proposed by Henseler et al. (2015). This suggests that the attributes are differentiated from each other, satisfying the prerequisite for proceeding with the subsequent steps in the study

c. Assessment of the Reliability of Independent Variable Scales

The reliability of the scales for the independent variables in the research model was evaluated. After removing items that did not meet the reliability criteria due to Corrected Item-Total Correlation being less than 0.3, the Cronbach's alpha values of the scales with the remaining items were all greater than 0.7. The item-total correlations were all above 0.3, and no item had a Cronbach's alpha if deleted value greater than the overall scale's Cronbach's alpha. Therefore, the scales with the retained items used in the research model satisfy the reliability requirements for measuring the latent constructs.

Table 4.21. Assessing the reliability of the independent variable scales

Factors	Contents	Cronbach's Alpha	Number of items	Items are deleted
I	Initiating	0.799	5	I1
P	Planning	0.911	9	-
IP	Implementing	0.875	6	-
C	Controlling	0.869	7	-
CS	Closing	0.843	5	-

d. Model fit assessment

The SRMR index is a goodness-of-fit measure for PLS-SEM models and can be used to prevent parameter bias in the model (Henseler et al., 2014). A model is considered well-fitting if the SRMR value is less than 0.08; however, the model can still be deemed acceptable if the SRMR value is below 0.1 (Hu & Bentler, 1999).

Table 4.22. Results of model fit to research data

	Saturated model	Estimated model
SRMR	0.077	0.082

d. Evaluation of R-square, F-square coefficient

The R-square coefficient measures the explanatory power of the model for a dependent variable in the research model. According to Hair et al. (2014), R-square values of 0.67, 0.33, and 0.19 correspond to strong, moderate, and weak levels of explanation, respectively.

Table 4.23. Coefficient of R-square and F-square

	R-square	R-square adjusted			
C	0.153	0.141			
CS	0.443	0.435			
IP	0.252	0.245			
P	0.107	0.103			
f-square					
	C	CS	I	IP	P
C		0.293			
CS					
I	0.041			0.159	0.12
IP	0.009	0.086			
P	0.038	0.073		0.072	

According to the analysis results from the research sample, the R-square value for the Closing group is 0.443, indicating that the model explains 44.3% of the variance in this group, which represents a moderate level of explanatory power. In addition, the Implementing group is explained at a level of 25.2% by the model, which is considered above moderate.

Hair et al. (2014) suggest that the f-square coefficient indicates the explanatory power of one variable for another. Specifically:

- $f^2 < 0.02$ reflects that the two variables have almost no relationship,
- $0.02 < f^2 < 0.15$ indicates a weak relationship,
- $0.15 < f^2 < 0.35$ indicates a moderate relationship, and
- $f^2 > 0.35$ indicates a strong relationship between the two variables.

4.3.6. Discussion of Research Model Results

4.3.6.1. Discuss Results of the Impact of Factors on the Construction Project Management Process (Stage 1)

The magnitude of B indicates the impact of each factor on the project management process. Accordingly, the order of impact from strong to weak of the factors in groups is: Controlling, Closing, Implementing, Planning and Initiating. The findings of this study seem to be in the same trend as previous studies when the goal of building a project management process is aimed at the effectiveness of project management in. The factors of controlling group has the strongest impact on the project management process according to studies, this stage is considered the most important in the green project management process and effective management will make the difference between the success and failure of the project. Within the ISO 21500 project management framework, the *Controlling* process group serves as a fundamental determinant of project success, particularly in the construction industry where projects are capital-intensive, complex, and risk-prone. This process ensures that project execution remains aligned with planned objectives through continuous monitoring, evaluation, and corrective actions. Economically, effective project controlling minimizes waste, enhances productivity, and safeguards investment efficiency, thereby contributing directly to both micro- and macroeconomic sustainability. A crucial factor underpinning successful controlling is the selection of appropriate control and monitoring methods tailored to the specific characteristics of construction projects. Proper methods enable early identification of cost deviations, schedule slippages, and quality deficiencies, allowing managers to implement timely corrective measures. According to Hexagon (2024), projects that employ robust control systems and periodic progress monitoring are significantly more likely to meet cost and schedule objectives compared to those with limited oversight. Equally important is the practice of periodic monitoring and reporting to stakeholders, which strengthens accountability, supports transparent communication, and facilitates informed decision-making throughout the project life cycle. Another critical element is financial readiness, as having sufficient project budgets to pay for remaining tasks ensures continuity and prevents delays caused by cash flow disruptions. In parallel, the competence of project managers plays a decisive role in interpreting performance data, implementing control systems, and managing deviations. Skilled managers are capable of integrating cost, schedule, and quality information to provide comprehensive performance insights — an essential factor for maintaining economic efficiency and project stability. From a human resource perspective, long-term human resource management practices enhance the retention and development of skilled professionals, which is essential for maintaining consistent project quality and organizational learning. Sustainable human resource policies contribute to labor stability and reduce training costs, which ultimately benefits the overall economic performance of construction firms (Nadafi, Moosavirad, & Ariafar, 2017). Moreover, effective coordination among stakeholders is indispensable in resolving emerging issues, preventing conflicts, and maintaining smooth project execution. Stakeholder collaboration reduces transaction costs, improves problem-solving efficiency, and reinforces the overall governance capacity of the project system. Collectively, these controlling-related factors — including proper control methods, periodic monitoring, adequate budgeting, managerial competence, long-term human resource development, and stakeholder coordination — form an integrated framework that drives economic efficiency and project sustainability. Empirical studies have confirmed that projects with well-developed control systems, such as those applying *Earned Value Management (EVM)*, experience fewer cost overruns and better resource utilization (Khan, Sharma, & Pathak, 2021). Similarly, Flyvbjerg (2013) argues that the absence of rigorous control mechanisms in major infrastructure projects often leads to "lock-in" decisions and systemic cost escalation. Therefore, the *Controlling* group should not be perceived merely as a technical function but as a strategic economic mechanism ensuring that construction investments yield their intended social and financial returns. By strengthening controlling practices, construction organizations and policymakers can enhance project success rates, optimize capital efficiency, and contribute to the sustainable growth of the construction sector and the broader economy.

In fact, in Vietnam, according to result in-depth interviews with experts, the project manager will use these monitoring and control processes to observe every aspect of the project thereby detecting potential and remediation, in addition to which the project manager will integrate monitoring and control activities to provide feedback on the project. planner and if there is a change in the project scope then it will be input to the initialization process, in line with the deprivation theory here. (Rumaithi & Beheiry, 2016) (Gunduz & Almuajebh, 2020) (Olawale & Sun, 2015) (Alotaibi, et al., 2025) (C.Dinsmore, et al., 2011)

The factors of "Closing group" has the second largest impact on the project management process which is explained through the indicators in the group. This can be considered as the closing stage of the management process, so the factor of "project closing time" is very meaningful to this factor in the project management process because determining the right project time or completion period to end the management task is one of the goals of success in any project. At the same time, this process also includes closing or transferring a project that is canceled for some reason to avoid affecting the cost of the project. This result is in line with previous studies in infrastructure construction projects, the achievement of documents, legality and human factors as factors that strongly affect the project management closure process, inadvertently emphasizing that the project management process has been ineffective. (C.Dinsmore, et al., 2011) (Tummalapudi, et al., 2022).

Firstly, careful consideration of long-term effects when troubleshooting issues during project closure represents a strategic foresight with profound impacts on the Iron Triangle. While resolving immediate problems, this approach involves selecting solutions that are durable and sustainably sound. Such strategic choices, though potentially incurring slightly higher initial costs for more robust materials or methods, significantly reduce future maintenance costs, operational expenses, and potential remediation costs over the asset's lifespan (Kats, 2010), thus optimizing total lifecycle costs. This forward-thinking approach, while possibly extending the immediate closure timeline marginally, ultimately saves considerable time by preventing recurrent problems and minimizing operational downtime. Critically, it directly elevates the inherent and functional quality of the asset, ensuring it maintains its intended performance, particularly in terms of green building features and longevity, a key aspect of sustainability (Kibert, 2016).

