Developing Performance Management framework for Road Construction Projects in Ethiopia

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DECLARATION

I declare that this thesis is my original work and has not been submitted, in whole or in part, for the award of any degree or diploma at this or any other university. All sources of information and materials used for this study have been duly acknowledged and referenced in accordance with academic standards.

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DEDICATION

This study is dedicated to the loving memory of my father. Although he did not live to see the completion of this work, his values, sacrifices, and unwavering belief in the importance of education remain the foundation of my journey. His strength, guidance, and encouragement continue to inspire me in all that I do. May his soul rest in eternal peace.

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ABSTRACT

Performance management remains a persistent challenge in road construction projects in developing countries, where cost overruns, schedule delays, quality deficiencies, and coordination failures continue to undermine infrastructure delivery. In Ethiopia, these challenges are compounded by institutional constraints, capacity limitations, fragmented performance measurement practices, and uneven adoption of digital technologies. Despite the strategic importance of road infrastructure to national development, empirical evidence on integrated performance management frameworks tailored to the Ethiopian road construction context remains limited. This study addresses this gap by developing and empirically validating a comprehensive performance management framework for road construction projects in Ethiopia.

The study adopts a quantitative correlational research design grounded in performance management and project management theory. Data were collected through a structured questionnaire administered to professionals involved in Ethiopian road construction projects, including contractors, consultants, project managers, and public-sector stakeholders. A total of 132 valid responses were analyzed following data screening procedures. Descriptive statistics were used to assess the level of implementation of Critical Success Factors (CSFs), Key Performance Indicators (KPIs), Building Information Modelling (BIM) and digital practices, contextual factors, and overall project performance. Reliability analysis using Cronbach's alpha confirmed acceptable internal consistency across all measurement scales. Pearson correlation analysis was then employed to examine relationships among the study constructs.

The findings reveal that the implementation of CSFs, KPIs, and BIM practices in Ethiopian road construction projects is moderate, with substantial variability across projects. Planning and coordination, financial management, and managerial competence emerged as particularly influential CSFs. Project performance outcomes were found to be uneven, with persistent challenges in cost and schedule performance despite relatively stronger quality outcomes. BIM and digital practices exhibited positive but moderate associations with project performance, reflecting partial and uneven adoption across the sector. Contextual factors, particularly regulatory processes, payment systems, market conditions, and environmental factors, were found to significantly influence project performance.

Correlation analysis demonstrated statistically significant relationships among CSFs, KPIs, BIM adoption, contextual factors, and overall project performance, providing empirical validation for the proposed performance management framework. The results confirm that project performance is shaped by the interaction of internal management practices, performance measurement systems, digital capabilities, and external contextual conditions.

The study contributes to theory by extending integrated performance management perspectives to a developing-country infrastructure context and clarifying the contingent role of BIM as an enabling rather than deterministic factor. Practically, the study provides an empirically grounded framework and evidence-based guidance for project managers, contractors, and policymakers seeking to improve road construction performance in Ethiopia. The research concludes that sustainable performance improvement requires a holistic, context-sensitive approach that aligns managerial practices, KPIs, digital tools, and institutional conditions.

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LIST OF ABBREVIATIONS /ACRONYMS

BIM	Building Information Model
BSC	Balanced Scorecard
BM	Benchmarking
CPM	Contemporary Performance Management
CSF	Critical Success Factor
EFQM	European Foundation of Quality Management
HRM	Human resource management
IMF	International Monetary Fund
ICT	Information and Communication Technology
IT	Information Technology
KPI	Key Performance Indicator
PE	Performance Evaluation
PM	Performance management
PMS	Performance management system
QM	Quality Management
SD	Standard deviation
SPSS	Statistical Package for Social Sciences

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Performance management in construction projects has evolved from a narrow emphasis on cost and time control toward a multidimensional and strategic management process that incorporates quality, safety, stakeholder satisfaction, environmental performance, organizational learning, and long-term value creation (Kaplan & Norton, 1996; Chan, Scott & Lam, 2002; Brown, 2020; Perumal, Rajendran & Subramanian, 2018). This shift reflects growing recognition that traditional performance measures, while necessary, are insufficient to capture the complexity of contemporary project environments or to support proactive managerial decision-making (Silvi et al., 2015; Baird, 2016; Moullin, 2017).

Road construction projects, in particular, represent highly complex socio-technical systems characterized by long project durations, substantial public investment, multiple interdependent stakeholders, regulatory oversight, environmental exposure, and significant socio-economic impacts. These characteristics intensify delivery risks and amplify the consequences of poor performance, making structured Performance Management Systems (PMS) essential governance instruments rather than mere reporting tools (Ward, Bicknell & Young, 1991; Bititci et al., 2015; Mischke, 2025). Effective PMS enable alignment between project-level execution and organizational or national development objectives, facilitate systematic monitoring and feedback, and support continuous performance improvement across the project life cycle.

Road development in Ethiopia has progressed through distinct historical and institutional phases. Early road construction initiatives were limited in scale, with modest network expansion prior to the mid-1970s. Subsequent governments placed increasing strategic emphasis on transport infrastructure, leading to substantial growth in total road length and road density over successive national development programmes (Desta, 2015; ERA, 2019). Despite these investments, national road coverage and service quality have remained constrained relative to demand, and performance deficiencies have persisted across many projects (ERA, 2019; Gebrehiwot & Luo, 2017).

Empirical studies consistently document poor performance outcomes in Ethiopian road construction projects, including extensive schedule delays, significant cost overruns, inefficient resource utilization, quality non-compliance, and safety shortcomings (Ayalew, Dakhli & Lafhaj, 2016; Kassaye, 2016; Koshe & Jha, 2016; Mitikie, Lee & Lee, 2017). For example, delay rates of 61–80 percent and cost deviations exceeding 20-40 percent have been reported across multiple project categories, while a large proportion of completed road projects failed to meet planned budget and time targets (Desta, 2015; Mestofa, 2015; Shiferaw, Jekale & Mohammed, 2016). These patterns indicate systemic weaknesses rather than isolated project-level failures.

The literature attributes these performance problems to a combination of managerial, financial, technical, and institutional factors, including ineffective project planning and control, inadequate risk management, delayed payments and cash-flow constraints, price escalation of materials, unreliable supply chains, shortages of skilled personnel, weak coordination and communication, and slow decision-making processes (Zewdu & Aregaw, 2015; Sinesilassie, Tabish & Jha, 2017; Gebrehiwot & Luo, 2017; Adekunle, Aigbavboa & Ejohwomu, 2020). Notably, many Ethiopian studies focus on identifying factors affecting performance rather than on integrated mechanisms for improving performance, leaving a gap in actionable management frameworks.

Traditional performance measurement approaches in construction have historically emphasized financial and schedule indicators, which provide retrospective information on activities already completed (Yaghoobi & Haddadi, 2016; Oyewobi et al., 2015). While such measures remain important, they are limited in their ability to support corrective action, strategic alignment, or learning, particularly in dynamic and uncertain environments (Baird, 2016). This limitation has driven the transition toward performance management frameworks that integrate financial and non-financial measures; internal and external perspectives; leading and lagging indicators; and short-term and long-term objectives (Silvi et al., 2015; Moullin, 2017).

PM theory further distinguishes between structural (technical) control, which concerns what is measured and how targets are set, and social control, which relates to how performance information is used in managerial routines, communication, and decision-making (Bititci, 2015; Bititci et al., 2015). Sustainable performance improvement requires a balance between these dimensions. However, evidence suggests that PM practices remain weakly institutionalized within Ethiopian construction organizations, particularly at the project level, where performance information is often underutilized for learning and improvement.

Balanced Scorecard (BSC) frameworks have been widely adopted as strategic PM tools (Kaplan & Norton, 1996; Lueg, 2015), yet their generic structure often overlooks industry-specific characteristics, project temporality, sustainability requirements, and the influence of social and natural environments in infrastructure delivery (Pirot, 2016). Consequently, construction researchers advocate context-sensitive PM frameworks that incorporate Critical Success Factors (CSFs) reflecting managerial and organizational enablers, alongside Key Performance Indicators (KPIs) that capture multidimensional project outcomes (Chan, Scott & Lam, 2002; Ward, Bicknell & Young, 1991).

CSFs represent the limited number of conditions that must be effectively managed to achieve project success, including leadership quality, planning effectiveness, financial capacity, stakeholder engagement, and organizational competence (Rockart, 1979; Chan, Scott & Lam, 2002). KPIs operationalize these conditions into measurable indicators that enable monitoring, comparison, and feedback across performance dimensions such as cost, time, quality, safety, productivity, and stakeholder satisfaction (Adewunmi, Iyagba & Omirin, 2017; Adekunle, Aigbavboa & Ejohwomu, 2020). The integration of CSFs and KPIs within PMS is therefore essential for translating strategic intent into operational control.

Recent literature also highlights the growing role of digital technologies, particularly Building Information Modelling (BIM), in enhancing performance management through improved information integration, visualisation, coordination, and real-time monitoring (Challa, Patil & Kumar, 2022; Lafhaj, Elghaish & Soudani, 2023). BIM-enabled practices such as 4D scheduling and 5D cost management offer significant potential for improving planning accuracy, reducing rework, and strengthening decision support. However, in developing-country contexts, BIM adoption remains uneven due to constraints related to skills, standards, organizational readiness, and institutional support (Makori, 2023; Shalla & Mengistu, 2023). This reinforces the need to position digitalization as an enabling component within a broader PMS framework rather than as a standalone solution.

In summary, Ethiopia's expanding road infrastructure programme, persistent performance deficiencies, and fragmented performance practices underscore the need for a contextually adapted and empirically validated performance management framework that integrates CSFs, KPIs, contextual factors, and digital tools to improve road construction project performance.

1.2 Statement of the Research Problem

Despite sustained public investment and strategic prioritization of road infrastructure, Ethiopian road construction projects continue to exhibit systemic performance shortcomings, including delays, cost overruns, quality non-compliance, safety incidents, and stakeholder dissatisfaction. Evidence from project audits, sector reports, and academic studies suggests that these outcomes stem from entrenched weaknesses in planning, coordination, financial management, capability development, and institutional governance rather than from isolated technical failures (Desta, 2015; Ayalew, Dakhli & Lafhaj, 2016; Adekunle, Aigbavboa & Ejohwomu, 2020).

Current performance assessment practices within Ethiopian road projects remain largely reactive and compliance-driven, focusing primarily on cost tracking and schedule reporting. Such practices provide limited insight into underlying performance drivers and fail to link managerial and organizational enablers (CSFs) with measurable outcomes (KPIs). Moreover, performance information is seldom integrated with contextual risk factors or digital tools in a manner that supports systematic diagnosis and continuous improvement (Islam & Suhariadi, 2018; Challa, Patil & Kumar, 2022).

While numerous studies have examined individual factors affecting construction project performance in Ethiopia, such as delays, cost overruns, or contractor capability, there is a notable absence of integrated empirical frameworks that explain how CSFs, KPIs, contextual conditions, and digitalization practices jointly influence overall project performance. The lack of such evidence-based frameworks limits the ability of practitioners and policymakers to prioritize interventions, allocate resources effectively, and institutionalize performance improvement practices.

Accordingly, the central research problem addressed in this study is the absence of a comprehensive, contextually grounded, and empirically validated performance management framework tailored to Ethiopian road construction projects.

1.3 Research Gap

The literature reveals four interrelated gaps. First, there is limited quantitative evidence establishing the relationships between CSFs, KPIs, and overall project performance within the Ethiopian road construction sector. Second, existing PMS and PM frameworks are predominantly developed in advanced economies and remain insufficiently adapted to Ethiopia's institutional, socio-economic, and technological context. Third, prior studies tend to focus on isolated performance dimensions rather than holistic integration of enabling factors, measurable outcomes, and contextual influences. Fourth, despite increasing interest in BIM and digitalization, there is little empirical evidence demonstrating how these tools can be embedded within an integrated PMS framework suitable for Ethiopian road projects.

1.4 Objectives of the Study

1.4.1 General Objective of the Study

The general objective of this study is to develop and empirically validate a comprehensive performance management framework for road construction projects in Ethiopia by examining the relationships among Critical Success Factors, Key Performance Indicators, contextual factors, digitalization practices, and overall project performance.

1.4.2 Specific Objectives of the Study

The specific objectives of the study are to:

1. Identify the key Critical Success Factors influencing performance in Ethiopian road construction projects.
2. Examine the Key Performance Indicators used to assess project performance outcomes.
3. Analyze the influence of contextual factors on road construction project performance.

4. Assess the role of Building Information Modelling and digital practices in enhancing performance management.
5. Examine the relationships among CSFs, KPIs, contextual factors, digitalization, and project performance using quantitative correlational analysis.
6. Develop an empirically grounded performance management framework suitable for the Ethiopian road construction sector.

1.5 Research Questions

The study is guided by the following research questions:

1. What Critical Success Factors significantly influence road construction project performance in Ethiopia?
2. Which Key Performance Indicators are most relevant for assessing performance outcomes in Ethiopian road projects?
3. How do contextual factors affect the performance of road construction projects?
4. What role does Building Information Modelling play in performance management within Ethiopian road construction projects?
5. What relationships exist among CSFs, KPIs, contextual factors, digitalization, and overall project performance?
6. How can the empirically identified relationships among Critical Success Factors, Key Performance Indicators, contextual factors, and digitalization practices be synthesized into a comprehensive performance management framework for road construction projects in Ethiopia?

1.6 Significance of the Study

This study makes both theoretical and practical contributions to the fields of construction management and performance management.

From a theoretical perspective, the study extends existing PMS and PM literature by providing empirical evidence from a developing-country context, where institutional capacity, governance arrangements, and technological maturity differ significantly from those of advanced economies.

By quantitatively examining the relationships between CSFs, KPIs, contextual factors, and digitalization practices, the study contributes to a deeper understanding of how performance drivers interact within project-based organizations, addressing gaps identified in prior studies that focused on isolated performance indicators (Chan, Scott & Lam, 2002; Ward, Bicknell & Young, 1991; Bititci et al., 2015).

From a practical perspective, the findings offer evidence-based guidance to contractors, consultants, clients, and policymakers involved in Ethiopian road construction projects. The proposed PMS framework supports improved decision-making, prioritization of interventions, resource allocation, and stakeholder coordination. Furthermore, by incorporating BIM and digital practices within the PMS, the study promotes data-driven performance monitoring, transparency, and continuous improvement, thereby enhancing project delivery effectiveness and sectoral efficiency (Challa, Patil & Kumar, 2022; Adekunle, Aigbavboa & Ejohwomu, 2020).

1.7 Reasons for Choosing the Topic

The motivation for selecting this research topic arises from persistent and well-documented performance challenges in Ethiopian road construction projects, including delays, cost overruns, quality deficiencies, safety incidents, and stakeholder dissatisfaction. Despite extensive public investment and strategic prioritization of road infrastructure, existing project delivery practices have not consistently achieved desired performance outcomes (Desta, 2015; Ayalew, Dakhli & Lafhaj, 2016; ERA, 2019).

In addition, professional practice and academic literature indicate a lack of locally validated and integrated PMS frameworks that align global performance management principles with Ethiopian institutional and operational realities. While numerous studies have identified factors affecting project performance, limited attention has been given to developing and empirically validating holistic performance management mechanisms capable of guiding systematic improvement (Zewdu & Aregaw, 2015; Sinesilassie, Tabish & Jha, 2017). Addressing this gap is both academically relevant and practically necessary to support sustainable infrastructure development.

1.8 Scope and Alignment of the Study

This study focuses on medium- to large-scale road construction projects in Ethiopia, involving public-sector clients, contractors, consultants, and associated stakeholders. The scope is limited to project-level performance management practices and does not extend to macro-level transport policy evaluation.

Methodologically, the study adopts a quantitative correlational research design, enabling empirical examination of relationships between CSFs, KPIs, contextual factors, digitalization practices, and overall project performance. The research is conceptually grounded in Performance Management (PM) theory and aligned with project management maturity perspectives, ensuring both theoretical rigour and practical applicability (Silvi et al., 2015; Bititci et al., 2015; Moullin, 2017).

The structure and analytical focus of the study are explicitly aligned with subsequent chapters, including descriptive analysis (Chapter 4), correlation-based discussion of findings (Chapter 5), and development of an empirically grounded PMS framework (Chapter 6), thereby ensuring coherence between research design, analysis, and contribution.

1.9 Thesis Structure

This thesis is structured into seven interrelated chapters, each building logically on the preceding chapter to address the study's aim and research questions.

Chapter 1 introduces the research context by defining the problem, identifying research gaps, and presenting the study's aim, objectives, and research questions. It also outlines the significance, scope, and conceptual orientation of the study within both global and Ethiopian road construction contexts.

Chapter 2 provides a critical review of relevant literature on performance management in construction projects. It examines theoretical perspectives, empirical findings, and existing performance management frameworks, with particular attention to Critical Success Factors, Key

Performance Indicators, digitalization, and contextual influences. The chapter concludes by developing the conceptual framework that guides the empirical investigation.

Chapter 3 describes the research methodology adopted to achieve the study objectives. It justifies the quantitative correlational research design and explains the sampling strategy, data collection instruments, measurement constructs, and data analysis procedures, including reliability and validity considerations.

Chapter 4 presents the empirical results derived from the analysis of survey data collected from Ethiopian road construction projects. It reports descriptive statistics and correlation results related to Critical Success Factors, Key Performance Indicators, BIM and digital practices, contextual factors, and overall project performance.

Chapter 5 discusses the empirical findings in relation to existing theories and prior studies. It interprets the observed relationships among the study variables and synthesizes the results to develop and validate an integrated Construction Project Performance Management framework tailored to the Ethiopian road construction context.

Chapter 6 outlines the study's contributions to theory and practice. It demonstrates how the validated framework advances performance management knowledge in developing-country construction environments and provides practical implications for policymakers, practitioners, and project stakeholders.

Finally, Chapter 7 presents the overall conclusions of the study, discusses its limitations, and proposes directions for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Performance management (PM) in construction projects is widely recognized as a critical determinant of project efficiency, delivery reliability, quality assurance, cost control, and stakeholder satisfaction. Within road construction, effective PM extends beyond the traditional "iron triangle" of time, cost, and quality to include safety performance, environmental compliance, community engagement, governance requirements, and organizational learning (Brown, 2020; Perumal et al., 2018). The literature consistently shows that structured Performance Management Systems (PMS) enable the translation of strategic intent into operational control by aligning project-level priorities with organizational goals, improving resource allocation decisions, and institutionalizing monitoring and feedback routines. In this sense, PMS are not merely reporting mechanisms but governance instruments that shape behaviors, decision-making, and learning across project stakeholders.

This chapter reviews the evolution, definitions, and core characteristics of PM, with particular emphasis on its objectives, principles, and significance within construction management. It examines barriers that constrain PM effectiveness and synthesizes strategies proposed in the literature to overcome these constraints. In addition, the chapter considers PMS life-cycle perspectives and critically evaluates dominant PM models and frameworks, highlighting their strengths, limitations, and applicability to construction and infrastructure delivery. The review further contextualizes performance management globally and within Ethiopia, identifying critical success factors (CSFs), key performance indicators (KPIs), and performance measures commonly associated with road construction outcomes. By integrating global best practice perspectives with Ethiopian and developing-country evidence, the chapter establishes the theoretical and practical foundations for developing a contextually relevant performance management framework for Ethiopian road construction projects.

To ensure coherence and progression, the chapter follows a structured flow. First, it establishes foundational concepts through key definitions and historical development, providing theoretical grounding for later sections. Second, it consolidates understanding of PMS characteristics, importance, objectives, and guiding principles. Third, it synthesizes barriers and mitigation strategies to connect theory to implementation realities. Fourth, it evaluates existing frameworks and life-cycle models, enabling critical reflection on their suitability for complex road project environments. Finally, the chapter narrows to construction-specific and Ethiopia-specific conditions, enabling the integration of CSFs, KPIs, and measurable metrics into a framework that reflects the operational and institutional realities of Ethiopian road projects.

2.2 Theoretical Framework

2.2.1 Key Theories in Construction Project Performance Management

In research, theories provide systematic explanations that organize knowledge, clarify relationships among constructs, and support interpretation and prediction of observed phenomena (Babbie, 2016; Creswell, 2014). In construction project performance management, theoretical perspectives guide how researchers conceptualize the drivers of project outcomes, such as time, cost, quality, safety, and stakeholder satisfaction, and how performance measurement and control systems should be structured to influence those outcomes (Love et al., 2020). For road construction projects, where delivery is shaped by high interdependence, uncertainty, and institutional oversight, theory becomes essential for explaining why performance varies across projects and what mechanisms enable improvement.

Performance Measurement Theory provides a foundational lens for understanding how organizations design and deploy systematic metrics to assess efficiency, effectiveness, and strategic progress. The theory emphasizes that performance should be evaluated using valid and reliable indicators covering both financial and non-financial dimensions, enabling evidence-based decision-making, organizational learning, and continuous improvement (Neely, Gregory & Platts, 1995; Franco-Santos et al., 2012). Within project-based environments such as construction, Performance Measurement Theory reinforces the need for multidimensional performance criteria, cost, time, quality, safety, and stakeholder value, so that management control and corrective actions are informed by a balanced understanding of delivery (Luu, Cao & Park, 2008; Ma et al., 2020). In effect, the theory positions systematic measurement as a prerequisite for meaningful and sustained performance improvement.

Contingency Theory argues that there is no single best management or measurement system; rather, effectiveness depends on contextual variables including organizational structure, project complexity, environmental uncertainty, governance arrangements, and resource capacity (Fiedler, 1964; Donaldson, 2001). In construction and infrastructure projects, contingency logic suggests that differences in regulatory environments, site conditions, contractor capability, and supply chain reliability require adaptable and context-specific performance management systems. Consequently, Contingency Theory foregrounds contextual fit, flexibility, and responsiveness as key determinants of project and organizational performance (Rahman & Kumaraswamy, 2005).

Institutional Theory explains organizational behavior through the influence of external institutional pressures, including coercive regulatory requirements, normative professional expectations, and mimetic tendencies under uncertainty (DiMaggio & Powell, 1983). Organizations adopt structures and practices not solely for technical efficiency but also to secure legitimacy, stability, and acceptance within their environments (Scott, 2008). In construction and infrastructure delivery, institutional forces, such as government procurement policies, donor conditions, professional norms, and stakeholder expectations, shape performance management practices, including what is measured, how reporting is done, and how compliance is assessed. Institutional Theory therefore highlights that performance outcomes depend not only on internal efficiency but also on the organization’s capacity to conform to institutional expectations and sustain legitimacy (Loosemore, Raftery & Lingard, 2012). In road construction projects, these institutional pressures influence PMS design, implementation discipline, and the behavioral use of performance information.

Systems Theory conceptualizes organizations and projects as holistic arrangements of interdependent subsystems that must function coherently to achieve optimal outcomes. Von Bertalanffy (1968) emphasizes that systems operate through dynamic interaction among inputs, processes, outputs, and feedback loops, and that effectiveness depends on alignment and responsiveness across these components. In project environments, Systems Theory implies that performance cannot be explained through isolated variables; rather, outcomes emerge from the interactions among people, technology, procedures, and external conditions (Kast & Rosenzweig, 1972). In road construction, characterized by technical, financial, human, regulatory, and technological subsystems, performance is an emergent property shaped by procurement efficiency, supply chain stability, coordination effectiveness, environmental constraints, and the maturity of monitoring systems. This theoretical lens therefore supports integrated, feedback-driven performance management that emphasizes coordination, learning, and continuous improvement across subsystems.

Project Management (PM) Theory provides structured principles, methodologies, and tools guiding planning, execution, control, and closure to achieve objectives related to time, cost, scope, quality, and risk (Kerzner, 2017). It is grounded in the premise that projects follow structured life cycles and require formalized processes, role clarity, coordinated resources, and robust control mechanisms to deliver value consistently (PMI, 2021). In construction settings defined by complexity and multiple stakeholders, PM Theory supports disciplined governance through KPIs, reporting systems, and feedback cycles, strengthening predictability, reducing variability, and enabling timely corrective action. Accordingly, PM Theory complements measurement-oriented and institutional perspectives by specifying the operational mechanisms through which performance can be planned, monitored, and improved.

2.2.2 Definitions and Conceptual Clarifications

Clear conceptualization of performance, performance measurement, performance measures, performance measurement systems, and performance management frameworks is essential for developing an effective framework for road construction projects. Construction, particularly in developing contexts such as Ethiopia, is characterized by complexity, stakeholder plurality, multi-layered delivery structures, and dynamic operating conditions. For this reason, definitions that foreground continuity, strategic alignment, multidimensionality, and improvement loops provide the most appropriate grounding for the proposed framework.

Definition of Performance Management

Performance management (PM) has been defined in varied ways, reflecting different disciplinary emphases. Moynihan (2008) describes PM as a structured system that produces performance information through strategic planning and measurement, providing a basis for decision-making. While this highlights the informational role of PM, it is less explicit regarding continuous improvement and capability development. Smither and London (2009) conceptualize PM as an ongoing process encompassing goal setting, employee development, feedback, formal evaluation, and the linking of performance to recognition and reward, emphasizing continuity and human-centred development, features that are particularly relevant in construction where team performance and coordination are critical.

Biron, Farndale, and Paauwe (2011) define PM as a set of practices aimed at improving the efficiency and effectiveness of individuals and organizations. Although this definition captures organizational outcomes, it is less explicit about how operational and project-level controls interact with strategy. Atkinson (2012) views PM as the use of performance measurement information to manage organizations efficiently, endorse learning, and support continuous improvement; an interpretation strongly aligned with construction projects where evolving risks require adaptive learning. Aguinis (2023) offers a particularly comprehensive definition, framing PM as “a continuous process of identifying, measuring, and developing the performance of individuals and work teams and aligning the performance with the organization’s strategic goals”. This definition is especially suitable for construction projects because it integrates continuous improvement, strategic alignment, and multi-level performance relationships.

Bititci, Cocca, and Ates (2016) further reinforce PM as an iterative closed-loop process in which performance measures are used to manage and develop organizational performance through continuous adjustment to changing operating environments. This is critical in road construction contexts where variability, uncertainty, and interdependencies require responsiveness. Armstrong (2017) complements these perspectives by emphasizing structured goal setting aligned to strategic objectives, performance review, and people development, offering a practical basis for integrating human capability development with delivery controls. Finally, Janudin et al. (2023) define PM broadly as planning, implementing, and monitoring activities to enhance organizational efficiency and effectiveness, supporting integration across operational and strategic dimensions.

For the purposes of this research, performance management is conceptualized as a continuous process of identifying, measuring, and developing the performance of individuals and project teams while aligning these activities with the strategic objectives of road construction organizations (Aguinis, 2023). Effective PM in dynamic construction environments additionally requires iterative adjustment to emerging conditions (Bititci, Cocca & Ates, 2016) and structured goal setting, monitoring, and capability development routines (Armstrong, 2017). This integrated understanding establishes a suitable foundation for developing a contextually relevant PM framework for Ethiopian road construction projects that addresses both operational performance and strategic delivery outcomes.

Definition of Performance

The concept of performance remains contested in management literature, with Lebas (1995) emphasizing that performance involves deploying and managing the causal factors that lead to timely achievement of objectives under contextual constraints. This perspective aligns strongly with project-based environments where time, cost, quality, and safety outcomes must be attained amid uncertainty and resource limitations. More recent conceptualizations sustain this systemic view. Yadav (2020) positions performance as a holistic construct integrating efficiency, effectiveness, and adaptability. In road construction projects, where conditions such as weather variability, material availability, contractual changes, and stakeholder pressures frequently shift, performance must be understood not only as outputs achieved but also as the capability of the project system to adjust and remain delivery-effective under constraint.

Definition of Performance Measurement

Performance measurement is generally defined as the systematic collection, analysis, and use of metrics to evaluate the efficiency and effectiveness of actions. Foundational accounts describe performance measurement as the use of multi-faceted measures to understand organizational or project performance (Neely et al., 1996; Bourne et al., 2003; Taticchi et al., 2010). Neely et al. (2005) emphasize the systematic evaluation of inputs, outputs, transformation processes, and productivity—dimensions directly relevant to road construction where labor, equipment, materials, and sequential workflows must be monitored. Yaghoobi and Haddadi (2016) define performance measurement as a systematic process for acquiring acceptable performance data and the factors influencing it, highlighting a diagnostic function important for managing construction complexity. Smith and Bititci (2017) similarly position performance measurement as encompassing measure development, target-setting, data collection and analysis, and assessment of performance gaps, reinforcing the importance of feedback loops in project-based industries.

Contemporary perspectives increasingly emphasize adaptability and digital integration. Fernandes et al. (2021) argue that performance measurement now frequently involves real-time monitoring, dashboards, and integrated data streams, developments that resonate with emerging practices in Ethiopian road construction where digitalization is gradually increasing. In construction projects, performance measurement therefore supports proactive control of productivity, material utilization, sequencing reliability, and compliance performance.

Definition of Performance Measures

Performance measures are commonly conceptualized as indicators that capture how well objectives are being achieved. Bourne et al. (2003) and Neely et al. (2005) define performance measures as quantifiable metrics reflecting efficiency and/or effectiveness, while Sapri and Pitt (2005) emphasize that measures demonstrate the extent to which objectives are met, strengthening the strategic link between indicators and intent. The literature further classifies performance measures as financial/non-financial, internal/external, quantitative/qualitative, and leading/lagging (Neely et al., 1997; Meyer, 2008). In road construction, this classification is particularly important because lagging measures such as cost overrun or schedule delay must be balanced with leading measures such as design approvals, equipment readiness, or stakeholder satisfaction to enable early corrective action. Recent studies, such as Kamalirad et al., 2022, further advocate integrating sustainability, digitalization, and stakeholder indicators, reflecting the growing multidimensionality of construction performance assessment.

Definition of Performance Measurement Systems (PMS)

A performance measurement system (PMS) refers to the architecture through which performance measures are designed, implemented, monitored, and used. Neely et al. (2005) describe PMS as a systematic approach for evaluating inputs, outputs, transformation processes, and productivity, an interpretation directly aligned with construction operations where labor, material flows, equipment utilization, and output quality must be systematically monitored. Smith and Bititci (2017) conceptualize PMS as including target-setting, data collection, analysis, reporting, and performance-gap diagnosis, emphasizing the need for integration rather than fragmented reporting. Contemporary perspectives highlight PMS as enabling continuous improvement and real-time insight, particularly through digital tools (Cocca & Alberti, 2020; Marzouk et al., 2023). In the Ethiopian road construction context, where performance problems often persist due to weak monitoring and feedback discipline, the strengthening of PMS architecture is especially important for improving delivery reliability.

Definition of Performance Management Framework

A performance management framework (PMF) is broader than a PMS, integrating measurement with monitoring, analysis, decision-making, organizational learning, and improvement cycles. Bititci, Cocca and Ates (2016) emphasize PM as a repeated closed-loop process in which measures guide adaptation to changing environments, an approach well-suited to construction projects where shocks such as material shortages, disputes, and scope changes are common. Armstrong (2017) similarly emphasizes continuous alignment of goals, monitoring, and capability development. Recent studies (e.g., Akhtar & Sushil, 2018; Gigloo, 2018) define PMF as a structured combination of processes, methodologies, metrics, and systems designed to guide performance, while Sharul Effendy et al. (2023) emphasize planning, implementation, monitoring, and improvement in organizational effectiveness. For road construction in Ethiopia, an effective PMF must therefore integrate strategic alignment, project-level KPIs, stakeholder engagement, monitoring discipline, and feedback loops that enable corrective action and learning across project cycles.

