


**ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS SCHOOL OF COMMERCE**

**DEPARTMENT OF PROJECT MANAGEMENT**

# EVALUATING THE EFFECTIVENESS OF EARNED VALUE MANAGEMENT (EVM) INTEGRATION IN COST AND SCHEDULE CONTROL IN PRIVATE REAL ESTATE BUILDING PROJECTS IN ADDIS ABABA, ETHIOPIA

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**A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR MASTER OF ART IN PROJECT MANAGEMENT**

**July 2026**

**Addis Ababa, Ethiopia**

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**By**

**Kirubel Kebede**



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**Addis Ababa, Ethiopia**

# STATEMENT OF DECLARATION

I declare that the research thesis entitled ***"Evaluating the Effectiveness of Earned Value Management (EVM) Integration in Cost and Schedule Control in Private Real Estate Building Projects in Addis Ababa, Ethiopia"*** is my original work and hasn't been published or summitted for any kind of qualification elsewhere. All sources of material used in the work have been duly acknowledged.

Kirubel Kebede W/Tsadik

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Date: _____

# STATEMENT OF CERTIFICATION

This is to certify that, this project work ***"Effectiveness of Earned Value Management (EVM) Integration in Cost and Schedule Control in Private Real Estate Building Projects in Addis Ababa"*** undertaken by Kirubel Kebede partial fulfillment of the requirement for Master of Arts in Project Management at Addis Ababa University School of Commerce, is an original work and not summited earlier for any Degree either at this university or any other university.

_____

Mahir Jebril (PhD)

Research Project Advisor

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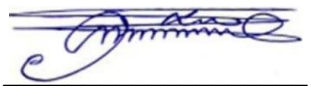
**SCHOOL OF COMMERCE**

**PROJECT MANAGEMENT PROGRAM**

# "Evaluating the Effectiveness of Earned Value Management (EVM) Integration in Cost and Schedule Control in Private Real Estate Building Projects in Addis Ababa, Ethiopia"

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# Tables of Contents

**Acknowledgements** ..... V

**List of Tables** ..... IX

**List of Figures** ..... X

**List of Acronyms and Abbreviations** ..... XI

**Abstract** ..... XII

**CHAPTER ONE** ..... 1

**1. INTRODUCTION** ..... 1

**1.1. Background of the study** ..... 1

**1.2. Statement of the Problem** ..... 3

**1.3. Research Objective** ..... 4

**1.4. Research Questions** ..... 5

**1.5. Research Hypothesis** ..... 5

**1.6. Significance of the Study** ..... 5

**1.7. Scope of the Study** ..... 6

**1.8. Operational Definitions** ..... 7

**1.9. Organization of document** ..... 10

**CHAPTER TWO** ..... 11

**2. REVIEW OF LITERATURE** ..... 11

**2.1 Concepts about Construction Project Management** ..... 11

**2.1.1. Project** ..... 11

**2.1.2 Project management** ..... 11

**2.1.3 Project monitoring and control** ..... 14

**2.1.4 Construction project performance** ..... 15

**2.1.5 Cost control** ..... 16

**2.1.6 Schedule control** ..... 16

**2.2. Theoretical Framework EVM** ..... 17

**2.2.1 Overview of the construction industry** ..... 17

**2.2.2 Application of Earned Value Management** ..... 20

**2.2.3 Earned Value Management performance metrics** ..... 21

**2.2.4 EVM: Project performance scenarios** ..... 24
**2.2.5 Earned Value Management integration** ..... 26
**2.2.6 Schedule performance** ..... 28
**2.2.7 The role of Earned Value Management (EVM)** ..... 28
**2.2.8 The role of EVM in the integration of Schedule Control & Cost Control** ..... 30
**2.2.9 Factors that affect EVM** ..... 30
**2.3. Empirical Literature Review** ..... 31
**2.4 Conceptual Framework** ..... 34
**CHAPTER THREE** ..... 36
**3. RESEARCH METHODOLOGY** ..... 36
**3.1 Description of the Study Area** ..... 36
**3.2 Research Philosophy and paradigm** ..... 36
**3.3 Research Design and Approach** ..... 37
**3.4 Type and Sources of Data** ..... 37
**3.5 Sampling** ..... 37
**3.5.1 Population, sampling frame and sampling unit** ..... 37
**3.5.2 Sampling size determination** ..... 38
**3.5.3 Sampling technique and procedure** ..... 39
**3.6 Data Collection, Sources, Types and Instruments** ..... 40
**3.6.1 Primary data collection method** ..... 40
**3.6.2 Data collection procedure** ..... 42
**3.7 Data Validity and Reliability** ..... 42
**3.7.1 Validity** ..... 42
**3.7.2 Reliability** ..... 43
**3.7.3 Data quality control** ..... 43
**3.7.4 Methods of data analysis** ..... 44
**3.8 Ethical Consideration** ..... 44
**CHAPTER FOUR** ..... 45
**4. RESULTS AND DISCUSSION** ..... 45
**4.1 Response Rate** ..... 45
**4.2 Demographic Profile of Respondents** ..... 45
**4.2.1 Gender and educational background** ..... 46

**4.3.2 Professional role and experience** ..... 47
**4.3.3 Company category and digital maturity** ..... 49
**4.4 Descriptive Statistic** ..... 51
**4.4.1 Current Level of EVM Adoption Status** ..... 51
**4.4.2 EVM Integration** ..... 53
**4.4.3 Effectiveness in cost and schedule control** ..... 54
**4.4.4 Challenges in EVM Adoption** ..... 57
**4.5 Inferential Statistic** ..... 60
**4.5.1 Correlation Analysis** ..... 60
**4.5.2 Regression Analysis** ..... 64
**4.5.3 Result of Linear Regression** ..... 69
**4.6. Summary of Hypothesis** ..... 70
**CHAPTER FIVE** ..... 72
**5. SUMMARY, CONCLUSSION AND RECOMMENDATION** ..... 72
**5.1 Summary of Findings** ..... 72
**5.2 Conclusion** ..... 73
**5.3 Recommendations** ..... 74
**5.4 Suggestions for Future Researchers** ..... 75
**REFERENCE** ..... 77
**Annex: Questionnaire for study on "Effectiveness of Earned Value Management (EVM) Integration in Cost and Schedule Control in Private Real Estate Building Projects in Addis Ababa”** ..... 91
**Annex 3. Cover letter accompanying questionnaire/ question** ..... 97