Secondly**,** good coordination between stakeholders in the project closure is paramount for ensuring a seamless transition and maximizing project benefits, with direct positive impacts on the Iron Triangle. Clear and thorough coordination minimizes misunderstandings regarding final deliverables and financial settlements, thereby preventing costly disputes or rework stemming from misaligned expectations (Dinsmore & Cabanis-Brewin, 2018). Harmonious collaboration facilitates a streamlined handover process, reducing delays in obtaining final approvals and operational commencement. Moreover, this enhances the quality of the asset handover by ensuring end-users and maintenance teams are fully trained on sustainable features, thereby preserving the asset's intended performance quality throughout its operational life (Labuschagne & Brent, 2005). From a sustainability perspective, this coordination is vital for securing the project’s environmental and social legacy.

Thirdly, long-term commitments of stakeholders to project objectives extending beyond physical completion are critical for realizing the full sustainability potential of a project and safeguarding its enduring effectiveness across the Iron Triangle. Such commitment ensures continued investment in maintaining the asset's sustainable features, protecting the initial capital outlay and securing anticipated operational cost savings (Kats, 2010). This long-term perspective ensures the project's benefits endure over time, preventing premature degradation or failure that would necessitate costly and time-consuming repairs or replacements. Consequently, it upholds the asset's functional quality, ensuring continuous performance according to design specifications and maintenance of its environmental and social functions (Kibert, 2016). This embodies Sustainable Project Management, transforming short-term project success into long-term value creation.

Fourthly, acceptance of government agencies for the project completion serves as a critical external validation, directly impacting a project's effectiveness across the Iron Triangle. Timely government acceptance prevents potential fines, penalties, or stop-work orders resulting from non-compliance, thereby protecting the project’s budget and avoiding costly delays in obtaining operational permits (Reinhardt, 2017). This formal acceptance is a testament to the project's adherence to all relevant building codes, environmental regulations, and safety standards, formally verifying that the construction meets stipulated legal and technical quality criteria (Stanitsas et al., 2021). From a sustainability perspective, this process provides external legitimacy to the project’s sustainable attributes, reinforcing its environmental performance and reputation.

Finally, documenting lessons learned at the project closure is a cornerstone of organizational learning and continuous improvement, profoundly impacting the effectiveness of future projects. While requiring a small investment of time and resources during closure, this process significantly reduces costs in subsequent projects by allowing future teams to avoid repeating costly mistakes and optimize processes (PMBOK 2017). By capturing best practices and identified pitfalls, future projects can streamline their planning and execution, benefiting from improved processes and avoiding delays. This systematic knowledge transfer enhances the quality of future project management processes and deliverables, contributing to higher quality outcomes across the organization's portfolio (Tran et al., 2020). From a sustainability perspective, documenting lessons learned is crucial for advancing sustainable construction practices by capturing insights on green technologies, sustainable procurement, and waste management, fostering a culture of continuous improvement in sustainable construction.

In summary, these sustainability-oriented factors, when actively pursued and integrated into the Closing phase, transform project completion from a mere administrative task into a strategic process for long-term value creation. They expand the traditional definition of project effectiveness by embedding environmental and social considerations, ensuring that projects not only meet immediate objectives but also contribute to a more sustainable future.

Factors of implementing project management work is the third most inspected group that has the strongest impact on the project management process. The factors discovered in this process are the outputs of the Planning process.

The management implementation group has little influence because most of the factors in this group are pre-documented, the implementation is completely based on those documents, and other factors are predetermined and rarely changed, so the impact on the entire PMP process can be perceived as minimal. For research in Vietnam, the process of implementing project management will require the coordination of many stakeholders, so the risk may have been allocated and the responsibility may have increased.

The collective understanding and knowledge base of project team members are pivotal for successful project implementation, particularly when integrating sustainability. A comprehensive grasp of construction processes, best practices, and potential challenges minimizes errors, enhances problem-solving capabilities, and facilitates quicker, more informed decision-making, thereby improving time efficiency and reducing costs associated with rework, delays, and disputes. This profound knowledge directly translates into higher quality of work, as team members are better equipped to execute tasks according to specifications, standards, and regulatory requirements.

From a sustainability perspective, a thorough understanding extends beyond technical construction knowledge to encompass a deep appreciation of sustainability principles, practices, and specific project sustainability goals. When team members (ranging from site managers to skilled laborers) possess high awareness and commitment to sustainable practices, they are more likely to implement waste segregation correctly, optimize energy consumption on-site, adhere to environmental regulations, and employ eco-friendly construction techniques (Sang et al., 2018). This 'human factor' is critical for driving social sustainability, as knowledgeable and engaged teams are more likely to prioritize safety, fair working conditions, ethical labor practices, and responsible community engagement (Zhong et al., 2018). This collective understanding transforms sustainability from a top-down directive into an embedded operational commitment, directly impacting the quality of sustainable deliverables and reinforcing overall project effectiveness.

Proactive mitigation of environmental impacts directly influences project effectiveness by minimizing risks and fostering positive stakeholder relationships, which ultimately benefits the Iron Triangle. Failing to manage environmental impacts (e.g., pollution, noise, dust, ecosystem disruption) can lead to significant project delays due to regulatory interventions, community protests, legal challenges, or stop-work orders, thereby increasing costs related to fines, remediation, legal fees, or project suspension (Reinhardt, 2017). Conversely, active mitigation ensures adherence to environmental regulations and community expectations, which safeguards project quality in terms of compliance, reputation, and public acceptance.

From a sustainability standpoint, this factor is central to both environmental and social pillars. It involves engaging stakeholders (e.g., local communities, environmental agencies) to understand their concerns and actively implementing measures to reduce the project's ecological footprint during implementation (Olander, 2007). This not only fulfills legal and environmental commitments but also enhances the project's social license to operate, fostering community acceptance, reducing social risks, and strengthening the developer's reputation (Porter & Kramer, 2006). By proactively addressing and mitigating environmental impacts, projects effectively manage external risks, ensure smoother implementation, and protect their economic viability.

Effective management of construction waste during the implementation phase is a direct and quantifiable contributor to both project effectiveness and sustainability. Poor waste management practices, characterized by haphazard disposal and lack of segregation, lead to increased disposal costs, inefficient site logistics (e.g., overcrowded sites, difficult access), and potential regulatory fines, thereby negatively impacting project cost and time (Shen et al., 2007). Conversely, implementing robust waste management (e.g., source reduction, segregation, recycling, reuse) reduces disposal volumes, potentially generates revenue from recycled materials, and optimizes site organization, contributing directly to cost savings and improved time efficiency. This meticulous approach also ensures a cleaner, safer worksite, indirectly enhancing quality by reducing contamination and improving working conditions.

From a sustainability perspective, effective waste management is a cornerstone of environmental performance. It directly reduces the burden on landfills, conserves finite natural resources (through recycling and reuse of materials), and minimizes the environmental footprint of construction activities (Kibert, 2016). This practice also aligns profoundly with principles of economic sustainability by transforming waste into a valuable resource, reducing overall project expenditures, and contributing positively to the project's LCC (Kats, 2010). Thus, implementing robust waste management protocols during execution demonstrably enhances project efficiency across the Iron Triangle while simultaneously delivering significant environmental and economic benefits.

In summary, these sustainability-oriented factors, when effectively integrated and managed during the Implementation phase, are not merely peripheral additions. Instead, they act as critical enablers that reinforce and expand the traditional Iron Triangle objectives. They transform potential trade-offs into strategic advantages, driving enhanced project effectiveness through improved efficiency, reduced risks, and superior value creation, especially within the dynamic context of Vietnamese construction. The absence of foundational elements like modern technology, however, can severely undermine the efficacy of these other factors, leading to a compromised ability to achieve both project efficiency and sustainable outcomes

The last two group, Planning and Initiating, have an impact on the project management process, and this result is also consistent with previous studies because project management planning is considered the center of modern project management. it is also similar to Pmbok's standard recommendations when investing in project management processes and procedures to support planning. Planning does not guarantee success as it will fail without planning (Pmbok); Even in public sector projects, our research has proven that the planning process and the competence of the project manager play a role in the success of the project. The project initiation process team in previous studies using real-world survey data has concluded that there is not enough attention of the initial phase to the success of the project, and very few studies have looked at this stage of the project management process (Dvira, et al., 2003) (Irfan, et al., 2021) (Heydari, et al., 2022)

From the above quantitative results, project managers can take advantage of the implementation and evaluation of the effectiveness of sustainability in separate process groups, consider when building each group in the management process how to bring the highest efficiency to the entire project management process and towards the goal of successful projects in the construction industry in Vietnam. Furthermore, considering these factors helps to ensure that the project is properly completed from the outset, using sustainability-oriented groups of factors that make it easy for stakeholders to integrate sustainability management into the management process according to ISO standards for business and construction activities. For example, in the control process group, the factor of technology integration will help control become faster, more convenient and easier, while technology will help reduce and control environmental problems.