Table 2.1: Comparison of Definitions

Concept	Author(s)	Key Definition	Relevance to Road Construction Projects
Performance	Lebas (1995)	Management of causal factors to achieve predefined objectives under constraints	Reflects objective-driven project delivery amid uncertainty and resource limitations
	Yadav (2020)	Holistic construct integrating efficiency, effectiveness, and adaptability	Captures dynamic and evolving nature of road projects
Performance Measurement	Neely et al. (1996; 2005)	Multi-dimensional assessment of efficiency and effectiveness through inputs, processes, and	Foundation for KPIs in road construction

		outputs	
	Yaghoobi & Haddadi (2016)	Systematic collection of performance data and influencing factors	Supports diagnostic control and root-cause analysis
	Smith & Bititci (2017)	Developing measures, setting targets, analyzing data, and assessing gaps	Aligns with monitoring and reporting routines
Performance Measures	Bourne et al. (2003)	Quantitative and qualitative metrics of efficiency and effectiveness	Measures cost, time, quality, safety, productivity
	Sapri & Pitt (2005)	Indicators demonstrating achievement of objectives	Strengthens linkage between objectives and KPIs
Performance Measurement System (PMS)	Neely et al. (2005)	Structured system evaluating inputs, outputs, productivity, and outcomes	Mirrors workflow and resource use in road construction
	Smith & Bititci (2017)	Integrated system for targets, data collection, analysis, and gap assessment	Supports evidence-based corrective actions
Performance Management Framework (PMF)	Bititci et al. (2016)	Closed-loop adaptive process linking measurement, learning, and response	Matches uncertain and evolving project environments
	Armstrong (2017)	Continuous goal alignment, monitoring, feedback, and development	Supports project and organizational learning
	Sharul Effendy et al. (2023)	Planning, implementation, monitoring, and continuous improvement cycle	Supports holistic governance for public road projects

For this study, performance is conceptualized as the capability of a project system to achieve intended objectives efficiently and effectively within contextual constraints. Performance measurement refers to the systematic collection, analysis, and interpretation of multidimensional indicators that capture efficiency, effectiveness, and improvement needs. Performance measures constitute quantifiable or qualitative indicators linked to strategic or project objectives, whereas a performance measurement system represents the structured processes and tools used to generate, analyze, and report performance information. A performance management framework integrates these elements into a continuous, closed-loop process that aligns individual, team, and project-level results with organizational strategy while enabling feedback, decision-making, and continuous improvement. This integrated conceptualization is particularly relevant for road construction in Ethiopia, where dynamic site conditions, institutional processes, and complex stakeholder relationships require a comprehensive, adaptive, and practically implementable performance governance system.

2.2.3 Development of Performance Management

The concept of performance management has evolved from a narrow emphasis on financial outputs and annual appraisal routines toward more integrated, strategic, and continuous systems. Early approaches prioritized performance measurement for control and accountability, focusing on outputs, cost containment, and timelines to ensure compliance with organizational objectives (Moynihan, 2008). These systems were largely top-down, internally oriented, and reactive, often producing reporting outputs with limited organizational learning value or improvement capability (Moynihan, 2008; Smither & London, 2009). In many settings, performance reporting operated as an administrative requirement rather than a mechanism that shaped behavior and delivery outcomes.

As strategic management principles expanded, PM increasingly became linked to alignment between individual and team performance and organizational strategy (Aguinis, 2013). Smither and London (2009) reinforced PM as a continuous process involving goal setting, development, feedback, and evaluation. This shift marked a decisive movement away from one-off appraisal activity toward continuous systems that support capability strengthening and delivery alignment. By operationalizing strategic intent through targets and feedback routines, PM began to function as a platform for informed decision-making and sustained performance improvement (Armstrong, 2017).

Technological advancement and digitalization further accelerated PM development through real-time data collection, automated dashboards, and dynamic monitoring tools (Cosa & Torelli, 2024; Uzule, Zarina & Shina, 2024). In construction and SMEs, digital tools can strengthen responsiveness to emerging risks and inefficiencies, enabling earlier intervention and tighter control. Contemporary PMS also incorporate non-financial indicators—stakeholder satisfaction, innovation, sustainability, and safety, reflecting an expanding multidimensional understanding of performance (Ibrahim, Zayed & Lafhaj, 2024). This evolution supports the transition from purely financial or output metrics to integrated assessment systems suited to complex, multi-stakeholder projects.

More recent PM frameworks increasingly incorporate sustainability, governance, and inter-organizational collaboration. ESG integration extends accountability beyond internal operations to supply chains and collaborative networks (Asiaei, Farzipoor Saen & Khodayari, 2025; Maestrini, Bititci & Martinez, 2018). In construction, where delivery is networked and temporary, inter-organizational PM supports shared goal setting, transparency, and coordinated accountability among contractors, subcontractors, suppliers, and clients (Altin, McCarthy & Sezer, 2018). Risk management and resilience are also increasingly embedded, supporting performance evaluation under uncertainty and rapid change rather than only under stable conditions (Kairliyeva & Adeyeye, 2023).

Overall, contemporary PM converges toward an integrated, iterative, and multidimensional approach balancing operational control, strategic alignment, and continuous improvement (Bititci, Cocca & Ates, 2016). Human capability development, goal setting, and feedback loops remain central for translating strategic objectives into measurable results in complex project-based environments (Armstrong, 2017; Aguinis, 2023). These developments have direct relevance to Ethiopian road projects, where performance challenges extend beyond cost and time to include safety outcomes, community relations, environmental compliance, and institutional process constraints.

2.2.4 Performance Management System Characteristics in the Construction Industry

The characteristics of effective PMS have been widely examined in management and construction literature, with scholars commonly conceptualizing PMS around three interrelated dimensions: system features, organizational roles, and operational processes (Globerson, 1985; Maskell, 1998; Neely et al., 1997; Franco-Santos et al., 2007). This tripartite perspective provides a comprehensive framework for understanding not only what PMS consists of, but also how it functions and why it delivers value within complex organizational and project environments.

In construction, particularly in large-scale infrastructure and road projects, these characteristics acquire heightened importance due to the sector's fragmented structure, temporary project organizations, and exposure to uncertainty. Effective PMS in this context must therefore go beyond static measurement to function as an integrated managerial capability that supports coordination, learning, and adaptive control throughout the project lifecycle.

System Features and Infrastructural Characteristics

At the foundational level, an effective PMS requires robust technical and organizational features that enable clarity, consistency, and strategic relevance. Core features include the integration of financial and non-financial performance measures, the use of comparable and standardized indicators, and explicit alignment between performance metrics and organizational strategy (Neely et al., 2001; Kennerley & Neely, 2003). Financial indicators such as cost variance and cash flow stability remain essential, but their effectiveness is substantially enhanced when complemented by non-financial measures capturing safety performance, quality compliance, productivity, environmental impact, and stakeholder satisfaction.

Beyond indicator design, PMS effectiveness is strongly influenced by infrastructural support systems, including reliable data collection mechanisms, information technologies, and analytical capabilities. Construction projects generate large volumes of dispersed site data, and without appropriate systems to capture, process, and interpret this information, performance measurement becomes fragmented and reactive rather than proactive. The literature emphasizes that PMS infrastructure must be embedded within routine managerial practices, enabling performance information to inform planning meetings, progress reviews, and corrective action decisions rather than remaining isolated within reporting documents (Amaratunga & Baldry, 2002; Ankrah & Proverbs, 2005).

Importantly, PMS features must be understandable and usable by practitioners. Overly complex measurement systems risk disengagement, inconsistent application, and superficial compliance. Effective PMS therefore balances analytical sophistication with practical usability, ensuring that indicators are clearly defined, data requirements are realistic, and outputs are intelligible to both technical and managerial stakeholders (Bititci, Turner & Begemann, 2000).

Core Roles and Organizational Functions of PMS

Beyond technical features, PMS fulfils a range of strategic, operational, and relational roles within construction organizations. At the strategic level, PMS functions as a translation mechanism that converts high-level organizational objectives into actionable performance targets and KPIs. By linking corporate strategy to project execution, PMS strengthens vertical alignment and ensures that day-to-day decisions reflect broader organizational priorities (Marr, 2015; Bourne et al., 2018).

At the operational level, PMS supports real-time monitoring and diagnostic control within dynamic construction environments. Through continuous tracking of schedule adherence, cost performance, resource utilization, and quality outcomes, PMS enables project managers to identify emerging deviations and intervene before performance problems escalate (Luu et al., 2008). This operational role is particularly critical in road construction projects, where activities are sequential, geographically dispersed, and sensitive to external disruptions such as weather and logistics constraints.

PMS also performs an important relational and governance role by enhancing transparency, communication, and trust among project stakeholders. Clear performance indicators and shared reporting structures facilitate coordination between clients, consultants, contractors, and subcontractors, reducing ambiguity and disputes over responsibilities and outcomes (Chan & Chan, 2004). In this sense, PMS contributes not only to performance control but also to improved governance and collaborative behavior across organizational boundaries.

Processes and Operational Activities of the Performance Management System

The effectiveness of a PMS in road construction projects is fundamentally determined by the robustness and coherence of its underlying processes. PMS operates through a set of interrelated and iterative activities that collectively enable organizations to plan, measure, monitor, evaluate, and improve project performance over time. These activities typically include performance planning, indicator selection, data collection, analysis, feedback generation, corrective action, and periodic system review (Kueng, 2000; Bititci et al., 2012).

As illustrated in Figure 2.1, the PMS is conceptualized as an integrated process embedded within sequential project stages and reinforced through a continuous improvement cycle. This integration ensures that performance management is not treated as a standalone control function but as an ongoing managerial capability that evolves alongside the project life cycle.

Stage 1: Planning and Performance Target Setting

The PMS process begins at the planning stage, where project objectives are translated into measurable performance targets. At this stage, Critical Success Factors (CSFs) and Key Performance Indicators (KPIs) are defined in alignment with project scope, cost, schedule, quality, safety, and resource constraints. Establishing clear and realistic targets provides a reference baseline against which subsequent performance can be assessed. In road construction projects, this stage is particularly critical due to the long project durations, complex stakeholder interfaces, and exposure to contextual uncertainties such as funding variability and environmental conditions.

Stage 2: Performance Measurement

Once targets are established, the PMS progresses to systematic performance measurement. This stage focuses on the collection of reliable and timely data related to predefined KPIs, including cost performance, schedule adherence, quality outcomes, safety indicators, productivity, and equipment utilization. Data are typically sourced from site records, progress reports, financial statements, and safety logs. Accurate measurement at this stage ensures that performance information reflects actual project conditions rather than subjective perceptions, thereby strengthening the credibility of subsequent analysis and decision-making.

Stage 3: Monitoring and Performance Control

The monitoring and control stage involves tracking measured performance against planned targets and identifying deviations, trends, and emerging risks. Performance data are analyzed to detect cost overruns, schedule slippage, quality non-conformities, and safety incidents. In road construction projects, early identification of deviations is essential for preventing escalation into major delays or cost impacts. This stage supports proactive management by enabling timely interventions rather than reactive responses after performance failures have occurred.

Stage 4: Review, Reporting, and Feedback

At the review and reporting stage, analyzed performance information is communicated to relevant stakeholders through formal reporting and review mechanisms. Management reviews play a critical role in interpreting performance results, diagnosing root causes of deviations, and evaluating the effectiveness of existing control measures. Feedback generated at this stage facilitates organizational learning by informing managers and project teams about what is working well and where adjustments are required. Importantly, this feedback is not limited to operational issues but may also inform revisions to performance indicators, targets, and monitoring practices.

Stage 5: Improvement and Corrective Actions

The final stage of the PMS process focuses on implementing corrective and preventive actions aimed at improving future performance. Lessons learned from performance reviews are used to refine work processes, adjust resource allocations, strengthen coordination mechanisms, and update performance targets. This stage reinforces the role of PMS as a learning-oriented system that supports continuous improvement rather than mere performance reporting. In road construction projects, where conditions evolve over time, such adaptive capability is essential for sustaining performance across different project phases.

Continuous Improvement Cycle

Underlying all stages of the PMS is a continuous feedback loop that links performance outcomes back to planning and decision-making. As shown in Figure 2.1, insights generated through measurement, monitoring, and review feed back into subsequent planning cycles, enabling continuous refinement of CSFs, KPIs, and performance targets. This cyclical logic positions PMS as a dynamic organizational capability that supports learning, risk management, and evidence-based decision-making across the entire project life cycle (Bititci et al., 2012).

PM process: Planning → Measurement → Monitoring → Review → Improvement

STAGE 1: Planning & Target Setting

PROCESS: Define objectives, CSFs, and KPIs

KEY FOCUS: Scope, cost, time, quality, safety targets

↓

STAGE 2: Performance Measurement

PROCESS: Data Collection & Measurement

KEY FOCUS: KPIs for cost, schedule, quality, safety

↓

STAGE 3: Monitoring & Control

PROCESS: Performance Tracking & Analysis

KEY FOCUS: Variance analysis and risk identification

↓

STAGE 4: Review & Reporting

PROCESS: Evaluation & Feedback

KEY FOCUS: Management review and decision-making

↓

STAGE 5: Improvement & Corrective Actions

PROCESS: Learning & Continuous Improvement

KEY FOCUS: Corrective actions and lessons learned

↓

↺ Continuous Performance Cycle

(Feeds back to Planning)

Figure 2.1: Integrated PM Process and Stages for Road Construction Projects

Benefits of Performance Measurement in Construction Projects

When effectively designed and implemented, performance measurement delivers substantial practical benefits in construction by transforming dispersed and often fragmented site information into actionable control signals. Regular measurement of progress, productivity, quality compliance, safety performance, and cost consumption enables early detection of deviations and supports timely corrective actions before overruns become irreversible (Neely, 2000; Kagioglou et al., 2001).

In road construction projects, where work is spatially distributed and exposed to environmental variability, performance measurement supports short-interval planning, resource reallocation, and coordination across multiple contractors and suppliers. Furthermore, when used for benchmarking, performance measurement enables organizations to compare delivery capability across projects, identify best practices, and improve processes related to procurement, equipment utilization, and inspection workflows (Chan & Chan, 2004).

Crucially, the literature emphasizes that these benefits arise not from measurement alone, but from the feedback mechanisms and decision routines through which performance information is interpreted and acted upon. Without systematic response mechanisms, measurement risks becoming an administrative burden rather than a driver of improvement.

Importance of Performance Management in Construction Contexts

Performance management assumes particular importance in construction due to the sector's reliance on temporary, multi-organizational project teams operating under uncertainty. PM systems provide the connective tissue linking strategic intent to operational delivery by translating organizational priorities into measurable controls such as schedule reliability, cost variance, rework levels, safety incidents, productivity rates, and stakeholder approvals (Moullin, 2017; Micheli & Mura, 2017).

In road construction, this linkage supports disciplined decision-making in areas that frequently drive underperformance, including design change control, claims administration, materials logistics, equipment readiness, and interface management among multiple parties. For resource-constrained organizations, including small and medium-sized contractors, structured performance management also strengthens organizational learning by documenting successes and failures, thereby enabling repeatable performance improvement across projects (Saunila, 2017).

Objectives of Performance Management Systems

The objectives of performance management can be understood as complementary governance functions that collectively support effective project delivery. First, PM clarifies organizational and project priorities by converting strategic goals into explicit targets and measures, thereby strengthening coherence across organizational units and project teams (Thomas, 2004).

Second, PM enhances operational control by enabling continuous monitoring, diagnosis of performance gaps, and responsive adjustment of plans, resources, and processes (Aguinis, 2019). Third, PM strengthens accountability by establishing transparent expectations and evidence trails that justify managerial decisions, expenditures, and corrective actions to internal and external stakeholders (Hatry, 2016). This accountability function is particularly salient in infrastructure projects, which often involve public funding, regulatory oversight, and heightened scrutiny.

Finally, PM supports organizational learning by formalizing feedback loops and capturing lessons that inform future planning, procurement, and risk management practices. In this way, PM contributes to both short-term control and long-term capability development.

Key Principles Underpinning Effective Performance Management

Contemporary performance management principles emphasize that measurement must be purposeful, usable, and embedded within decision-making routines that enable action. Effective PMS are typically characterized by strategic alignment, stakeholder engagement, and outcome orientation, ensuring that measures reflect organizational objectives and delivery priorities while balancing leading and lagging indicators (Brown, 2020; Aguinis, 2023; Reading, 2022).

Equally important is contextual fit. PM systems must recognize that governance arrangements, organizational culture, institutional capacity, and project environments shape how feedback and accountability mechanisms operate in practice (DeNisi et al., 2021). Systems that ignore contextual realities risk superficial compliance and limited impact.

Finally, effective PM systems must remain adaptive. They should be simple enough to enable consistent application, yet flexible enough to evolve in response to changing risks, stakeholder expectations, and delivery conditions (Reading, 2022). These principles position performance management not as a static reporting exercise, but as a learning-oriented governance process that supports alignment, engagement, and continuous improvement.

In summary, PMS characteristics in the construction industry integrate technical features, organizational roles, and operational processes to create systems capable of supporting strategic alignment, operational control, accountability, and learning. Effective PMS is not merely about measurement; it is about how information is generated, interpreted, and used to influence behavior and decisions within complex project environments. By embedding performance management within organizational routines and aligning it with contextual realities, construction organizations can enhance their capacity to deliver consistent, sustainable, and high-quality project outcomes (Aguinis, 2023; Reading, 2022; Brown, 2020).

While the literature provides a clear consensus on the characteristics and process requirements of effective PMS in construction, implementation outcomes remain inconsistent in practice. In project-based environments, the value of PMS depends not only on indicator design and reporting routines, but also on organizational capability, stakeholder behavior, data reliability, and the wider institutional context within which projects are delivered. The following section therefore synthesizes the main barriers that constrain PMS implementation globally, in developing countries, and specifically within the Ethiopian construction sector.

2.3 Barriers to Effective Performance Management System Implementation

Effective PMS in construction projects rely on the coherent integration of CSFs, KPIs, reliable measurement mechanisms, and continuous feedback and reporting structures. In principle, PMS provides a structured basis for monitoring performance, supporting managerial decision-making, and enhancing project outcomes across cost, time, quality, safety, and sustainability dimensions.

In practice, however, PMS implementation remains uneven and frequently ineffective, particularly in complex project-based industries such as construction.

Despite extensive global reforms in construction management and project governance, empirical studies consistently show that PMS adoption is constrained by a combination of structural, institutional, cultural, technical, and project-specific barriers. These challenges are not confined to developing economies; rather, they exist globally but are significantly amplified in developing-country contexts, where resource limitations, weak institutional capacity, governance deficiencies, and low technological readiness shape the project delivery environment. In contrast, developed economies tend to exhibit more mature PMS frameworks embedded within formal organizational and regulatory systems, although implementation challenges persist even in these contexts (Egan, 1998; Neely et al., 2005).

This section synthesizes barriers to PMS implementation across three analytical levels, global, developing-country, and Ethiopian contexts, to establish a comprehensive foundation for the conceptual framework proposed in this study.

2.3.1 Global Barriers to PMS Implementation

At the global level, infrastructure and construction projects face multidimensional constraints that limit the effectiveness of PMS, even in environments with relatively advanced management practices. One of the most frequently cited barriers is the misalignment between PMS components and organizational or project-level strategic objectives. Performance measurement tools such as KPIs, scorecards, and benchmarking systems often fail when they are adopted as standardized or generic templates rather than being tailored to the specific strategic priorities, risks, and operational realities of construction projects (Jusoh et al., 2008; Baird, 2017). This lack of strategic fit weakens the relevance of performance data and reduces managerial commitment to PMS outputs.

A further global challenge is the persistent overemphasis on financial performance indicators at the expense of non-financial measures. Although contemporary performance management literature strongly advocates balanced measurement systems that integrate safety, quality, innovation, environmental sustainability, and stakeholder satisfaction, many construction organizations continue to prioritize cost and profit-based metrics (Dossi & Patelli, 2010; Abdallah & Alnamri, 2015). This narrow focus limits the capacity of PMS to capture multidimensional project performance and obscures early warning signals related to safety risks, quality failures, or stakeholder dissatisfaction (Upadhaya et al., 2014).

The fragmented nature of the construction supply chain also presents a significant global barrier. Construction projects typically involve multiple independent actors, including clients, consultants, contractors, subcontractors, and suppliers, each operating with distinct objectives, reporting systems, and information standards. This fragmentation undermines data integration, creates inconsistent performance reporting formats, and blurs accountability lines, thereby weakening the effectiveness of PMS across the project lifecycle (Chan et al., 2017).

Cultural resistance to performance measurement further constrains PMS implementation. Performance management systems require transparency, accountability, and systematic evaluation, which may be perceived by project teams as mechanisms of control or blame rather than learning and improvement. Organizational cultures characterized by risk aversion, professional silos, or resistance to change often impede the acceptance and sustained use of PMS tools (Ferreira & Otley, 2009).

In addition, the technical complexity of comprehensive PMS models, such as the Balanced Scorecard (BSC) or Excellence frameworks, can discourage adoption. These models demand advanced analytical capability, reliable data flows, and sustained managerial attention, conditions that are not always feasible in fast-paced, resource-constrained project environments (Nørreklit et al., 2012). Even where PMS frameworks are formally introduced, data quality and reliability issues remain a persistent concern due to inaccurate reporting, inconsistent measurement intervals, and missing or incomplete data sets (Dekker et al., 2013).

Collectively, these global barriers demonstrate that PMS challenges are inherent to the construction sector, even in advanced economies, and provide a baseline against which developing-country constraints can be more clearly understood.

2.3.2 Barriers to PMS Implementation in Developing Countries

In developing-country contexts, PMS implementation is constrained by deeper and more systemic challenges rooted in governance structures, institutional capacity, resource availability, and technological readiness. Weak institutional frameworks are widely recognized as a fundamental barrier. Many developing countries lack clearly defined performance standards, formalized national KPI systems, and robust monitoring and enforcement mechanisms, which limits the institutional legitimacy and consistency of PMS practices (Scott, 2008; Zakari, 2016).

Resource constraints further exacerbate PMS implementation challenges. Financial limitations restrict investment in data management systems, digital tools, training programs, and specialized PMS personnel. At the same time, shortages of skilled human resources reduce the capacity of project teams to design appropriate KPIs, interpret performance data, and translate measurement outcomes into corrective action (Al-Tmeemy, 2011; Aman, 2017). As a result, PMS often exists only at a superficial or symbolic level.

Technological limitations constitute another major barrier. While digital tools such as Building Information Modelling (BIM), automated data capture, GPS-based monitoring, and real-time dashboards are increasingly integral to PMS in developed economies, their adoption in developing countries remains limited. Low levels of digital infrastructure, insufficient technical skills, and resistance to technological change reduce data accuracy, delay reporting, and increase reliance on subjective assessments (Kulatunga et al., 2011).

Governance-related challenges, including corruption, patronage networks, and political interference, further undermine PMS objectivity and credibility. Manipulated reports, biased evaluations, and weak accountability mechanisms distort performance information and weaken the link between measured outcomes and managerial decision-making (Osman, 2019). In addition, the absence of standardized KPI frameworks means that performance indicators are often project-specific, inconsistent, and unsuitable for benchmarking or longitudinal analysis (Chan & Chan, 2001; CBBP-KPI, 2003).

Poor documentation and weak knowledge retention practices also limit the effectiveness of PMS. In many developing countries, project records are incomplete, poorly archived, or lost at project completion, preventing organizations from using historical data for learning and continuous improvement (Bourne et al., 2005). These challenges are compounded by the inherent complexity and vulnerability of infrastructure projects, which are frequently affected by cost overruns, delays, design changes, and force-majeure events that disrupt continuous performance monitoring (Makori, 2023).

Overall, PMS implementation in developing countries is not merely a technical exercise but a systemic challenge requiring improvements in governance, institutional capacity, leadership commitment, and technological capability.

2.3.3 Barriers to PMS Implementation in the Ethiopian Construction Sector

The Ethiopian construction sector exhibits a distinctive combination of institutional, operational, and contextual barriers that significantly constrain the effective implementation of PMS, particularly in road construction projects. Empirical studies consistently report persistent underperformance across cost, time, quality, safety, and stakeholder satisfaction dimensions, indicating structural weaknesses in performance monitoring and control systems (Tadesse, 2021; Teklewold et al., 2022).

At the institutional level, Ethiopia lacks a standardized national framework for construction KPIs. Performance management practices vary across client organizations, including the Ethiopian Roads Administration (ERA), municipal authorities, and regional agencies, resulting in fragmented and inconsistent reporting systems. Regulatory enforcement, particularly in relation to safety standards, quality assurance, and schedule compliance, remains weak, further reducing the effectiveness of PMS implementation (Debela, 2022).

Resource and financial constraints represent a critical barrier. Chronic budget shortages, inflationary pressures, foreign currency constraints, and delayed payments to contractors disrupt project execution and undermine sustained investment in performance monitoring systems. Effective PMS requires stable funding for data collection, reporting tools, and skilled personnel, conditions that are not consistently met in the Ethiopian context (Bairu, 2018).

Technical capacity limitations also affect PMS effectiveness. Several studies highlight deficiencies in project management competence among contractors, consultants, and client representatives, particularly in relation to KPI design, performance data analysis, and evidence-based decision-making (Kebede, 2020; Amare & Mengistu, 2021). These capacity gaps weaken the operationalization of CSFs and reduce the usefulness of PMS outputs.

Digitalization remains limited across the sector. Although BIM and other digital technologies are internationally recognized as enablers of improved performance management, their adoption in Ethiopia remains minimal due to high initial costs, limited skills, and a weak digital culture within construction organizations (Teshome, 2021). Consequently, performance reporting relies heavily on manual processes, increasing delays, inconsistencies, and data reliability problems.

Fragmented project delivery structures further complicate PMS implementation. Ethiopian road projects typically involve multiple subcontractors and suppliers with varying technical and managerial capabilities, resulting in incompatible reporting systems and fragmented performance data (Weldegebriel, 2018). Weak documentation and record-keeping practices exacerbate these challenges, with studies reporting persistent issues related to inaccurate data, delayed reporting, and incomplete project records (Shalla & Mengistu, 2023).

Procurement and governance issues also undermine PMS effectiveness. Bureaucratic procurement procedures, prolonged approval processes, and susceptibility to political influence affect contractor selection, supervision quality, and impartial performance evaluation (Jasen, 2023). Finally, environmental and contextual factors, such as complex terrain, unpredictable weather, remote project locations, and security concerns, disrupt continuous monitoring and performance measurement (Teklewold et al., 2022).

Cultural and behavioral resistance represents an additional constraint. Performance management is often perceived by construction stakeholders as punitive rather than developmental, leading to reluctance in transparent reporting, benchmarking, and performance disclosure (Girma & Hailemichael, 2019).

2.3.4 Implications for the Conceptual Framework

The barriers identified across global, developing-country, and Ethiopian contexts directly inform the structure of the conceptual framework proposed in this study. The framework positions Critical Success Factors (CSFs) as key managerial and organizational conditions associated with stronger KPI implementation and improved project performance outcomes. It also incorporates contextual conditions, such as institutional capacity, governance quality, market instability, and site/environmental constraints, as external influences that shape the operating environment within which performance management practices are implemented. In addition, digitalization and BIM are conceptualized as enabling capabilities that can strengthen coordination, improve data quality, and support timely reporting and decision-making, thereby enhancing the effectiveness of performance monitoring and control. Consistent with the study's correlational design, these relationships are interpreted as associations rather than causal pathways, providing a theoretically grounded basis for the empirical examination undertaken in subsequent chapters.

2.4 Strategies to Overcome Barriers to Effective PMS Implementation

Overcoming the barriers to effective PMS implementation in construction projects requires a multi-layered and context-sensitive strategy that addresses institutional, organizational, technological, and behavioral constraints simultaneously. International experience demonstrates that PMS failures rarely stem from technical shortcomings alone; rather, they arise from weak strategic alignment, limited capacity, fragmented governance structures, and resistance to performance-based accountability. Consequently, effective strategies must move beyond isolated technical fixes and instead promote systemic integration of CSFs, KPIs, contextual enablers, and digital tools across the project lifecycle.

This section synthesizes global best practices, developing-country adaptations, and Ethiopia-specific reform priorities to propose actionable strategies capable of strengthening PMS implementation in road construction projects.

2.4.1 Strengthening Strategic Alignment and PMS Customization

A critical strategy for overcoming PMS failure is ensuring strong alignment between performance measurement systems and organizational as well as project-level strategic objectives. PMS frameworks should be designed as decision-support systems rather than compliance-driven reporting tools. This requires tailoring KPIs to reflect project priorities, contractual arrangements, risk profiles, and stakeholder expectations, rather than adopting generic or externally imposed indicator sets (Jusoh et al., 2008; Baird, 2017).

In construction projects, strategic alignment can be enhanced by explicitly linking CSFs to measurable KPIs and mapping these indicators to project outcomes such as time, cost, quality, safety, and sustainability. Such alignment improves managerial ownership of PMS outputs and ensures that performance data directly informs corrective actions and strategic decision-making.

2.4.2 Adopting Balanced and Multidimensional Performance Measurement

To overcome the overreliance on financial indicators, organizations should adopt balanced performance measurement approaches that integrate financial and non-financial dimensions. Balanced measurement frameworks enhance visibility into operational efficiency, safety performance, quality compliance, environmental impact, innovation, and stakeholder satisfaction (Kaplan & Norton, 2001; Upadhaya et al., 2014).

In construction contexts, multidimensional PMS enables early detection of performance deviations that may not yet be reflected in cost figures, such as declining safety standards or quality defects. This proactive capability is particularly important in road construction projects, where delayed corrective actions often result in costly rework and disputes.

2.4.3 Improving Institutional and Governance Frameworks

At the institutional level, strengthening regulatory frameworks and governance mechanisms is essential for sustainable PMS implementation. Governments and client agencies should develop standardized national or sector-level KPI frameworks for construction projects to promote consistency, benchmarking, and transparency (Chan & Chan, 2001; Scott, 2008).

Clear performance standards, mandatory reporting requirements, and independent monitoring mechanisms enhance accountability and reduce opportunities for manipulation or selective reporting. Strong institutional oversight also legitimizes PMS practices and encourages contractors and consultants to engage more seriously with performance measurement systems.

2.4.4 Enhancing Capacity and Professional Competence

Capacity building is a cornerstone strategy for addressing PMS implementation barriers in developing-country contexts. Effective PMS requires project managers, engineers, and client representatives to possess adequate skills in KPI design, data collection, analysis, and interpretation. Continuous professional development programs, targeted training, and integration of performance management modules into engineering and construction management curricula are therefore essential (Kumar et al., 2021).

In the Ethiopian context, strengthening managerial and analytical competence directly enhances the effectiveness of CSFs by improving decision quality, consistency of monitoring, and responsiveness to performance deviations.