# List of Tables

Table 1 Key Metrics of EVM (based on PMI 2008) ..... 22
Table 2 Performance indicators and variances in the EVM technique ..... 22
Table 3 Forecast indicators in the EVM technique ..... 23
Table 4 Critical factors of EVMs environment ..... 31
Table 5 Cronbach's alpha values ..... 43
Table 6 Distribution of respondents and their role in their organization ..... 48
Table 7 Distribution of respondents by organizational work experience ..... 48
Table 8 Distribution of respondents by project monitoring software/tool ..... 50
Table 9 Descriptive statistics for EVM integration variables. ..... 54
Table 10 Descriptive statistics for cost control variables. ..... 55
Table 11 Descriptive statistics for schedule control variables. ..... 57
Table 12 Descriptive statistics for challenges in EVM adoption. ..... 58
Table 13 Normality of test for Cost Control Variable ..... 61
Table 14 Normality of test for Schedule Control Variable ..... 62
Table 15 Correlation analysis result ..... 63
Table 16 Cost Control Model Summary ..... 66
Table 17 Schedule Control Model Summary ..... 66
Table 18 Model Summary for Model 1 ..... 67
Table 19 Model 1: ANOVA result ..... 67
Table 20 Model Summary for Model 2 ..... 68
Table 21 Model 2: ANOVA result ..... 68
Table 22 Unstandardized and standardized Regression Coefficients for the Effect of EVM integration on Cost Control ..... 69
Table 23 Unstandardized and standardized Regression Coefficients for the Effect of EVM integration on Schedule Control ..... 70
Table 24 Summary of Hypothesis ..... 71

# List of Figures

Figure 1 Project Management Process Groups ..... 13
Figure 2 Project Management Process Groups ..... 14
Figure 3 Monitoring and Control Project Work ..... 15
Figure 4 The Global Sector Growth Between 2015-2030 ..... 18
Figure 5 The Overall Regional Growth Rate of The Construction Industry, 2021-2030 ..... 19
Figure 6 Outlines the main EVM concepts over time and at a given analysis point.ost Variance. ..... 24
Figure 7 The EVM key metrics for early and late projects with cost under- and overruns (Vanhoucke, 2015) ..... 25
Figure 8 The PV and EV metrics for a late (left) and early (right) project (Vanhoucke, 2021). ..... 26
Figure 9 Conceptual Framework ..... 35
Figure 10 Proportion of respondents by sex. ..... 46
Figure 11 Proportion of respondents by educational level. ..... 47
Figure 12 Proportion of respondents by building grade (GC) classification (a) and company size (b) ..... 49
Figure 13 Distribution of respondents by level of digital maturity. ..... 51
Figure 14 Distribution of respondents by EVM adoption status (SA-0) ..... 52
Figure 15 Histogram Chart for Cost Control Variable ..... 61
Figure 16 Histogram Chart for Schedule Control Variable ..... 62
Figure 17 P-P/Q-Q Normality Test for Cost Control ..... 64
Figure 18 P-P/Q-Q Normality Test for Schedule Control ..... 65
Figure 19 EVM integration and both cost control and schedule control scatterplots with regression line . 65
Figure 20 Homoscedasticity Scatterplot for both regression model ..... 66

## List of Acronyms and Abbreviations

| | | |
|---|---|---|
| **AC** | - | Actual Cost |
| **ACWP** | - | Actual Cost (Actual Cost of Work Performed) |
| **ANSI/EIA 748** | - | American National Standard Institute/Electronic Industrial Alliance Standard 748 (EVM Standard) |
| **BAC** | - | Budget at Completion |
| **BCWP** | - | Budget Cost for Work Performed |
| **BCWS** | - | Budget Cost for Work Scheduled |
| **CPI** | - | Cost Performance Index |
| **CPM** | - | Critical Path Method |
| **CV** | - | Cost Variance |
| **EAC** | - | Estimated at Completion |
| **ETC** | - | Estimated to Complete |
| **EV** | - | Earned Value |
| **EVM** | - | Earned Value Management |
| **GC** | - | Grade Contractor |
| **PMBOK®** | - | Project Management Body of Knowledge |
| **PMI** | - | Project Management Institute |
| **PMIS** | - | Project Management Information System |
| **PV** | - | Planned Value |
| **SPI** | - | Schedule Performance Index |
| **SV** | - | Schedule Variance |
| **TCPI** | - | To-Complete Performance Index |
| **VAC** | - | Variance at Completion |
| **WBS** | - | Work Breakdown Structure |

# Abstract

*Effective cost and schedule performance control remains significant challenge for the construction sector in the country. Empirical evidence demonstrates that only a few companies employ structured and advanced project monitoring tools. A study was undertaken to assess the current level of Earned Value Management (EVM) integration and the barriers to its adoption within the private real estate building construction projects in Addis Ababa. Data were collected through structured questionnaires administered to project professionals across 54 randomly selected construction projects from 31 different organizations, achieving a high response rate of 93.1%. The study utilized descriptive statistics to summarize demographic data and current EVM practices, alongside inferential statistics to analyze relationships. Results indicated that 64.8% of the organizations currently utilize EVM; however, the depth of integration was found to be moderate and often reliant on manual processes. Statistical analysis confirmed a statistically significant positive relationship between EVM integration and cost control ($r=0.442$, $p<0.05$) and schedule control ($r=0.591$, $p<0.001$). Furthermore, regression analysis identified EVM integration as a significant predictor of project performance, explaining 19.6% of the variance in cost control and 34.9% of the variance in schedule control. Major barriers to adoption included a lack of technical expertise, weak management commitment, and the absence of standardized procedures. Nevertheless, respondents view EVM as a highly effective tool for early detection of cost overruns and schedule delays. The study concludes that EVM has strong potential to improve project monitoring and controlling in Addis Ababa's construction sector if existing organizational and technical barriers are adequately addressed.*



**Key words**: Earned Value Management, Cost Control, Schedule Control, Real Estate Construction, Project Monitoring, Addis Ababa

# CHAPTER ONE

## 1. INTRODUCTION

This chapter introduces the foundation of the study in which it introduces the key variables of Earned Value Management (EVM) Integration, cost control and schedule control in the context of Private Real Estate Building Projects in Addis Ababa. The chapter begins with a detailed background of the problem, followed by a problem statement that highlights the need to examine EVM effectiveness in schedule and cost control. It then presents the research objectives, questions, significance, and concludes with the scope of the study, along with definitions of key terms. The final section describes the organization of the dissertation.

### 1.1. Background of the study

Effective cost and schedule performance control continues to challenge the construction industry globally. Many projects are experiencing significant cost overruns and time delays due to weak planning, fragmented control system and lack of integrated performance measurement (Hasan et al., 2021a). Empirical evidence from Ethiopia demonstrates that only a few companies employ structured and advanced project monitoring tools, whereas most firms depend on basic reporting formats instead of integrated control systems (Zewdu, 2016). One of the popular tools used to control projects regarding cost and time is the earned value method (EVM). Earned value management is a project management technique for measuring project performance and progress in an objective manner (Project Management Institute, 2021).