4.3.6.2. Discuss Results of PLS- SEM Model (Stage 2)

The structural model results, as presented in Table 4.24 and Figure 4.1, indicate that most of the direct relationships between attributes in the model are statistically significant, with p-values less than 0.05, and the impact coefficients are positive. This provides support for hypotheses H6, H7, H9, H10, H11, H12, H13, and H14. However, hypothesis H8, which posits a relationship between the implementation (IP) and control (C) stages, does not find sufficient evidence to support it. The p-value associated with the impact factor in this relationship is 0.181, which is greater than 0.05, indicating that IP does not have a significant effect on C. Indeed, the lack of evidence supporting the relationship between implementation (IP) and control (C) suggests that while C serves as a pivotal step in the process, its influence may not always be directly attributable to IP. In practical terms, it's plausible that many projects may undergo concurrent management of implementation and control phases. This finding resonates particularly well within the context of Vietnam's construction project management practices, especially concerning sustainability attributes.

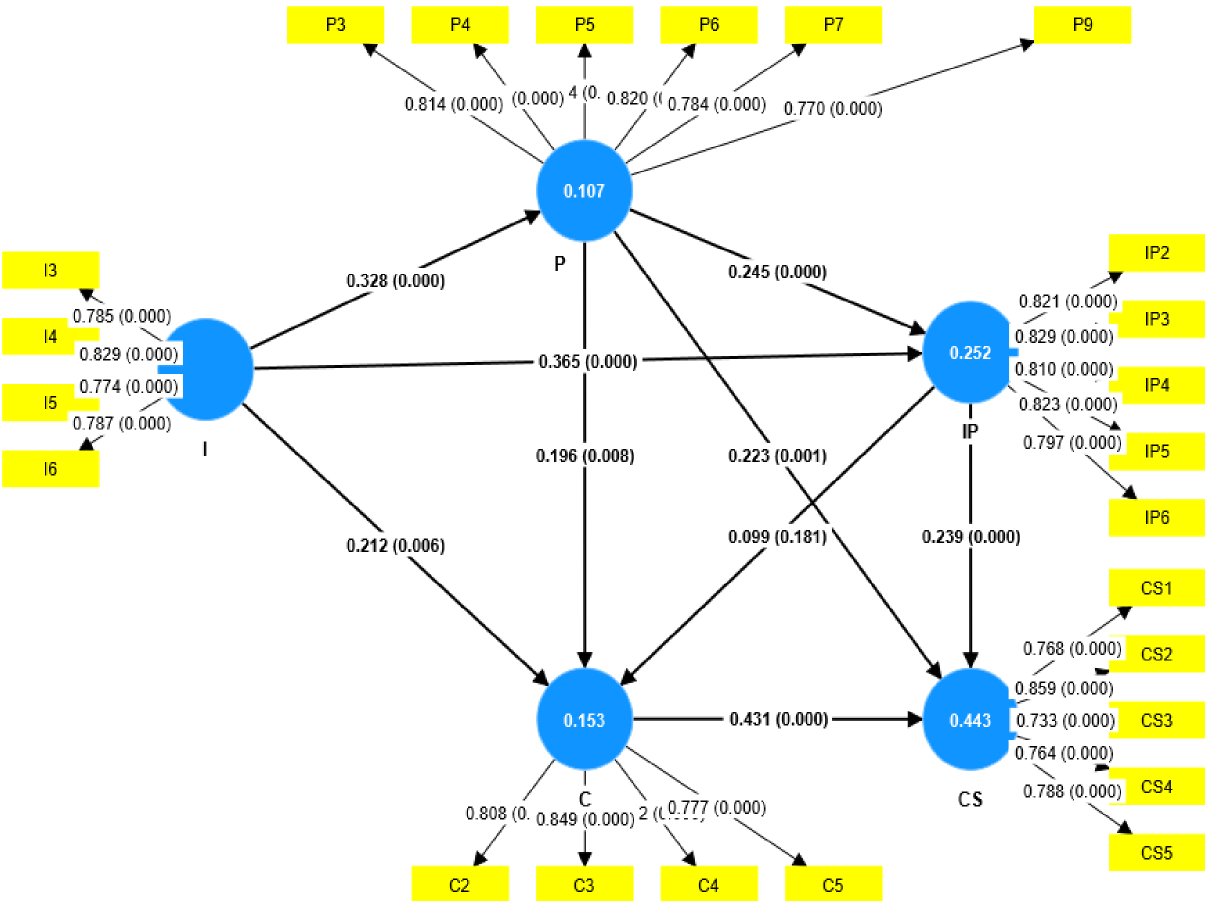


Figure 4.1. Model test results with no intermediate variables

Research on controlling outcomes of transport infrastructure investment projects in Vietnam has highlighted deficiencies in establishing adequate monitoring mechanisms during project implementation (Le, 2021). Furthermore, both public and private projects in Vietnam encounter various limitations, such as budget and time deviations, and challenges in environmental control and timely decision-making processes during implementation (Thương & Tuyên, 2022). These issues underscore the need for better integration and consistency between different project management stages, particularly between implementation and downstream control, to enhance overall project outcomes and sustainability practices.

The results from Table 4.24 underscore the significance of various attributes in influencing the dependent variable. Notably, Hypothesis 9 (C to CS) demonstrates the strongest effect, indicating that the control process significantly impacts the closing stage of the project. This highlights the critical importance of thorough project control measures before project closure to mitigate errors, aligning with previous research findings.

Following closely, Hypothesis 13 (I to IP) exhibits the second strongest impact, emphasizing the crucial role of the initiating process in project management. The initiation phase lays the foundation for subsequent stages and significantly influences the outcomes of implementation management and specific project planning. This finding is consistent with prior research, which highlights the pivotal role of the initiating process (Varajão, et al., 2017). All proposed ideas and project charters serve as guiding principles for subsequent project stages, providing a framework for effective management practices.

The significance of planning management is evident in the impact coefficients of Hypotheses 7 and 14, which are 0.245 and 0.223, respectively. Planning requires precision and meticulousness, serving as the input for implementation. During the closing phase of the project, it is imperative to review how closely the project adhered to the plan. However, the role of control in the context of sustainability research with project management in Vietnam appears less clear, as indicated by the lower coefficients in the model for Hypotheses 8, 10, and 12.

While Hypotheses 6, 7, and 9 align with previous theories regarding the sequential process of project management, the impact of sustainability attributes alters the project management process, particularly in the Vietnamese context where the relationship between Implementing (IP) and Controlling (C) (H8) does not hold.

Qualitative insights derived from expert interviews provided crucial explanatory depth to this empirical disconnect. Project managers frequently cited fragmented data collection and inadequate IT infrastructure as significant impediments, particularly impacting the ability to monitor sustainability performance. As one interviewee highlighted, "Sustainability metrics, if collected, are often buried in separate reports or manual logs. By the time they reach the decision-makers, the work on site has already moved on," echoing findings by Hoang and Vu (2020) regarding data delays in Vietnamese construction. This deficiency in real-time, integrated data feedback in Monitoring & Controlling prevents timely and informed adjustments during Implementation, effectively decoupling these two crucial phases concerning sustainable construction practices (Shen et al., 2010).

Furthermore, a pervasive reactive management culture, often driven by intense pressure on cost and schedule, was identified. While sustainability goals might be articulated in planning documents, the Implementing teams' daily focus remains heavily on meeting traditional progress and budget targets. Environmental or social compliance issues, if not directly impacting immediate project completion or safety, are often overlooked until an external audit or a significant incident (Pham & Tran, 2019). This systemic failure to leverage Controlling as a proactive guidance mechanism for sustainable Implementation means that green initiatives are often "bolted-on" rather than "built-in" (Silvius & Schipper, 2014).

Morover, weak formal feedback mechanisms and organizational silos further exacerbated this disconnect. Information gathered during monitoring, especially concerning deviations from sustainable practices, was frequently not communicated effectively or in a timely manner back to the Implementing teams. This lack of transparent communication and a culture of blame often led to a reluctance to report negative findings, hindering adaptive learning and continuous improvement in sustainable construction (Tran et al., 2020). The combined effect of these operational deficiencies within the Vietnamese construction industry is that, even if individually effective in their traditional functions, the Implementing and Monitoring & Controlling process groups operate in parallel rather than in synergy when it comes to consistently achieving and enhancing sustainability objectives. Consequently, the findings lead to failure to reject Hypothesis H8, indicating a significant operational gap where the interrelationship between these two process groups is insufficient to drive effective sustainability integration.