2.4.5 Leveraging Digitalization and BIM as Enablers of PMS

Digital transformation plays a pivotal role in overcoming PMS barriers related to data quality, timeliness, and transparency. Technologies such as BIM, digital dashboards, automated progress tracking, and mobile data collection systems significantly improve the reliability and accessibility of performance information (Kulatunga et al., 2011).

BIM enables integrated visualization of time, cost, and quality performance, facilitating real-time monitoring and evidence-based decision-making. While initial investment costs and skill requirements may be high, phased implementation strategies, starting with pilot projects, can make digital adoption more feasible in resource-constrained environments (Teshome, 2021).

2.4.6 Reducing Fragmentation through Integrated Project Management Practices

To address fragmentation within the construction supply chain, integrated project management and collaborative contracting approaches should be encouraged. Early stakeholder involvement, standardized reporting templates, and shared information platforms promote coordination and reduce inconsistencies in performance measurement (Chan et al., 2017).

Clear role definition and accountability structures further enhance PMS effectiveness by ensuring that performance responsibilities are explicitly assigned and monitored across contractors, subcontractors, and consultants.

2.4.7 Strengthening Documentation, Knowledge Management, and Learning

Effective PMS depends on reliable historical data and institutional memory. Establishing standardized documentation procedures, centralized data repositories, and knowledge management systems enables organizations to retain performance records beyond individual projects (Bourne et al., 2005).

Such systems support benchmarking, trend analysis, and organizational learning, transforming PMS from a short-term monitoring tool into a long-term performance improvement mechanism.

2.4.8 Promoting a Performance-Oriented Organizational Culture

Cultural and behavioral barriers can be mitigated by reframing PMS as a developmental and learning-oriented system rather than a punitive control mechanism. Leadership commitment is crucial in fostering a culture that values transparency, continuous improvement, and evidence-based decision-making (Ferreira & Otley, 2009).

Incentive structures linked to performance improvement, rather than fault-finding, encourage stakeholder engagement with PMS processes and reduce resistance to transparent reporting.

2.4.9 Context-Specific Strategies for the Ethiopian Road Construction Sector

In Ethiopia, PMS reform strategies must be contextually grounded. Priority actions include developing harmonized KPI guidelines across public client agencies, stabilizing project financing mechanisms to support continuous monitoring, and gradually mainstreaming digital tools within road projects (Debela, 2022; Bairu, 2018).

Addressing procurement inefficiencies, reducing bureaucratic delays, and strengthening independent supervision mechanisms are also critical to ensuring fair performance evaluation and effective use of PMS outputs. Furthermore, adapting PMS frameworks to account for environmental, geographical, and security-related challenges enhances their practical relevance in remote road projects (Teklewold et al., 2022).

2.4.10 Strategic Alignment with the Conceptual Framework

The strategies outlined above directly reinforce the proposed conceptual framework of this study. By strengthening institutional capacity, enhancing professional competence, integrating digitalization, and embedding contextual sensitivity, these strategies enhance the effectiveness of CSFs, improve KPI reliability, and ultimately drive better project performance outcomes. This strategic integration ensures that PMS implementation in Ethiopian road construction projects is not only theoretically sound but also operationally feasible.

2.5 Performance Management in Road Construction Projects: Cycle, Process, and Stages

Performance management in road construction is best understood through three complementary lenses: (i) the cycle, which reflects continuous improvement logic; (ii) the process, which specifies the operational activities through which performance information is produced and used; and (iii) the stages, which locate these activities across the project life cycle. This distinction prevents performance management from being treated as a reporting routine and instead positions it as an embedded governance mechanism that links targets, monitoring, feedback, and corrective actions across planning, execution, and close-out phases.

Central to this evolution is the performance management cycle, which conceptualizes performance management as a continuous and iterative loop rather than a one-off evaluative exercise. The cycle typically encompasses planning, monitoring, evaluation, feedback, and improvement, ensuring that performance objectives, such as timely completion, cost efficiency, quality assurance, and safety performance, are systematically defined, tracked, and refined throughout the project life span. The cyclical nature of performance management emphasizes learning and adaptation, enabling insights generated at one phase of the project to inform subsequent decisions and actions (Aguinis, 2013; Bititci, Cocca & Ates, 2016).

This cyclical logic is particularly relevant in road construction projects, which are characterized by long durations, phased execution, evolving stakeholder requirements, and exposure to external uncertainties such as weather conditions, supply-chain disruptions, and regulatory changes. In the Ethiopian context, where road projects often operate under fluctuating resource availability, institutional constraints, and diverse stakeholder expectations, a continuous performance management cycle provides a structured mechanism for maintaining control while allowing adaptive responses to emerging challenges.

2.5.1 Performance Management Cycle in Road Construction

The performance management cycle represents the overarching conceptual logic underpinning CPM systems. It frames performance management as an ongoing process of goal setting, measurement, reflection, and improvement, rather than a static reporting activity. By reinforcing feedback loops, the cycle ensures that performance information is actively used to inform decision-making and organizational learning, rather than remaining retrospective or symbolic (Bititci et al., 2016).

In road construction projects, this cycle supports iterative refinement of plans and targets as project conditions evolve. For example, performance feedback from early construction phases, such as earthworks or drainage, can inform adjustments in scheduling, resource deployment, or quality control practices during subsequent paving or finishing stages. This cyclical logic strengthens governance by linking performance outcomes directly to managerial action and continuous improvement.

2.5.2 Performance Management Process in Road Construction Projects

While the performance management cycle provides the overarching logic of continuous improvement, the performance management process specifies the structured sequence of activities through which this logic is operationalized. In road construction projects, the literature commonly identifies a set of interrelated process activities that translate strategic intent into actionable routines (Otley, 2016; Pedersen & Sudzina, 2012).

The process typically begins with the definition of performance objectives and KPIs, where organizational strategy, CSFs, contractual requirements, and stakeholder expectations are translated into measurable indicators. This is followed by planning and resource allocation, during which targets are established, responsibilities assigned, and monitoring mechanisms configured. The monitoring and measurement phase involves systematic data collection related to progress, cost, quality, safety, and productivity. Performance evaluation and review then interpret collected data to assess deviations from planned targets, identify root causes, and evaluate effectiveness. Finally, feedback and corrective action close the loop by informing managerial decisions, process adjustments, and future planning activities.

In road construction contexts, this process orientation ensures that performance management supports real-time control and proactive intervention rather than post-project evaluation. By embedding performance processes within routine site meetings, progress reporting, and managerial reviews, CPM systems enhance responsiveness to emerging risks and operational disruptions.

2.5.3 Performance Management Stages Across the Road Project Life Cycle

Complementing the cycle and process perspectives, performance management stages introduce a temporal dimension by specifying when activities occur across the project life cycle. Commonly identified stages include the planning stage, execution stage, assessment stage, and feedback and improvement stage (Sinclair & Zairi, 1995; Moullin, 2017).

During the planning stage, strategic objectives, CSFs, KPIs, and performance targets are established, ensuring alignment between organizational priorities and project delivery requirements. The execution stage focuses on monitoring and measurement, where performance data is continuously collected as construction activities progress. The assessment stage involves formal evaluation of performance outcomes against predefined targets, enabling systematic diagnosis of deviations and underlying causes. The feedback and improvement stage integrates lessons learned into corrective actions, revised plans, and future projects, reinforcing organizational learning and performance maturity.

For Ethiopian road construction projects, clearly defined performance stages are particularly important due to the scale and duration of projects, as well as the involvement of multiple public and private stakeholders. Stage-based performance oversight helps ensure that monitoring and evaluation activities are not overlooked or delayed, and that corrective actions are grounded in structured assessment rather than ad hoc intervention.

2.5.4 Integrating Cycle, Process, and Stages: An Analytical Perspective

The distinction among cycle, process, and stages is analytically important and strengthens conceptual clarity. The performance management cycle represents the holistic and continuous logic of performance improvement; the performance management process defines how this logic is enacted through structured activities; and the performance management stages clarify the temporal sequencing of those activities across the project life cycle.

For road construction projects, particularly in developing-country contexts such as Ethiopia, this integrated perspective ensures that performance management is embedded across planning, execution, monitoring, evaluation, and learning phases. By linking strategic intent to operational routines and temporal milestones, CPM systems strengthen delivery governance, accountability, and adaptability.

2.5.5 Strategic Integration of CSFs, KPIs, and Stakeholder Perspectives

Embedding CSFs, KPIs, and stakeholder perspectives within the performance management cycle, process, and stages ensures that CPM remains both strategic and operational. Stakeholder participation in objective definition, KPI selection, and performance review enhances legitimacy, transparency, and shared ownership of performance outcomes. Feedback loops further ensure that measured results inform planning and monitoring routines, reinforcing learning and continuous improvement (Bourne et al., 2000; Gutierrez et al., 2015).

In the Ethiopian road construction sector, this systematic integration supports improved accountability in publicly funded projects, enhances transparency in performance reporting, and strengthens alignment between project delivery and national infrastructure development priorities. By institutionalizing performance management across the project life cycle, CPM frameworks provide a structured mechanism for addressing persistent challenges such as cost overruns, schedule delays, quality deficiencies, and safety risks (Aguinis, 2019; Armstrong & Taylor, 2020).

In summary, performance management in road construction projects is best understood through an integrated lens that combines the continuous improvement logic of the performance management cycle, the operational clarity of the performance management process, and the temporal structure of performance management stages. This integrated framework enables CPM systems to function as dynamic governance mechanisms that support control, learning, and adaptation across complex project environments. For Ethiopian road construction projects, such an approach provides a robust foundation for improving delivery performance while strengthening institutional capacity and strategic alignment.

Table 2.2: **Mapping PM Process Activities and Stages to CSFs and KPIs in Road Construction Projects**

PM Stage	PM Process Activity	Key CSFs Activated	Representative KPIs	Performance Focus
Planning Stage	Define objectives and KPIs	Strategic alignment; stakeholder engagement; planning competence	Schedule baseline accuracy; cost estimate reliability; clarity of stakeholder requirements	Alignment of strategy with delivery priorities
	Planning and resource allocation	Financial capacity; resource availability; technical capability	Budget adequacy ratio; equipment readiness index; availability of skilled labor	Project feasibility and readiness
Execution Stage	Monitoring and measurement	Contractor competence; supply-chain reliability; leadership effectiveness	Schedule adherence (%); cost variance (CV); material delivery delay rate; safety incident rate	Control of ongoing project performance
Assessment Stage	Performance evaluation and review	Governance quality; supervision effectiveness; data reliability	KPI variance analysis results; quality non-conformance rate; audit and compliance score	Performance diagnosis and accountability
Feedback & Improvement Stage	Feedback and corrective action	Learning culture; management commitment; organizational adaptability	Number of corrective actions implemented; rework reduction rate; improvement cycle closure rate	Continuous improvement and organizational learning

Table 2.2 illustrates how performance management in road construction projects operates as an integrated system, where the continuous improvement cycle provides strategic logic, the performance management process defines operational routines, and performance management stages ensure temporal alignment across the project life cycle. By explicitly mapping Critical Success Factors to Key Performance Indicators at each stage, the framework ensures that performance management remains both theoretically grounded and operationally actionable.

2.6 Critical Review of PM in Construction: CSFs, KPIs, Performance Measures, BIM, and Contextual Factors

Recent scholarship consistently highlights the increasing complexity associated with assessing project-level performance in construction, largely due to the limitations of traditional financial and output-oriented metrics and the inherently multidimensional nature of contemporary projects. Conventional indicators, cost, time, and quality, remain foundational; however, they are widely recognized as inadequate in environments characterized by diverse stakeholder expectations, rapid technological innovation, sustainability imperatives, and heightened safety requirements (Moradi et al., 2021; Khadim et al., 2022; Rathnayake & Middleton, 2019). As a result, performance measurement (PM) has evolved from a retrospective control mechanism into a continuous, iterative management process that informs planning, guides execution, and enables timely corrective action, thereby strengthening decision-making, accountability, and organizational learning (Parikh and Phugat, 2019; Xu et al., 2020; Silvi et al., 2015).

This evolution has been particularly pronounced in infrastructure and road construction projects, where long project durations, public-sector accountability, environmental exposure, and multi-stakeholder involvement amplify performance risks. In developing-country contexts such as Ethiopia, the need for multidimensional performance assessment is further intensified by institutional and operational constraints, including prolonged administrative approval cycles, right-of-way acquisition challenges, intermittent cash-flow disruptions linked to certification and payment processes, supply-chain unreliability, and weather-driven productivity variability. Under such conditions, effective performance management requires the integration of globally recognized performance constructs with locally sensitive indicators that capture institutional bottlenecks and site-level production realities alongside conventional project controls.

A defining feature of contemporary construction PM is the expanded use of KPIs that extend beyond the traditional cost–time–quality triad. A growing body of literature advocates the incorporation of non-financial performance dimensions, including stakeholder engagement, environmental performance, technological adoption, safety management, and innovation capability (Bhagwat and Delhi, 2020; Rathnayake & Middleton, 2019; He et al., 2021). Stakeholder-oriented KPIs emphasize communication effectiveness, collaboration quality, and expectation alignment, reflecting the recognition that successful project execution depends on coordinated interaction among diverse actors. Environmental KPIs capture sustainability outcomes such as resource efficiency, waste reduction, and ecological impact mitigation, while technology-related indicators, particularly those associated with digitalization through Building Information Modelling (BIM), automation, and data analytics, provide insight into innovation capacity, productivity enhancement, and operational efficiency (He et al., 2021).

Safety performance measurement has similarly evolved from reactive accident reporting towards predictive and proactive indicators that support hazard anticipation, behavioral safety, and the development of a positive safety culture. Collectively, these multidimensional KPIs enable a holistic understanding of project performance by aligning short-term operational outcomes with long-term organizational resilience, sustainability, and knowledge generation (Fung & Siow, 2013; Bedford et al., 2008). However, despite these conceptual advances, persistent challenges remain, including inconsistencies in indicator definitions, methodological fragmentation, and continued reliance on subjective or self-reported data, all of which constrain comparability and robust implementation across projects and organizations (Mohammadi et al., 2018; Al-Saraji, 2021).

To address these limitations, contemporary research increasingly emphasizes integrated project-level performance frameworks that explicitly link CSFs, KPIs, and strategic objectives. CSFs identify the limited number of managerial, organizational, technical, and contextual conditions that must be effectively addressed to achieve project success, including leadership competence, stakeholder coordination, resource allocation, risk management, and technological capability (Pinto and Slevin, 1987; Singh and Sharma, 2020; Kumar et al., 2023). KPIs operationalize these CSFs into measurable, actionable indicators that function as both leading indicators (e.g. early risk detection, on-time task completion) and lagging indicators (e.g. final cost outcomes, client satisfaction, safety incidents), enabling continuous feedback and strategic realignment (Barnabè, 2011; Francioli & Cinquini, 2014; Wang et al., 2014).

The integration of CSFs and KPIs is widely regarded as a pivotal advancement in construction performance management, as it establishes explicit cause–effect relationships between operational inputs and strategic outcomes. Strategy maps and maturity-based frameworks are frequently used to visualize these linkages, translating organizational strategy into operational priorities and facilitating prescriptive decision-making across the project lifecycle (Kaplan and Norton, 2008; Lueg, 2015; Maya, 2016). In road construction projects, for example, a CSF such as effective stakeholder coordination can be operationalized through KPIs including the frequency of coordination meetings, the proportion of timely approvals, and client satisfaction scores, thereby enabling systematic management of otherwise qualitative success conditions (Bhagwat and Delhi, 2020).

Parallel to these developments, Project Performance Management (PPM) frameworks have evolved beyond the traditional "iron triangle" to incorporate multidimensional perspectives encompassing strategic alignment, operational execution, and stakeholder-oriented outcomes (Bonghez & Grigoroiu, 2013; Ahmed, 2023; Maqsoom et al., 2020). Whereas earlier models focused narrowly on budget and schedule adherence, contemporary frameworks emphasize organizational strategy, team effectiveness, innovation capacity, ethical standards, and long-term business value (Kerzner, 2010; Chen & Lin, 2018; Szatmari et al., 2021). Integrated PPM frameworks therefore combine quantitative and qualitative indicators, support real-time monitoring, and enable evidence-based decision-making that aligns project outputs with broader organizational and societal objectives (Rankin et al., 2008; Ling et al., 2009; Swarup et al., 2011).

Contractor performance has also been consistently identified as a critical determinant of construction project success. Delays and inefficiencies are frequently attributed to inappropriate contractor selection, labor shortages, inadequate technical capacity, or financial constraints (Alfalah et al., 2024; Dasí et al., 2021). Contemporary contractor assessment frameworks adopt multidimensional perspectives encompassing time, cost, quality, safety, technical competence, resource availability, and organizational experience, often supported by multi-criteria decision-making techniques such as the Analytic Hierarchy Process (AHP) to prioritize performance indicators and strengthen oversight (Alzahrani & Emsley, 2013; Alfalah et al., 2024).

Beyond individual projects, construction sector performance must also be understood in systemic economic, social, and environmental terms. Industry fragmentation, weak communication, low levels of standardization, and volatile demand exacerbate project risks and constrain productivity, particularly in developing economies (Gordon & Curtis, 2018; Rotimi et al., 2015; Brown, 2020). These challenges are compounded by slow technological adoption, limited workforce skills, and inadequate risk management practices (Page and Norman, 2014; Curtis, 2018). Comprehensive performance management therefore requires integration of project-specific indicators with broader measures addressing workforce development, innovation capacity, organizational resilience, and social outcomes such as employee wellbeing and community impact (Unterhitzenberger & Bryde, 2018; Bryson et al., 2019).

Within this complex environment, Performance Management Systems (PMS) provide structured mechanisms for aligning individual, team, and organizational objectives. Recent studies emphasize continuous, feedback-rich PMS models that enhance employee development, managerial capability, and operational alignment (Vadnal, 2017; Umair, 2023). Emerging innovations, including real-time monitoring, AI-enabled analytics, and advanced digital platforms, further strengthen transparency, accountability, and continuous improvement, provided they are embedded within coherent managerial routines rather than implemented as isolated technical solutions.

In summary, contemporary construction performance management is characterized by a shift towards multidimensional, integrated, and strategically aligned frameworks. Effective systems extend KPIs beyond cost, time, and quality to incorporate stakeholder engagement, environmental performance, technological adoption, safety, and innovation (Rathnayake and Middleton, 2019; Bhagwat and Delhi, 2020; He et al., 2021). By systematically integrating CSFs, KPIs, contextual factors, and digital tools within structured PMS and PPM frameworks, construction organizations, particularly in developing-country contexts, can enhance real-time decision-making, foster organizational learning, improve sustainability, and establish a robust foundation for long-term value creation (Perumal et al., 2018; Silvi et al., 2015; Bedford et al., 2008).

2.7 Performance Management in Construction Projects in Developing Countries

Road construction performance in Ethiopia is frequently constrained by limited uptake of formal project management and performance control practices, resulting in persistent challenges related to schedule reliability, cost control, quality compliance, safety performance, and stakeholder satisfaction. Empirical studies and sectoral assessments consistently report substantial schedule slippage and significant deviations from baseline targets across multiple performance dimensions, reflecting enduring capability, governance, and institutional weaknesses within project delivery systems (Makori, 2023; Pawar & Dhawale, 2021; World Bank, 2021; PMI, 2021). In Ethiopia, these performance constraints are exacerbated by resource limitations, fragmented supply chains, uneven contractor capacity, and procedural bottlenecks embedded within public-sector approval, certification, and payment processes (LSE, 2022; World Bank, 2021; Wubet, Burrow & Ghataora, 2021). Collectively, these conditions undermine the consistent application of standardized project management routines and highlight the necessity for structured, context-sensitive PMS capable of supporting monitoring, control, organizational learning, and continuous improvement.

Effective PMS in Ethiopian road construction projects therefore require the systematic integration of CSFs with KPIs to enable comprehensive and actionable performance evaluation. CSFs such as project planning effectiveness, contractor capability, supply-chain reliability, stakeholder engagement, environmental management, and governance discipline constitute foundational conditions for achieving project objectives (Pawar & Dhawale, 2021; Worku et al., 2021; Rashid et al., 2022). These CSFs are operationalized through KPIs including schedule adherence, budget compliance, quality control outcomes, safety performance, dispute minimization, and environmental monitoring indicators (Makori, 2023; Worku et al., 2021; Rashid et al., 2022). By combining financial and non-financial KPIs, project teams can conduct stage-specific performance measurement, integrate leading and lagging indicators, benchmark outcomes against best practices, and derive actionable insights for resource allocation, risk mitigation, and corrective intervention (Pawar & Dhawale, 2021; Challa et al., 2022). However, the effective use of performance data remains contingent upon organizational and human capacity, requiring project-team participation in target setting, indicator design, and interpretation, supported through structured training, mentoring, and capability development initiatives (Challa et al., 2022; Turner, 2016).

A multidimensional PMS approach strengthens managerial decision-making and promotes sustainable outcomes. By explicitly linking CSFs to KPIs within structured frameworks that incorporate continuous feedback loops, benchmarking mechanisms, and stakeholder engagement processes, project managers are better positioned to identify deviations early, optimize resource allocation, and implement timely corrective measures (Makori, 2023; Pawar & Dhawale, 2021). This approach moves beyond the traditional "iron triangle" by incorporating safety, productivity, environmental compliance, and stakeholder satisfaction, thereby aligning technical execution with broader socio-economic development objectives (Mahamid, 2016; Worku et al., 2021). Integrative PMS frameworks can therefore address both project-level inefficiencies and organizational capability gaps, strengthening transparency, accountability, and sustainable infrastructure delivery within Ethiopia's road construction sector (Abebe & Gebremedhin, 2020; Ayele, 2019).

2.7.1 PMS Requirements in Developing Countries: Evidence from Ethiopia

Performance measurement in low-maturity construction environments such as Ethiopia must prioritize simplicity, feasibility, and operational relevance. Fragmented data systems, weak monitoring practices, and limited digital infrastructure necessitate streamlined KPI sets that minimize reporting burdens while still providing timely and meaningful performance insights. Many KPIs can be collected manually or through basic spreadsheet-based systems, enabling organizations to progressively strengthen measurement capability as institutional maturity and data reliability improve (Berhanu & Diriba, 2021; Alemu, 2022; Assefa & Lema, 2020).

KPIs must be explicitly aligned with CSFs reflecting Ethiopian delivery realities, including funding reliability, contractor competence, effective planning, resource utilization efficiency, supply-chain stability, and safety culture development (Abdulrahman, 2010; Bassioni, Price & Hassan, 2004; Yang et al., 2010; Wubet, Burrow and Ghataora, 2021). Such alignment ensures that performance measurement remains actionable rather than symbolic, enabling monitoring of both outcome indicators and the underlying drivers of success, especially in response to recurring challenges such as payment delays, material shortages, equipment downtime, and supervision gaps (Berhanu & Diriba, 2021; Wubet, Burrow & Ghataora, 2021).

The KPI framework should address universally recognized performance dimensions, time, cost, quality, safety, productivity, and stakeholder satisfaction, while also incorporating indicators sensitive to local bottlenecks (Chan and Chan, 2004; Bassioni et al., 2004; CII, 2019). Within Ethiopia, indicators such as schedule variance, milestone achievement rates, cost variance, payment processing delays, defect frequency, rework rates, and compliance with Ethiopian Roads Authority specifications are particularly salient (ERA, 2023; World Bank, 2022).

While simplicity remains essential, KPI systems should be designed for scalability and gradual digital integration. International evidence shows that BIM supports real-time schedule tracking (4D), cost integration (5D), defect tagging, safety hazard mapping, and productivity monitoring, thereby improving transparency and reducing subjectivity (Bryde, Broquetas & Volm, 2013; Zhang et al., 2020; Challa et al., 2022). Ethiopia-specific indicators—such as right-of-way clearance effectiveness, payment certificate processing time, quarry and asphalt plant reliability, equipment uptime, and grievance resolution—enhance contextual relevance by directly targeting dominant delivery constraints (ERA, 2023; World Bank, 2022; AACRA, 2020).

2.7.2 Challenges in Construction Project Management Practices in Ethiopia

The Ethiopian construction industry has historically exhibited significant reliance on foreign-led operations, constraining domestic contractor development and limiting long-term capacity building. This structural dependency has contributed to recurrent underperformance and exposed persistent gaps in managerial competence and operational effectiveness (LSE, 2022; World Bank, 2021). Comparative assessments rank Ethiopian construction management practices among the lower-performing contexts in Africa, reinforcing the urgency of systemic improvement (PMI, 2021; LSE, 2022).

Empirical evidence indicates limited adoption of standardized project management procedures, particularly in safety management, risk management, schedule control, and integrated monitoring practices (Zoubeir, 2020; PMI, 2021). Performance outcomes are consistently weak: schedule adherence is notably poor, and deviations across cost, quality, resource utilization, and safety indicators remain substantial (World Bank, 2021; Zoubeir, 2020). These deficiencies are primarily attributed to inadequate planning, limited professional expertise, weak stakeholder coordination, delayed decision-making, and insufficient monitoring and control mechanisms (Kerzner, 2017; Turner, 2016; Jiang et al., 2018).

Project complexity, manifested through mobile workforces, multiple subcontractors, geographically dispersed sites, and high interface dependency, is further compounded by economic pressures, resource scarcity, and institutional weaknesses, making baseline discipline difficult to sustain (Jiang et al., 2018; Zoubeir, 2020). Persistent performance problems include delays, escalating costs, quality non-compliance, and safety incidents, with evidence suggesting that a significant proportion of construction time may be consumed by non-value-adding activities and avoidable workflow interruptions (Ayalew et al., 2016). Lean construction principles have therefore been proposed to reduce inefficiencies through workflow optimization, systematic waste elimination, and continuous value creation; however, successful implementation requires managerial capability, appropriate equipment strategies, and consistent regulatory enforcement (Trivedi & Kuma, 2014; Jingkuang, 2011; Ajayi et al., 2017; Khopade et al., 2022).

Domestic contractors also face high operational risk exposure, including cash-flow shortages, delayed payments, late site possession, equipment breakdowns, late material deliveries, inflationary pressures, and weak internal coordination (Wubet, Burrow & Ghataora, 2021). Comparable challenges have been observed in irrigation and urban road projects, reinforcing the need to strengthen managerial practice, institutional capacity, and stakeholder coordination across the sector (AACRA, 2020; Asrat & Eshetu, 2024).

Within this study, these challenges are treated not only as background conditions but as measurable contextual influences that inform the selection of locally relevant CSFs and shape the KPI set used to operationalize performance outcomes.

2.7.3 Key Factors Affecting Road Construction Performance in Ethiopia and Improvement Mechanisms

Road construction performance in developing countries is shaped by interacting organizational, managerial, and resource-related factors. Contractors' financial, managerial, and technical capacities consistently emerge as critical determinants of performance, and these capabilities can be strengthened through targeted interventions (Enshassi et al., 2009; Doloi, 2013; Shalla & Mengistu, 2023). Decision-support tools such as AHP and TOPSIS are widely applied to prioritize performance drivers and evaluate improvement strategies (Saaty, 2008; Chan et al., 2004). Empirical evidence repeatedly identifies financial capacity, liquidity strength, cash-flow management, and timely payment, as among the most influential drivers, followed by managerial competence and technical capability (Kheni & Nolan, 2013; Gudiene et al., 2014; Rashid et al., 2022).

Key internal constraints affecting Ethiopian road construction include cash-flow shortages, delayed subcontractor payments, weak leadership, understaffing, equipment maintenance gaps, fragmented coordination, inadequate training, deficient planning and scheduling, poor communication, and low worker motivation (Agyekum-Mensah & Knight, 2017; Mahamid, 2016; Alsuliman, 2019). Improvement mechanisms proposed across the literature include dynamic management practices, recruitment of competent personnel, efficient organizational structures, incentive and accountability systems, timely financial flows, standardized work procedures, continuous training, knowledge-sharing routines, and teamwork development (Nonaka & Takeuchi, 1995; Ajmal & Koskinen, 2008; Love et al., 2016; Dakhil et al., 2019).

Project management capability is a pivotal determinant of performance. Weak governance, inadequate oversight, poorly structured decision-making, and limited stakeholder engagement constrain effectiveness and increase cost and schedule deviation (Belassi & Tukel, 1996; Olateju et al., 2011; Maeregu, 2021). Continuous monitoring systems, structured reporting mechanisms, and formal feedback loops strengthen managerial visibility and enable timely corrective action (Keith, 1996; Kothari, 2004; Challa et al., 2022).

Stakeholder management is equally critical. Inadequate early stakeholder identification, weak communication, inconsistent follow-up, and lack of dedicated coordination roles frequently result in delays, disputes, and reduced stakeholder satisfaction (Olander & Landin, 2005; Aapaoja & Haapasalo, 2014; Mok et al., 2015). Empirical prioritization approaches highlight the importance of shared project objectives, competent leadership, and systematic assessment of stakeholder attitudes to reduce interface risk (Aaltonen, 2011; Davis, 2016).

Resource management, including financial, human, material, and information resources, further influences performance. Deficiencies in financial planning, human resource systems, procurement, logistics reliability, and information management reduce productivity and compromise quality (Shao & Müller, 2011; Tsoulfas & Pappis, 2020; Tadesse, 2021; Agyekum-Mensah et al., 2020; Refera et al., 2025; Makori, 2023). Integrating resource planning with CSFs and KPIs within structured PMS frameworks supports predictive interventions that improve schedule reliability, cost control, and operational efficiency.

Finally, knowledge management, knowledge acquisition, sharing, retention, and application, emerges as a strategic enabler in resource-constrained environments. Organizations that institutionalize learning routines demonstrate improved decision quality, adaptability, and delivery efficiency (Neare Jabo, 2024). In summary, improving road construction performance in Ethiopia requires a multipronged strategy addressing organizational capacity, managerial effectiveness, stakeholder engagement, resource systems, and knowledge mobilization. Structured PMS that link CSFs to KPIs, integrate financial and non-financial metrics, and promote continuous learning provide a robust foundation for sustainable infrastructure outcomes (Shalla & Mengistu, 2023; Challa et al., 2022; Makori, 2023; Neare Jabo, 2024).

2.8 Integrated PMS in Construction Projects: CSFs, KPIs, and Contextual Perspectives (Across Developed and Developing Countries)

An integrated PMS treats construction performance as a chain of alignment rather than a set of isolated indicators: CSFs define what must go right, KPIs translate CSFs into observable targets, and performance measures operationalize KPIs into calculable metrics and evidence for monitoring, feedback, and improvement. This logic is common across contexts, but the relative emphasis differs: developing-country delivery environments prioritize governance quality, funding reliability, contractor capability, stakeholder coordination, and basic control discipline, whereas more mature environments place additional weight on advanced project governance, sustainability, digital maturity, and organizational learning routines (Rockart, 1979; Bititci et al., 2012; Bourne et al., 2018; Mahamid, 2016; Lafhaj et al., 2023; Makori, 2023; Pawar and Dhawale, 2021).