Earned Value Management contributes a holistic solution by which it combines project scope, cost and schedule metrics into performance indicators, for example Cost Performance Index (CPI) and Schedule Performance Index (SPI) (Hasan *et al*., 2021b). While EVM has been implemented effectively in several developed contexts, its broader institutionalization is limited by challenges such as data reliability issues, lack of sufficient technical expertise within project teams, and organizational resistance to adoption in many developing countries (Hussein and Moradinia, 2023).

In many developing regions, particularly in Africa construction industry sector projects often suffer from persistent cost escalation and extended project durations. This is largely due to inadequate project monitoring and control practices, dependence on traditional scheduling tools and limited

capacity for real time performance estimations. Studies in the developing countries show that EVM brings enhanced visibility, variance analysis and predictive capacity. However, its consistency in application within projects is hindered by organizational maturity, lack of standard controlling process and procedures and insufficient training (Hussien and Moradinia, 2023).

Garomsa *et al*. (2019) stressed that Ethiopia's construction sector plays important role in supporting fast urbanization and infrastructure development; however, it remains beset by budget overruns, schedule slippage and risk burdened monitoring system. Traditional cost control mechanisms dominate, and relying on planned against actual comparisons provides limited early warning capability. Empirical studies show that, although some projects adopt EVM and their practice is still growing, effective project management are hampered by low digital maturity, fragmented documentations and limited awareness (Mulugeta, 2017; Demere, 2023).

In the local context of Addis Ababa, building construction projects are marked by frequent schedule changes, cost variability and inefficient monitoring practices, which add to its financial and operational risks. A case study of condominium project in Bole Arabsa area revealed widespread delays and cost variances, which is mainly due to material shortages, unit rate fluctuations and variation orders (Jembere *et al*., 2020). These challenges indicate that the traditional monitoring and controlling tools are insufficient for managing complex and large-scale building projects and, thus, there is a strong need for integrated project performance methodologies and tools such as EVM to offer real time diagnostic and forecasting capabilities.

EVM's potential lies in its capacity to integrate project work scope, budget and schedule into actionable performance metrics (Hasan *et al*., 2021b). For cases such as Addis Ababa's rapid urbanization and expanding building construction sector, this integration could deliver more accurate forecasts, early alerts for variance and enhanced management responsiveness. However, little is known about how systematically EVM is deployed in local construction firms and what organizational and technical barriers exist or how effective it is in improving cost and schedule performance.

Therefore, this study aims to address a significant gap, bridging modern project control theory with practice in a rapidly growing urban construction environment. In addition to information to stakeholders (contactors, clients, consultants and city planners), the insights provided will support

policy and capacity building efforts towards more disciplined cost and schedule control in Addis Ababa and beyond.

## 1.2. Statement of the Problem

Projects failure in Ethiopia can be attributed to several issues, each of which can significantly affect project cost, schedule and performance depending on how effectively they are handled. One of the major challenges faced by construction projects is the inability to complete them on schedule with allocated budget and stated quality standards (Deneke, 2020). Mulugeta (2017) noted that cost overruns, schedule delays and poor-quality delivery have become common occurance in construction projects in Addis Ababa, often leading to client disatisfaction. Regardless of the critical role of EVM in integrating cost, schedule and scope of project into performance management, its adoption among local construction firms remains limited (Reda *et al*., 2025). Traditional cost control methods, such as comparisons between planned and actual performance, continue to dominate most projects; however, they provide limited early warning of potential cost or schedule variances (Chowdhury & Akter, 2021; Thoengsal & Tumpu, 2022).

Empirical research in Ethiopia shows that, although some contractors have experimented working with EVM, its implementations is not fully widespread and is inconsistent due to low digital maturity, fragmented documentation, lack of training and weak managerial commitment and support/follow-up (Mulugeta, 2017). These institutional and technical barriers impair proactive decision making and prevent the systematic use of key EVM metrics such as CPI, SPI and EAC), which are essential for forecasting and controlling the project performance (Hasan *et al*., 2021b).

In Addis Ababa, building projects reports show frequent budget escalation from the baseline budget and schedule slippage from the original master schedule and delayed detects of variances. These issues mainly aggravate financial risk and undermine stakeholder/clients' or project funders confidences, and it affects everyone from the contractors to city planners (Mulugeta, 2017). Accordingly, effective integration of Earned Value Management (EVM) is crucial for timely identification of project issues, thereby enabling necessary and proactive corrective actions (Gaddam and Landage, 2025).

Hence, unless these issues are addressed, the problem risks persisting or worsening that could lead to project failures, continued reliance on rudimentary control methods that, in turn, lead to escalating projects costs, project delays, contractual disputes, and reduced public trusts. Although

studies in many countries demonstrate that Earned Value Management (EVM) improves cost and schedule performance, there is still very limited empirical evidence on how EVM is actually used within Ethiopia building construction sectors. Most existing research focuses on other types of projects such as road, water work, and infrastructure leaving clear gap regarding the effectiveness of EVM specially in urban building projects (Zewdu and Aregaw, 2015; Belay *et al*., 2021).

Regionally, there are studies showing enhanced forms of EVM, for example as risk integrated or digital supported EVM models (Duc, 2025). However, these approaches have not been studied within Addis Ababa building construction environment, where project characteristics, organizational capabilities and monitoring practices have difference from. This shows presence of gap in understanding whether EVM techniques can be adapted to local contexts.

At the construction industry level, it is observed that there is a clear lack of evidence how organizations such as digital readiness, staff skills, documentation quality and management commitment can significantly influence the adoption and performance of EVM and there are no empirical evidence quantifying these effects. Without this insight it is unclear why EVM application remains inconsistent or why some firms benefit from it while others do not.

Methodologically, it is observed that previous local studies relied largely on descriptive assessment rather than analytical models that measures the actual effectiveness of EVM on cost and schedule outcomes, as a result, there is little quantified evidence demonstrating whether or not EVM integration leads to a better performance in Addis Ababa private building project.

Hence, despite the recognized benefits of Earned Value Management (EVM), its integration into cost and schedule control system in Addis Ababa projects remains limited, inconsistent and poorly understood. The perceived unclarity regarding the effectiveness of Earned Value Management (EVM) highlights significance to investigate what factors influence its adaption and how it can be applied systematically to address persistent cost overrun and schedule delays.