Additionally, the role of intermediate variables is evaluated, revealing that attributes I and P influence CS through intermediaries. Factor I exerts an effect on attributes C and IP through an intermediate variable, with the largest impact coefficient observed for I on CS at 0.317, indicating the strongest impact of I on CS through intermediate attributes.

Table 4.24. Path coefficient

	Original sample (O)	**T statistics (|O/STDEV|)**	**P values**	**Significant**
C -> CS	0.431	5.911	0.000	Yes
I -> C	0.212	2.763	0.006	Yes
I -> IP	0.365	5.760	0.000	Yes
I -> P	0.328	5.054	0.000	Yes
IP -> C	**0.099**	**1.338**	**0.181**	**No**
IP -> CS	0.239	3.602	0.000	Yes
P -> C	0.196	2.670	0.008	Yes
P -> CS	0.223	3.191	0.001	Yes
P -> IP	0.245	3.698	0.000	Yes

The proposed model of sustainable-oriented attributes of the PMP involving construction projects in Vietnam

Based on the findings from the PLS-SEM analysis, a model of sustainable-oriented attributes of project management processes involving construction projects in Vietnam is proposed (Figure 3). This model encompasses the five stages of project management along with their associated twenty-four (24) attributes, having arrows denoting the direction of influence. The proposed model serves as a tool for examining and preliminarily assessing sustainability at each sub-process of the PMP.

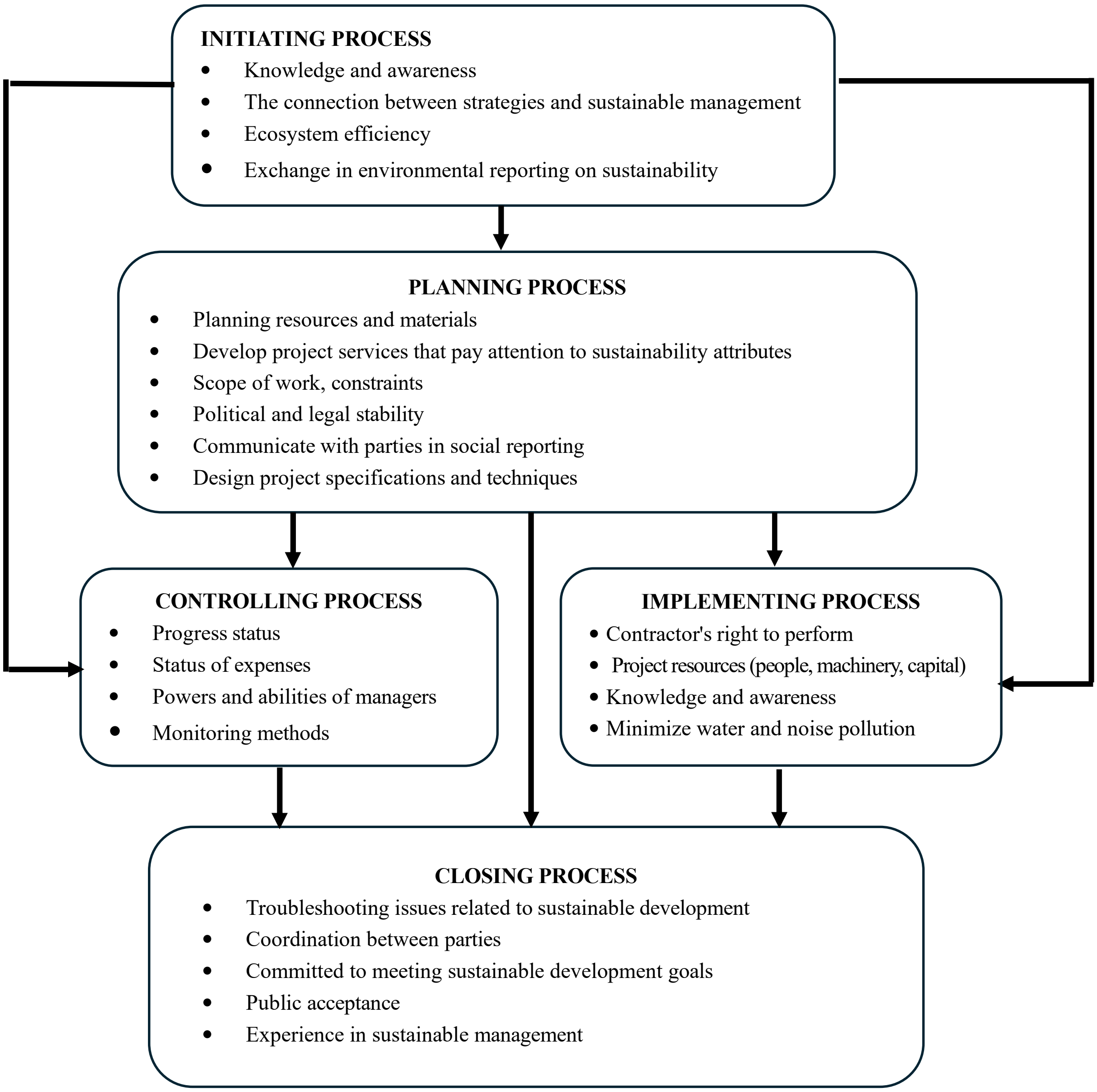


Figure 4.1. The sustainable-oriented model of attributes influencing the PMP of construction project.

Managers can leverage this model to implement and evaluate sustainability measures across distinct stages, involving contractors, investors, and construction units to ensure alignment with these attributes. Moreover, adopting this model can aid in supporting enhancements and ensuring the attainment of construction objectives.

By utilizing the sustainable-oriented model, stakeholders can readily identify processes and pinpoint underlying causes and constraints contributing to slow progress, misaligned goals, and other project-related challenges. For instance, to attain sustainability objectives, managers should ensure stakeholder engagement, formulate a sustainability strategy, and devise management solutions to address sustainability issues while maintaining ongoing stakeholder communication to capture timely information. Moreover, in the situation of poor project planning or unclear project planning, the proposed model plays a key role in tracing overlooked attributes during the PMP of construction projects. The proposed model may help project managers to tackle problems of their construction projects at root causes, thereby facilitating more effective project management practice.

4.4. Existing Limitations in Construction Project Management Practices in Vietnam

Construction project management is inherently complex, requiring close coordination among various stakeholders and components throughout the entire project lifecycle. While Vietnam has made notable progress in the construction sector, project management practices still exhibit significant shortcomings that directly impact investment efficiency, project quality, and timely completion. This study includes in-depth interviews with executives and senior project managers from construction enterprises to identify the key limitations currently facing project and enterprise-level construction management in Vietnam.

First, the most significant limitation lies in inadequate long-term planning and forecasting. Many projects are initiated without a comprehensive and synchronized master plan or lack robust feasibility studies. Planning is often carried out in a superficial manner, overlooking critical risks such as price volatility, policy changes, or socio-environmental impacts. Consequently, projects frequently require revisions in scope, total investment, and timelines—leading to resource waste and reduced efficiency of public and private investment.

Second, cost management remains a persistent weakness in many construction projects. Cost overruns are common, primarily due to poor control of actual construction volumes, design changes during implementation, and a lack of independent and objective cost appraisal. Current construction pricing norms and unit cost systems are often outdated and misaligned with real market conditions, causing inaccuracies in estimating total investment requirements.

Third, project delays are frequent, significantly affecting investment efficiency and the achievement of project objectives. Common causes include delays in land clearance, design changes, lack of counterpart funding, and inadequate contractor capacity. Additionally, the lack of effective progress monitoring tools and weak enforcement mechanisms further exacerbate delays, with few effective remedies or penalties in place.

Fourth, the tendering and contractor selection process remains problematic. In some instances, direct appointment or superficial bidding still occurs, undermining competition and transparency in the construction market. Contractor selection often prioritizes the lowest bid rather than a comprehensive evaluation of financial capacity, technical qualifications, and past performance. As a result, unqualified contractors are sometimes awarded projects, negatively impacting construction quality and execution.