In developing contexts, especially road infrastructure, the role of PMS is not only to report outcomes like cost and time but to provide diagnostic visibility into recurring constraints, such as supply unreliability, approval delays, payment interruptions, and coordination failures, so that corrective action can be taken early and consistently (Makori, 2023; Pawar & Dhawale, 2021; Worku et al., 2021). Therefore, an effective integrated PMS must combine financial and non-financial measures, include both leading and lagging indicators, and be grounded in feasible data sources (progress records, payment certificates, QA/QC logs, safety logs, and structured stakeholder feedback) (Neely et al., 2000; Neely et al., 2005; Parmenter, 2015; Bourne et al., 2018).

2.9 CSFs: Across Developed and Developing Countries

CSFs represent a limited set of priority conditions that largely determine delivery success and must therefore be the starting point for integrated PMS design (Rockart, 1979; Amade et al., 2015). Empirical evidence across developing contexts shows that CSFs cluster around: (i) project management competence and team capability, (ii) stakeholder/client coordination, (iii) contractor capacity and resource logistics, (iv) governance and regulatory reliability, and (v) safety, quality, and environmental compliance, each shaping not only time and cost outcomes but also stakeholder satisfaction and broader organizational benefits (Chan & Chan, 2004; Abal-Seqan, Pokharel & Naji, 2023; Damoah, Ayakwah & Twum, 2021; Singh & Sharma, 2020; Mbugua, 2022; Silva & Warnakulasuriya, 2016).

Context sensitivity is crucial: where institutions and markets are less predictable, CSFs linked to funding reliability, approval cycles, procurement integrity, and coordination discipline become disproportionately influential, and their effects typically propagate through productivity, rework, disruption frequency, and schedule reliability (Debela, 2019; Osman, 2019; Kisavi, 2015; Weldegebriel, 2018). In more mature systems, these risks are comparatively buffered by stable procurement and governance mechanisms, allowing stronger emphasis on sustainability integration, digital delivery capability, and systematic organizational learning (Yong & Mustaffa, 2015; Khamaksorn, 2010; Serrador & Turner, 2014).

2.10 Integrated CSFs: Global and Ethiopian Evidence

Consistent with the study's correlational design, the CSF categories are treated as analytically distinct but empirically related drivers that can co-vary with project performance outcomes (cost, time, quality, safety, and stakeholder satisfaction) rather than being interpreted as causal mechanisms (Kothari, 2004).

2.10.1 Project Management and Team Competence

Leadership, planning rigour, coordination, communication effectiveness, and disciplined supervision consistently explain substantial variance in project outcomes across contexts (Chan & Chan, 2004; Kerzner, 2013; Abal-Seqan, Pokharel & Naji, 2023). Ethiopian evidence similarly links performance slippage to weaknesses in planning realism, supervision consistency, and managerial experience, reinforcing the importance of competence as a foundational CSF category (Weldegebriel, 2018; Debela, 2022; G/Hiwot, 2018).

2.10.2 Stakeholder and Client Management

Stakeholder identification, expectation alignment, and approval coordination reduce conflict, rework, and interface delays, particularly where institutional processes are fragmented (Lamprou & Vagiona, 2017; Kothandath & Haran, 2017). Ethiopian studies likewise emphasize that unclear objectives, inconsistent client decisions, and limited community engagement can amplify disputes and delay approvals, which then translate into schedule and cost deviation (Osman, 2019; Debela, 2019).

2.10.3 Contractor Capacity and Resource Management

Financial stability, cash-flow control, equipment adequacy, skilled labor availability, and logistics reliability remain among the most repeatedly validated determinants of delivery predictability (Alzahrani and Emsley, 2012; Singh and Sharma, 2020; Osman, 2019). Where contractor capacity is constrained, the most visible pathways are productivity loss, increased downtime, delayed mobilisation, and quality nonconformance, patterns repeatedly reported within Ethiopian road and building projects (Belay, Tekeste and Ambotors, 2017; Weldegebriel, 2018).

2.10.4 Technology, Innovation and Knowledge Management

Digital practices, especially BIM-enabled coordination and schedule/cost integration, support performance by reducing design errors, strengthening information flow, and improving monitoring reliability (Zhang, 2005; Cheung et al., 2004; Kärnä & Junnonen, 2016). Even where full BIM maturity is limited, incremental digitalization can strengthen transparency and reduce variation and rework through better coordination and issue tracking (Adewunmi et al., 2017; Mbugua, 2022).

2.10.5 Governance, Regulatory and Environmental Factors

Stable procurement, contract clarity, consistent approvals, and enforcement reliability influence predictability and risk exposure in construction delivery systems (Gupta & Narasimham, 1998; Zhang, 2005). In Ethiopia, procurement inefficiency, approval delays, and contract interpretation issues are frequently identified as systemic constraints that undermine schedule reliability and quality assurance (Debela, 2019; Damoah, Ayakwah & Twum, 2021).

2.10.6 Human and Organizational Factors

Workforce motivation, safety culture, ethics, and structured training contribute to sustained performance and capability development. Mature sectors institutionalize these through formal safety management systems and learning routines, while evidence from Ethiopia continues to report gaps in training and safety practice consistency, indicating the importance of human factors for long-term resilience (Sanvido et al., 1992; Serrador & Turner, 2014; Belay, Tekeste & Ambotors, 2017; Weldegebriel, 2018).

Table 2.3: Integrated CSFs in Construction Projects – Global and Ethiopian Evidence

Integrated CSF Category	Key Elements Emphasized in Global Literature	Evidence from Ethiopian Construction Sector	Analytical Implications for This Study
Project Management and Team Competence	Leadership capability, decision-making quality, planning rigour, coordination, communication effectiveness, problem-solving skills, baseline discipline	Weak leadership, inadequate planning, inconsistent supervision, limited managerial experience; frequent cost overruns and schedule slippages	Confirms managerial competence as a primary CSF and justifies inclusion of planning, coordination, and leadership indicators
Stakeholder and Client Management	Early stakeholder identification, expectation alignment, transparent communication, conflict mitigation, approval coordination	Inconsistent client decisions, limited community engagement, unclear objectives, frequent disputes and approval delays	Highlights heightened importance of stakeholder management in fragmented institutional contexts
Contractor Capacity and Resource Management	Financial stability, cash-flow control, skilled labor availability, equipment adequacy, material planning, logistics reliability	Chronic financial constraints, labor shortages, equipment breakdowns, delayed material supply, reduced productivity	Supports treating contractor capacity as a core CSF influencing time, cost, and quality performance
Technology, Innovation and Knowledge Management	BIM adoption, digital scheduling, integrated platforms, benchmarking, organizational learning systems	Limited BIM adoption; incremental digital tools improve coordination, transparency, and monitoring reliability	Justifies BIM as a performance-enabling CSF rather than a standalone determinant

Source: Synthesized from global and Ethiopian construction management literature

2.11 KPIs in Developed and Developing-Country Construction Projects

KPIs translate CSFs and strategic intent into measurable targets that enable monitoring, diagnosis, and performance comparison. Across contexts, core KPIs remain time, cost, quality, safety, and client satisfaction; however, developing-country environments typically require additional KPIs reflecting funding timeliness, mobilization reliability, supply continuity, and institutional compliance because these factors strongly influence delivery stability (Bititci et al., 2012; Bourne et al., 2018; Laryea & Hughes, 2011; Enshassi et al., 2017).

For Ethiopia, KPI design should prioritize feasibility and decision usefulness, balancing outcome indicators (e.g., cost variance, cash-flow variance) with process indicators that provide early warning (e.g., milestone reliability, productivity, equipment utilization, rework) using routine site records (Neely et al., 2005; Parmenter, 2015; Upadhaya et al., 2014). Where digital maturity increases, the same KPI set can be progressively automated, improving reliability and reducing subjectivity (Cheung et al., 2004; Zhang, 2005).

Table 2. 4: Suggested Minimal and Practical KPI Set for Road Construction Projects in Developing Countries: Ethiopia Focus

Financial / Outcome Indicators (Lagging)

• Cost variance (% actual cost vs approved budget)
• Project profit margin (%)
• Cash-flow variance (delay in days)

Operational / Process Indicators (Leading and Lagging)

• Schedule performance index (SPI) or percentage of milestones achieved on time
• Labor productivity (m^2/day, m^3/day, or task-specific output units)
• Equipment utilization rate (hours used vs hours available)
• Rework percentage (cost or labor hours attributable to defects)
• Material wastage (% of material ordered)

Quality and Safety Indicators

• Non-conformance incidents per 1,000 work-hours
• Lost Time Injury Frequency Rate (LTIFR)
• Defect density (defects per 1,000 inspection points)

Stakeholder / Customer Indicators

• Client satisfaction score (structured survey)
• Supplier lead-time variance

Capability and Compliance Indicators (Organizational)

• Percentage of staff trained on standard operating procedures (SOPs)
• Percentage of certified project managers
• Documentation completeness score (project file audit)

Data Sources and Normalization

• **Primary sources:** site timesheets, daily progress reports, procurement and financial records, safety logs, QA/QC inspection reports, client surveys
• **Secondary sources:** regulatory reports, industry association summaries, audited financial statements (where available)
• **Normalization factors:** project size (contract value), contract type (traditional / turnkey / EPC), project complexity (urban–rural, ground conditions), and climatic seasonality

2.12 Performance Measures and Integrated Assessment Frameworks

Performance measures operationalize KPIs into specific metrics, calculation rules, data sources, and reporting frequency so that KPI results become actionable rather than symbolic (Neely et al., 2005; Parmenter, 2015). In construction, these measures commonly include schedule and cost variance, productivity indices, defects and rework levels, safety incident rates, resource utilization ratios, and stakeholder satisfaction scoring; integrated frameworks extend measurement to sustainability and organizational learning where feasible (Najmi & Kehoe, 2001; Saunila & Ukko, 2012; Tsoulfas & Pappis, 2020).

Benchmarking supports this system by providing comparative reference points that strengthen learning and discipline; however, where data systems are fragmented, benchmarking must begin with standardized templates and consistent definitions before cross-project comparisons become credible (Kärnä & Junnonen, 2016; Adewunmi et al., 2017; Cheung et al., 2004).

2.12.1 Types of Performance Measures

Performance measures may be categorized as financial versus non-financial, objective versus subjective, quantitative versus qualitative, and leading versus lagging indicators (Nudurupati et al., 2007; Bisbe & Malagueno, 2012; Verbeeten & Boons, 2009; Drury, 2015). Financial measures are typically lagging and evaluate profitability and budget control, while non-financial measures often act as leading indicators that enable earlier corrective action through productivity, safety, and quality signals (Ittner & Larcker, 1998; Dossi & Patelli, 2010; Teeratansirikool et al., 2013; Upadhaya et al., 2014). In low-buffer environments, the practical value of leading indicators is heightened because early intervention can prevent small deviations from compounding into major time and cost overruns (Upadhaya et al., 2014).

2.12.2 Developing Performance Measures from CSFs and Strategy

Measures should be derived from CSFs and strategic objectives to ensure alignment, relevance, and prioritization of high-impact drivers (Kaplan, 2012; Niven, 2014; Groen, Van de Belt and Wilderom, 2012). Translating CSFs into KPI-measure sets reduces the risk of over-measuring low-value indicators and strengthens managerial focus on controllable drivers such as planning discipline, coordination routines, resource flow reliability, and compliance quality (Amare & Mengistu, 2021; Teklewold et al., 2022). Financial measures reflect strategy outcomes, while non-financial measures enable proactive operational control through early risk signals (Jusoh et al., 2008; Hegazy & Tawfik, 2015; Larimo, Nguyen & Ali, 2016).

2.12.3 Performance Measures Linking CSFs and KPIs across Contexts

Performance measures complete the CSF–KPI chain by generating the evidence through which CSFs manifest in outcomes such as schedule reliability, cost control, quality conformance, safety performance, and stakeholder satisfaction (Neely et al., 2000; Bassioni, Price & Hassan, 2004). In developing contexts, additional measures that capture funding timeliness, mobilization reliability, material availability, approval delay frequency, and monitoring effectiveness are often necessary because they reflect the binding constraints that drive performance variance (Osman, 2019; Tadesse, 2021; Makori, 2023). Developed contexts more commonly extend measurement to lifecycle sustainability, digital maturity, and advanced supply-chain indicators, reflecting higher system maturity and stronger data infrastructure (Silva & Warnakulasuriya, 2016; Saunila & Ukko, 2012).

2.13 Benefits of Integrated CPM Systems

Integrating CSFs, KPIs, and performance measures within a coherent CPM system improves clarity of priorities, strengthens early visibility of emerging risks (e.g., productivity decline, rework growth, delayed approvals), and enables more disciplined corrective control and accountability. Over time, standardization, benchmarking, and feedback routines support learning and continuous improvement, strengthening competitiveness and stakeholder confidence in project delivery systems (Tung et al., 2011; Baird, 2017; Bourne et al., 2018). In Ethiopia, implementation feasibility is improved through standardized templates, clear indicator definitions, and consistent reporting routines, which help stabilize measurement under common constraints such as incomplete records and uneven digital infrastructure (Cheung et al., 2004; Nudurupati et al., 2007).

2.14 Benchmarking in Ethiopian Construction

In Ethiopia, benchmarking can function as a practical extension of CPM by converting measurement into comparative learning. Internal benchmarking (across projects, regions, and contract types) supports standardization and identifies replicable practices, while selective external benchmarking enables firms and agencies to identify capability gaps relative to regional competitors and internationally financed project requirements (Neely, Gregory & Platts, 2005; Kärnä and Junnonen, 2016). However, benchmarking effectiveness remains constrained by inconsistent indicator definitions, manual record-keeping, and heterogeneous project typologies. Benchmarking initiatives are therefore more likely to succeed when they begin with a minimal KPI set, use standardized templates for data capture and validation, and embed benchmarking outputs into routine performance reviews and corrective-action tracking (Adewunmi, Iyagba & Omirin, 2017; Upadhaya et al., 2014). A sequential CPM implementation pathway is therefore appropriate: (i) align measurement with strategy and locally relevant CSFs; (ii) select a balanced KPI set; (iii) institutionalize site and head-office data routines; (iv) apply internal/external benchmarking to set targets and expose gaps; and (v) conduct trend and root-cause analysis to drive corrective action and continuous improvement (Franco-Santos et al., 2012; Silvi et al., 2015).

2.15 BIM as a Performance Management Enabler

Building Information Modelling (BIM) refers to an integrated digital approach for creating, managing, and sharing structured project information across the asset life cycle, enabling coordinated design, planning, delivery, and performance control (Eastman et al., 2011). In road infrastructure, BIM principles are applied to corridor and terrain modelling, alignments, drainage, utilities, quantities, and materials, enabling stakeholders to work from a coordinated information base that strengthens planning discipline and monitoring reliability. BIM strengthens performance management by linking design information to programme logic (4D) and cost structures (5D), improving visibility of sequencing risks and cost drivers. It supports quality assurance through specification-linked model information and structured inspection workflows and improves coordination through shared data environments, particularly valuable where coordination gaps contribute to delays, rework, and variation growth (Aman, 2017; Girma & Hailemichael, 2019).

Consistent with the study's correlational design, BIM is examined as a performance-enabling capability associated with improved coordination, information quality, and monitoring effectiveness, rather than as a deterministic driver of project success.

2.16 Literature Gaps

Overall, the literature indicates that performance management systems in developed economies typically reflect higher organizational maturity, earlier integration of sustainability and digital technologies, and greater emphasis on lifecycle value metrics supported by stronger data infrastructure. By contrast, performance systems in many developing-country environments prioritize institutional stability, funding reliability, contractor mobilization capacity, dispute control, and basic project controls, with measurement often constrained by fragmented reporting and limited digital capability. These contrasts suggest that performance management design in Ethiopia should begin with a minimal but strategically aligned KPI set, supported by feasible data routines, benchmarking practices, and incremental digitalization, rather than attempting to implement complex frameworks without supporting capacity. Despite the growth of studies on CSFs, KPIs, and digital tools, the Ethiopian road construction literature remains limited in integrated empirical evidence demonstrating how these constructs are statistically associated within local delivery conditions. This gap provides justification for the study's quantitative correlational design, which examines observed associations among CSFs, BIM and digital practices, KPIs, contextual conditions, and project performance in Ethiopian road construction projects.

2.17 Conceptual Framework

The conceptual framework presents an integrated representation of the relationships among Critical Success Factors (CSFs), Key Performance Indicators (KPIs), BIM and digital practices, contextual conditions, and overall project performance in Ethiopian road construction projects. The framework reflects the multidimensional nature of construction performance in developing-country infrastructure environments and is grounded in construction management literature (Chan & Chan, 2004; Makori, 2023; Lafhaj, Elghaish & Soudani, 2023).

Within the framework, CSFs constitute key explanatory conditions. Drawing on empirical and theoretical literature, these include planning and design quality, managerial competence, contractor technical capability, financial and resource mobilization capacity, stakeholder coordination, governance and institutional support, risk management, and technology readiness (Rockart, 1979; Belassi & Tukel, 1996; Alzahrani & Emsley, 2013; Shalla & Mengistu, 2023). These CSFs represent organizational, managerial, technical, and institutional conditions that are consistently linked to the achievement of project objectives.

KPIs represent measurable performance dimensions through which project outcomes are assessed, including schedule adherence, cost variance, quality compliance, safety performance, resource utilization, environmental performance, productivity, and stakeholder satisfaction (Chan, Scott & Lam, 2002; Wang, Wan & Zhao, 2014). In the framework, stronger CSF implementation is expected to be associated with stronger KPI results because planning, resourcing, coordination, supervision, and governance practices shape how reliably projects execute their delivery plans.

BIM and digital practices are incorporated as enabling capabilities that may strengthen coordination, information accuracy, and decision-making across the project life cycle. BIM supports design coordination, clash detection, structured information sharing, and (where implemented) enhanced planning and monitoring integration such as 4D/5D applications (Eastman et al., 2011; Azhar, 2011; Lafhaj, Elghaish & Soudani, 2023). Within the Ethiopian context, where adoption is uneven, BIM-related capabilities are expected to be associated with reduced information fragmentation and improved monitoring reliability, thereby supporting improved KPI performance.

Overall project performance is conceptualized as a multidimensional construct encompassing time, cost, and quality outcomes, alongside safety performance, environmental sustainability, stakeholder satisfaction, organizational learning, and socio-economic contribution. This reflects contemporary literature emphasizing that project success extends beyond the “iron triangle” toward long-term value creation and capability development (Toor & Ogunlana, 2010; Serrador & Turner, 2014; Makori, 2023).

Contextual factors are incorporated as external conditions that shape the project delivery environment and help explain variability in performance outcomes across projects. These include institutional quality, governance effectiveness, funding reliability, ICT readiness, labor skills availability, regulatory procedures, terrain, climate, and stakeholder dynamics (Olawumi & Chan, 2021; Hassan et al., 2020). In Ethiopia, constraints such as delayed payments, limited digital readiness, challenging terrain, and complex stakeholder interfaces are particularly salient and may coincide with weaker KPI and performance outcomes even where internal practices are relatively strong.

Overall, the framework provides a structured foundation for examining statistical relationships among CSFs, BIM and digital practices, KPIs, contextual conditions, and project performance in Ethiopian road construction projects. Consistent with the study’s correlational design, the framework is interpreted as representing theoretically informed associations rather than deterministic causal pathways. It informs construct operationalization and the correlation analysis procedures described in Chapter 3.

2.18 Rationale and Theoretical Foundations

The conceptual framework is informed by complementary theories to strengthen analytical robustness. Project Management Theory explains how structured planning, control, and coordination are associated with performance outcomes across the project life cycle (Kerzner, 2017; PMI, 2021). Institutional Theory highlights how governance systems, regulatory pressures, and legitimacy requirements shape organizational behavior and performance in public infrastructure delivery (DiMaggio and Powell, 1983; Scott, 2008). The Resource-Based View supports the inclusion of CSFs such as managerial competence, contractor capability, financial capacity, and technological resources by emphasizing that sustained performance depends on valuable and well-organized internal resources (Barney, 1991). Systems Theory justifies the integrated structure of the framework by conceptualizing road projects as open systems in which technical, organizational, and environmental elements interact dynamically through feedback loops and interdependence (Von Bertalanffy, 1968; Kast & Rosenzweig, 1972). Together, these perspectives capture internal enablers and external constraints, offering a holistic basis for interpreting performance patterns in developing-country road construction contexts.

Table 2. 5: **Alignment of Integrated CSFs, KPIs, and Performance Measures for Road Construction Projects**

Integrated CSF	CSF Code	Key Performance Indicator (KPI)	KPI Description	Performance Measures / Indicators
Project Planning & Coordination Effectiveness	CSF1	Schedule Performance	Extent to which project activities are completed in accordance with the approved schedule	Schedule adherence (%); milestone completion rate; schedule variance
		Risk & Coordination Effectiveness	Effectiveness of coordination and early risk identification during project execution	Frequency of coordination issues; effectiveness of mitigation actions
Contractor Financial Capacity & Resource Mobilization	CSF2	Cost Performance	Ability to control project costs within approved budgets	Cost variance; budget overrun (%)
		Cash-Flow Stability	Adequacy and timeliness of financial resources to sustain construction activities	Cash-flow continuity; funding release timeliness
Technical & Managerial Competence	CSF3	Productivity Performance	Effectiveness of technical skills and managerial decisions in achieving output targets	Labor productivity; decision-making effectiveness
		Management Effectiveness	Quality of leadership, supervision, and coordination of project activities	Responsiveness of management; coordination effectiveness
Supply Chain & Resource Management	CSF4	Resource Utilization Efficiency	Efficiency of labor, equipment, and material utilization	Equipment utilization rate; labor allocation efficiency
		Material & Equipment Availability	Reliability of supply chains in supporting construction operations	Frequency of material shortages; equipment downtime
Quality, Safety & Environmental Management	CSF5	Quality Performance	Degree to which completed works meet specified standards	Defect rate; rework level; compliance with specifications
		Safety Performance	Effectiveness of safety management in preventing incidents	Accident frequency; safety incident rate
		Environmental	Integration of environmental	Environmental

		Compliance	protection measures into project execution	compliance level; incident occurrence
Stakeholder Engagement & Governance	CSF6	Stakeholder Satisfaction	Extent to which stakeholder expectations are met	Stakeholder satisfaction level; dispute frequency
		Governance Effectiveness	Transparency and effectiveness of project oversight mechanisms	Effectiveness of reporting systems; accountability clarity
Organizational Learning & Capability Development	CSF7	Learning & Improvement Capability	Ability to capture lessons learned and improve future performance	Frequency of lessons learned application; training adequacy
Project Performance (Outcome Construct)	CSF8	Overall Project Performance	Aggregate performance across cost, time, quality, safety, and stakeholder dimensions	Composite performance index; alignment with stated objectives

To ensure analytical parsimony and contextual relevance, the study adopts a minimal, but strategically representative KPI set capturing schedule, cost, quality, financial stability, resource efficiency, safety, environmental compliance, stakeholder satisfaction, and BIM usage. This approach aligns with recommendations for performance measurement in developing-country construction environments, where data availability and reporting consistency.

2.19 Conceptual Framework Diagram

The preceding review has established that performance management in road construction projects is best understood as a multidimensional system shaped by interrelated CSFs, measurable indicators, contextual delivery conditions, and enabling digital practices. The literature further demonstrates that effective performance management operates through continuous improvement cycles, structured operational processes, and clearly defined project life-cycle stages, rather than through isolated measurement activities or retrospective reporting (Bourne et al., 2000; Bititci, Cocca and Ates, 2016; Otley, 2016). However, existing studies often address these elements in isolation, with limited integration between strategic intent, operational execution, and delivery conditions, particularly within developing-country road construction contexts. To address this gap, this study synthesizes the reviewed theories and evidence into an integrated conceptual framework linking CSFs, BIM and digital practices, KPIs, contextual conditions, and overall project performance. Figure 2.2 presents the proposed framework, which provides the analytical foundation for the empirical examination undertaken in subsequent chapters.

Figure 2.2 illustrating hypothesized associations among CSFs, BIM and digital practices, KPIs, contextual conditions, and overall project performance in Ethiopian road construction projects. The framework is interpretive and does not imply deterministic causality, consistent with a correlational research design.

Critical Success Factors (CSFs)
• Project planning and coordination competence
• Contractor financial and technical capacity
• Resource mobilization and cash-flow stability
• Governance and institutional support
• Stakeholder engagement and communication
• Monitoring, supervision, and compliance mechanisms
• Organizational and technical capability

BIM and Digital Practices (Enabling Layer)
• Design coordination and information integration
• 4D/5D planning and cost integration
• Quantity take-off and cost estimation
• Clash detection and constructability support
• Data sharing and lifecycle information management

Key Performance Indicators (KPIs)
• Schedule adherence and milestone reliability
• Cost performance and financial control
• Quality compliance and rework levels
• Safety performance
• Resource and equipment utilization
• Environmental performance
• Stakeholder satisfaction
• Team and leadership effectiveness

Overall Project Performance
• Time, cost, and quality outcomes
• Safety and environmental sustainability
• Stakeholder satisfaction
• Organizational learning and capacity development
• Socio-economic contribution

Figure 2.2: Conceptual framework Diagram

The framework illustrates the analytical relationships among Critical Success Factors, BIM and digital practices, Key Performance Indicators, and overall project performance in Ethiopian road construction projects. BIM is conceptualized as an enabling mechanism that strengthens performance measurement and coordination, while contextual conditions influence the effectiveness of performance management practices. The framework reflects hypothesized associations derived from the literature and does not imply deterministic causal relationships, consistent with the study's correlational research design.

2.20 Chapter Conclusion

This chapter has reviewed PMS in the construction industry, emphasizing the multidimensional and context-sensitive nature of construction performance in contemporary project environments. The literature shows that effective performance management requires frameworks that balance traditional delivery metrics with non-financial and socio-environmental considerations, supported by structured monitoring routines and feedback-driven improvement cycles (Bourne et al., 2000; Bititci, Cocca and Ates, 2016). While international studies provide established CSFs, KPI sets, and CPM models, their direct transfer to developing-country environments—such as Ethiopia—is constrained by institutional capacity limitations, fragmented data practices, uneven contractor capability, supply-chain instability, and limited digital readiness (Challa et al., 2022; Lafhaj et al., 2023).

The review further indicates that digital tools, particularly BIM and related practices, have potential to strengthen coordination, information reliability, and monitoring discipline; however, the performance relevance of these tools depends on adoption maturity and organizational readiness rather than being a standalone guarantee of success (Eastman et al., 2011; Azhar, 2011). Importantly, the evidence also shows that project outcomes are shaped not only by internal managerial and technical practices but also by external delivery conditions such as funding reliability, governance procedures, terrain and climate constraints, and stakeholder dynamics, which help explain performance variability across projects operating under different constraints (Olawumi and Chan, 2021; Hassan et al., 2020).

Accordingly, this chapter has synthesized theory and empirical evidence into an integrated conceptual framework linking CSFs, BIM and digital practices, KPIs, contextual conditions, and overall project performance. The CSF → KPI → performance logic adopted in this study provides a structured basis for operationalizing constructs and examining statistical associations among them, consistent with the correlational research design employed in subsequent chapters.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodological framework adopted to address the research objectives and research questions of the study. It explains and justifies the philosophical positioning, research paradigm, research approach, research design, and the procedures used for data collection and data analysis in examining performance management in Ethiopian road construction projects. A coherent and transparent methodological structure is essential to ensure the rigour, validity, and reliability of the study's findings and to provide a defensible foundation for the development of an empirically grounded performance management framework.

To ensure internal consistency and logical alignment among methodological choices, the study adopts the Research Onion framework proposed by Saunders, Lewis and Thornhill (2016). This framework provides a structured, layered logic for research design by linking philosophical assumptions to practical decisions related to research approach, strategy, data collection, and analysis. Its application enables explicit justification of methodological choices and demonstrates how abstract theoretical positions are translated into operational research procedures.

The application of this framework supports alignment between theoretical assumptions and practical research procedures, thereby strengthening internal methodological consistency throughout the study. It also enhances transparency by demonstrating how abstract philosophical assumptions are operationalized into specific design choices, measurement instruments, and analytical procedures. The following sections present and justify each layer of the Research Onion as applied in this research.

Figure 3.1 provides a procedural overview of how the study's methodological components are logically connected and presents the conceptual layering of research decisions. The study progresses from a positivist philosophical stance to a deductive approach and a quantitative, cross-sectional correlational design. Data collection is conducted through a structured questionnaire survey, followed by descriptive statistical analysis and Pearson correlation analysis to examine associations among Critical Success Factors, Key Performance Indicators, BIM and digital practices, contextual factors, and overall project performance. This structured flow clarifies how methodological decisions collectively support the empirical validation of the proposed performance management framework.

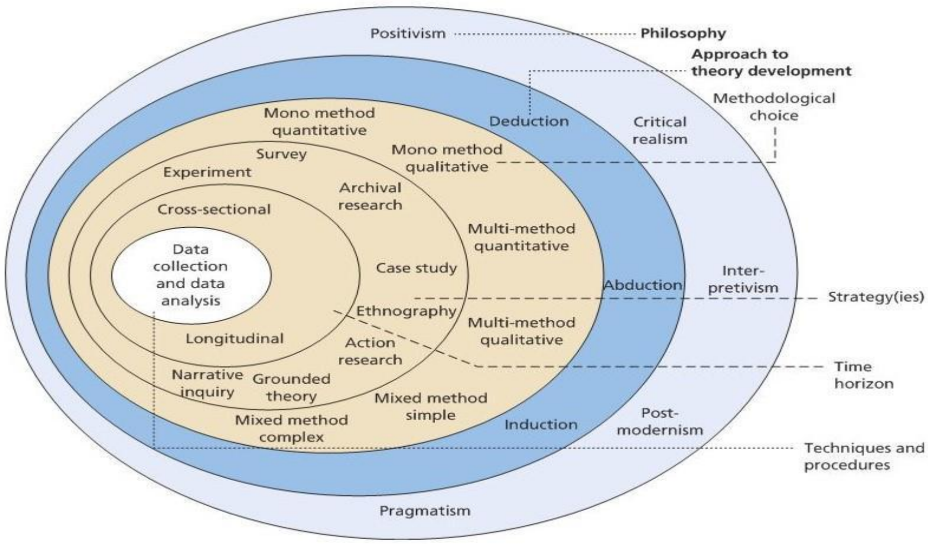

Figure 3.1: Research Onion (Saunders, Lewis, & Thornhill, 2016).

3.2 Research Philosophy

3.2.1 Ontological Position

This study is grounded in an objectivist ontological position, which assumes that social phenomena, such as project cost deviations, schedule delays, productivity levels, and safety performance, exist independently of individual perceptions and can therefore be examined as objectively observable and measurable realities (Collis & Hussey, 2014). Within the Ethiopian road construction context, many performance-related attributes are routinely captured through formal project documentation, monitoring reports, and institutional reporting systems, indicating that these phenomena exist regardless of respondents' subjective interpretations.

This ontological stance aligns with the study's focus on measurable constructs, including Critical Success Factors, Key Performance Indicators, contextual influences, BIM adoption, and overall project performance. It supports the identification of empirical patterns and associations across multiple projects and stakeholder groups and provides an appropriate foundation for developing a performance management framework that is evidence-based and capable of sector-level application.