## 1.3. Research Objective

The general objective of the study is to assess the effectiveness of integrating Earned Value Management (EVM) in improving cost and schedule control within private real estate building construction projects in Addis Ababa.

The study aims to achieve the following specific objectives.

1. To assess the current level of EVM integration and implementation practice in private real estate building construction projects.
2. To evaluate the effect of EVM integration on cost control performance in private real estate building construction projects.
3. To determine the effect of EVM integration on schedule control performance in private real estate building construction projects.
4. To analyze the key challenges that limit the effective adoption and utilization of EVM private real estate building construction projects.

## 1.4. Research Questions

The following are key questions raised in the study.

1. What are the current level and effect of EVM integration and implementation practice among private real estate building construction project in Addis Ababa?
2. What are the key challenges limiting the effective adaption and utilization of EVM in private real estate building construction project in Addis Ababa?

## 1.5. Research Hypothesis

**H1.** Earned Value Management (EVM) integration has significant positive effect on cost control performance in private real estate building construction project in Addis.

**H2.** Earned Value Management (EVM) integration has significant positive effect on schedule control performance in private real estate building construction project in Addis Ababa.

## 1.6. Significance of the Study

This study is believed to contribute to both academic knowledge, practical application and outcomes for policy related issues. From an academic perspective, it will address empirical studies examining the effectiveness of EVM integration in the context of Addis Ababa building construction sector. Previous studies in Ethiopia are largely limited to single case assessment or sector specific applications, leaving substantial gaps in the understanding of the extent to which EVM influences cost and schedule performance across multiple building projects. By giving quantitative evidence on the relationship between EVM integration and project performance, this information helps in understanding of project control methodologies in emerging construction

markets. It will also provide a basis for future researchers to expand theoretical and empirical work performance measurement, construction management, and project monitoring systems.

Practically, the study provides construction firms especially stakeholders like contractor/project managers, client and consultant with important critical insights on how EVM can enhance cost and schedule control by identifying current implementation gaps and highlight the factors that influence successful EVM integration. The research will also equip experts with specific areas for improvement in their monitoring and control systems. Analyzing the challenges that hinder effective EVM adoption can assist organizations in developing strategies to improve project capabilities. Furthermore, project owners and stakeholders can use the findings to improve decision making, reduce risk related to cost increment and time overrun with in project execution and assures more predictable project outcomes.

The study also has policy significance. Its findings can support regulatory bodies, public construction agencies and professional association in developing clearer guidelines, standards and frameworks for integrating EVM into project monitoring and control practices. In a construction industry where cost overrun and a schedule delay are persistent challenges, evidence-based insight from this research may indicate policy reforms aimed at improving project governance, reporting mechanisms and monitoring standards.

## 1.7. Scope of the Study

This study is confined to specific thematic, geographical, temporary and methodological scopes to ensure clarity and focus regarding addressing the research problem.

Thematically, the study focuses on assessing the effective implementation of Earned Value Management (EVM) integration in improving cost and schedule control in building construction project. The main variables examined in this research includes EVM integration (independent variable), cost control performance and schedule control performance (dependent variables). The study does not cover other projects management processes such as procurement, contact administration or quality management unless they directly relate to EVM practices.

Geographically the study covers and limited to private real estate building construction project located within Addis Ababa. The city is chosen for its many construction projects, frequent large and complex buildings, and persistent cost and schedule overruns.

Temporally, the study focuses on building projects undertaken within the past five to seven years. This time span ensures availability of recent data and reflects current industry practices, monitoring systems and organizational conditions influencing EVM adoption. The time interval also aligns with the increased push form improved project control in Ethiopia's construction sector.

Methodologically, the study employs a quantitative research approach supported by descriptive and inferential analysis. Data were collected through structured questionnaires. Descriptive statistic techniques were used to analyze the research question related to the current level of EVM integration and key challenges limiting the effective adaption and utilization of EVM. As for inferential statistics, regression model (simple linear regression) was used to evaluate the effectiveness of EVM integration on cost and schedule control performance in private real estate building project. In addition to these, qualitative interview was incorporated to clarify contextual issue or challenges but did not form the primary analytical approach.

## 1.8. Operational Definitions

### Earned Value Management (EVM) Integration

Earned Value Management is a structured approach to planning, cost collection and performance measurement. It facilitates the integration of project scope, schedule, cost, risk and resource objectives and the establishment of a base plan for performance measurement (National Defense Industrial Association, 2013).

### EVM Metrics

Earned Value Management Metrics are standardized performance indicators that combine project scope, cost and schedule information to facilitate the monitoring and control of project performance. The principal metrics includes Cost Variance (CV) and Schedule Variance (SV), which measure deviations in project cost and schedule by comparing earned value to actual and planned values, respectively. In addition, CPI) and SPI serve as indicators of cost and schedule efficiency. Together, these metrics provide early warning of project performance issues and support forecasting of project completion cost and timelines (Anbari, 2003; Vandevoorde and Vanhoucke, 2006).

**Earned Value (EV)**

Earned Value is the value of work performed expressed in terms of the budget assigned to that work; also, it referred to as Budget Cost for Work Performed (BCWP) (Project Management Institute, 2011).

**EV = % of Actual Work Completed × Budget at Completion (BAC)**

**Planned Value (PV)**

Planned Value is the value of work planned, expressed in terms of budget assigned to that work. It serves as the project's financial baseline, answering the question: *"How much work, in monetary terms, should have been completed by now according to the project plan?"* (Project Management Institute, 2011).

**Actual Cost (AC)**

Actual Cost (AC) is the cost actually incurred and recorded in accomplishing work performance within a given time period (Project Management Institute, 2011).

**Cost Variance (CV)**

Cost Variance (CV) measures cost performance on a project. It is the arithmetic difference between Earned Value and Actual Cost (Cost Variance = Earned Value – Actual Cost) (Project Management Institute, 2011).

**Schedule Variance (SV)**

Schedule Variance measures schedule performance on a project. It is the arithmetic difference between Earned Value and Planned Value (Schedule Variance = Earned Value – Planned) (Project Management Institute, 2011).

**Cost Performance Index (CPI)**

It measures cost efficiency on the project. It is the ratio of Earned Value to Actual Cost (Cost Performance Index = Earned Value / Actual Cos) (Project Management Institute 2011).

**Schedule Performance Index (SPI)**

It measures Schedule efficiency on the project. It is the ratio of Earned Value to Planned Value (Schedule Performance Index = Earned Value / Planned Value) (Project Management Institute, 2011).

**Estimate at Completion (EAC)**

It is the estimated total cost of completing all of the project work; equal to the Actual Cost plus the estimated cost of completing all of the remaining project work (Project Management Institute, 2011).