Fifth, the level of professionalism in project management is still relatively low. Many project owners lack experienced and technically qualified project management teams, particularly for large-scale or complex projects. The roles of project management consultants and construction supervisors are frequently underutilized or treated as formalities. This leads to ineffective control over quality, cost, and schedule, increasing operational risks throughout the project lifecycle.

Sixth, corruption and vested interests affect some projects, particularly in areas such as project approval, fund allocation, inspection, and disbursement. These practices result in low construction quality, inflated costs, and misallocation of public funds. Although the legal framework has been tightened in recent years, enforcement remains inconsistent and lacks truly independent oversight mechanisms.

Finally, the adoption of technology in project management is still limited. Modern tools and platforms such as Building Information Modeling (BIM), Project Management Information Systems (PMIS), or Enterprise Resource Planning (ERP) systems have yet to be widely implemented. Project management methods largely remain manual and paper-based, which reduces transparency and complicates cross-checking among stakeholders.

CHAPTER 5. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

5.1. Conclusion

5.1.1. Conclusion relating to Constrution Project Management Process in Vietnam

This thesis provides valuable insights into the construction project management process (CPMP) in Vietnam, particularly within the context of sustainability-oriented factors. The research highlights the specifics of how construction projects in Vietnam operate and achieve efficiency, while challenging some traditional assumptions of international project management frameworks such as PMBOK and ISO 21500.

A key finding in the conclusions regarding CPMP in Vietnam is the identification of "leverage points" that do not entirely align with traditional priorities. While international theories often emphasize the planning phase as the most decisive factor, this study shows that the controlling and closing process groups have a significantly stronger influence on the efficiency of construction project management in Vietnam. This finding is a significant theoretical contribution, suggesting that in the context of a developing economy with specific fluctuations and challenges (such as inconsistencies in regulations, resource constraints, and reliance on individual experience), the ability to closely monitor, make timely adjustments, and learn from experience is more crucial than initial detailed planning. This does not mean that planning is unimportant, but rather that in Vietnamese practice, the role of controlling and closing is more decisive in ensuring the effectiveness of project management.

Furthermore, the thesis also clarifies that CPMP in Vietnam still faces many limitations. Although ISO standards have been translated and promulgated (TCVN 11866:2017 is equivalent to ISO 21500:2012), practical application remains limited, mainly due to low awareness, lack of mandatory requirements, and reliance on individual experience rather than standardized procedures. This creates a "gap" between theory and practice, leading to inconsistencies and difficulties in objectively evaluating project effectiveness.

Factors such as process digitalization, adaptive planning methodologies, stakeholder engagement, and a robust legal framework have been identified as essential catalysts for sustainable integration into CPMP in Vietnam. Therefore, to enhance CPMP effectiveness in the future, Vietnam needs to focus on strengthening control and feedback mechanisms, fostering a culture of continuous learning, and improving project management capacity at all levels, from strategic to implementation. This conclusion is not only theoretically significant but also provides important practical guidance for managers, investors, and policymakers in Vietnam.

5.1.2. Conclusion relating to the aspects of economics

This thesis provides a thorough and comprehensive analysis of the economic aspects of construction project management in Vietnam, particularly within the context of integrating sustainability factors. The research focuses on conceptualizing construction projects as structured systems designed to mobilize, allocate, and transform investment capital into economic, social, and environmental value. This represents a significant step forward from the traditional economic approach, which focuses solely on short-term profits, shifting towards a long-term and holistic economic perspective.

One of the thesis's outstanding economic contributions is the identification of the Controlling and Closing phases that have the strongest impact on the economic efficiency of construction projects in Vietnam. This finding is crucial because it implies that close monitoring of project performance, timely corrective action, and a clearly structured project completion process are not merely management activities but strategic economic mechanisms to protect and maximize investment value. Specifically, effective control helps minimize resource waste, optimize labor productivity, and prevent cost overruns and delays - factors that cause serious economic damage to the project. Similarly, the project completion phase, through the documentation of lessons learned and comprehensive evaluation, creates "knowledge capital" that helps future projects operate more efficiently, minimize financial risks, and enhance sustainable profitability.

The thesis also emphasizes that integrating sustainability-oriented elements is not merely a matter of ethical or regulatory compliance, but a decisive factor in investment efficiency and the creation of long-term economic value. This is clearly demonstrated by connecting abstract sustainability concepts with quantifiable economic variables related to project outcomes. For example, considering long-term efficiency from the investment stage (through life cycle cost analysis - LCC) helps projects achieve higher net present value (NPV), protect cash flow, and optimize actual profits.

Furthermore, the thesis highlights the economic importance of transparency, accountability, and stakeholder collaboration. In a market-oriented economy like Vietnam, these factors not only improve the efficiency of resource allocation but also minimize "transaction costs" arising from lack of information, conflicts of interest, or corruption. When sustainability factors are integrated into each stage of the CPMP, they directly impact economic indicators such as cost performance, schedule compliance, and output quality, thereby contributing to the overall investment efficiency and sustainable economic development of construction projects.

5.1.3. Conclusions relating to the sustainability of construction projects in Vietnam

This thesis conducted a comprehensive analysis, asserting that sustainability is not a secondary objective but a core determinant of the success of construction projects in Vietnam. The study developed an empirical model confirming that integrating sustainability-oriented elements into all stages of project management (from initiation to closure) is essential to ensure long-term economic, social, and environmental value.

One of the most important conclusions is that the thesis successfully contextualized the theory of sustainable project management into Vietnamese practice, an area where previous research has been limited. The study has clarified that in the context of a developing economy like Vietnam, with its characteristics of fragmented stakeholder networks, uneven institutional capacity, and increasing sustainability needs, sustainability factors are not only international standards but also urgent requirements for improving investment efficiency and creating long-term value. This is particularly relevant to national commitments on Sustainable Development (e.g., Resolution 06-NQ/TW and the COP26 carbon neutrality goals), demonstrating that sustainable project management is not only a responsibility but also a competitive advantage.

The sustainability of construction projects in Vietnam, according to the thesis, is demonstrated through three pillars:

Economic sustainability: The thesis proves that sustainability-oriented factors, when integrated, improve economic efficiency through optimizing lifecycle costs (LCC), minimizing resource waste, and enhancing financial resilience. In particular, tight control during the project implementation and completion phases helps protect investment capital from cost overruns and delays, ensuring the project generates real and lasting economic value.

Social Sustainability: Research emphasizes the role of effective human resource management, stakeholder engagement, and transparent communication in promoting social objectives such as workplace safety, fair working conditions, and community acceptance. This creates a solid "Social License to Operate," minimizing conflict and enhancing the project's legitimacy.

Environmental Sustainability: Factors such as the application of modern technologies (BIM), effective construction waste management, and proactive environmental assessment have been identified as key elements in minimizing negative environmental impacts. This not only helps the project comply with regulations but also contributes to larger goals of reducing carbon emissions and using resources responsibly.

In short, the thesis asserts that for construction projects in Vietnam to be truly sustainable, there needs to be a shift in mindset from viewing sustainability as a compliance requirement to viewing it as an integrated strategy at each stage of the CPMP, aiming not only to achieve cost, time, and quality efficiency, but also to create comprehensive and lasting value for society and the environment.

5.2. Managerial implication of finding

5.2.1. Managerial implications of findings in terms of construction projects in Vietnam

One major implication drawn from the research findings is that the key challenge in sustainability-oriented construction project management in Vietnam does not lie in the absence of legal provisions, but rather in weak enforcement mechanisms and the lack of binding requirements for internationally recognized project management standards. In fact, many sustainability-related requirements—such as environmental impact assessment (EIA), social impact considerations, bidding transparency, and cost control—are already stipulated in the Construction Law (2014, amended 2020), the Law on Public Investment (2019), the Law on Environmental Protection (2020), and the Law on Bidding (2013, amended 2023). However, the empirical results of this study indicate that without stronger procedural enforcement and standardized management frameworks, these requirements remain formalistic and are insufficiently operationalized at the project level.

Accordingly, the following recommendations focus not only on managerial improvements but also on specific regulatory instruments that should be amended or supplemented to mandate sustainability-oriented project management practices based on ISO standards, particularly for public investment and large-scale construction projects.