3.2.2 Epistemological Position

The study adopts an empiricist epistemology, which holds that knowledge is primarily derived from systematic observation, numerical measurement, and empirical testing (Easterby-Smith, Thorpe & Jackson, 2021). In this research, empiricism underpins the use of a structured questionnaire, numerical rating scales, and statistical analysis to examine performance management constructs within Ethiopian road construction projects.

By prioritizing observable and measurable evidence, this epistemological position strengthens the reliability and replicability of the study's findings, particularly in assessing empirical relationships among CSFs, KPIs, contextual conditions, BIM adoption, and project performance. This stance is consistent with the study's intention to generate findings that are grounded in empirical data while remaining sufficiently generalizable to inform performance management practice across the sector.

3.2.3 Research Paradigm: Positivism

The research is situated within the positivist paradigm, which assumes that reality can be objectively measured, quantified, and analyzed using established statistical techniques (Saunders, Lewis & Thornhill, 2019). Positivism supports hypothesis-oriented inquiry and the identification of generalizable patterns and relationships among variables, making it well suited to the study's aim of examining how CSFs, contextual factors, BIM adoption, and PMS maturity relate to project performance outcomes in Ethiopian road construction.

In particular, the positivist paradigm justifies the use of structured measurement instruments and statistical procedures for both scale evaluation and relationship assessment. As such, positivism provides an appropriate philosophical foundation for developing an empirically grounded and sector-relevant performance management framework.

3.3 Research Approach

The study follows a deductive research approach, which involves drawing on existing theory and prior empirical studies to derive propositions and relationships that are subsequently examined using empirical data (Bryman, 2016). Deduction aligns with objectivism and positivism by emphasizing measurement, testing, and systematic verification.

This approach is appropriate because constructs such as CSFs, KPIs, PMS maturity, contextual constraints, and project performance have been widely examined in global construction management literature, enabling the development of theoretically informed expectations that can be empirically examined within the Ethiopian road construction context. Deductive logic strengthens methodological coherence by ensuring that the proposed performance management framework is both theoretically anchored and empirically validated. In this study, PMS maturity is reflected through the level of implementation of CSFs, KPI usage, and supporting digital practices rather than treated as a separate construct.

3.4 Research Design

The study employs a quantitative, cross-sectional correlational research design, which is appropriate for examining relationships among variables measured at a single point in time. This design enables the simultaneous measurement of multiple constructs, CSFs, KPIs, contextual factors, BIM adoption, PMS maturity, and overall project performance, across a broad population of professionals involved in Ethiopian road construction projects.

The correlational design is justified because the purpose of the study is to identify the strength and direction of statistical associations rather than to manipulate variables or explore subjective narratives. Cross-sectional survey designs are widely used in construction management research due to their efficiency and suitability for geographically dispersed professional populations (Creswell & Creswell, 2018).

The quantitative design enables latent constructs to be translated into measurable variables through structured instruments, supporting objective and replicable measurement. While qualitative methods can provide deeper contextual insights, they typically produce non-numerical data that limit statistical generalization. Given the study's objective of developing an empirically grounded framework applicable at sector level, a quantitative approach is prioritized (Muzafar et al., 2023; Fu et al., 2024). Positioning this research within this methodological tradition enhances its relevance and alignment with current scholarly practice.

Consistent with the study's correlational design, observed relationships are interpreted as statistical associations rather than causal effects, and no claims of prediction or intervention impact are made.

3.4.1 Justification for Quantitative Design

The quantitative-only approach is justified for several reasons. First, security constraints in certain project locations limit the feasibility of extensive qualitative fieldwork. Second, standardization is enhanced using structured questionnaires, enabling consistent measurement across respondents, stakeholder groups, and project settings. Third, generalizability is strengthened, as quantitative data support sector-level inference required for a framework intended for broad application. Fourth, objectivity is enhanced by reducing reliance on individual narratives and minimizing researcher-induced bias. Finally, advanced analytical procedures, such as reliability testing and correlation analysis, require structured quantitative datasets (Hair et al., 2020).

Overall, the quantitative cross-sectional design provides the methodological rigour required for a doctoral study focused on performance management framework development.

3.4.2 Mitigation of Limitations of Quantitative Design

A key limitation of cross-sectional quantitative designs is the inability to support strong causal inference, as variables are measured at a single point in time. In addition, survey-based instruments may not fully capture informal practices and institutional dynamics influencing performance management implementation.

To mitigate these limitations, several strategies are applied. Detailed descriptive analysis is used to identify trends and variability across constructs. Content validity is strengthened through expert review and theoretical grounding of items. Reliability is assessed using Cronbach's alpha and item–total statistics. Correlation results are interpreted conservatively as associations rather than causal effects and are contextualized through comparison with existing literature.

These strategies enhance interpretive rigour while remaining consistent with the selected design and support the credibility and defensibility of the study's findings.

3.5 Research Strategy

A survey research strategy is adopted, consistent with the requirements of a quantitative, cross-sectional correlational research design. Survey strategies are particularly appropriate for collecting standardized data from a large population within a limited time frame and at relatively low cost (Saunders et al., 2019). Given the geographically dispersed nature of Ethiopian road construction projects and the wide distribution of professionals across regions and project sites, surveys enable broad sectoral coverage while maintaining consistency and comparability of responses.

The survey strategy supports the study's objective of examining relationships among CSFs, KPIs, BIM adoption, contextual factors, and overall project performance across multiple organizational and project settings. It also aligns with the positivist paradigm by facilitating objective measurement and statistical analysis of predefined constructs using structured instruments.

3.6 Population and Sampling

3.6.1 Target Population

The target population for this study comprises professionals directly involved in the planning, supervision, execution, and management of road construction projects in Ethiopia. These include project managers, resident engineers, site engineers, contract administrators, monitoring and evaluation officers, Ethiopian Roads Administration (ERA) district engineers, consulting engineers, and Grade 1 contractors.

These professional groups were selected because they possess direct and practical knowledge of project performance management practices, including planning and control procedures, performance measurement routines, and contextual challenges affecting road project delivery. Their roles position them as key informants capable of providing informed and reliable responses regarding CSFs, KPIs, BIM adoption, contextual factors, and overall project performance.

3.6.2 Sampling Technique

A stratified random sampling technique was employed to ensure proportional representation of the major stakeholder groups, namely public-sector agencies, contractors, and consulting organizations. Stratification enhances representativeness by capturing diversity in organizational roles, responsibilities, and perspectives within the Ethiopian road construction sector.

Within each stratum, purposive sampling was applied to select respondents with a minimum of five years of professional experience in road construction projects. This criterion ensured that participants possessed sufficient exposure to performance management practices and project delivery challenges, thereby improving the relevance, credibility, and reliability of the data collected.

3.6.3 Sample Size

A target sample size of 170 respondents was adopted for the study. This size is consistent with methodological recommendations suggesting a minimum of 150–200 observations where multiple latent constructs are examined simultaneously (Kline, 2016; Hair et al., 2020).

The selected sample size provides adequate statistical power, supports model stability, and ensures reliability of parameter estimates, while remaining feasible within the practical constraints of data collection in the Ethiopian road construction context. It also enables meaningful sector-level generalization of findings.

3.7 Instrument Development

The survey questionnaire was developed based on validated measurement scales widely used in construction performance management literature (Chan & Chan, 2004; Ahiaga-Dagbui & Smith, 2014) and subsequently adapted to reflect the Ethiopian road construction context. Adaptation involved contextualizing terminology, operational conditions, and institutional arrangements relevant to ERA-managed and contractor-executed projects.

To enhance content relevance and clarity, the draft instrument was reviewed by subject-matter experts in construction management and experienced practitioners from ERA. A pilot study involving 15 respondents was then conducted to assess clarity, cultural appropriateness, reliability, and logical flow of the questionnaire. Feedback from the pilot study informed minor revisions, including rewording ambiguous items and improving sequencing.

Each construct was measured using between three and six items on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree)**,** consistent with recommended practices for multivariate and latent-variable research (Hair et al., 2022). The instrument integrates perceptual assessments and practice-oriented indicators, enabling comprehensive evaluation of relationships among CSFs, KPIs, BIM adoption, contextual constraints, and project performance.

3.8 Data Collection Methods

Data were collected using a structured self-administered questionnaire designed to capture respondents' perceptions of performance management practices and outcomes in Ethiopian road construction projects. A self-administered instrument was selected because it supports standardized measurement across geographically dispersed project sites, reduces interviewer influence, and enables respondents to complete the questionnaire at a convenient time, thereby improving response quality and consistency.

3.8.1 Modes of Distribution and Administration

The questionnaire was distributed through multiple channels to maximize accessibility and response rates across regions with varying levels of digital connectivity. The primary channels included:

(i) online survey platforms (e.g., Google Forms and Qualtrics),
(ii) email distribution to organizational mailing lists and professional networks, and
(iii) physical delivery and collection where internet access was unreliable or where respondents preferred paper-based completion.

This mixed-mode distribution approach increased coverage by enabling participation from both digitally connected and less connected project environments. It also reduced non-response bias by offering respondents flexible options for participation. To maintain measurement consistency across modes, the questionnaire content, item wording, scaling, and ordering were kept identical in both online and paper formats.

3.8.2 Data Collection Procedures

Prior to distribution, prospective participants were provided with a short study information statement outlining the study purpose, anonymity assurances, and voluntary nature of participation. For online distribution, a survey link was shared together with instructions for completion. For physical distribution, respondents received printed questionnaires along with a consent statement and were given sufficient time to complete the instrument before collection. Follow-up reminders were issued through email and professional contacts to encourage completion and reduce partial responses.

3.8.3 Structure of the Questionnaire and Measurement Scale

The questionnaire comprised seven sections covering: demographic characteristics, performance management practices, Critical Success Factors, Key Performance Indicators, BIM and digital practices, contextual factors, and overall project performance. All substantive items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Likert scaling is widely used in performance management research due to its ability to capture structured perceptions reliably and support statistical aggregation into composite constructs (Parmenter, 2015). The survey design enabled the computation of construct-level mean scores and dispersion (standard deviation) and supported subsequent reliability testing and correlational analysis.

3.9 Validity

Validity was addressed systematically to ensure methodological rigour and to confirm that the questionnaire adequately measured the conceptual domains under investigation. Given the study’s correlational design and reliance on questionnaire measurement, content validity was prioritized to ensure that items meaningfully represented the constructs of CSFs, KPIs, BIM and digital practices, contextual factors, and project performance relevant to Ethiopian road construction projects.

3.9.1 Establishing Content Validity

Construct domains were first defined through a structured review of international and Ethiopian literature on performance management in construction and road infrastructure delivery. Based on these domains, an initial pool of items was generated and then assessed for relevance, clarity, and contextual suitability.

A panel of seven experts reviewed the instrument, comprising senior ERA practitioners, academic specialists in construction management, contractors, and BIM professionals. Each expert had a minimum of five years' experience in the relevant domain. The panel evaluated each item using a four-point relevance scale (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant). The use of a four-point scale prevents neutral scoring and encourages more discriminating validity judgments.

3.9.2 Content Validity Index Procedures

The Item-level Content Validity Index (I-CVI) and Scale-level Content Validity Index (S-CVI) were calculated using established thresholds. Items scoring below acceptable levels were revised for clarity, contextual fit, or conceptual alignment, while items judged redundant or weak were removed. A second refinement round was conducted (Delphi-style) for items requiring further clarification, enabling the instrument to converge toward content accuracy and contextual appropriateness.

This validity process ensured that the final instrument reflected the conceptual framework and Ethiopian road construction realities, while remaining sufficiently aligned with international performance management constructs to allow scholarly comparability.

3.10 Pilot Testing Procedures

A pilot study involving 15 respondents was conducted prior to the main survey to test feasibility, clarity, and preliminary measurement performance. Pilot participants were drawn from the same professional population as the main study to ensure contextual relevance and to evaluate whether terminology, sequencing, and response format were appropriate for Ethiopian road construction professionals.

The pilot test assessed:

(i) item clarity and comprehension,

(ii) questionnaire length and completion time,

(iii) consistency of interpretation across stakeholder roles, and

(iv) preliminary internal consistency reliability.

Preliminary reliability testing using Cronbach's alpha indicated acceptable internal consistency for exploratory instrument refinement. Feedback from pilot participants informed minor improvements, including rewording ambiguous items, improving transitions between sections, and refining sequencing to improve logical flow. Pilot responses were excluded from the final dataset to avoid duplicate measurement and to prevent potential response conditioning.

3.11 Ethical Considerations

Ethical principles were observed throughout the study to ensure responsible research practice and protect participants' rights. Participation was voluntary, and all respondents were informed of the purpose, scope, and nature of the study prior to completion. Informed consent was obtained, and participants were assured that they could withdraw at any stage without any adverse consequence.

To protect confidentiality and anonymity, no personally identifiable information was collected. Survey responses were stored securely, with access restricted to the researcher, and were used exclusively for academic purposes. Findings were reported in aggregated form to prevent identification of individuals, organizations, or project sites. The study complied with ethical guidelines and research standards prescribed by the University of Selinus and relevant academic research bodies.

3.12 Data Analysis Techniques

Data analysis followed a structured quantitative approach consistent with the study's cross-sectional correlational research design. Analysis was conducted using SPSS, following a sequential process designed to ensure data quality, confirm measurement adequacy, and examine relationships among study constructs.

The analytical strategy was structured in stages:
(i) data preparation and screening,
(ii) measurement quality assessment (reliability),
(iii) descriptive statistical profiling, and
(iv) correlation analysis to test associations among constructs.

3.12.1 Preliminary Data Preparation and Screening

Prior to analysis, the dataset was screened for completeness, accuracy, and suitability for inferential procedures. Missing data were assessed using frequency distributions in SPSS. Variables with less than 5% missingness were retained without imputation, and missingness patterns were reviewed to ensure that missing values were not systematically associated with specific respondent groups or constructs.

Assumption checks were conducted prior to correlation analysis. Normality was examined using skewness and kurtosis statistics, with values within approximately ±2 treated as acceptable for approximate univariate normality in applied social science contexts. Linearity and homoscedasticity were assessed using scatterplots of composite variables.

3.12.2 Data Cleaning and Coding

All completed questionnaires were screened for completeness. Questionnaires with excessive missing data (greater than approximately 20% of items) were excluded to preserve data quality and reduce potential bias.

Data entry was conducted in Microsoft Excel to support preliminary verification and traceability. Each questionnaire was assigned a unique identification code. Responses were checked for out-of-range values and inconsistencies, with Likert-scale responses verified to fall within the range 1–5. Where discrepancies were identified, entries were cross-checked against original questionnaires; unresolved cases were treated as missing values. The verified dataset was imported into SPSS for formal statistical analysis.

All variables were coded numerically using a standardized coding scheme. Demographic variables (e.g., organizational type, respondent role, education level) were assigned numeric categories. Construct items were coded consistently using a five-point Likert scheme. Any negatively worded items were reverse coded prior to generating composite construct scores to ensure interpretive consistency. Given the correlational nature of the study and the low proportion of missing values, pairwise deletion was applied in correlation analysis to maximize use of available data while preserving observed relationships.

3.12.3 Scale of Measurement

Multiple levels of measurement were used in accordance with the nature of study variables. Nominal scales were used for categorical demographics, ordinal scales for ranked characteristics, and continuous scale measurement was used for variables such as age and years of experience where recorded numerically.

Construct items (CSFs, KPIs, BIM and digital practices, contextual factors, and project performance) were measured using Likert scales. Although Likert-scale responses are ordinal in strict terms, composite scores derived from multi-item scales were treated as approximately interval-level measures for analytical purposes, consistent with widely accepted practice in construction management and applied social science research. This permitted computation of means, standard deviations, and Pearson correlation coefficients.

3.12.4 Reliability Analysis

Internal consistency reliability was assessed using Cronbach’s alpha for each construct (CSFs, KPIs, BIM and di gital practices, contextual factors, and project performance). A Cronbach’s alpha threshold of 0.70 or higher was considered acceptable, consistent with methodological standards commonly applied in behavioral and management research. Item–total correlations and “alpha if item deleted” statistics were reviewed to confirm that items contributed meaningfully to their scales before proceeding to correlational testing.

3.13 Data Analysis Procedures

3.13.1 Descriptive Statistical Analysis

Descriptive analysis constituted the first substantive stage of analysis and was used to summarize respondent characteristics and evaluate perceived implementation and performance levels across constructs. Frequency distributions and percentages were used to describe respondent demographics (role, organization type, region, education level, and years of experience). Measures of central tendency (mean) and dispersion (standard deviation) were computed for each item and for composite construct scores.

Descriptive analysis served two purposes. First, it provided an empirical profile of performance management practices and perceived performance outcomes in Ethiopian road construction projects. Second, it supported preliminary assessment of data quality by identifying unusual response distributions or anomalies prior to inferential analysis.

3.13.2 Correlation Analysis

Pearson correlation analysis was employed to examine the strength and direction of associations among CSFs, KPIs, BIM and digital practices, contextual factors, and overall project performance. Two-tailed significance testing was applied at conventional thresholds. Correlation coefficients were interpreted in terms of direction and magnitude (weak, moderate, or strong), and results were interpreted conservatively as evidence of association rather than causation, consistent with the cross-sectional non-experimental design.

Pearson correlation was selected due to the approximately normal distribution of composite variables, interval-like properties of multi-item Likert scales, and the study's focus on linear association strength.

3.14 Software Used

The following software tools were used to support data analysis and interpretation:

1. **SPSS** – data management, descriptive statistics, reliability testing (Cronbach's alpha), assumption checks, and correlation analysis

2. **Microsoft Excel / Tableau** – preliminary data checking, visualization, and preparation of charts and figures for reporting purposes

These tools are widely used in construction management and social science research and support robust quantitative analysis and transparent reporting (Pallant, 2020; Field, 2018; Hair et al., 2019; Kline, 2016).

3.15 Chapter Summary

This chapter presented a rigorous and contextually grounded methodological framework for investigating performance management in Ethiopian road construction projects. Guided by a positivist research philosophy and a quantitative cross-sectional correlational design, the study operationalised CSFs, KPIs, BIM and digital practices, contextual factors, and project performance into measurable constructs suitable for empirical analysis.

The use of a structured questionnaire, developed from established literature, refined through expert review and content validity procedures, and strengthened through pilot testing, enhanced measurement reliability, objectivity, and contextual relevance. Clear sampling procedures, ethical safeguards, and systematic data screening improved transparency and credibility. The sequential analytical approach, comprising data preparation, descriptive analysis, reliability testing, and Pearson correlation analysis, was selected in direct alignment with the study's objectives and conceptual framework. Collectively, this chapter provides a defensible methodological foundation for the results and empirical findings presented in Chapter Four. This shows methodological intentionality. The methodological choices adopted in this chapter ensure analytical rigour, internal consistency, and empirical defensibility, providing a robust platform for the presentation and interpretation of results in Chapter.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS, AND RESULTS

4.1 Introduction

This chapter presents the empirical results of the study derived from quantitative data collected from professionals involved in road construction projects in Ethiopia. The chapter focuses on the systematic presentation and preliminary analysis of the data in order to establish a robust empirical foundation for the inferential analysis undertaken in the subsequent chapter.

In line with the research objectives and the methodological framework outlined in Chapter Three, the analysis proceeds through three main stages: assessment of response rate and data quality, descriptive statistical analysis of the study constructs, and evaluation of the reliability of the measurement scales. The constructs examined include Critical Success Factors, Key Performance Indicators, Building Information Modelling and digital practices, contextual factors, and overall project performance.

Descriptive statistics are employed to summarize respondents' perceptions regarding the level of implementation and effectiveness of performance management practices across Ethiopian road construction projects. Reliability analysis is conducted to confirm the internal consistency of the measurement instruments prior to inferential analysis. The results presented in this chapter provide essential empirical context and methodological justification for the Pearson correlation analysis and interpretive discussion presented in Chapter Five.

4.2 Response Rate and Data Quality

4.2.1 Response Rate

A total of 170 structured questionnaires were distributed to professionals representing key stakeholder groups within the Ethiopian road construction sector, including the Ethiopian Roads Administration, regional road authorities, consulting engineering firms, and Grade One contracting organizations. Of these, 155 completed questionnaires were returned, yielding a response rate of 91%.

Following data screening procedures, 155 questionnaires were deemed complete and suitable for analysis. This response rate exceeds the minimum thresholds commonly recommended for quantitative research in construction management and infrastructure studies and is considered sufficient to support robust statistical analysis and contextually generalizable findings.

4.2.2 Data Screening and Preparation

Prior to statistical analysis, the dataset was examined for missing values, outliers, and distributional properties. Missing responses were minimal and randomly distributed across cases, indicating no systematic response bias. On this basis, pairwise deletion was applied during correlation analysis to maximize data utilization while maintaining statistical validity.

Skewness and kurtosis statistics were examined to assess approximate univariate normality. All constructs exhibited skewness and kurtosis values within the acceptable range of ±2, indicating that the data approximated a normal distribution and were suitable for parametric statistical techniques, including Pearson correlation analysis.

These diagnostic checks confirm that the dataset meets the assumptions required for descriptive and correlational analysis and is of sufficient quality to support reliable interpretation of the results.

4.3 Respondent Profile: Analysis and Interpretation

4.3.1 Gender of Respondents

The gender distribution indicates that male respondents constituted most of the sample (73.0%, n = 111), while female respondents accounted for 27.0% (n = 41). This pattern reflects the male-dominated nature of the road construction industry in Ethiopia, particularly within technical, managerial, and site-based roles. Although female participation remains comparatively limited, the inclusion of more than one-quarter female respondents provides meaningful gender representation. The gender composition is therefore considered adequate for capturing industry-relevant perspectives without introducing systematic bias into the analysis.

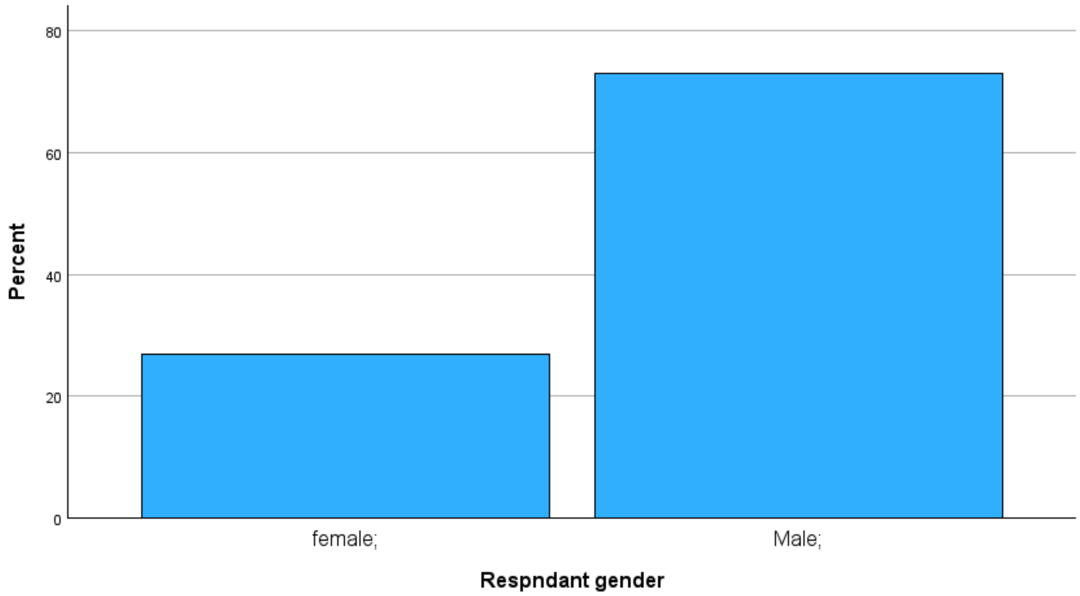

Figure 4.1: Gender of Respondents

4.3.2 Age Distribution of Respondents

The age profile shows that respondents were predominantly within economically active and professionally mature age groups. The largest proportion fell within the 36–45 years category (41.4%, n = 63), followed by those aged 26–35 years (34.2%, n = 52). Smaller proportions were observed among respondents aged 46–55 years (15.8%, n = 24), while younger respondents aged 16–25 years (6.6%, n = 10) and those aged 56 years and above (2.0%, n = 3) were relatively limited.

This distribution suggests that most respondents possess substantial professional maturity and decision-making responsibility, thereby enhancing the reliability of their assessments of performance management practices in road construction projects.

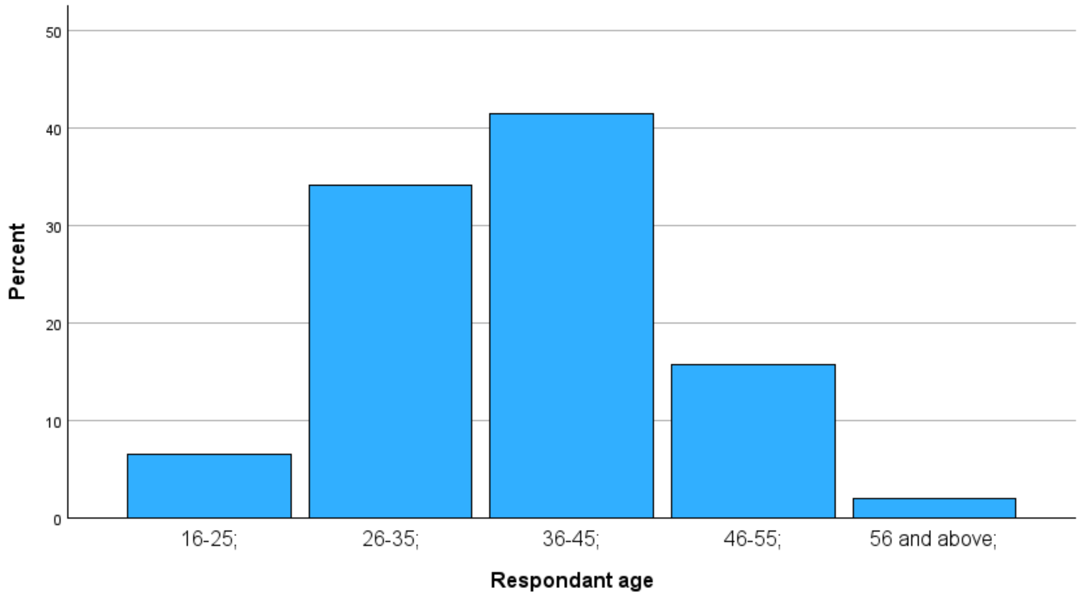

Figure 4.2: Age Distribution of Respondents

4.3.3 Position in the Project

Respondents occupied a wide range of project roles, ensuring comprehensive stakeholder representation. Consultants constituted the largest group (30.2%, n = 40), followed by contractor representatives (22.4%, n = 34) and project managers (20.4%, n = 31). Additional roles included site engineers (19.4%, n = 29), client representatives (9.9%, n = 11), and claims experts (1.3%, n = 2).

This distribution confirms that the dataset captures perspectives from planning, execution, supervision, and oversight functions, which is essential for a holistic examination of Critical Success Factors, Key Performance Indicators, and project performance outcomes.

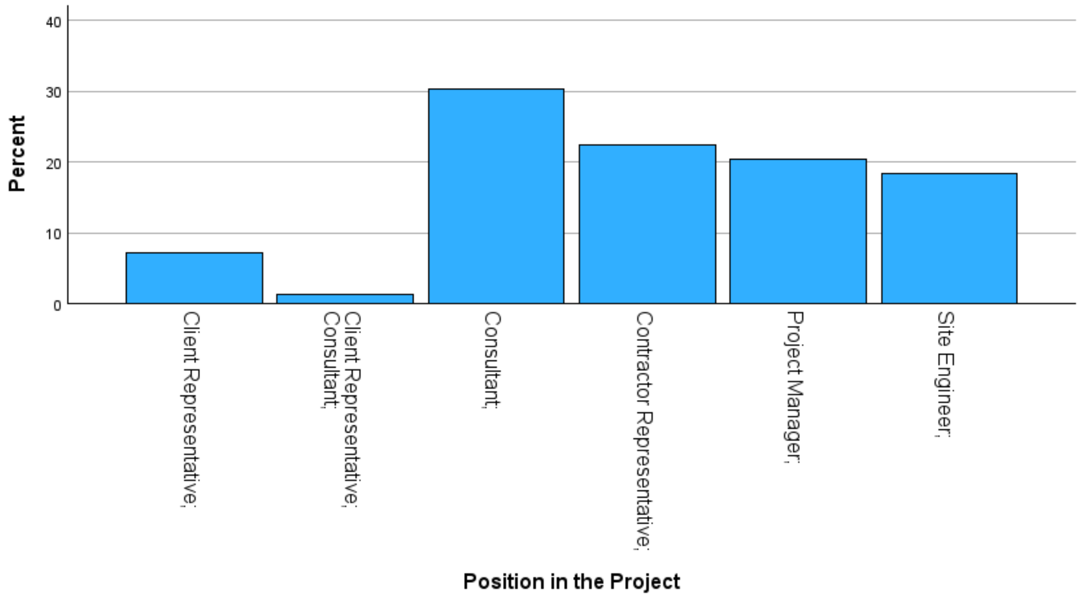

Figure 4.3: Position in the Project

4.3.4 Years of Experience in the Construction Industry

Analysis of professional experience indicates that the majority of respondents possessed extensive industry experience. More than half of the sample reported over ten years of experience (55.3%, n = 84), while 27.6% (n = 42) had between seven and ten years of experience. Respondents with four to six years (9.9%, n = 15) and one to three years (6.6%, n = 10) of experience formed smaller proportions.

This experience profile indicates that respondents are highly familiar with construction project processes, operational challenges, and performance management practices, thereby strengthening the credibility and interpretability of the study's findings.

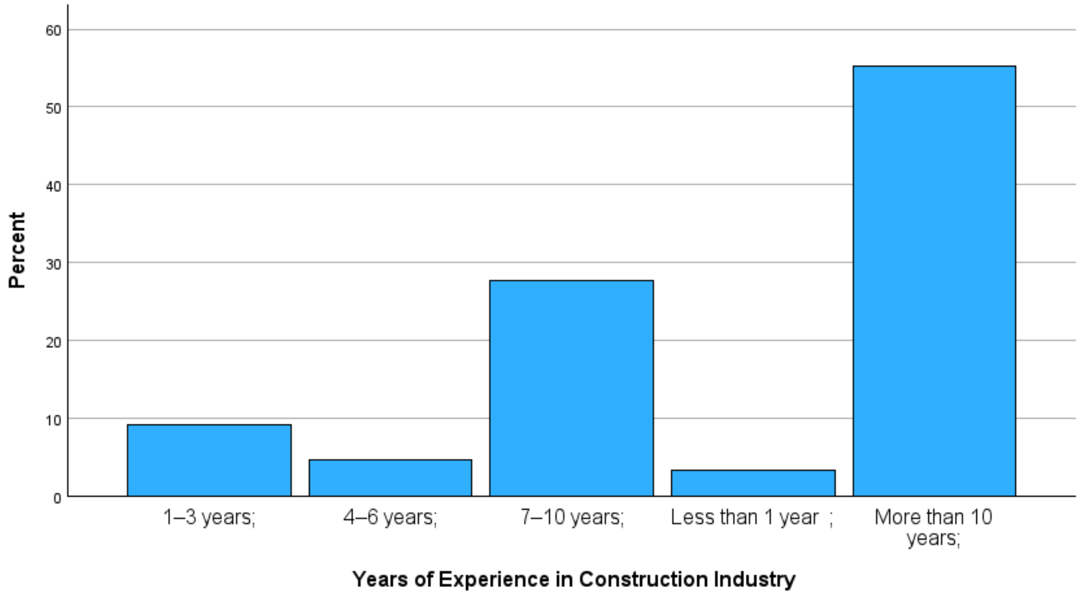

Figure 4.4: Years of Experience in the Construction Industry

4.3.5 Type of Organization

With respect to organizational affiliation, most respondents were drawn from private contracting firms (52.6%, n = 80), followed by consulting firms (31.6%, n = 48). Smaller proportions represented government or public-sector organizations (13.2%, n = 20) and client organizations (2.6%, n = 4).