**Estimate to Complete (ETC)**

It is the estimated cost of completing all of the remaining project work (Project Management Institute, 2011).

**Construction Project**

It is organized process involving the construction, remodeling, refurbishing, retrofitting, or adapting a building or infrastructure (The Construction Wiki, 2022).

## 1.9. Organization of document

The remaining chapters of this research paper are organized as follow:

Chapter Two; - Review of Literature: This chapter represents a comprehensive review of theoretical, conceptual and empirical literature related to Earned Value Management (EVM), cost and schedule control in construction projects. It stresses on global, regional and local research to establish the knowledge base, identify gaps and develop the conceptual framework for the study.

Chapter Three: This chapter outlines the methodological approach to be adopted, including the research design, population and sampling techniques, data collection instruments, procedures and methods of analysis. It also details the variables under investigation, the analytical model including descriptive statistics and inferential statistics and the techniques for ensuring data validity and reliability.

Chapter Four; this chapter summarizes and presents the collected data using descriptive and inferential statistical methods. It includes analysis of EVM integration levels, challenges affecting adoption and the results of regression models examining the relationship between EVM integration and project performance. Findings are interpreted in relation to study's objectives, research question, hypothesis and literature.

Chapter Five; The final chapter summarizes the major findings, draw conclusion, based on the results, and provides evidence-based recommendations for construction firms, policymakers and future research. It highlights the practical implication of the study and suggests areas that require further investigations.

# CHAPTER TWO

# 2. REVIEW OF LITERATURE

## 2.1 Concepts about Construction Project Management

This subsection explains the key concept and constructs used in this research. Clarity is important to frame how Earned Value Management (EVM) and project cost & schedule control performance are understood within contemporary construction management. Accordingly, definitions are here provided, drawn from recent published papers and aligned with the study objectives.

### 2.1.1. Project

A project is a collection of interrelated activities undertaken to achieve a specific objective within a predetermined timeframe, using allocated resources and meeting the required quality standards (Wysocki, 2019). Similarly, PMI (2023) describes a project as a temporary undertaking aimed at producing a unique product, service, or result.

The main objective of a project is to deliver specified outputs, which can be achieved through the application of established project management principles, supported by practical experience and the effective use of appropriate tools and techniques. According to Kerzner (2017), these tools and techniques enhance the utilization of available resources by facilitating the flow of work both across functional areas and through different levels of the organizational structure.

### 2.1.2 Project management

Project management is application of knowledge, skill, tools and techniques to project activities to meet project requirements. Project management refers to guiding the project work to deliver the intended outcomes. Project teams can achieve the outcomes using a broad range of approaches, e.g., predictive, hybrid and adaptive (PMI, 2017).

According to (Houston & Bove, 2020; Swaidi, 2023; Yepifanova & Dzhedzhula, 2022), project management is the process of planning, organizing and managing resources to achieve specific goals within a defined timeframe, cost and quality. Wysocki (2019) also explains that it encompasses range of activities, including project planning, role allocation, procurement of appropriate resources and tools, schedule development and control, information sharing,

stakeholder communication, milestone achievement, and leadership. These activities collectively ensure the successful completion of objectives within the established deadlines.

Although projects are initiated with clearly defined objectives, their scope is progressively refined throughout the project life cycle. Project managers transform broad conceptual goals into detailed and actionable plans while establishing mechanisms to monitor, evaluate, and control changes as they arise (Lewis, 2023). Effective project management therefore requires both careful planning and the flexibility to accommodate change without compromising project objectives.

The primary purpose of project management is to ensure that project deliverables, resources, personnel, and processes are coordinated efficiently and completed according to schedule. When properly implemented, it enhances predictability, increases the likelihood of success, facilitates the timely delivery of intended outputs, supports effective problem-solving, enables proactive risk management, and promotes the optimal use of organizational resources. It also assists organizations in identifying underperforming projects, implementing corrective actions, or terminating projects that are no longer viable. Furthermore, it helps balance competing constraints and minimize their effects on project performance (Ebrahem, 2017).

Conversely, inadequate project management can result in numerous adverse outcomes, including unmet requirements, schedule delays, budget overruns, poor-quality outputs, excessive rework, resource wastage, uncontrolled scope expansion, reputational damage, stakeholder dissatisfaction, and ultimately the failure to achieve project objectives.

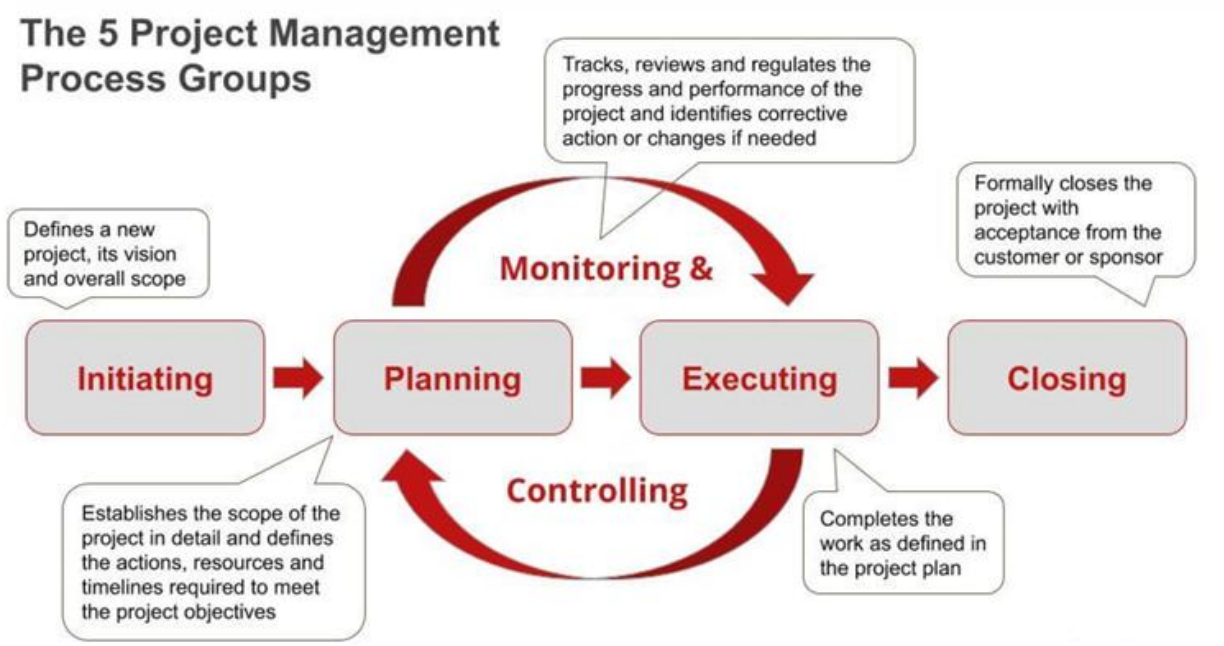
To facilitate effective project execution, project management activities are organized into Process Groups, which represent a structured set of inputs, tools and techniques, and outputs to provide a systematic framework for managing projects as illustrated in Figures 1 and 2.