5.2.1.1. Enhancing financial capacity and capital efficiency through mandatory lifecycle-oriented control

While lifecycle cost considerations are implicitly encouraged in current regulations, they are not systematically enforced. It is therefore recommended that Decree No. 10/2021/NĐ-CP on construction cost management and Decree No. 15/2021/NĐ-CP on construction project management be amended to explicitly require

Lifecycle Cost Control (LCC) and Value Engineering as compulsory components of the planning and controlling phases for public investment projects and projects exceeding a defined capital threshold.

This amendment would shift the prevailing focus from short-term capital expenditure (CAPEX) optimization toward total cost of ownership (TCO), ensuring that design, material selection, and technology choices are evaluated based on long-term operational (OPEX) and maintenance impacts. Such a requirement would directly support Vietnam's emission reduction commitments and national targets for green construction development, while also aligning with ISO 21500/21502 principles on value realization across the project life cycle.

To address enforcement gaps during execution and controlling phases, it is recommended that Decree No. 15/2021/NĐ-CP be supplemented with provisions requiring the use of digital project control systems—such as BIM-based cost and schedule monitoring—for public investment projects. The integration of BIM, IoT, and data analytics should not be treated as optional innovation but as a mandatory control mechanism enabling real-time monitoring, early deviation detection, and transparent reporting to regulatory authorities. This would significantly reduce indirect costs associated with delays and rework, while enhancing accountability in capital use.

5.2.1.2. Institutionalizing organizational learning and human capital through standardized project management frameworks

Although project closure and documentation are mentioned in existing regulations, they are often treated as administrative formalities. Based on the study's findings, it is recommended that Decree No. 15/2021/NĐ-CP be revised to require a formalized lessons-learned management system as a compulsory output of the closing phase, particularly for public investment projects.

This requirement should include standardized templates, independent review mechanisms, and centralized knowledge repositories managed by sectoral authorities. Such institutionalization would transform individual project experience into organizational knowledge capital, reducing the recurrence of systematic errors and improving productivity across future projects, consistent with findings by Love and Sing (2013).

While professional certifications are encouraged in practice, they are not uniformly required by law. It is therefore recommended that the Law on Construction and its guiding decrees specify minimum competency requirements for project managers of public investment projects, explicitly referencing ISO 21500/ISO 21502 and PMBOK 7 principles. This would elevate sustainability-oriented project management from voluntary adoption to a regulated professional standard, ensuring consistent application of process-based and value-oriented management practices.

5.2.1.3. Strengthening enforcement mechanisms to create a fair and sustainable investment environment

Enhancing procurement transparency through enforceable digital mechanisms

Transparency in bidding is already regulated under the Law on Bidding and its guiding decrees (e.g., Decree No. 25/2020/NĐ-CP). However, enforcement remains uneven. It is recommended that electronic bidding platforms and data disclosure requirements be strengthened and linked directly to compliance audits, particularly for projects financed by public investment capital. This would reduce corruption-related transaction costs and attract capable contractors competing on genuine value creation rather than informal advantages.

Aligning stakeholder interests through enforceable process requirements

Although stakeholder consultation is mandated in environmental and planning regulations, it is rarely integrated into core project management processes. It is therefore recommended that stakeholder coordination requirements be embedded explicitly into project management regulations, particularly at the initiating and planning stages, in line with ISO 21500 principles. This would help harmonize economic objectives with social acceptance and environmental responsibility, reducing conflict-driven delays and legal disputes—an issue especially critical for large-scale social housing and infrastructure programs.

5.2.2. Managerial implications of findings in terms of the aspects of economics

5.2.2.1. Re-envisioning Investment Efficiency through Dynamic Control and Lifecycle Value:

The dissertation's finding on the paramount importance of the **Controlling** phase carries profound economic implications for Vietnam's construction industry. In a context frequently characterized by project delays and cost overruns (as seen in major infrastructure projects where initial estimates are often significantly exceeded, echoing Flyvbjerg's (2014) insights into megaprojects and observed in Vietnam's specific challenges regarding fragmented regulations and limited resources), static initial planning proves insufficient. Instead, dynamic financial resilience becomes paramount. Managerial directions must thus encompass:

Proactive Life Cycle Costing (LCC) Integration: Management should mandate comprehensive LCC analyses from the earliest design and planning stages, transcending mere initial capital expenditure (CAPEX) considerations. This involves prioritizing materials, technologies, and construction methods that demonstrably reduce long-term operational (OPEX) and maintenance costs. For instance, investing in green building features - a sector projected to expand significantly in Vietnam to 582 projects by 2030 (Mordor Intelligence, 2023) - may increase CAPEX but yields substantial operational savings, enhancing the project's Net Present Value (NPV) and overall financial viability over its lifespan (Hwa, 2018).

Implementation of Advanced, Sustainability-Oriented Control Systems: Beyond traditional time and cost KPIs, project control systems must integrate Sustainability Performance Indicators (SPIs) covering energy consumption, waste generation, and social impacts. Technologies like BIM, IoT-enabled sensors, and real-time data analytics can provide continuous monitoring, enabling early detection and rectification of deviations. This proactive approach mitigates costly reworks, minimizes resource wastage, and safeguards profit margins against regulatory penalties or reputational damage arising from environmental non-compliance.

5.2.2.2. Cultivating Knowledge Capital and Strategic Organizational Learning for Future Prosperity:

The dissertation's emphasis on the Closing phase as a critical determinant of PME redefines project closure from a mere administrative formality into a strategic economic imperative. This phase is pivotal for creating organizational knowledge capital - an intangible asset with significant long-term economic returns. Strategic managerial directions must therefore focus on:

Institutionalizing Robust Lessons Learned Systems: Companies must develop structured frameworks for systematically documenting, analyzing, and disseminating project insights. This transforms tacit knowledge residing in individual experiences into explicit organizational knowledge. Such systems, drawing from successful implementations and identified pitfalls, reduce the recurrence of costly errors, optimize future project planning, and enhance overall organizational efficiency and competitive advantage (Youndt et al., 2004). This directly contributes to Vietnam's national productivity goals, targeting 5.5% annual labor productivity growth between 2021-2030

Investing in Project Management Human Capital with a Long-term View: Developing "competent project managers" transcends mere technical skills. It encompasses nurturing leadership with a sustainability mindset, ethical judgment, and adaptability.

Continuous professional development, aligned with international standards (ISO 21500, PMBOK 7th Ed.), builds a resilient workforce capable of navigating complex projects and mitigating financial risks associated with poor decision-making or resource mismanagement. This creates a sustainable competitive advantage by fostering a culture of excellence and innovation.

5.2.2.3. Fostering Market Efficiency and Responsible Investment Climate:

Implicit in the dissertation's broader findings are calls for enhancing economic efficiency at the market level, particularly in an emerging economy like Vietnam. Managerial focus must shift towards:

Advocating for Transparent and Competitive Procurement Processes: Enterprises should actively participate in and demand transparent bidding and procurement processes. This directly combats the economic inefficiencies stemming from corruption and unfair competition, which inflate project costs without adding value (Sohail & Cavill, 2008). Given the substantial public investment (USD 15 billion allocated for 2021-2025 infrastructure projects) and increasing Foreign Direct Investment (FDI) in Vietnam, ensuring fair market mechanisms is paramount for attracting responsible capital and optimizing public fund utilization.

Proactive Stakeholder Alignment and Governance: The dissertation highlights the importance of connecting project objectives with stakeholder benefits. Management must strategically engage all stakeholders—investors, government agencies, and local communities—to align economic interests and foster long-term commitments. This proactive approach to governance minimizes costly conflicts, delays, and legal challenges, securing the "social license to operate" (Moffat & Zhang, 2014) and ensuring consistent capital flows, which are vital for projects in Vietnam's dynamic economic landscape.

Academic Contributions

This dissertation makes several significant academic contributions to the literature on construction project management and sustainability by advancing theoretical integration, empirical validation, and methodological rigor. By explicitly linking sustainability-oriented attributes to project management process groups, the study addresses a long-standing gap between sustainability research and project management process theory.

First, the study contributes theoretically by reconceptualising sustainability as a process-embedded phenomenon rather than a static outcome or peripheral objective. Prior research has predominantly examined sustainability in terms of project outputs, certification outcomes, or performance indicators, with limited attention to the managerial processes that shape sustainability throughout the project lifecycle. By aligning sustainability attributes with the five project management process groups, this dissertation advances a process-oriented perspective that integrates sustainability into the core logic of project management theory.