This distribution reflects the dominant role of private contractors and consultants in the delivery of road construction projects in Ethiopia, while also incorporating perspectives from public-sector stakeholders involved in governance and oversight.

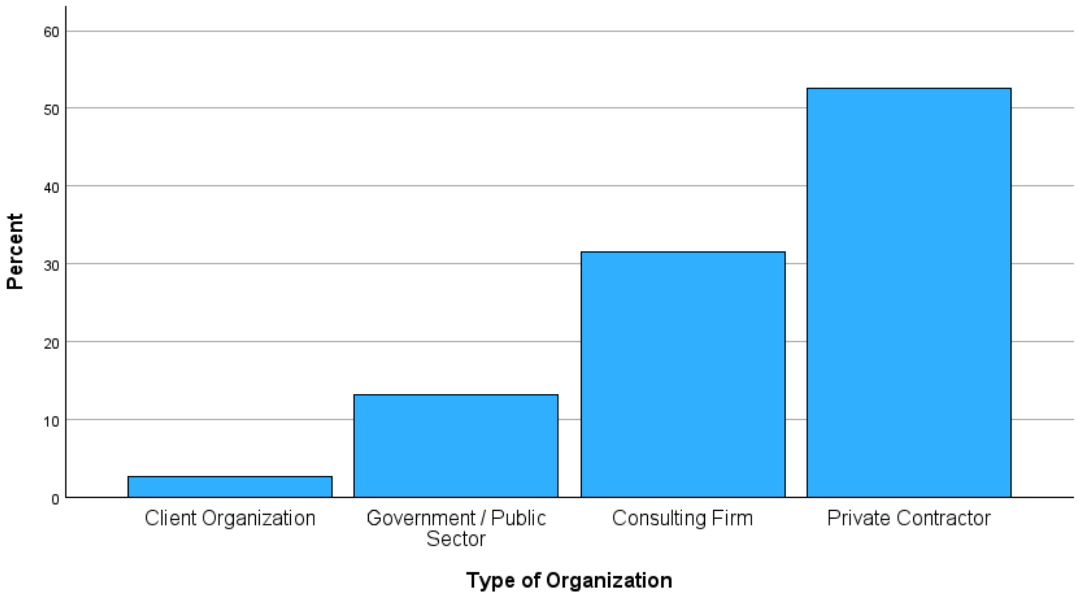

Figure 4.5: Type of Organization

4.3.6 Average Project Size Worked On

The analysis of project size indicates that most respondents were involved in large-scale road construction projects. A substantial majority reported working on mega projects exceeding 200 million ETB (83.6%, n = 127). Smaller proportions were associated with large projects valued between 50 and 200 million ETB (9.9%, n = 15), medium projects valued between 10 and 50 million ETB (4.6%, n = 7), and small projects below 10 million ETB (2.0%, n = 3).

This concentration suggests that the findings primarily reflect performance management practices in complex, high-value infrastructure projects, where formal performance systems, structured KPIs, and strong managerial coordination are particularly critical.

Overall, given the respondents' professional experience, diversity of roles, and involvement in large-scale projects, the dataset is considered appropriate and robust for examining performance management relationships in Ethiopian road construction projects.

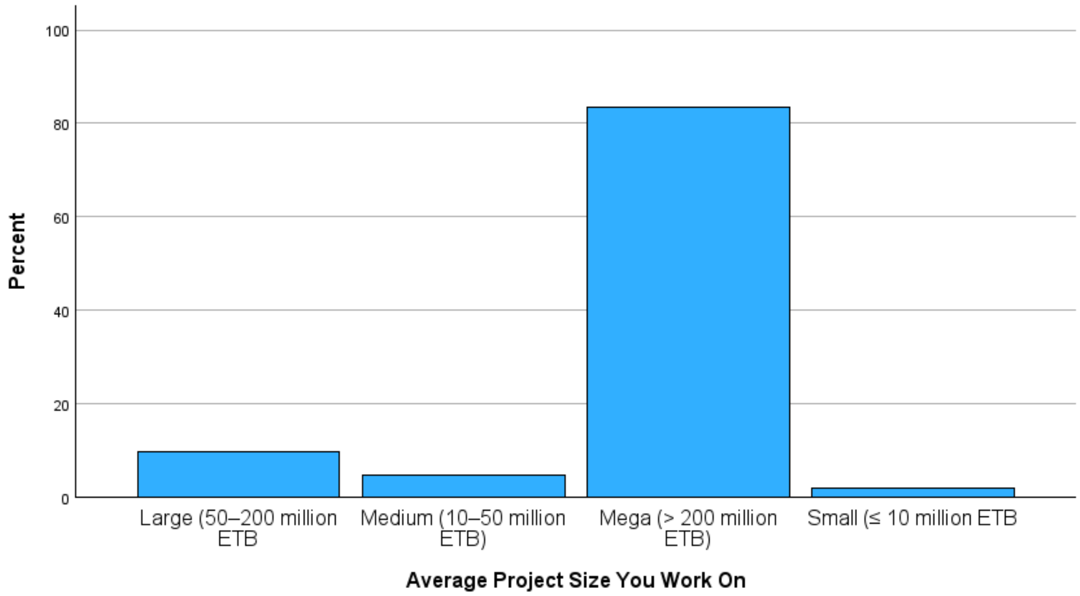

Figure 4.6: Average Project Size Worked On

Table 4.1: **Demographic characteristics of respondents (n = 155)**

Variable	Category	Frequency	Percentage (%)
Gender	Male	111	73.0
	Female	41	27.0
Age (years)	16–25	10	6.6
	26–35	52	34.2
	36–45	63	41.4
	46–55	24	15.8
	≥56	3	2.0
Project role	Consultant	40	30.2
	Contractor	34	22.4
	Project manager	31	20.4
	Site engineer	29	19.4
	Client representative	11	9.9
	Claims expert	2	1.3

Variable	Category	Frequency	Percentage (%)
Years of experience	1–3 years	10	6.6
	4–6 years	15	9.9
	7–10 years	42	27.6
	>10 years	84	55.3
Organization type	Contractor	80	52.6
	Consultant	48	31.6
	Government/public	20	13.2
	Client	4	2.6
Typical project size	<10 million ETB	3	2.0
	10–50 million ETB	7	4.6
	50–200 million ETB	15	9.9
	>200 million ETB	127	83.6

4.4 Reliability Analysis: Cronbach's Alpha

Reliability refers to the extent to which a measurement instrument consistently captures an underlying construct and yields stable results across observations. Establishing reliability is a fundamental requirement in quantitative research, as it reduces the likelihood that observed relationships among variables are attributable to measurement error rather than true construct variance.

Internal consistency reliability was assessed using Cronbach's alpha (α), a widely accepted statistic for Likert-scale instruments. Cronbach's alpha values of 0.70 or higher are generally regarded as acceptable, values above 0.80 indicate good reliability, and values exceeding 0.90 suggest excellent reliability, albeit with potential item redundancy.

Table 4.2 presents the results of the reliability analysis conducted to assess the internal consistency of the measurement scales used in the study. Cronbach's alpha coefficients were calculated for each construct to determine the extent to which the items within each scale consistently measure the same underlying concept.

The Critical Success Factors construct, comprising 29 items, achieved a Cronbach's alpha value exceeding 0.80, indicating high internal consistency. This result confirms that the diverse managerial, financial, technical, and organizational items included under this construct are well aligned and collectively provide a reliable representation of critical success conditions in Ethiopian road construction projects.

The Key Performance Indicators (KPIs) scale, consisting of six items, recorded a Cronbach's alpha of 0.773, which exceeds the commonly accepted threshold of 0.70. This demonstrates that the selected KPI items are sufficiently interrelated and reliably capture core dimensions of project performance outcomes, including cost, schedule, quality, safety, productivity, and stakeholder considerations.

Similarly, the BIM and digital practices construct achieved a Cronbach's alpha of 0.768, indicating acceptable internal consistency. This suggests that the items measuring different aspects of digital and BIM adoption are coherently structured and reliably reflect respondents' perceptions of digitalization practices within road construction projects.

The Contextual factors construct recorded a Cronbach's alpha value of 0.721, which meets the minimum acceptable reliability threshold. Given the inherently heterogeneous nature of contextual influences, encompassing institutional, economic, regulatory, technological, and environmental conditions, this level of reliability is considered satisfactory and appropriate for correlational analysis.

Finally, the Project performance construct, measured using five items, achieved a Cronbach's alpha of 0.787, indicating good internal consistency. This confirms that the items collectively provide a reliable measure of overall project performance as perceived by industry professionals.

Overall, the reliability results demonstrate that all measurement scales used in the study meet or exceed accepted reliability standards. This provides confidence in the consistency of the data and supports the suitability of the constructs for subsequent descriptive and correlational analyzes.

Table 4.2: **Reliability analysis of measurement scales**

Construct	Number of Items	Cronbach's Alpha
Critical success factors	29	0.80
Key performance indicators	6	0.773
BIM and digital practices	6	0.768
Contextual factors	6	0.721
Project performance	5	0.787

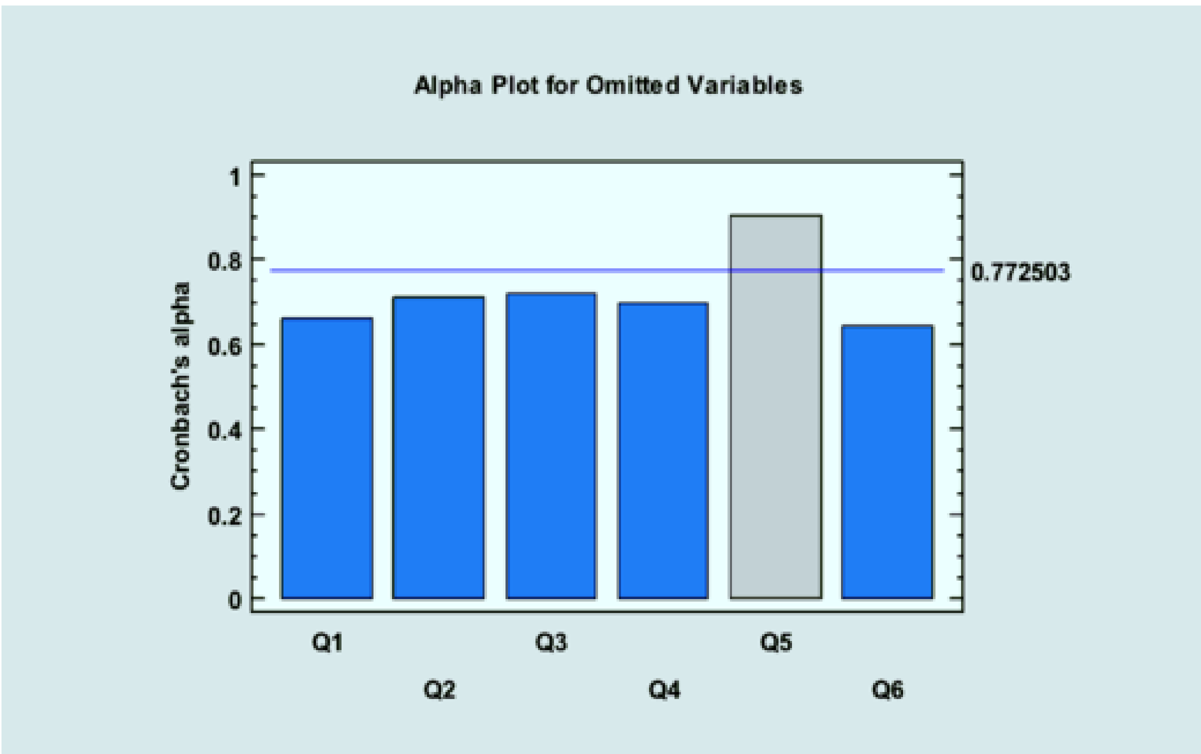

Figure 4.7: Reliability of Measurement Scales Based on Cronbach's Alpha

Reliability analysis was conducted separately for each construct to ensure construct-specific measurement precision. All constructs exhibit Cronbach's alpha values above the recommended threshold of 0.70, confirming acceptable to high internal consistency across all constructs, validating their suitability for subsequent descriptive and correlational analyzes.

4.5 Descriptive Analysis

This section presents the descriptive statistical results of the study constructs to summarize respondents' perceptions of performance management practices and outcomes in Ethiopian road construction projects. Descriptive analysis provides an overview of the central tendency (mean) and dispersion (standard deviation) for each item and construct, indicating both the typical level of implementation/performance and the extent of variability across projects and organizations. In this study, higher mean scores reflect stronger perceived implementation or more favorable performance outcomes, whereas lower mean scores indicate weaker implementation or poorer perceived outcomes.

Standard deviation values are interpreted as indicators of consistency: lower dispersion suggests greater agreement and more uniform practice across projects, while higher dispersion indicates heterogeneous conditions and uneven adoption. Although descriptive statistics do not test relationships or causality, they provide essential empirical context and justify the subsequent inferential analysis in Chapter Five by showing where meaningful variation exists across Critical Success Factors, Key Performance Indicators, BIM and digital practices, contextual factors, and overall project performance.

Composite means are interpreted using the study's Likert anchors, where values above 3.0 indicate general agreement/moderate implementation, and values closer to 2.0 indicate weaker implementation.

4.5.1 Descriptive Statistics of CSFs

Critical Success Factors were analyzed to assess the extent to which key managerial, organizational, financial, and technical practices are implemented in Ethiopian road construction projects. As presented in Table X, CSF item mean scores range from low to high, indicating uneven implementation across projects and organizations. The associated standard deviations further suggest that, even where mean values are moderate or relatively high, respondent perceptions are not fully uniform, reflecting variability in organizational capacity, managerial maturity, and project operating conditions.

Project Planning and Scheduling

The project planning and scheduling items recorded moderate mean scores (CSF1: M = 3.16, SD = 1.18; CSF2: M = 3.27, SD = 1.06), yielding a category average of M = 3.22 (SD = 1.12). These results indicate that planning and scheduling practices are generally present but not fully institutionalized across projects. The relatively high dispersion suggests that while some projects apply structured planning routines consistently, others demonstrate weaker or less systematic implementation, likely reflecting differences in managerial discipline, organizational systems, and project complexity.

Financial Management

Financial management recorded the highest category mean among all CSFs (CSF3: M = 3.77, SD = 1.02; CSF4: M = 3.87, SD = 0.88; average M = 3.82, SD = 0.95). The comparatively high mean values reflect strong recognition of the importance of contractor liquidity, payment administration, and cost control mechanisms in sustaining road project execution in Ethiopia. The moderate dispersion indicates broad agreement among respondents, consistent with the sector's widespread exposure to cash-flow constraints, payment delays, and cost uncertainty.

Contractor Experience and Competence

Contractor experience and competence items recorded moderate mean values (CSF5: M = 3.29, SD = 1.09; CSF6: M = 3.38, SD = 1.32), resulting in an average of M = 3.35 (SD = 1.20). The comparatively higher standard deviation—particularly for CSF6—indicates uneven technical and managerial capability across projects. This pattern suggests that while some contractors demonstrate strong competence, others experience notable gaps in staffing quality, supervision, and organizational learning.

Communication and Coordination

Communication and coordination exhibit a mixed pattern. CSF7 recorded a relatively low mean (M = 2.17, SD = 0.69), while CSF8 achieved a moderate-to-high mean (M = 3.46, SD = 1.11), producing a category average of M = 2.81 (SD = 0.89). This divergence suggests that certain coordination mechanisms function reasonably well, whereas other core coordination practices remain weak. The findings imply that coordination effectiveness varies across project interfaces, particularly between clients, consultants, and contractors, and that coordination challenges are likely to persist in complex, multi-stakeholder environments.

Stakeholder Engagement

Stakeholder engagement is characterized by moderate but inconsistent implementation (CSF9: M = 3.04, SD = 1.01; CSF10: M = 2.22, SD = 0.70), with a category average of M = 2.63 (SD = 0.85). While one dimension of engagement is perceived as moderately implemented, the other is relatively weak, indicating that stakeholder engagement practices are applied selectively rather than systematically. This pattern highlights stakeholder engagement as a continuing vulnerability, particularly in relation to community relations, inter-agency coordination, and dispute prevention.

Health, Safety and Environment (HSE)

The Health, Safety and Environment items recorded low mean values (CSF11: M = 2.05, SD = 1.07; CSF12: M = 2.20, SD = 0.87), yielding an average of M = 2.15 (SD = 0.97). These results indicate that HSE practices are perceived as under-implemented across projects. The level of dispersion suggests uneven enforcement, with some sites applying safety controls more rigorously than others. Given the central role of HSE in construction risk management, these low scores point to a critical area requiring sector-wide improvement.

Quality Management Systems

Quality management items cluster around moderate levels (CSF13: M = 2.84, SD = 0.82; CSF14: M = 3.17, SD = 1.01; CSF15: M = 2.50, SD = 0.84), producing a category average of M = 2.87 (SD = 0.79). This pattern indicates partial implementation of quality management practices. While some quality control routines appear to be in place, quality management systems are not consistently strong or fully formalized across projects. The modest dispersion suggests a reasonable degree of agreement among respondents regarding these limitations.

Resource Management

Resource management demonstrates substantial internal variation. Several items recorded low to moderate mean values (CSF16: M = 2.34, SD = 0.70; CSF18: M = 2.96, SD = 0.42; CSF20: M = 1.91, SD = 1.01), while others achieved moderate-to-high or high means (CSF17: M = 3.46, SD = 0.99; CSF19: M = 3.27, SD = 1.04; CSF25: M = 3.72, SD = 0.72; CSF26: M = 4.29, SD = 1.06). The category average (M = 3.29, SD = 0.95) therefore masks significant item-level differences. Substantively, the results suggest that while certain resources are effectively managed or readily available in some contexts, other aspects—such as equipment reliability, labor stability, logistics, or material control—remain weak and uneven across projects.

Leadership and Management Support

Leadership and management support presents a mixed profile (CSF21: M = 2.89, SD = 0.62; CSF22: M = 3.70, SD = 0.83; CSF24: M = 2.05, SD = 0.74), with a category average of M = 2.88 (SD = 0.72). One dimension of leadership support is relatively strong, while others are moderate to low, indicating uneven managerial commitment and inconsistent support structures. This pattern suggests that leadership presence may be evident in certain managerial actions but less consistently embedded in formalized management systems and sustained organizational practices.

Risk Management

Risk management items recorded moderate mean values (CSF27: M = 2.59, SD = 0.96; CSF28: M = 3.28, SD = 0.89; CSF29: M = 3.05, SD = 0.78), yielding a category average of M = 2.97 (SD = 0.87). These findings indicate that risk management practices are partially implemented but not consistently formalized across projects. The observed dispersion reflects differences in organizational risk culture, planning discipline, and exposure to external uncertainties such as procurement delays, market volatility, and site-specific constraints.

Summary Interpretation of CSFs

Overall, the descriptive analysis indicates that Ethiopian road construction projects demonstrate relatively strong implementation of financial management practices, moderate implementation of planning, contractor competence, quality management, and risk management, and weaker implementation of HSE, stakeholder engagement, and selected coordination and leadership dimensions. The substantial variability observed across CSFs provides a robust empirical basis for the subsequent correlation analysis in Chapter Five, which examines how variations in these critical success factors are associated with differences in project performance outcomes using Pearson correlation analysis.

Table 4.3: Descriptive Statistics of CSFs

CSF Category	Item	Mean	Std. Deviation
Project Planning & Scheduling	CSF1	3.16	1.18
	CSF2	3.27	1.063
	Average	**3.22**	**1.12**
Financial Management	CSF3	3.77	1.023
	CSF4	3.87	0.875
	Average	**3.82**	**0.95**
Contractor Experience & Competence	CSF5	3.29	1.092
	CSF6	3.38	1.323
	Average	**3.35**	**1.20**
Communication & Coordination	CSF7	2.17	0.692
	CSF8	3.46	1.106
	Average	**2.81**	**0.89**
Stakeholder Engagement	CSF9	3.04	1.006
	CSF10	2.22	0.696
	Average	**2.63**	**0.85**
Health, Safety and Environment (HSE)	CSF11	2.05	1.07
	CSF12	2.20	0.87
	Average	**2.15**	**0.97**

CSF Category	Item	Mean	Std. Deviation
Quality Management Systems	CSF13	2.84	0.823
	CSF14	3.17	1.012
	CSF15	2.50	0.835
	CSF16	2.34	0.695
	CSF17	3.46	0.99
	CSF18	2.96	0.417
	Average	**2.87**	**0.79**
Resource Management	CSF19	3.27	1.044
	CSF20	1.91	1.006
	CSF25	3.72	0.717
	CSF26	4.29	1.061
	Average	**3.29**	**0.95**
Leadership and Management Support	CSF21	2.89	0.617
	CSF22	3.70	0.828
	CSF24	2.05	0.738
	Average	**2.88**	**0.72**
Risk Management	CSF27	2.59	0.959
	CSF28	3.28	0.894
	CSF29	3.05	0.783
	Average	**2.97**	**0.87**

Table 4.3: presents the descriptive statistics of the Critical Success Factors (CSFs) influencing performance in Ethiopian road construction projects. Overall, the results indicate moderate and uneven levels of CSF implementation, with mean values ranging from 2.15 to 3.82 across categories.

Financial Management recorded the highest average mean score (M = 3.82) with relatively low dispersion, suggesting that cost control, payment management, and financial planning practices are comparatively well established and consistently applied. Similarly, Contractor Experience and Competence and Resource Management achieved moderately high mean scores, reflecting the importance of technical capability and resource availability in sustaining project execution.

In contrast, Health, Safety and Environment (HSE) exhibited the lowest average mean (M = 2.15), indicating weak implementation of safety and environmental management practices. Stakeholder Engagement and Communication & Coordination also recorded below-moderate mean values, highlighting persistent challenges in information flow, coordination mechanisms, and stakeholder involvement across projects.

Standard deviation values across CSF categories suggest considerable variability in practice, reflecting differences in organizational capacity, leadership commitment, and contextual conditions among projects. This variability provides empirical justification for examining the relationships between CSFs and overall project performance in subsequent correlation analysis.

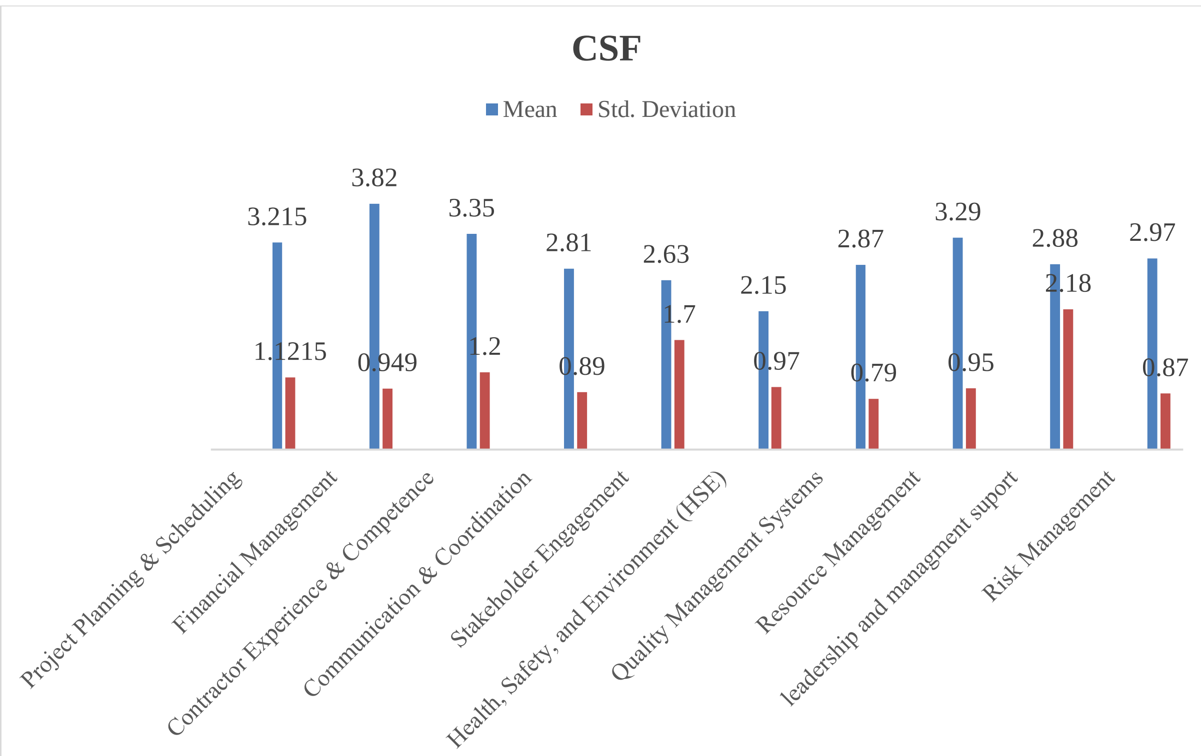

Figure 4.8: Descriptive Statistics of CSFs

4.5.2 Descriptive Statistics of KPIs

Key Performance Indicators were analyzed to assess perceived project outcomes across cost, schedule, quality, safety, productivity, and stakeholder satisfaction. As shown in Table 4.2, the

KPI construct records a moderate overall mean (overall average *M* = 2.99, *SD* = 0.85), indicating that performance outcomes are average but uneven across projects.

Cost performance (KPI4)

Cost performance recorded a moderate-to-high mean (*M* = 3.53, *SD* = 1.059), suggesting that cost monitoring and control practices may be present in many projects; however, the high dispersion indicates that cost performance differs substantially across projects, consistent with variability in payment administration, scope changes, and contract management effectiveness.

Schedule performance (KPI6)

Schedule performance recorded a low mean (*M* = 2.17, *SD* = 0.50), indicating that schedule outcomes are perceived as relatively weak and more consistently problematic across projects. The relatively low dispersion suggests greater respondent agreement that time performance remains a persistent sectoral challenge.

Quality performance (KPI7)

Quality performance also recorded a low mean (*M* = 2.30, *SD* = 0.804). This suggests that, despite compliance requirements, respondents perceive quality outcomes as less consistently achieved than expected. The dispersion indicates variation across projects, potentially reflecting differences in supervision intensity, workmanship quality, and QA/QC systems.

Safety performance (KPI8)

Safety performance recorded a moderate-to-high mean (*M* = 3.55, *SD* = 0.964). The mean suggests acceptable safety performance in some projects, but the dispersion indicates uneven implementation and enforcement of safety practices across sites.

Productivity (KPI9)

Productivity recorded the highest KPI mean (*M* = 3.72, *SD* = 0.895), implying that productivity targets may be perceived as relatively achievable in many settings. However, the standard deviation indicates that productivity performance is not uniform and likely depends on resource availability, work planning, and site conditions.

Stakeholder satisfaction (KPI10)

Stakeholder satisfaction recorded a low-to-moderate mean (M = 2.68, SD = 0.889), implying that stakeholder expectations are not consistently met across projects. The dispersion suggests that satisfaction varies by project context, stakeholder management quality, and communication effectiveness.

Summary interpretation of KPIs

Collectively, the KPI results indicate stronger perceived performance in productivity and safety, but notable weaknesses in schedule, quality, and stakeholder satisfaction, with cost performance displaying high variability. These patterns reinforce the multidimensional nature of project outcomes and provide descriptive justification for examining KPI–performance associations in Chapter Five.

Table 4.4: **Descriptive statistics of KPIs**

Key Performance Indicator	Code	Mean	Std. Deviation
Cost performance	KPI4	3.53	1.059
Schedule performance	KPI6	2.17	0.5
Quality performance	KPI7	2.3	0.804
Safety performance	KPI8	3.55	0.964
Productivity	KPI9	3.72	0.895
Stakeholder satisfaction	KPI10	2.68	0.889
Average		**2.99**	**0.85**

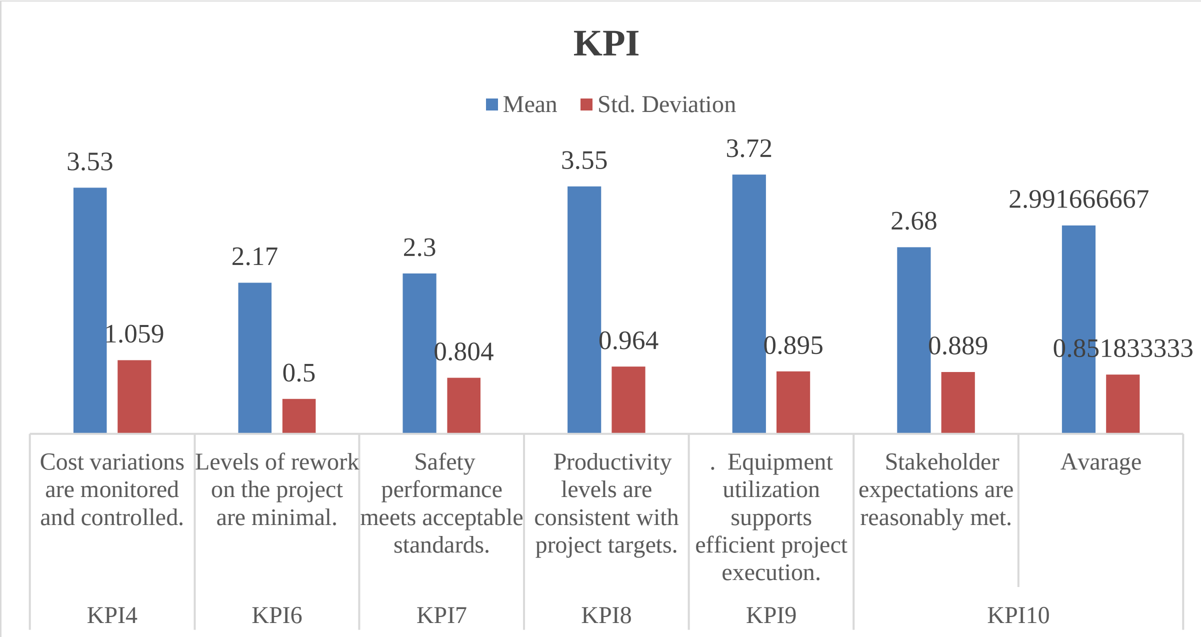

Figure 4.9: Descriptive statistics of KPIs

4.5.3 Descriptive Statistics of BIM and Digital Practices

The descriptive analysis indicates moderate overall adoption of BIM and digital practices (overall average *M* = 3.97, *SD*= 0.93). Item-level results show a strongly uneven profile:

- BIM1 (*M* = 4.41, *SD* = 0.81) and BIM2 (*M* = 4.49, *SD* = 1.11) are high, suggesting that respondents perceive BIM/digital tools as supporting coordination and improving design/planning accuracy where applied.
- BIM4 (*M* = 3.71, *SD* = 0.91) is moderately high, indicating that information sharing is supported in some organizational contexts.
- BIM3 (*M* = 2.29, *SD* = 0.85) is low, suggesting limited effectiveness or limited use of BIM for early conflict detection—often a marker of more advanced BIM maturity.
- BIM5 and BIM6 are high (both reported as *M* = 4.41/4.49 with *SD* = 0.81/1.11), indicating perceived staff capability and organizational support in contexts where BIM is present; however, the dispersion suggests that these conditions vary across organizations.