*Figure 1 Project Management Process Groups*

| Knowledge Areas | Project Management Process Groups | | | | |
|---|---|---|---|---|---|
| | **Initiating Process Group** | **Planning Process Group** | **Executing Process Group** | **Monitoring and Controlling Process Group** | **Closing Process Group** |
| **4. Project Integration Management** | 4.1 Develop Project Charter | 4.2 Develop Project Management Plan | 4.3 Direct and Manage Project Work<br>4.4 Manage Project Knowledge | 4.5 Monitor and Control Project Work<br>4.6 Perform Integrated Change Control | 4.7 Close Project or Phase |
| **5. Project Scope Management** | | 5.1 Plan Scope Management<br>5.2 Collect Requirements<br>5.3 Define Scope<br>5.4 Create WBS | | 5.5 Validate Scope<br>5.6 Control Scope | |
| **6. Project Schedule Management** | | 6.1 Plan Schedule Management<br>6.2 Define Activities<br>6.3 Sequence Activities<br>6.4 Estimate Activity Durations<br>6.5 Develop Schedule | | 6.6 Control Schedule | |
| **7. Project Cost Management** | | 7.1 Plan Cost Management<br>7.2 Estimate Costs<br>7.3 Determine Budget | | 7.4 Control Costs | |
| **8. Project Quality Management** | | 8.1 Plan Quality Management | 8.2 Manage Quality | 8.3 Control Quality | |
| **9. Project Resource Management** | | 9.1 Plan Resource Management<br>9.2 Estimate Activity Resources | 9.3 Acquire Resources<br>9.4 Develop Team<br>9.5 Manage Team | 9.6 Control Resources | |
| **10. Project Communications Management** | | 10.1 Plan Communications Management | 10.2 Manage Communications | 10.3 Monitor Communications | |
| **11. Project Risk Management** | | 11.1 Plan Risk Management<br>11.2 Identify Risks<br>11.3 Perform Qualitative Risk Analysis<br>11.4 Perform Quantitative Risk Analysis<br>11.5 Plan Risk Responses | 11.6 Implement Risk Responses | 11.7 Monitor Risks | |
| **12. Project Procurement Management** | | 12.1 Plan Procurement Management | 12.2 Conduct Procurements | 12.3 Control Procurements | |
| **13. Project Stakeholder Management** | 13.1 Identify Stakeholders | 13.2 Plan Stakeholder Engagement | 13.3 Manage Stakeholder Engagement | 13.4 Monitor Stakeholder Engagement | |

*Source: (PMI, 2017, P. 25)*

*Figure 2 Project Management Process Groups*



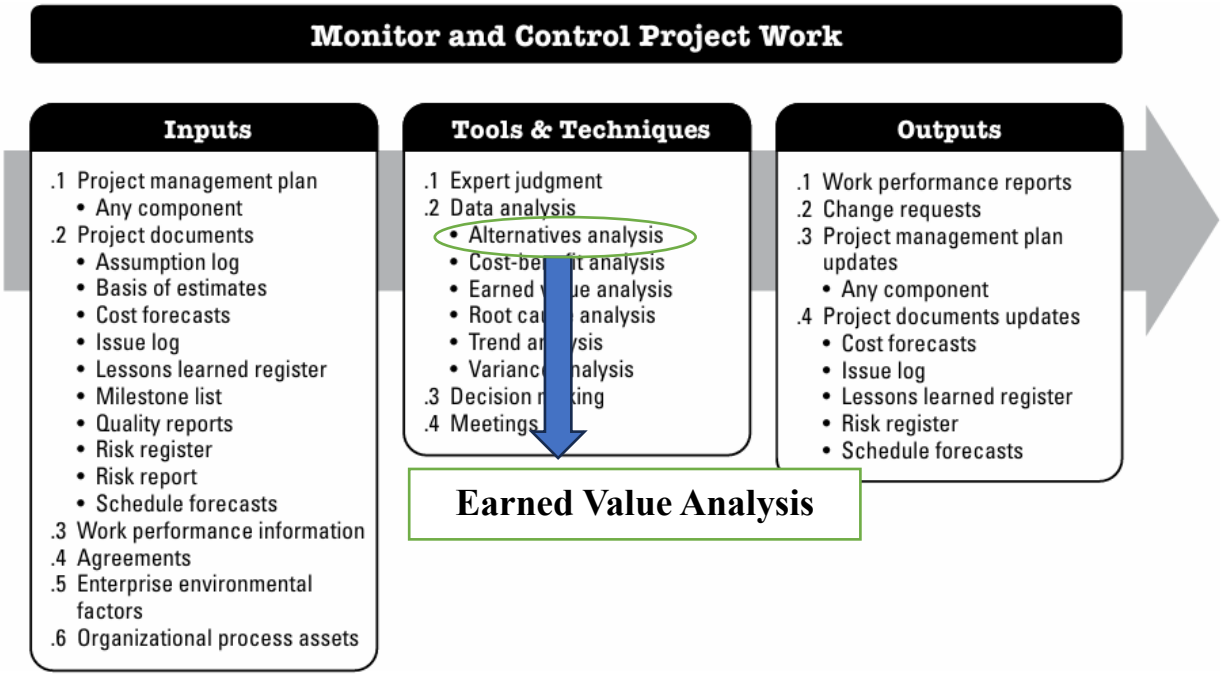

*Source: Starev, I. (2020).*

### 2.1.3 Project monitoring and control

Project monitoring and controlling is a continues process in project management that involves collecting, recording and analyzing project performance data to ensure that the project progresses according to the plan and achieves its objectives (Munson, 2019; Yordanova, 2025). Monitoring focuses on tracking project activities and performance indicators to detect deviations, while control involves comparing to actual results with planned parameters, analyzing variance and implementing corrective actions to address any discrepancies (Munson, 2019; Derenska and Velykoivanenko, 2025). This process helps to identify risks, delay, cost overruns, and quality issues early, enabling timely decision making and adjustments to keep the project on schedule and within budget (Atout, 2018; 2019). Effective project monitoring and control requires clear indicators, regular reporting, stakeholder communication, and the use of tools such as Earned Value Management (EVM) and project management software's like primavera (Tom & Paul, 2013; Ulusoy and Hazır, 2021). Overall, project monitoring and control integrates data driven oversight with proactive management to optimize project outcomes and resource use (Marco, 2011; Magomedbekov *et al*., 2025). In addition, PMI (2017) indicated that monitoring and controlling project works is the process of tracking, reviewing and reporting the overall progress to meet the

performance objectives defined in the project management plan. The key benefits of this process are that it allows stakeholders to understand the current state of the project, to recognize the actions taken to address any performance issues, and to have visibility into the future project status with cost and schedule forecasts. This process is performed throughout the project. The inputs, tools and techniques, and outputs of the process are depicted in Figure 3.