Second, the dissertation extends project management process theory by providing empirical support for the stage-specific relevance of sustainability attributes. While PMBOK and ISO 21500 frameworks propose lifecycle-based process structures, empirical studies validating the influence of these structures—particularly in relation to sustainability—remain scarce. This study empirically demonstrates that sustainability-oriented attributes within each process group significantly contribute to project management process effectiveness, thereby strengthening the theoretical foundations of process-based project management models.

Third, the study contributes to sustainability scholarship by systematically consolidating fragmented sustainability factors into a coherent, validated construct framework. Existing sustainability literature in construction is characterised by a proliferation of proposed factors that are often context-specific, overlapping, or insufficiently tested. Through expert interviews, exploratory factor analysis, and structural equation modelling, this dissertation refines and validates a parsimonious set of sustainability-oriented attributes, contributing to construct clarity and theoretical consistency.

Fourth, the dissertation advances methodological practice in sustainability and project management research by integrating qualitative and quantitative approaches in a structured, sequential design. The combination of expert interviews for construct development, survey-based exploratory factor analysis for dimensionality reduction, and regression and PLS-SEM for hypothesis testing and model validation enhances both the robustness and credibility of the findings. This mixed-methods approach provides a replicable methodological template for future research examining complex, multidimensional constructs.

Fifth, the study contributes to the literature by empirically operationalising project management process effectiveness as a multidimensional outcome influenced by sustainability-oriented practices. Rather than treating project success as a single aggregated measure, the dissertation positions PMP effectiveness as an explanatory construct shaped by managerial actions across lifecycle stages. This conceptualisation opens new avenues for research examining causal pathways between managerial processes and project performance outcomes.

Sixth, the dissertation provides context-sensitive empirical evidence from the construction industry in a developing and transitional economy, a context that remains underrepresented in mainstream project management and sustainability research. By situating the analysis within this context, the study enhances the external validity of process-based sustainability theories and responds to calls for greater geographic and institutional diversity in project management scholarship.

Finally, the study contributes to theory development by bridging normative standards and empirical research. While project management standards advocate sustainability integration, they often lack empirical substantiation. This dissertation provides evidence-based insights that inform and challenge existing normative frameworks, thereby supporting their evolution from prescriptive guidelines to empirically grounded theories.

In summary, this dissertation advances academic knowledge by integrating sustainability and project management process theory, validating a lifecycle-based sustainability-oriented model, and offering methodological innovations that strengthen the rigor and relevance of future research in construction project management and sustainability.

Key Findings and Novel Insights

This dissertation makes several important practical contributions to construction project management by translating the abstract concept of sustainability into a structured, process-oriented framework that can be directly applied by project managers, organisations, and policymakers. Rather than treating sustainability as a peripheral or post-project concern, the study provides actionable guidance on how sustainability can be embedded within everyday project management practices across the entire project lifecycle.

First, the study contributes to practice by operationalising sustainability at the level of project management processes. Through empirical validation, the dissertation identifies specific sustainability-oriented managerial attributes aligned with each of the five project management process groups—Initiating, Planning, Implementing, Controlling, and Closing. This process-based structure enables practitioners to move beyond generic sustainability commitments and instead focus on what should be done, when it should be done, and by whom at each project stage. As a result, sustainability becomes a manageable and assessable component of routine project management activities rather than an abstract strategic aspiration.

Second, the proposed model functions as a diagnostic and decision-support tool for project managers. By linking sustainability-oriented attributes to specific process groups, the model allows practitioners to identify where sustainability-related deficiencies originate within the project lifecycle. For example, failures observed during project execution or closure can be traced back to shortcomings in initiation or planning, such as inadequate stakeholder alignment or insufficient sustainability-oriented scope definition. This diagnostic capability supports more informed managerial interventions and reduces the tendency to address sustainability issues reactively rather than proactively.

Third, the study provides evidence-based prioritisation of managerial effort. The empirical results demonstrate that all five process groups significantly influence project management process effectiveness, with controlling and closing processes exhibiting particularly strong effects. This insight helps practitioners allocate managerial attention and organisational resources more strategically, especially under constraints of time, cost, and capacity. Rather than attempting to address all sustainability aspects simultaneously, managers can prioritise high-impact process stages while maintaining coherence across the lifecycle.

Fourth, the dissertation contributes to organisational practice by bridging the gap between sustainability awareness and implementation. Survey findings reveal that many practitioners possess conceptual knowledge of sustainability and project management standards but lack structured guidance for application. The sustainability-oriented PMP model developed in this study provides a clear pathway for translating knowledge into practice, thereby supporting organisational learning, capability development, and internal alignment. This contribution is particularly valuable for organisations operating in environments with limited regulatory enforcement or inconsistent sustainability requirements.

Fifth, the study offers practical guidance for aligning sustainability with traditional project success criteria. By embedding sustainability attributes within established project management processes, the model demonstrates that sustainability does not necessarily conflict with time, cost, and quality objectives. Instead, it shows how sustainability considerations can enhance process effectiveness, reduce downstream risks, and support long-term project value. This reframing is critical for gaining managerial buy-in in contexts where sustainability is often perceived as a cost burden rather than a value-adding practice.

Sixth, the findings have implications for organisational governance and capability development. The model can be used by construction firms to design training programmes, develop process checklists, and standardise sustainability-oriented project management practices across projects. At the organisational level, it supports the development of internal control and monitoring mechanisms that incorporate sustainability indicators into routine project reviews, progress reporting, and post-project evaluations.

Finally, the dissertation contributes to policy and industry-level practice by providing empirical evidence that sustainability integration is most effective when embedded within formalised project management processes. Policymakers and professional bodies can use the findings to inform the development of guidelines, contractual requirements, and industry standards that explicitly link sustainability expectations to project management process stages. This contribution is particularly relevant for construction sectors seeking to improve consistency, accountability, and performance in sustainability implementation.

In summary, the practical contribution of this dissertation lies in its ability to translate sustainability from a broad normative concept into a structured, process-driven managerial framework. By offering empirically grounded guidance that aligns sustainability with established project management practices, the study supports more systematic, transparent, and effective sustainability integration in construction project.

Research Limitations

Although this dissertation provides significant contribution to applied economics, i.e., project management, and sustainability, there are six limitations that reduce the values of the scope, generalizability, and theoretical depth of the findings.

First, the study is largely process-centric rather than outcome-centric. While the model successfully demonstrates that sustainability-oriented attributes across Initiating, Planning, Implementing, Controlling, and Closing significantly influence overall PMP effectiveness, it does not disaggregate *which sustainability dimensions* (economic, environmental, or social) most strongly drive *specific project outcomes* (e.g., cost overruns, schedule adherence, environmental performance, stakeholder satisfaction). As a result, the model confirms *that* sustainability integration matters but provides limited explanatory power regarding *how* or *through which mechanisms* sustainability attributes translate into differentiated project success outcomes. This gap restricts the model's usefulness for managers seeking to prioritize sustainability actions under constrained resources.

Second, the research adopts a cross-sectional design, which limits its ability to capture the dynamic and temporal nature of project management processes. Sustainability integration is inherently evolutionary: attributes relevant in early project stages may change in importance or manifestation as projects progress. By relying on one-time survey responses, the study assumes stability in managerial perceptions and practices across the project lifecycle. This creates a gap in understanding *causal sequencing*—for example, whether weak sustainability practices in Initiating can be compensated for by stronger controls later, or whether early-stage deficiencies irreversibly undermine sustainability performance.

Third, contextual and institutional factors are insufficiently theorized, despite being empirically acknowledged. The descriptive results show limited adoption of PMBOK/ISO 21500 frameworks and sustainability practices among practitioners, suggesting strong contextual constraints such as regulatory ambiguity, organizational maturity, and industry norms. However, these contextual influences are treated as background conditions rather than modeled variables. Consequently, the study does not explain why sustainability-oriented PMP attributes are weakly implemented in practice, nor does it distinguish between capability gaps (lack of knowledge), incentive gaps (lack of motivation), and institutional gaps (lack of enforcement or governance).

Fourth, the integration between sustainability theory and project management theory remains primarily additive rather than deeply integrative. Sustainability attributes are mapped onto existing PMP stages, but the study does not fully interrogate whether sustainability challenges the underlying assumptions of traditional project management (e.g., linearity, predictability, iron triangle dominance). As a result, sustainability is incorporated as an enhancement to conventional PMP rather than as a potential paradigm shift that might require alternative governance models, adaptive planning, or success criteria toward stakeholders.