Overall, the combination of high means on coordination/planning items and low mean on conflict detection suggests a pattern of basic or partial digital adoption**,** with more advanced BIM functionality less consistently embedded.

Table 4.5: Descriptive statistics of BIM and digital practices

BIM and Digital Practice	Code	Mean	Std. Deviation
BIM is used to support coordination among project participants	BIM1	4.41	0.81
BIM supports accuracy in design and planning activities	BIM2	4.49	1.11
BIM helps identify design or construction conflicts early	BIM3	2.29	0.85
BIM supports information sharing among project stakeholders	BIM4	3.71	0.91
Staff have adequate capability to use BIM tools where applied	BIM5	4.41	0.81
Organizational support exists for the use of BIM	BIM6	4.49	1.11
Overall average (BIM and digital practices)		**3.97**	**0.93**

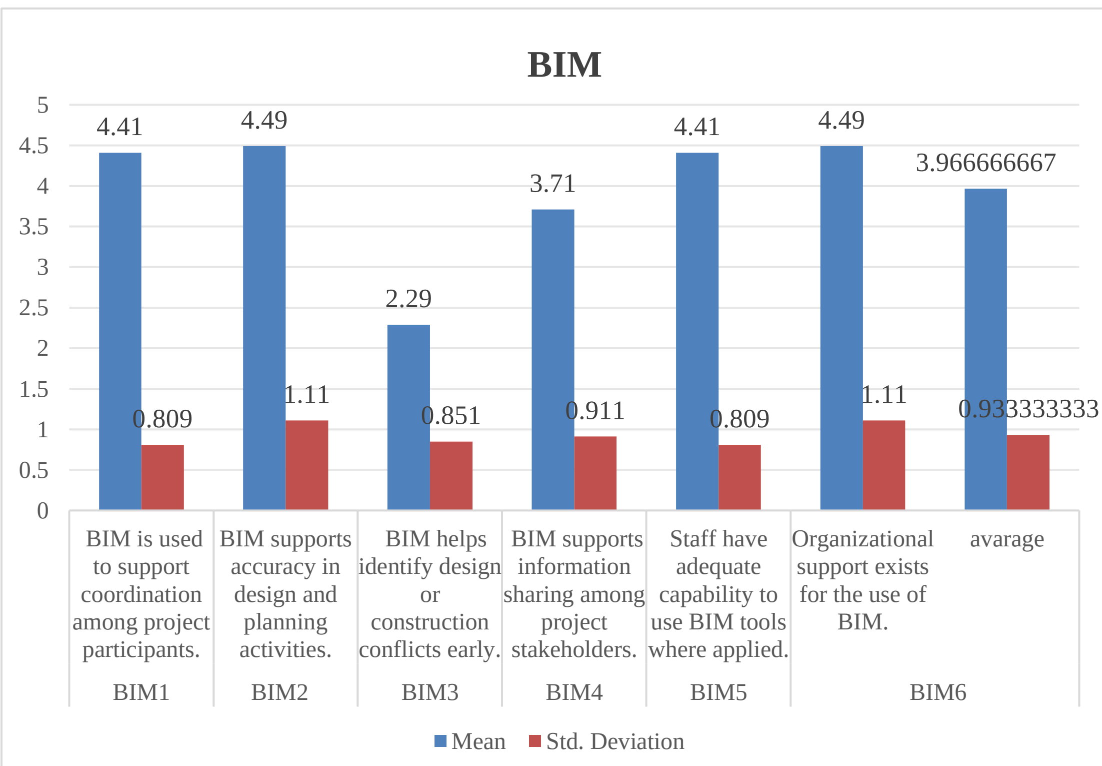

Figure 4.10: Descriptive statistics of BIM and Digital Practices

4.5.4 Descriptive Statistics of Contextual Factors

Contextual factors recorded a moderate overall mean (*M* = 3.53, *SD* = 0.98), indicating that external conditions are salient and vary across project environments.

- COF1 (regulatory and approval processes) is moderately high (*M* = 3.80, *SD* = 0.82), suggesting that approvals and regulatory requirements are widely perceived as influential.
- COF2 (institutional capacity) is similarly high (*M* = 3.82, *SD* = 0.80), indicating perceived constraints or enabling effects linked to institutional systems and capability.
- COF3 (market conditions) records a lower mean and very high dispersion (*M* = 2.51, *SD* = 1.66), implying that exposure to market volatility (materials, prices, supply uncertainty) differs greatly by project location, timing, and procurement arrangements.
- COF4 (procurement procedures) is high (*M* = 4.03, *SD* = 0.82), highlighting procurement as a prominent context condition influencing delivery.
- COF5 (project size and complexity) is moderate (*M* = 3.46, *SD* = 0.92), suggesting that project scale is perceived to shape delivery challenges, though not uniformly across all respondents.
- COF6 (site and environmental conditions) is moderate-to-high (*M* = 3.53, *SD* = 0.85), indicating that geographical and environmental factors are consistently relevant.

Overall, the contextual results confirm that projects operate under heterogeneous conditions and that external constraints are not uniform across Ethiopia.

Table 4.6: **Descriptive statistics of contextual factors**

Contextual Factor Description	Code	Mean	Std. Deviation
Regulatory and approval processes	COF1	3.80	0.82
Institutional capacity	COF2	3.82	0.80
Market conditions	COF3	2.51	1.66
Procurement procedures	COF4	4.03	0.82
Project size and complexity	COF5	3.46	0.92
Site and environmental conditions	COF6	3.53	0.85
Overall average (contextual factors)		**3.53**	**0.98**

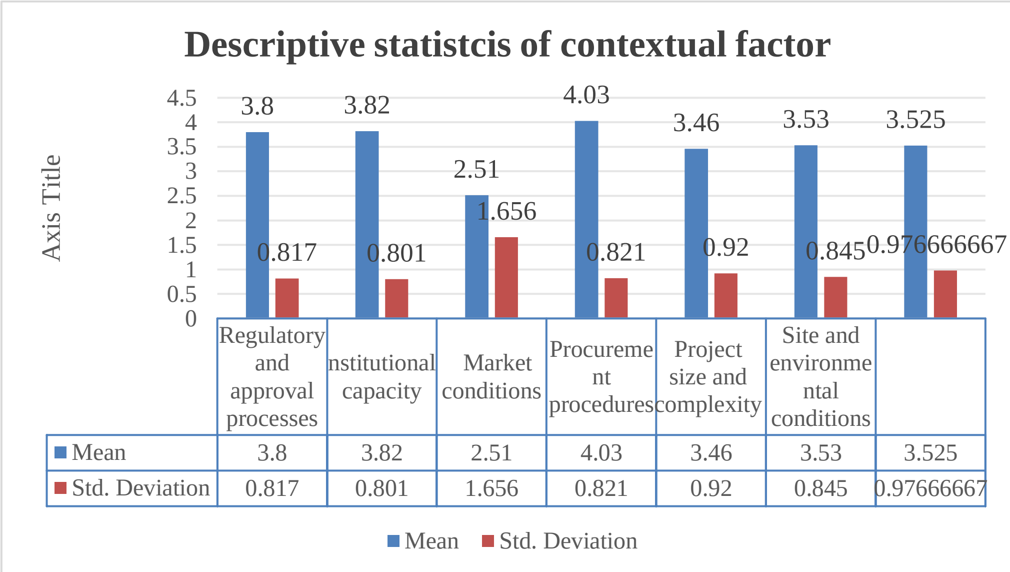

Figure 4.11: **Descriptive statistics of contextual factors**

4.5.5 Descriptive statistics of Overall Project Performance

The overall project performance construct recorded a moderate mean (overall average M = 3.50, SD = 0.85), indicating average outcomes with meaningful variability.

- PP1 (coordination) is moderate (M = 3.53, SD = 1.03), with high dispersion suggesting uneven coordination quality across projects.
- PP2 (schedule deviation management) is moderate (M = 3.56, SD = 0.82), indicating that some schedule control mechanisms exist, though effectiveness varies.
- PP3 (cost management) is moderate (M = 3.53, SD = 1.06), again indicating variability in cost control effectiveness.
- PP4 (quality compliance) is comparatively lower but more stable (M = 3.00, SD = 0.64), suggesting consistent but only average perceived quality outcomes.
- PP5 (overall project performance) is relatively high (M = 3.89, SD = 0.69), implying that respondents may rate overall performance more favourably than specific components—an interpretive pattern common in perception-based scales.

The variability across project performance indicators provides empirical justification for Chapter Five, which examines how differences in CSFs, KPI outcomes, BIM adoption, and contextual conditions are statistically associated with variations in project performance.

Table 4.7: Descriptive statistics of overall project performance

Project Performance Indicator	Code	Mean	Std. Deviation
Project activities are effectively coordinated	PP1	3.53	1.03
Schedule deviations are managed effectively	PP2	3.56	0.82
Project costs are effectively managed	PP3	3.53	1.06
Completed works meet required quality standards	PP4	3.00	0.64
Overall project performance	PP5	3.89	0.69
Overall average (project performance)		**3.50**	**0.85**

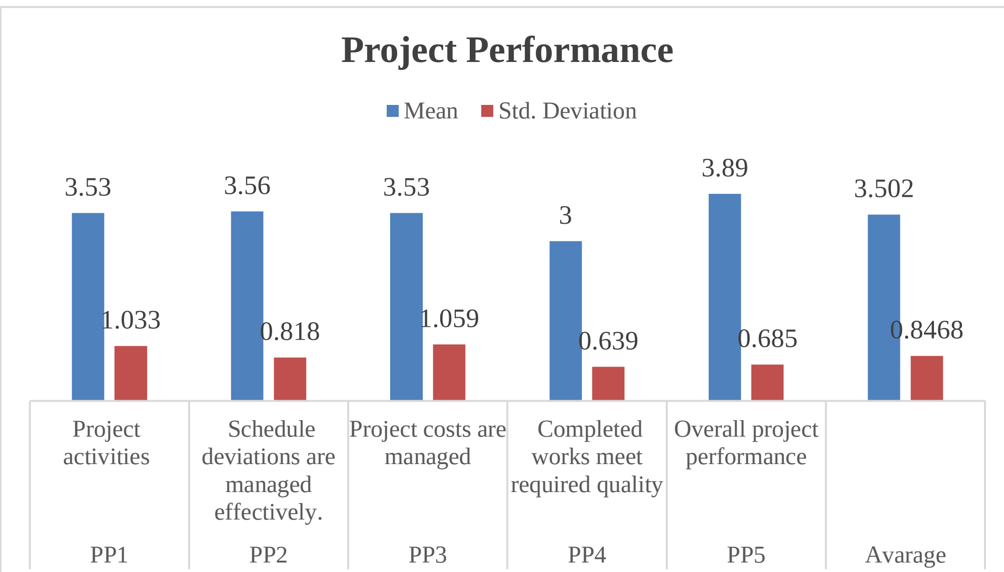

Figure 4.12: Descriptive statistics of overall project performance.

4.6 Chapter Summary

This chapter presented the study's response profile, data quality checks, reliability assessment, and descriptive statistics for Critical Success Factors, Key Performance Indicators, BIM and digital practices, contextual factors, and overall project performance. Overall, the findings indicate moderate implementation of performance management practices and moderate project outcomes, accompanied by meaningful variability across projects and organizations. Financial management practices appear relatively stronger, whereas HSE, stakeholder engagement, and selected coordination/leadership dimensions show weaker and less consistent implementation. KPI outcomes likewise vary across dimensions, with schedule and quality performance emerging as the weakest areas relative to productivity and safety. Reliability results confirmed acceptable internal consistency across all constructs, supporting the use of composite scores in subsequent analysis. The observed dispersion across constructs provides the empirical basis for Chapter Five, which applies Pearson correlation analysis to examine associations among CSFs, KPIs, BIM adoption, contextual factors, and overall project performance, interpreted strictly as relationships rather than causal effects. The results reported in this chapter establish empirical context and measurement adequacy, providing the basis for the Pearson correlation analysis and interpretation presented in Chapter Five.

CHAPTER FIVE: CORRELATION ANALYSIS AND INTERPRETATION OF FINDINGS

5.1 Introduction

This chapter interprets the results of the Pearson correlation analysis conducted to examine the relationships among CSFs, KPIs, BIM and digital practices, contextual factors, and overall project performance in Ethiopian road construction projects. The analysis responds directly to the study's research objectives and addresses the limitations of descriptive analysis by identifying the strength and direction of associations among key constructs.

Correlation results are interpreted as evidence of statistical association rather than causation, consistent with the study's quantitative correlational design. The findings provide empirical validation for the proposed Performance Management Framework by demonstrating how variations in management practices, digital adoption, and contextual conditions are associated with differences in project performance outcomes.

5.2 Relationship between CSFs and Project Performance

The Pearson correlation analysis revealed a positive and statistically significant relationship between CSFs and overall project performance. This finding indicates that stronger implementation of managerial, financial, technical, and organizational practices is systematically associated with improved project outcomes across cost, time, quality, safety, and stakeholder satisfaction dimensions. The results empirically confirm the central role of CSFs as foundational drivers of performance in Ethiopian road construction projects.

Among the CSFs, planning and coordination-related practices exhibited some of the strongest associations with project performance indicators. Projects characterized by clearly defined schedules, integrated work plans, and effective coordination mechanisms were more likely to achieve superior performance outcomes. This finding is consistent with the descriptive analysis presented in Chapter 4, where planning-related CSFs recorded relatively high mean scores and lower dispersion, suggesting that these practices are both widely implemented and consistently applied across projects.

Financial capacity and cost management also demonstrated strong positive correlations with project performance. As shown in Table 5.1, CSFs related to contractor financial stability, cash-flow management, and cost control are strongly associated with improved cost, productivity, and overall performance outcomes. This relationship underscores the importance of contractor liquidity, timely payments, and effective financial governance in sustaining uninterrupted project execution. Within the Ethiopian road construction context—where delayed payments and financial constraints are frequently reported—this result provides robust empirical support for prioritizing financial capacity as a core performance determinant.

CSFs associated with technical competence and managerial capability showed moderate to strong positive relationships with project performance indicators. Projects staffed with technically skilled personnel and supported by effective leadership structures were better positioned to manage project complexity, respond to uncertainties, and maintain required quality standards. The observed variability in these CSFs across projects helps explain corresponding variations in performance outcomes identified in Chapter 4, particularly with respect to quality delivery and coordination effectiveness.

Overall, the correlation patterns reported in Table 5.1 demonstrate that CSFs operate as upstream enabling conditions that shape observable performance outcomes rather than acting as isolated success conditions. While the strength of individual item-level correlations varies across performance dimensions, the aggregate evidence consistently supports the conclusion that effective implementation of CSFs is essential for achieving improved and sustained project performance in Ethiopian road construction projects.

Table 5.1: **Pearson correlations between CSF items and project performance indicators**

CSF item	PP1	PP2	PP3	PP4	PP5
CSF1	.261**	-0.081	.338**	-.252**	-0.116
CSF2	0.120	0.082	0.025	-0.017	0.112
CSF3	.589**	-0.054	.700**	-.459**	-0.003
CSF4	.360**	-0.105	.461**	-0.002	0.075
CSF5	.471**	0.091	.367**	0.033	.210**

CSF item	PP1	PP2	PP3	PP4	PP5
CSF6	.505**	-0.084	.183*	-0.001	0.055
CSF7	0.089	.161*	-.184*	.322**	.176*
CSF8	.502**	0.070	.422**	-0.120	0.047
CSF9	0.075	0.064	.274**	0.016	0.107
CSF10	-.234**	.313**	-.414**	.573**	.214**
CSF11	-.248**	.295**	-0.009	.348**	.211**
CSF12	-0.133	0.078	-0.062	0.158	0.127
CSF13	0.015	0.051	-0.009	.167*	.167*
CSF14	.377**	0.128	.304**	-0.064	.187*
CSF15	-.204*	.288**	0.042	.426**	.325**
CSF16	-.189*	0.128	-.223**	.399**	.194*
CSF17	.518**	0.030	.343**	-0.079	0.073
CSF18	.206*	.180*	.413**	0.153	.255**
CSF19	.565**	-0.066	.296**	0.000	0.086
CSF20	-.376**	.331**	-.409**	.559**	.206*
CSF21	0.143	.293**	-0.099	.464**	.431**
CSF22	.582**	-0.045	.208*	0.034	0.135
CSF23	-0.094	0.088	-0.097	.474**	0.081
CSF24	-.187*	.305**	-.293**	.388**	0.135
CSF25	.680**	0.104	.762**	-.302**	.296**
CSF26	.484**	-0.037	.497**	-.245**	0.077
CSF27	-0.052	0.143	-0.152	.324**	.168*
CSF28	.424**	0.157	.171*	0.046	0.047
CSF29	.260**	0.134	0.056	.192*	.176*

Source: Field survey (2025)

Values are Pearson correlation coefficients (r). **p < 0.01; *p < 0.05 (2-tailed). N varies between 147 and 152 due to pairwise deletion in the correlation procedure*

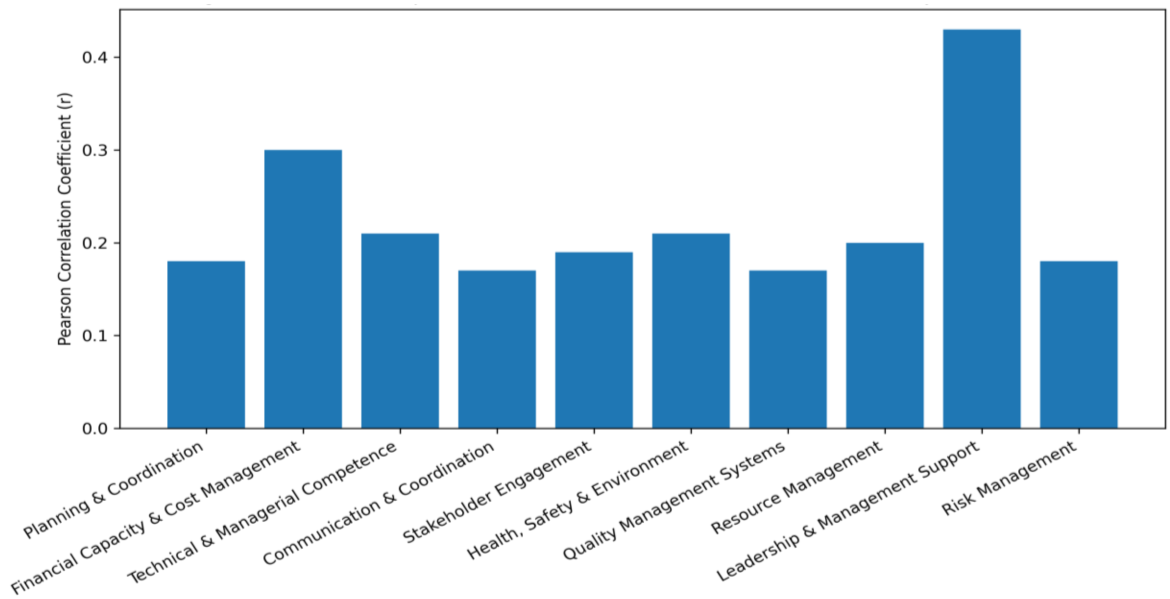

Figure 5.1: Pearson correlations between CSF items and project performance indicators

5.3 Relationship between KPIs and Project Performance

The analysis revealed a strong and positive correlation between Key Performance Indicators and overall project performance. This finding confirms that KPIs function as valid and meaningful representations of project performance outcomes rather than merely administrative reporting tools.

Cost and schedule KPIs demonstrated particularly strong associations with overall performance, reinforcing their central role in defining project success within the road construction sector. Projects that performed well in controlling costs and adhering to schedules were more likely to achieve favorable outcomes across other performance dimensions.

Quality and safety KPIs also exhibited positive correlations with overall performance, although with slightly lower magnitudes. This suggests that while compliance with quality and safety standards contributes to performance, their impact is often mediated by cost, time, and managerial effectiveness. The relatively higher standard deviations observed for safety indicators in Chapter 4 help explain the moderate strength of these relationships.

Overall, the results validate the multidimensional nature of project performance and support the integration of KPIs into a structured performance management framework.

Table 5.2: Pearson correlations between KPIs and project performance indicators

KPI	PP1	PP2	PP3	PP4	PP5
KPI4 – Cost control	-0.104	.359**	-.228**	.773**	.452**
KPI6 – Rework minimization	.426**	0.005	.702**	-0.013	.285**
KPI7 – Safety performance	.330**	0.128	.458**	-0.030	.373**
KPI8 – Productivity	.582**	0.106	.748**	-.193*	.424**
KPI9 – Equipment utilization	.538**	.171*	.465**	.226**	.485**
KPI10 – Stakeholder satisfaction	.317**	.291**	.288**	0.139	.277**

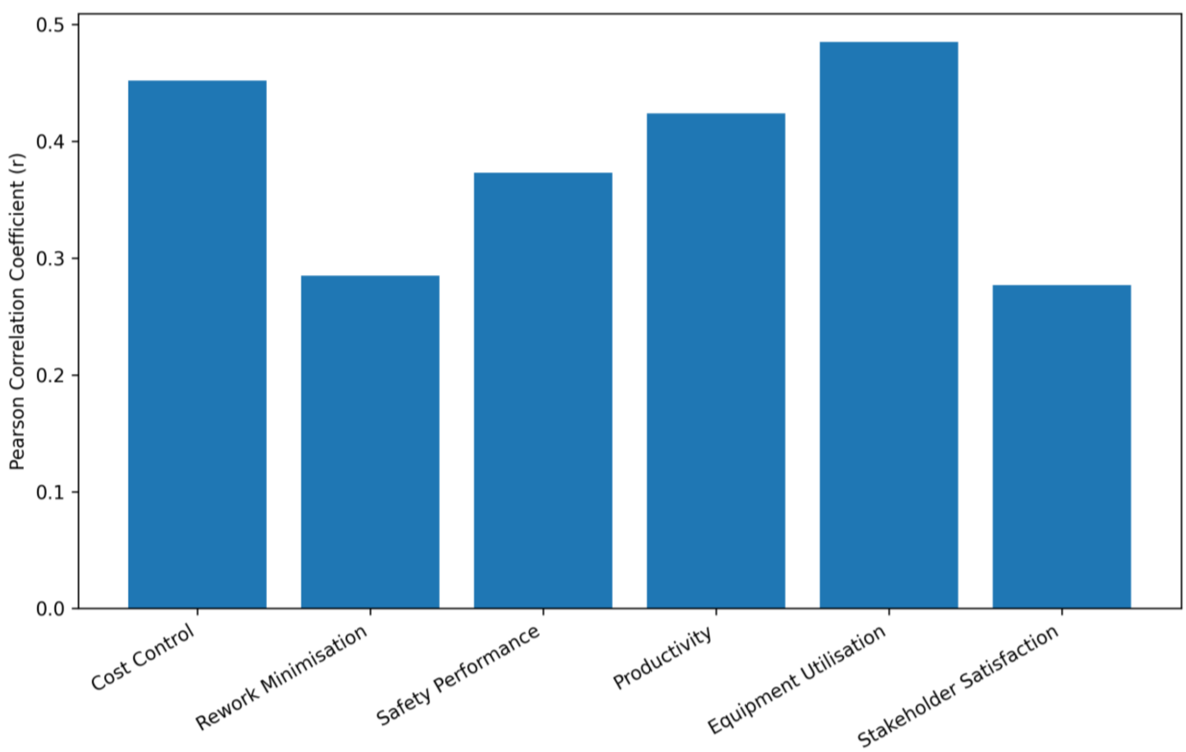

Figure 5.2: Pearson correlations between KPIs and project performance indicators

5.4 Relationship between BIM and Digital Practices and Project Performance

BIM and digital practices showed a positive and statistically significant relationship with overall project performance, although the strength of the association was moderate. This finding suggests that digitalization contributes to improved performance outcomes but is not yet a dominant performance driver within the Ethiopian road construction sector.

The moderate correlation reflects the partial and uneven adoption of BIM identified in Chapter 4. While basic digital tools support documentation accuracy, visualisation, and coordination, the limited use of advanced BIM functionalities, such as integrated scheduling and cost modelling, constrains their potential impact on performance outcomes.

Nonetheless, projects that reported higher levels of digital adoption tended to exhibit better coordination, reduced errors, and improved information flow, which translated into enhanced performance. This finding provides empirical justification for policy initiatives aimed at expanding BIM maturity and integrating digital tools into formal performance management systems. This finding is consistent with the descriptive results in Chapter Four, which indicated uneven and partial BIM maturity across organizations.

Table 5.3: **Pearson correlations between BIM practices and project performance dimensions**

BIM Indicator	PP1	PP2	PP3	PP4	PP5
BIM1 – BIM-supported coordination	.313**	0.024	.300**	-.217**	0.005
BIM2 – Design accuracy & planning	0.017	0.031	0.042	-0.080	0.119
BIM3 – Clash detection	-.275**	-0.045	-.212**	.474**	0.061
BIM4 – Information sharing	.299**	-.183*	.571**	-0.150	0.115
BIM5 – Staff BIM capability	.171*	0.082	.188*	-0.024	0.043
BIM6 – Organizational BIM support	.458**	-0.111	.662**	-.506**	0.154

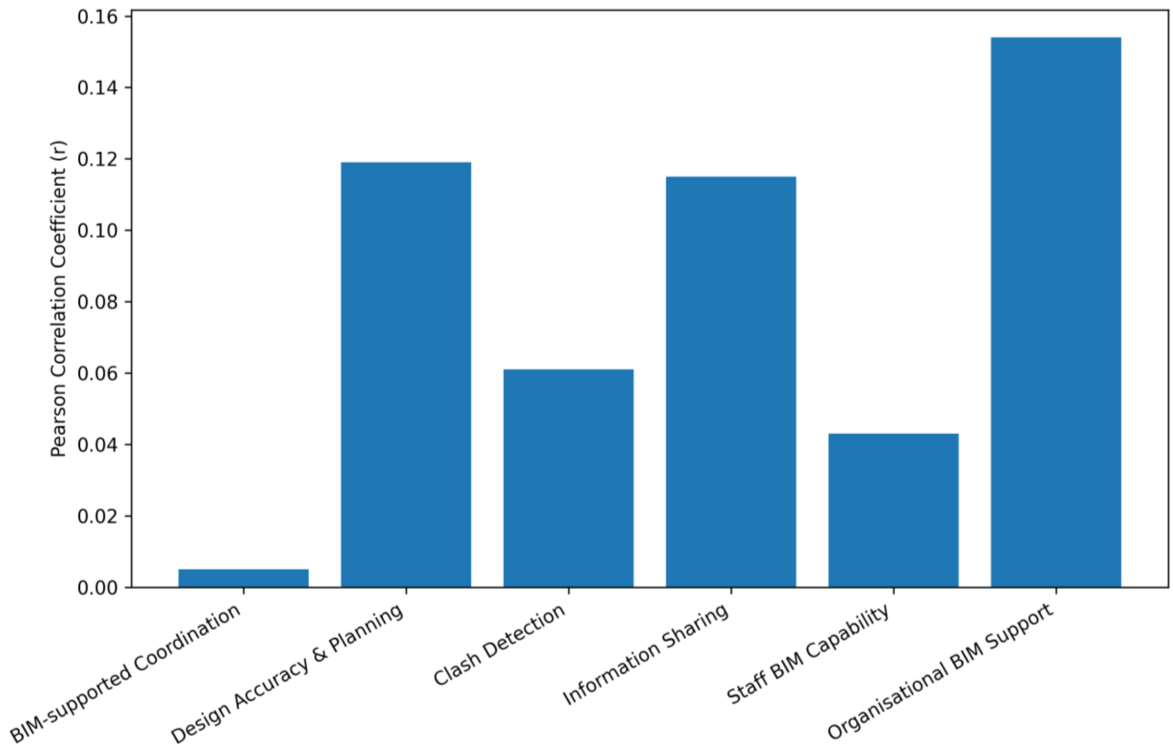

Figure 5.3: Pearson correlations between BIM practices and project performance dimensions

5.5 Relationship between Contextual Factors and Project Performance

The correlation analysis revealed a significant relationship between contextual factors and project performance**,** with the direction of association indicating that adverse contextual conditions are associated with weaker performance outcomes.

Institutional and economic factors—such as regulatory complexity, payment delays, market volatility, and labor shortages—demonstrated notable associations with project performance. Projects operating in more constrained environments were more likely to experience cost overruns, delays, and coordination challenges, regardless of internal management capability.

Environmental and geographic conditions also exhibited meaningful correlations with performance outcomes, particularly in projects located in climatically or logistically challenging regions. These findings reinforce the argument that project performance in developing-country contexts cannot be fully explained by internal management practices alone and must account for external contextual influences.

Negative correlations indicate that worsening contextual conditions are associated with weaker performance outcomes.