*Figure 3 Monitoring and Control Project Work*




*Source: (PMI, 2017, P. 105)*

### 2.1.4 Construction project performance

Traditionally, the performance of construction project is evaluated based on the three fundamental constraints of time, cost and quality. However, recent studies suggest that project performance should be assessed using a wider range of indicators, including safety, stakeholder satisfaction, communication, productivity and environmental impact (Ingle and Mahesh, 2020; Ibrahim *et al*., 2024). In addition, some recent studies conceptualized performance as multidimensional construct that integrates both financial and non-financial indicators and cost efficiency as well as schedule adherence and resource utilization (Love *et al*., 2020; Jiang 2021). Moreover, it is highlighted that performance measurement increasingly relies on a real time monitoring system and a data driven method rather than a traditional conventional reporting system (Almutairi *et al*., 2022).

In this study, construction project performance specifically will focus on cost and schedule performance, consistent with the performance dimensions measured through EVM.

### 2.1.5 Cost control

Cost control is a systematic process that runs throughout the entire project or enterprises operation, aiming to manage and regulate costs to reduce risk and improve financial benefits (Zhang, 2022). It involves planning, estimating, budgeting, monitoring and controlling expenses to ensure that the projects/business activities are completed within the approved budget (Igwe *et al*., 2020). In the construction projects, cost control techniques commonly include scheduling, budgeting, inspections, meeting and regular monitoring and evaluation to address challenges such as delays, resource productivity and unforeseen events (Livinus & Akoh, 2025). Today's landscape of cost control is increasingly supported by digital tools such as BIM, cloud-based cost tracking system and automated reporting, creating more precise, efficient, and transparent processes (Abubakar *et al*., 2020). These systems work in concert to manage and forecast project expenditures across the entire lifecycle, from design to operations. Overall cost control integrates financial oversights with operational management to optimize resource use and achieve project or organizational profitability (Teplická & Kadárová, 2025).

In this study, cost control is seen as a tool especially EVM metrics used to identify, measure and correct cost deviations.

### 2.1.6 Schedule control

Schedule control refers to processes of managing project activities, resources and time in a balanced way to ensure that project objectives are achieved within the planned schedule (Sabeghi & Tareghian, 2020). Schedule control mainly comprises monitoring the progress of activities, identifying deviations from the baseline schedule and making necessary adjustment to bring the schedule back on track while considering constraints such as budget and technical possibilities. According to Liu (2017), key factors influencing schedule controls includes the accuracy of design and reduction of design changes, construction preparation, planning, management, and goal setting. Digital technologies such as automated progress tracking, 4D BIM and integrated schedule systems have become central to modern schedule control practices (Vanhoucke, 2021). Overall, schedule control is a critical project management function focused on maintaining timely progress and adapting plans to meet project objectives effectively. (Sabeghi and Tareghian, 2020).

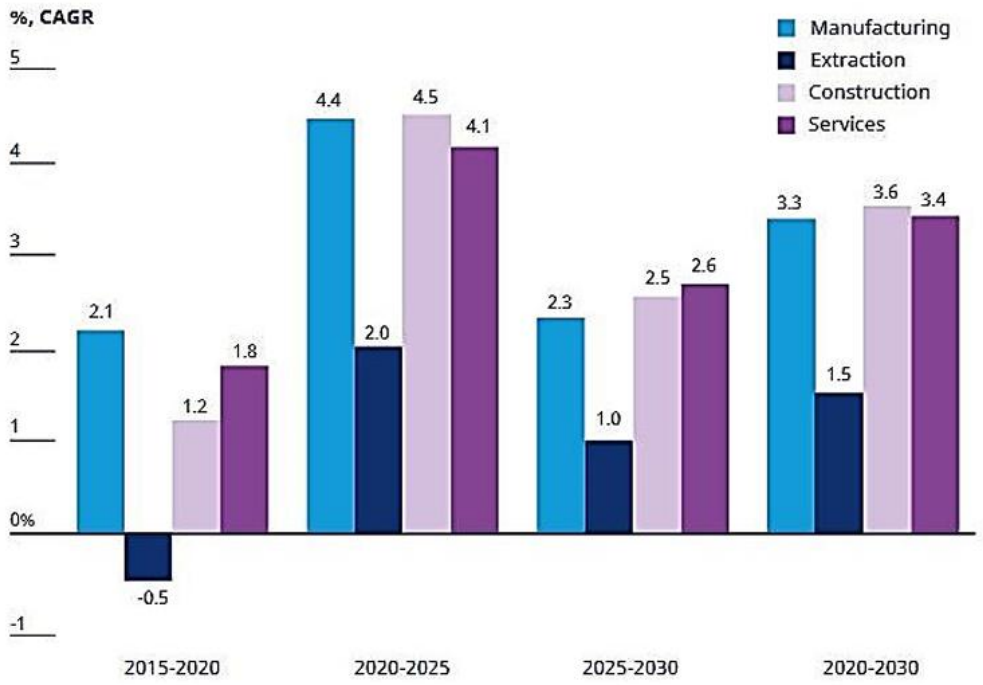
In this paper, schedule control is examined primarily through EVM schedule indicators such as Schedule Variance (SV) and schedule performance index (SPI).

## 2.2. Theoretical Framework EVM

### 2.2.1 Overview of the construction industry

The construction sector serves as a major driver of growth across economies worldwide, although considerable regional variations and challenges exist (The Economy Watch, 2023). The UN Economic Commission for Africa (UNECA) highlighted the construction sector as a key driver of growth in its price watch reports (ECA, 2021). The construction sector was a major contributor to economic growth, recording an average growth rate of 4.40% between 2020 and 2025 and surpassing both the manufacturing and services sectors (Oxford Economics, 2021). As shown in Figure 4, global sectoral growth projections indicate that construction is expected to continue expanding at a rate higher than manufacturing but lower than services during the period from 2025 to 2030.