Fifth, the reliance on self-reported data introduces perceptual and social-desirability bias, particularly in sustainability research where normative expectations are strong. Respondents may overstate awareness or commitment to sustainability, while actual project-level behaviors remain unobserved. The absence of objective performance data (e.g., environmental indicators, safety records, post-project evaluations) creates a gap between perceived PMP effectiveness and demonstrable sustainability outcomes.

Sixth, the empirical validation remains geographically and sectorally constrained. While the study provides valuable insights into construction project management in a specific national context, the findings cannot be readily generalized to other countries, procurement systems, or project types (e.g., infrastructure megaprojects, PPPs, IT or renewable-energy projects). Institutional maturity, legal frameworks, and stakeholder expectations differ substantially across contexts, and these differences may alter both the relevance and the relative importance of the identified attributes.

Finally, the study does not explore implementation pathways or managerial trade-offs. Although the model identifies critical sustainability-oriented attributes at each PMP stage, it does not specify how organizations can practically transition from low to high sustainability integration, nor how managers should manage conflicts between sustainability objectives and traditional constraints of time, cost, and scope. This leaves a gap between conceptual validation and actionable transformation.

LIST OF WORKS RELATED TO THE DISSERTATION THAT THE PHD CANDIDATE HAS PUBLISHED

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APPENDIX

SURVEY QUESTIONNAIRE

STUDY ON SUSTAINABILITY-ORIENTED FACTORS AFFECTING THE PROJECT MANAGEMENT PROCESS OF CONSTRUCTION PROJECTS IN VIETNAM.

Hello!

My name is Dinh Thuy Dung, a PhD student at the National Economics University in Hanoi. I am currently conducting a research project with the topic: "Study on sustainability-oriented factors affecting the project management process of construction projects in Vietnam"

We sincerely hope that you will share your valuable experiences. All information you provide will be kept completely confidential and used only for research purposes.

The information you contribute is critical data for the success of the research and the application of its results in practice. We look forward to receiving your attention and help.

Sincerely, thank you!

I. Assessment of the Influence of Factors

Please recall the most recent construction project in which you were involved, from start to finish. Then, kindly evaluate the level of influence of the sustainability-oriented factors on the project management process of construction projects in Vietnam, using the following five-point scale:

1	2	3	4	5
negligible effect	small effect	moderate effect	large effect	very large effect

STT	Factors	Level of influence				
		1	**2**	**3**	**4**	**5**
	Group of factors related to the project initiating process *(Initiating process)*					
IE.1	Human resource selection	1	2	3	4	5
IE.2	Active participation of stakeholders in the early stage	1	2	3	4	5
IE.3	Positive awareness of stakeholders about project management	1	2	3	4	5
IE.4	Having a clear connection between project objectives and benefits of stakeholders	1	2	3	4	5

STT	Factors	Level of influence				
		1	**2**	**3**	**4**	**5**
IE.5	Long-term efficiency considered in early stages of construction projects	1	2	3	4	5
IE.6	Active exchanging between stakeholders in the initial stage	1	2	3	4	5
…	Other opinions (if any) ……………………………… ……………………………………………………	1	2	3	4	5
	Group of factors related to the project planning process *(Planning process)*					
PL.1	Clear and transparent procurement and bidding processes	1	2	3	4	5
PL.2	Effective procurement management plan	1	2	3	4	5
PL.3	Accurate estimating activity resources and durations to develop schedule	1	2	3	4	5
PL.4	Paying attention to project requirements when creating work breakdown structure (WBS)	1	2	3	4	5
PL.5	Clear definitions of project scope and constraints	1	2	3	4	5
PL.6	Long-term stability of the political system and legislation	1	2	3	4	5
PL.7	Good communication between stakeholders to develop various project plans	1	2	3	4	5
PL.8	Active implementing environmental assessments to develop project management plan	1	2	3	4	5
PL.9	Clear project specifications to define project scope and activities	1	2	3	4	5
….	Other opinions (if any): ……………………………… ………………………………………………….....	1	2	3	4	5
	Group of factors related to the project implementing process *(Implementing process)*					
IP.1	Applying modern technologies and methods to the implementation stage	1	2	3	4	5
IP.2	Competent contractors and vendors	1	2	3	4	5
IP.3	Effectively using project resources	1	2	3	4	5
IP.4	Thorough understanding of project team members about construction projects	1	2	3	4	5

STT	Factors	Level of influence				
		1	**2**	**3**	**4**	**5**
IP.5	Active mitigating environmental impacts of construction projects to stakeholders	1	2	3	4	5
IP.6	Effective managing construction waste during the construction phase	1	2	3	4	5
…..	Other opinions (if any) ……………………..………… …………………………………………..………………	1	2	3	4	5
	Group of factors related to the project controlling process ***(Controlling process)***					
CT.1	Selecting proper methods to control construction projects.	1	2	3	4	5
CT.2	Periodic monitoring and controlling the project progress and reporting to stakeholders	1	2	3	4	5
CT.3	Having enough project budget to pay for remaining tasks	1	2	3	4	5
CT.4	Having competent project managers					
CT.5	Using proper methods to monitor construction projects	1	2	3	4	5
CT.6	Practicing project human resource management under a long-term view	1	2	3	4	5
CT.7	Effective coordinating project stakeholders to solve problems	1	2	3	4	5
….	Other opinions (if any): ……………………………… …………………………………………………………	1	2	3	4	5
	Group of factors related to the project closing process ***(Closing process)***					
CS.1	Careful considering long-term effects when troubleshooting issues	1	2	3	4	5
CS.2	Good coordination between stakeholders in the project closure	1	2	3	4	5
CS.3	Long-term commitments of stakeholders to project objectives	1	2	3	4	5
CS.4	Acceptance of government agencies for the project completion	1	2	3	4	5
CS.5	Documenting lessons learned at the project closure	1	1	3	4	5
…	Other opinions (if any) ……………………………… ………………………………………………………	1	2	3	4	5

Regarding the project you referred to when answering the questions above, please evaluate the effectiveness of its project management process based on the following five-point scale:"

Please assess the effectiveness of the project management process regarding 'Time' for the project you used to answer the previous questions. (Kindly mark an X at the level you consider appropriate.)	Level of effectiveness				
	1	2	3	4	5

Please assess the effectiveness of the project management process regarding 'Cost' for the project you used to answer the previous questions. (Kindly mark an X at the level you consider appropriate.)	Level of effectiveness				
	1	2	3	4	5

Please assess the effectiveness of the project management process regarding 'Quality' for the project you used to answer the previous questions. (Kindly mark an X at the level you consider appropriate.)	Level of effectiveness				
	1	2	3	4	5

II. General information

1. **Please indicate your role in the construction project ?**

☐ Project owner ☐ Construction contractor

☐ Project consultant ☐ Supplier contractor

☐ Project management/supervision consultant ☐ Other role (please specify): ………

2. **Please indicate your years of experience in the construction industry?**

☐ Less than 1 year ☐ From 5 to less than 10 years

☐ From 1 to less than 3 years ☐More than 10 years

☐ From 3 to less than 5 years

3. **Have you ever been aware of the concept of sustainable development in project management??**

☐ Never heard of it ☐ Somewhat aware

☐ Aware, but never applied ☐ Fully aware and have applied it in practice

4. **Have you ever been aware of the project management processes according to PMBoK and ISO 21500:2012 ?**

☐ Never heard of it ☐ Somewhat aware

☐ Aware, but never applied ☐ Fully aware and have applied it in practice

5. **Please indicate the type of project you referred to when answering Section ?**

☐ Apartment/Residential project ☐ Commercial center project

☐ Office high-rise project ☐ Mixed-use project (podium: commercial center, tower: residential)

☐ Other project (please specify): ………………………………

6. **Please indicate the total investment of the project you referred to in Section I ?**

☐ Less than or equal to 250 billion VND ☐ From 250 billion VND to 500 billion VND

☐ From 500 billion VND to 750 billion VND ☐ From 750 billion VND to 1,000 billion VND

☐ Greater than 1,000 billion VND

7. **Please indicate the source of capital for the project you referred to in Section I ?**

☐ State budget ☐ Private capital

☐ Foreign capital ☐ Other (please specify): …………………

- **For any information or feedback, please contact:**
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If you would like to receive the research results, please provide your contact information. We will send the results to you as soon as possible.

- Full Name: ……………………………………
- Phone or Zalo: ………………………………
- Email: ………………………………………