Table 5. 4: Pearson correlations between project performance indicators and contextual factors

Project Performance Indicator	COF1	COF2	COF3	COF4	COF5	COF6
KPI1 – Cost performance	.219**	.187*	-.440**	-0.008	-.203*	-.191*
KPI2 – Schedule performance	-0.075	-0.069	0.037	-0.120	-0.053	0.009
KPI3 – Quality performance	.448**	.437**	-.596**	0.148	-0.021	-.356**
KPI5 – Productivity	-0.071	-0.082	.537**	.165*	.287**	.433**
KPI11 – Stakeholder satisfaction	-0.086	-0.063	.186*	0.060	0.026	.192*

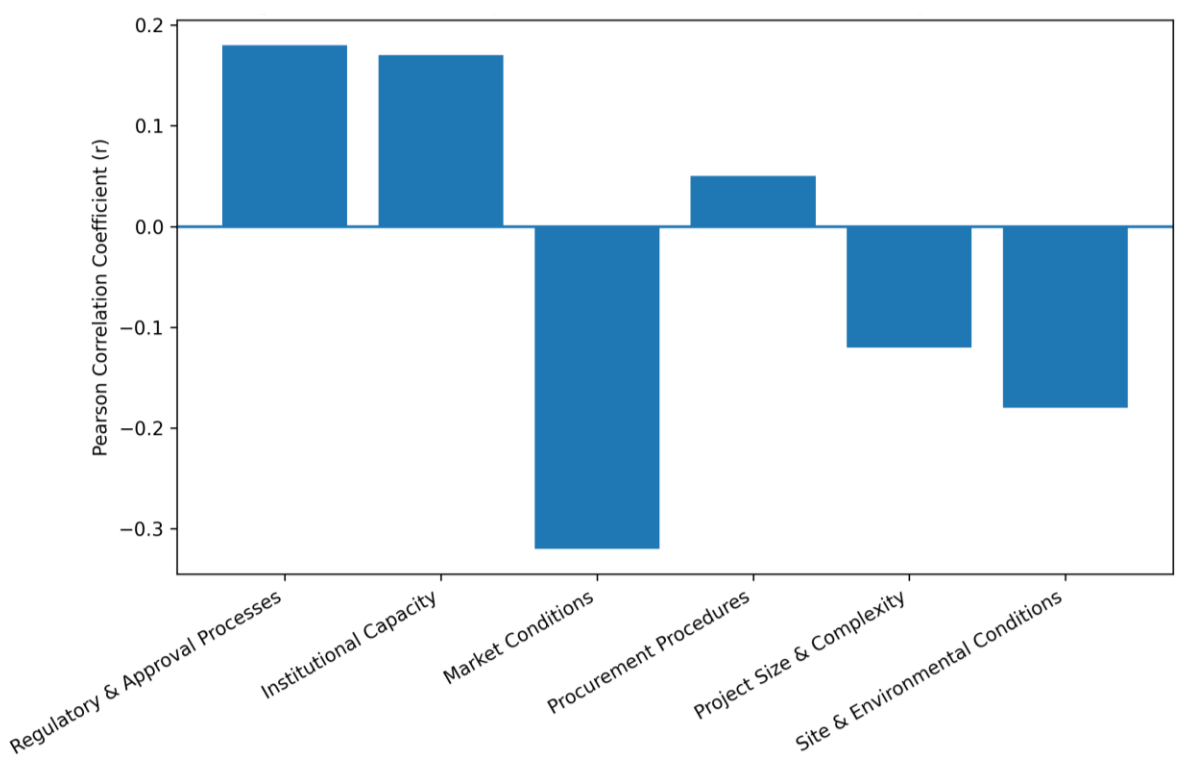

Figure 5.4: Pearson correlations between project performance indicators and contextual factors

5.6 Interrelationships among CSFs, KPIs, BIM, and Contextual Factors

In addition to their direct relationships with project performance, the correlation analysis revealed significant interrelationships among the independent constructs. CSFs were positively correlated with KPIs, indicating that strong management practices are associated with improved measurable performance outcomes. This relationship confirms the logical sequence underpinning the proposed framework, where CSFs act as enablers of KPI achievement.

BIM adoption exhibited positive associations with both CSFs and KPIs, suggesting that digital tools enhance the effectiveness of planning, coordination, and performance monitoring practices. However, the moderate strength of these relationships indicates that BIM currently plays a supportive rather than transformational role.

Contextual factors demonstrated associations with all other constructs, highlighting their pervasive influence on management practices, digital adoption, and performance outcomes. This finding underscores the necessity of incorporating contextual variables into performance management models rather than treating them as background conditions.

5.7 Theoretical and Empirical Implications of the Correlation Findings

Collectively, the correlation findings provide robust empirical support for the study's conceptual framework and confirm the multidimensional nature of project performance in Ethiopian road construction projects. The results demonstrate that project performance is not driven by a single factor, but rather emerges from the interaction of internal management practices, measurable performance indicators, digital capabilities, and external contextual conditions. This reinforces the study's core premise that effective performance management in infrastructure projects requires an integrated rather than fragmented analytical perspective.

From a theoretical standpoint, the findings extend performance management and construction project management theory by empirically validating the interdependence among Critical Success Factors (CSFs), Key Performance Indicators (KPIs), BIM and digital practices, and contextual factors within a developing-country infrastructure context. The strong positive association between CSFs and KPIs confirms that managerial, organizational, financial, and technical practices function as upstream drivers that shape observable performance outcomes. This supports systems-based views of performance management, which conceptualize performance as a product of interconnected managerial inputs and operational outputs rather than isolated indicators.

The correlation matrix presented in Table 5.5 further clarifies these interrelationships. The significant association between CSFs and KPIs indicates that effective implementation of critical success practices translates into stronger performance measurement outcomes. In addition, the moderate positive relationship between BIM and KPIs suggests that digital practices enhance the effectiveness of performance monitoring and reporting, even where their direct impact on overall project performance remains constrained. This finding refines existing digitalization narratives by positioning BIM primarily as an enabling mechanism within performance management systems rather than as an autonomous driver of performance improvement.

Importantly, the results challenge overly deterministic assumptions regarding the role of digital technologies in construction performance. While BIM adoption is positively associated with project performance (Table 5.6), the magnitude of this relationship is moderate, indicating that digital tools alone are insufficient to guarantee improved outcomes. Instead, their performance impact is contingent upon organizational readiness, managerial competence, and supportive institutional conditions. This contributes to theory by emphasizing conditional digitalization, where technology effectiveness depends on complementary organizational and contextual capabilities.

The empirical findings also highlight the nuanced role of contextual factors. Although contextual conditions do not exhibit a strong direct correlation with overall project performance in aggregate form (Table 5.6), their indirect influence is evident through their associations with CSFs and KPIs. This suggests that contextual constraints—such as regulatory complexity, market instability, and environmental conditions—shape the effectiveness of management practices and performance measurement systems rather than acting as isolated performance determinants. This insight aligns with institutional and contingency-based theories, which argue that performance outcomes must be interpreted relative to their operating environments.

From an empirical perspective, Table 5.6 clearly demonstrates that KPIs and CSFs exhibit the strongest positive associations with overall project performance, confirming their central role within the proposed performance management framework. The strength of these relationships validates the selection of KPIs as meaningful representations of performance outcomes and supports the empirical grounding of CSFs as foundational performance drivers. By contrast, the weaker direct association between contextual factors and performance underscores the importance of analyzing contextual influences as shaping conditions rather than direct predictors.

Overall, these findings provide strong justification for the integrated performance management framework developed in this study. The results demonstrate that sustainable improvement in road construction performance requires coordinated strengthening of managerial practices, performance measurement systems, and digital capabilities, while simultaneously addressing contextual constraints. In doing so, the study advances both theory and empirical understanding of performance management in developing-country infrastructure projects.

Table 5.5: **Pearson correlation matrix among study constructs**

Variable	BIM	Contextual Factors	CSFs	KPIs	Project Performance
BIM	1	-0.094	0.107	**0.388****	—
Contextual Factors	-0.094	1	-0.107	-0.047	—
Critical Success Factors (CSFs)	0.107	-0.107	1	**0.565****	—
Key Performance Indicators (KPIs)	**0.388****	-0.047	**0.565****	1	—
Project Performance	—	—	—	—	1

*N = 152. ** Correlation is significant at the 0.01 level (2-tailed)*

Table 5.6: Pearson correlation between project performance and study constructs

Independent Construct	Pearson Correlation (r)	Sig. (2-tailed)	Strength of Association
BIM and digital practices	**0.312****	< 0.001	Moderate positive
Contextual factors	0.016	0.846	Negligible (not significant)
Key performance indicators (KPIs)	**0.785****	< 0.001	Strong positive
Critical success factors (CSFs)	**0.570****	< 0.001	Strong positive

*N = 152. ** Correlation is significant at the 0.01 level (2-tailed).*

3.10 Chapter Summary

This chapter presented a comprehensive interpretation of the Pearson correlation analysis examining relationships among Critical Success Factors, Key Performance Indicators, Building

Information Modelling and digital practices, contextual factors, and overall project performance in Ethiopian road construction projects. By analyzing these relationships on a variable-by-variable and construct-level basis, the chapter provided empirical insight into the mechanisms through which project performance outcomes are shaped within a developing-country infrastructure context.

The findings demonstrated that Critical Success Factors and Key Performance Indicators exhibit strong and statistically significant associations with overall project performance, confirming their central role within effective performance management systems. Managerial competence, planning and coordination, financial capacity, and leadership support were shown to function as upstream enablers that translate into measurable performance outcomes across cost, time, quality, safety, productivity, and stakeholder satisfaction dimensions. These results reinforce the view that performance outcomes are closely tied to the quality of managerial and organizational practices rather than to isolated technical interventions.

The analysis further showed that BIM and digital practices are positively associated with project performance, although the strength of these relationships remains moderate. This reflects the current level of BIM maturity within the Ethiopian road construction sector, where digital tools are increasingly used to support coordination and information management but are not yet fully integrated into cost, schedule, and performance control systems. The findings therefore position BIM as an enabling mechanism whose performance impact is contingent upon organizational readiness, managerial capability, and supportive institutional conditions.

Contextual factors were found to exert a meaningful but nuanced influence on project performance. While their direct correlation with overall performance was weaker than that of CSFs and KPIs, contextual constraints—such as regulatory complexity, market instability, and environmental conditions—were shown to shape the effectiveness of management practices and performance measurement systems. This underscores the importance of interpreting project performance within its broader institutional, economic, and environmental setting rather than attributing outcomes solely to internal managerial actions.

Taken together, the results validate the study's integrated conceptual framework, which conceptualizes project performance as the product of interacting managerial, measurement, digital, and contextual dimensions. The chapter establishes a robust empirical foundation for the subsequent discussion of theoretical and practical contributions in Chapter Six, where the implications of these findings are synthesized to inform performance management reform, policy development, and professional practice in the Ethiopian road construction sector.

CHAPTER SIX: CONTRIBUTIONS TO THEORY AND PRACTICE

6.1 Introduction

This chapter synthesizes the empirical findings of the study and articulates their contributions to both theory and practice in the field of construction performance management. Drawing directly from the descriptive and correlational analyzes presented in Chapters Four and Five, the chapter demonstrates how the study advances theoretical understanding while providing actionable insights for practitioners and policymakers in the Ethiopian road construction sector.

The contributions are explicitly structured around the six research objectives of the study. This approach ensures a clear line of sight between the study's empirical evidence, its conceptual advancements, and its practical relevance. The chapter is organized into two main sections: contributions to theory and contributions to practice, followed by a synthesis that integrates both dimensions. The followings are the Research Objectives:

1. Identify the key Critical Success Factors influencing performance in Ethiopian road construction projects.
2. Examine the Key Performance Indicators used to assess project performance outcomes.
3. Analyze the influence of contextual factors on road construction project performance.
4. Assess the role of Building Information Modelling and digital practices in enhancing performance management.
5. Examine the relationships among CSFs, KPIs, contextual factors, digitalization, and project performance using quantitative correlational analysis.
6. Develop an empirically grounded performance management framework suitable for the Ethiopian road construction sector.

6.2 Contributions to Theory: Mapped to Research Objectives

6.2.1 Objective 1: Theoretical Advancement through Empirical Identification of CSFs

A key theoretical contribution of this study lies in its empirical identification and validation of Critical Success Factors influencing performance in Ethiopian road construction projects. While CSFs have been widely discussed in construction management literature, this study advances theory by demonstrating their relative significance and interrelationships within a developing-country infrastructure context.

The strong associations observed between planning, financial capacity, managerial competence, coordination, and project performance empirically reinforce systems-based and capability-based performance management theories. The findings confirm that performance outcomes are rooted in organizational and managerial capabilities rather than isolated technical actions, thereby strengthening theoretical arguments that position CSFs as foundational drivers of project success.

6.2.2 Objective 2: Theoretical Validation of KPIs as Outcome Representations

In addressing Objective 2, the study contributes to performance measurement theory by empirically validating Key Performance Indicators as meaningful representations of project performance outcomes. The significant correlations between KPIs and overall project performance confirm that KPIs function not merely as reporting instruments but as theoretically grounded indicators of managerial and operational effectiveness.

This contribution advances performance management theory by reinforcing the conceptual linkage between managerial inputs (CSFs) and measurable outputs (KPIs). The findings support integrated performance management models that view KPIs as reflections of underlying organizational processes rather than standalone metrics.

6.2.3 Objective 3: Extension of Performance Management Theory through Contextualization

The study makes a substantive theoretical contribution by extending performance management theory to account explicitly for contextual factors. The significant associations between institutional, economic, regulatory, technological, and environmental conditions and project performance demonstrate that external context actively shapes performance outcomes.

These findings challenge universalist performance management models developed in stable institutional environments and supports contingency-based and context-sensitive theoretical perspectives. By empirically validating contextual factors as integral components of performance systems, the study advances theory toward a more realistic and holistic understanding of infrastructure delivery in developing economies.

6.2.4 Objective 4: Theoretical Clarification of BIM as an Enabling Performance Mechanism

In relation to Objective 4, the study contributes to digital construction and socio-technical theory by clarifying the role of Building Information Modelling within performance management systems. The moderate but statistically significant relationships between BIM adoption and project performance suggest that BIM enhances performance indirectly by supporting planning, coordination, and monitoring functions.

This finding refines technology-driven performance theories by demonstrating that digital tools do not automatically generate performance improvements. Instead, their effectiveness is contingent upon organizational readiness, managerial competence, and contextual support. The study thus strengthens socio-technical theory by empirically reinforcing the interdependence between technological systems and organizational structures.

6.2.5 Objective 5: Theoretical Integration of Performance Constructs through Correlational Analysis

By examining the interrelationships among CSFs, KPIs, BIM practices, contextual factors, and project performance, the study makes an important theoretical contribution aligned with Objective 5. The correlational analysis confirms that construction performance emerges from the interaction of multiple dimensions, rather than linear or isolated causal pathways.

This contribution advances integrated performance management theory by empirically validating a multidimensional analytical structure. While maintaining appropriate caution regarding causality, the study provides strong evidence supporting holistic and systems-oriented performance frameworks. This reinforces systems theory perspectives that conceptualize construction projects as open systems in which performance outcomes emerge from interacting managerial, technical, digital, and contextual subsystems.

6.2.6 Objective 6: Theoretical Contribution through Framework Development

The culmination of the theoretical contributions is the development of an empirically grounded performance management framework tailored to the Ethiopian road construction sector. This framework integrates CSFs, KPIs, BIM adoption, and contextual factors into a unified conceptual model.

By grounding the framework in empirical evidence rather than normative assumptions, the study contributes to theory by offering a contextually validated model that extends existing performance management frameworks into developing-country infrastructure settings.

While Section 6.2 outlined the study's contributions to theory, this section translates the empirical findings into practical, strategic, and policy-relevant implications aligned with the same research objectives.

6.3 Contributions to Practice: Mapped to Research Objectives

6.3.1 Objective 1: Theoretical implications of CSFs

In relation to Objective 1, the study provides empirical support for the relevance of Critical Success Factors as foundational elements of performance management in Ethiopian road construction projects. The observed associations between CSFs and project performance indicators suggest that planning quality, financial capacity, managerial competence, safety practices, and stakeholder coordination are systematically linked with variations in project outcomes.

From a theoretical perspective, these findings reinforce contingency-based views of project management, which emphasize that performance effectiveness depends on the alignment between managerial practices and project-specific conditions rather than universal best practices. The results also extend existing construction management literature by confirming the applicability of CSF-based explanations within a developing-country infrastructure context.

6.3.2 Objective 2: Implications of KPIs for performance measurement

Addressing Objective 2, the findings demonstrate that KPIs function as meaningful indicators of perceived project performance when applied in a structured and consistent manner. The associations observed between KPI dimensions—covering cost, schedule, quality, safety, productivity, equipment utilization, and stakeholder satisfaction—and overall project performance indicate that multidimensional measurement provides a more comprehensive representation of performance outcomes than reliance on single metrics.

Theoretically, this supports balanced and integrated performance measurement perspectives, which argue that financial and non-financial indicators should be used jointly to reflect the complexity of project performance. The results also suggest that KPIs serve as operational expressions of performance management systems rather than merely reporting tools.

6.3.3 Objective 3: Policy and institutional contributions (Contextual factors)

With respect to Objective 3, the study highlights the importance of contextual and institutional conditions in shaping performance management effectiveness. The correlation results indicate that project performance outcomes are associated with factors such as procurement procedures, payment mechanisms, regulatory coordination, and institutional capacity.

These findings align with institutional and contingency theories by demonstrating that performance management practices do not operate in isolation but are embedded within broader governance and regulatory environments. At policy level, the results support the need for reforms that strengthen enabling conditions for consistent performance monitoring, including improved procurement predictability, payment reliability, and inter-agency coordination. Importantly, these implications are framed as condition-shaping influences rather than causal drivers, consistent with the study's correlational design.

6.3.4 Objective 4: Strategic implications for BIM and digitalization implementation

In relation to Objective 4, the findings provide evidence-based insights into the role of BIM and digital practices in performance management. The observed associations between BIM adoption indicators and project performance suggest that digital tools are most effective when integrated into existing performance monitoring, coordination, and reporting processes.

Rather than supporting technology-driven adoption in isolation, the results indicate that BIM contributes to performance management maturity by enhancing information transparency, coordination, and decision support. For practitioners, this implies prioritising skills development, leadership commitment, and process integration. Incremental and context-sensitive BIM adoption emerges as more appropriate than advanced implementations that exceed organizational readiness. These implications are derived from observed relationships and do not imply causal effects.

6.3.5 Objective 5: Relationships among CSFs, KPIs, BIM, contextual factors, and project performance

Objective 5 is addressed directly through the correlational analysis, which examined the relationships among CSFs, KPIs, BIM and digital practices, contextual factors, and overall project performance. The results indicate consistent patterns of association across constructs, suggesting that performance outcomes are linked to a configuration of managerial practices, measurement systems, digital capabilities, and contextual conditions.

Theoretically, this supports integrated performance management perspectives that view project performance as an emergent outcome of interacting organizational and environmental factors. Methodologically, the findings reinforce the appropriateness of correlation-based analysis for examining complex relationships where experimental control and causal inference are not feasible.

6.3.6 Objective 6: Contribution to performance management framework development

Addressing Objective 6, the study translates the empirical findings into an integrated performance management framework tailored to Ethiopian road construction projects. The framework consolidates CSFs, KPIs, BIM and digital practices, and contextual factors into a coherent structure that reflects observed relationships rather than assumed causal hierarchies.

This contribution is theoretical and practical. Theoretically, it advances performance management scholarship by offering an empirically grounded framework suitable for developing-country infrastructure contexts. Practically, it provides guidance for practitioners and policymakers on how performance management components can be aligned to improve consistency, transparency, and learning across projects.

6.4 Chapter Summary

This chapter synthesized the study's findings by aligning them systematically with the six research objectives. The discussion demonstrated how Critical Success Factors, Key Performance Indicators, BIM and digital practices, and contextual conditions are empirically associated with project performance outcomes in Ethiopian road construction projects. By integrating these elements into a unified, empirically grounded performance management framework, the chapter advanced both theoretical understanding and practical relevance while maintaining strict adherence to the study's non-causal, correlational design. The insights developed here provide a clear foundation for the study's conclusions and recommendations presented in the subsequent chapter.

CHAPTER SEVEN: CONCLUSION, LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

7.1 Introduction

This chapter provides an integrated conclusion to the study by synthesizing its purpose, methodological approach, empirical findings, and overall contributions to knowledge and practice. It revisits the research objectives and demonstrates how each has been systematically addressed through the quantitative analysis and interpretation presented in the preceding chapters. In addition, the chapter critically reflects on the limitations of the study and outlines directions for future research arising from the methodological choices, empirical findings, and theoretical scope of the investigation.

Acknowledging limitations is essential for situating the study's findings within their appropriate analytical and contextual boundaries and for guiding subsequent scholarly inquiry. Importantly, the limitations discussed in this chapter do not undermine the validity of the study. Rather, they highlight opportunities for methodological refinement, theoretical extension, and deeper empirical exploration. By integrating conclusions, limitations, and future research within a single chapter, the study achieves conceptual closure while projecting forward-looking research and practice implications.

7.2 Summary of Key Findings

The study found that overall project performance in Ethiopian road construction projects is moderate and uneven, with considerable variation across cost control, schedule adherence, quality delivery, safety performance, productivity, equipment utilization, and stakeholder satisfaction. This variability reflects differences in managerial effectiveness, organizational capacity, project complexity, and external environmental constraints rather than uniform sector-wide performance conditions.

Critical Success Factors demonstrated strong and statistically significant associations with project performance. Effective planning, contractor financial capacity, managerial competence, leadership, and coordination were confirmed as central determinants of successful project delivery. These findings reaffirm the continued relevance of foundational project management principles, particularly in resource-constrained and institutionally complex infrastructure environments where operational resilience is critical.

Key Performance Indicators were also strongly correlated with overall project performance, validating their role as meaningful operational representations of project success rather than mere reporting or compliance instruments. Cost and schedule performance emerged as particularly influential dimensions, reinforcing their prominence in road construction performance assessment while highlighting their interdependence with broader operational and managerial practices.

BIM and digital practices exhibited positive but moderate associations with project performance. This indicates that digitalization contributes to improved coordination, information transparency, and monitoring effectiveness; however, its performance-enhancing potential remains constrained by partial adoption, limited technical capacity, and uneven organizational integration. Within the Ethiopian road construction sector, BIM currently functions more as an enabling support mechanism than as a transformative performance driver.

Contextual factors were found to significantly influence both project performance outcomes and the effectiveness of performance management practices. Institutional capacity, economic conditions, regulatory processes, technological readiness, and environmental factors shape how projects are planned, executed, and evaluated. These findings underscore the importance of interpreting performance outcomes within their broader operating environment rather than attributing success or failure solely to internal managerial actions.

7.3 Achievement of Research Objectives

The findings demonstrate that all research objectives of the study were successfully achieved. The study identified and empirically examined the Critical Success Factors influencing performance in Ethiopian road construction projects, thereby addressing Objective 1. It examined the Key Performance Indicators used to assess project outcomes, fulfilling Objective 2, and analyzed the influence of contextual factors on project performance in line with Objective 3.

Furthermore, the study assessed the role of BIM and digital practices in enhancing performance management, addressing Objective 4, and examined the interrelationships among CSFs, KPIs, contextual factors, digital practices, and overall project performance using quantitative correlational analysis, satisfying Objective 5.

Most importantly, the study culminated in the development and empirical validation of an integrated performance management framework tailored to the Ethiopian road construction context, thereby achieving Objective 6. The framework reflects the multidimensional, interconnected, and context-dependent nature of project performance and provides a coherent structure for understanding, analyzing, and improving performance management practices across the sector.

7.4 Contributions to Knowledge and Practice

This study makes a substantive contribution to construction performance management research by empirically validating an integrated framework that links Critical Success Factors, Key Performance Indicators, BIM and digital practices, and contextual factors within a developing-country infrastructure context. By demonstrating the interdependence of internal management practices and external environmental conditions, the study extends performance management theory beyond narrow, organizational or indicator-based models.

Methodologically, the study contributes by demonstrating the application of quantitative correlational analysis to examine complex performance relationships in large-scale construction projects while maintaining analytical rigour and interpretive caution appropriate to non-causal research designs. The study provides empirical evidence that supports the use of parsimonious, context-sensitive measurement frameworks in environments characterized by data constraints and institutional complexity.

From a practical perspective, the study offers evidence-based guidance for improving performance management in Ethiopian road construction projects. The validated framework provides a structured foundation for policy formulation, professional practice, organizational learning, and capacity-building initiatives aimed at enhancing infrastructure delivery outcomes.

7.5 Study Limitations

Notwithstanding its contributions, the study is subject to several limitations that should be acknowledged when interpreting its findings.

7.5.1 Cross-Sectional Research Design

The study employed a cross-sectional research design, capturing respondents' perceptions at a single point in time. While appropriate for examining associations among variables and aligned with the study's correlational objectives, this design limits the ability to observe changes in performance management practices and project outcomes over time. Road construction projects typically span multiple years, during which managerial practices, organizational capacity, contextual conditions, and performance levels may evolve.

As a result, the findings reflect static relationships rather than dynamic or process-oriented interactions. Longitudinal research designs would allow future studies to examine how performance management practices influence project outcomes across different project phases and temporal contexts.

7.5.2 Correlational Nature of the Analysis

The study adopted a quantitative correlational methodology using Pearson correlation analysis. Although this approach effectively identifies the strength and direction of relationships among variables, it does not permit causal inference. Consequently, the significant associations observed between CSFs, KPIs, BIM adoption, contextual factors, and project performance should be interpreted as indicative of relationships rather than deterministic causal effects.

7.5.3 Reliance on Self-Reported Data

Data were collected using self-administered questionnaires that rely on respondents' perceptions and professional judgement. While respondents were experienced professionals directly involved in road construction projects, self-reported data are inherently subject to response bias, including social desirability bias and perceptual subjectivity. Although reliability testing confirmed acceptable internal consistency across all measurement scales, the use of perceptual data remains a methodological constraint.

7.5.4 Sample Scope and Generalizability

The sample comprised professionals from Ethiopian road construction projects, including public-sector agencies, consultants, and contractors. While this ensured strong contextual relevance, the findings may not be directly generalizable to other construction sectors or national contexts characterized by different institutional, economic, and regulatory environments. Variations in organizational size, project scale, and regional conditions may also have influenced respondents' perceptions.

7.5.5 Measurement and Conceptual Scope

Several constructs, particularly contextual factors and overall project performance, were operationalized as aggregated indices. While this facilitated analysis, it may have masked the differential effects of individual sub-dimensions. In addition, BIM and digital practices were measured at an aggregate level, capturing adoption rather than maturity or functional depth.

7.6 Directions for Future Research

Building on the study's findings and limitations, several directions for future research are proposed.

Future studies should consider longitudinal research designs to examine how performance management practices, digital adoption, and contextual conditions evolve across the project life cycle. Mixed methods approaches combining quantitative analysis with qualitative interviews or case studies could provide deeper insight into the mechanisms underlying observed statistical relationships.

Advanced analytical techniques such as Structural Equation Modelling, path analysis, or hierarchical regression could be employed to test causal relationships, mediating effects, and moderating influences. For example, future research could examine whether BIM mediates the relationship between Critical Success Factors and project performance, or whether contextual factors moderate these relationships.

Incorporating objective project performance data alongside perceptual measures would enhance measurement accuracy and empirical credibility. Comparative and cross-country studies could further test the transferability and adaptability of the proposed framework beyond the Ethiopian context.

Finally, future research could integrate broader theoretical perspectives, such as institutional theory, stakeholder theory, organizational learning theory, or innovation diffusion theory, to enrich explanations of performance management dynamics in construction projects.

7.7 Concluding Remarks

In conclusion, this research demonstrates that performance management in Ethiopian road construction projects is a complex, multidimensional, and context-sensitive process. While sound managerial practices and effective performance measurement systems are essential, their effectiveness is shaped by digital maturity and broader institutional, economic, and environmental conditions.

By adopting an integrated and empirically grounded performance management approach, stakeholders in the Ethiopian road construction sector can enhance project delivery outcomes, strengthen accountability, and achieve greater value for public investment. The study therefore provides a robust platform for both scholarly advancement and practical reform, contributing to more effective, transparent, and sustainable road infrastructure development in Ethiopia. In doing so, the study responds directly to longstanding calls for contextually grounded, empirically validated performance management models in developing-country infrastructure delivery.

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ANNEX I: SURVEY QUESTIONNAIRE

Part I: Demographic information of the Respondents.

(Please tick ✓or circle the appropriate option)

a) Gender

◯ Male ◯ Female

b) Age Group

◯ 18–25 ◯ 26–35 ◯ 36–45 ◯ 46–55 ◯ 56 and above

c) Role / Position in the Project

◯ Project Manager ◯ Site Engineer ◯ Contractor Representative ◯ Consultant ◯ Client Representative ◯ Supervisor / Technical Expert ◯ Other: ________

d) Years of Experience in Construction Industry

◯ Less than 1 year ◯ 1–3 years ◯ 4–6 years ◯ 7–10 years

◯ More than 10 years.

e) Type of Organization

◯ Government / Public Sector ◯ Private Contractor ◯ Consulting Firm

◯ Client Organization ◯ NGO ◯ Other: _________

f) Type of Construction Projects You Mostly Work On

◯ Building Projects ◯ Road / Highway Projects ◯ Water / Infrastructure Projects
◯ Industrial Projects ◯ Mixed Projects (Multiple types)

g) Average Project Size You Work On

◯ Small (≤ 10 million ETB) ◯ Medium (10–50 million ETB)
◯ Large (50–200 million ETB) ◯ Mega (> 200 million ETB)

Part II: PM of Road Construction Projects

Likert scale: ○1 Strongly Disagree ○2 Disagree ○3 Neutral ○4 Agree ○5 Strongly Agree

Section A: Critical Success Factors (CSFs)

Project Planning & Scheduling

1. Project objectives are clearly defined at the start of the project.
2. Project schedules are realistic in relation to available resources.

Contractor Financial Capacity

3. The contractor has adequate financial capacity to sustain project activities.
4. Cash-flow management supports continuity of construction work.

Technical & Managerial Competence

5. Project staff possess the technical skills required for their assigned tasks.
6. Project management demonstrates effective coordination of activities.

Supply Chain Reliability

7. Construction materials are generally available when required.
8. Equipment availability supports planned construction activities.

Stakeholder Engagement

9. Key stakeholders are involved at appropriate stages of the project.
10. Information exchange among stakeholders is timely and clear.

Safety Management

11. Safety procedures are applied consistently on site.
12. Safety risks are identified and managed systematically.

Quality Assurance

13. Construction activities comply with approved specifications.
14. Quality control processes are applied throughout the project life-cycle.

Environmental & Sustainability Compliance

15. Environmental management measures are integrated into project activities.
16. Project operations consider environmental protection requirements.

Knowledge Management & Learning

17. Lessons learned from previous projects are considered in current projects.
18. Training opportunities are provided to support staff development.

Resource Management

19. Human resources are allocated in line with project needs.

20. Material and financial resources are managed efficiently.

Governance & Oversight

21. Project governance arrangements support transparency.

22. Monitoring and reporting mechanisms support informed decision-making.

Project Leadership

23. Project leadership provides clear direction to the project team.

24. Decisions are made in a timely and accountable manner.

Funding & Resource Mobilization

25. Project funding is released in line with implementation needs.

26. Funding adequacy supports planned project activities.

27. Roles and responsibilities among project parties are clearly defined.

28. Coordination between design and construction teams supports smooth implementation.

29. Potential project risks are identified early and mitigation actions are planned.

Section B: KPIs / Project Performance —

30. Project activities generally follow the planned schedule.

31. Schedule deviations are managed effectively.

32. Project costs are managed within approved limits.

33. Cost variations are monitored and controlled.

34. Completed works meet required quality standards.

35. Levels of rework on the project are minimal.

36. Safety performance meets acceptable standards.
37. Productivity levels are consistent with project targets.
38. Equipment utilization supports efficient project execution.
39. Stakeholder expectations are reasonably met.
40. Overall project performance aligns with stated objectives.

Section C: BIM Adoption

41. BIM is used to support coordination among project participants.
42. BIM supports accuracy in design and planning activities.
43. BIM helps identify design or construction conflicts early.
44. BIM supports information sharing among project stakeholders.
45. Staff have adequate capability to use BIM tools where applied.
46. Organizational support exists for the use of BIM.

Section D: Contextual Factors

47. Regulatory and approval processes influence project implementation.
48. Institutional capacity affects project management effectiveness.
49. Market conditions influence material availability and costs.
50. Procurement procedures influence project timelines.
51. Project size and complexity affect management requirements.
52. Site and environmental conditions influence project execution.