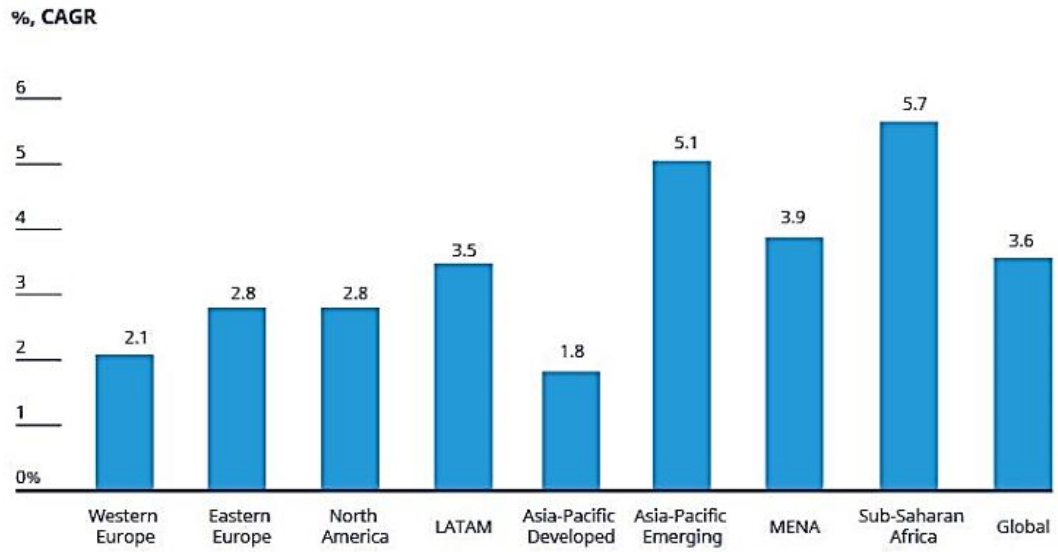
*Figure 4 The Global Sector Growth Between 2015-2030*




*Source: Oxford Economics (2021)*

According to Thrive (2023), the increase in construction output is projected to reach US1.75 trillion between 2020 and 2023. Emerging Asian countries will experience substantial construction growth through 2030, Additionally, the Sub- Saharan Africans are predicted to experience fast regional growth and rapid urbanization (Oxford Economics, 2021). The overall regional rate growth of construction industry is shown in Figure 5.

*Figure 5 Regional Growth Rate of The Construction Industry, 2021-2030*




*Source: Oxford Economics, (2021)*

Despite this substantial growth economic contribution, the construction industry repeatedly faces challenges in project implementation, primarily in schedule delays and cost overruns across both the developed and developing countries (Elghandour *et al*, 2021; Proaño-Narváez *et al*., 2022). These deviations from the project baseline can be undermining the financial viability of project and increase sunk cost for the nation (Tulu, 2018).

The complex and dynamic nature of construction project means a multitude of internal and external factors contribute to these overrun (Proaño-Narváez *et al*., 2022, Dong *et al*., 2025. The most critical factors often fall into three key areas:

**Planning and Management**: issues such as poor initiation, inaccurate cost estimation, design inefficiency and incompleteness, lack of clear scope definition and insufficient resource planning and allocation are highly influencing the cost overrun and schedule slippage (Tulu, 2018; Dong et., 2025).

**Resource and Supply Chain:** factors like material availability and material delivery delay, labour productivity and workmanship quality and availably and price fluctuation of material due to inflations directly impacts project costs and ability to maintain planned schedule (Tulu, 2018; Nejatyan *et al*., 2023).

External Environment: Elements outside the direct control of project team, such as unforeseen site condition, changes in government regulations, economic conditions and cultural ambiguities also contributes its significant risk (Dong *et al*., 2025; Tulu, 2018).

### 2.2.2 Application of Earned Value Management

Earned Value Management (EVM) is a project management methodology introduced in the 1060s and initially adopted by U.S. Department of Defense to integrate scope, cost and schedule performance measurement (Anbari, 2003; Webb, 2003; Dissanayake, 2013). Standard under ANSI/EIA -748, EVM evaluates project health by comparing planned work, completed work, and actual cost, enabling the early detection of performance issues. It supports the calculation of cost and schedule variances, forecasting project outcomes, and implementing corrective actions to maintain project objectives. Today, EVM is widely applied in construction, aerospace, manufacturing, and other industries to enhance project control and resource utilization (Naderpour & Mofid, 2011; Vanhoucke, 2012; Aramali et al., 2022; Proaño-Narváez et al., 2022).

Earned Value Management is widely recognized both as a project performance measurement tool and a project management control methodology, but there is no full consensus on which role predominates. It integrates scope, cost and schedule data to provide objective metrics like SPI and CPI. It enables project managers to monitor progress, forecast outcomes and identify variances early (Anbari, 2003; Czarnigowska, 2008; Sharma, 2013).

As a control methodology, EVM supports decision making by providing factual data to guide resource allocation and corrective actions, thus enhancing project efficiency and reducing risks (Proaño-Narváez *et al*., 2022; Chauhan, 2025; Widyarso *et al*., 2025;). Some researchers highlight that higher maturity in EVM system implementation correlates with better project outcomes, including fewer cost overrun and improved customer satisfaction, stressing its value as a comprehensive control framework (Aramali *et al*. 2023). Overall, EVM functions as both a performance measurement and control tool, with ongoing advancement improving its effectiveness in managing project schedule and cost (Colin *et al*; 2015; Avlijaš, 2022).

According to PMI (2023), EVM is a project management approach that combines scope, schedule, and resource measurements to assess project performance and progress. The methodology differentiates between performance and progress: performance is evaluated by comparing the earned value (budgeted cost of completed work) with the actual cost incurred, while progress is

measured by comparing earned value with planned value. Through continuous monitoring of these metrics, project managers can determine cost and schedule variances, calculate CPI and SPI, and forecast the project's final completion date and total cost.

### 2.2.3 Earned Value Management performance metrics

Earned Value Management (EVM) includes key metrics like cost, schedule and scope to evaluate project performance. The main metrics are Planned Value (PV), which is budgeted cost for schedule work and Earned Value (EV), representing the budgeted cost of work actually completed and Actual Cost (AC) which is the real cost incurred for the work performed (Vanhoucke, 2012; Reza and Khan, 2018; Chauhan, 2025). Vanhoucke (2009) notes that these metrics function as early warning indicators, enabling the rapid identification of project problems or the exploitation of emerging opportunities. Similarly, Wysocki (2019) stressed that they are used to determine both current and cumulative cost and schedule variances throughout the project lifecycle.

Araszkiewicz and Bochenek (2019) presented the fundamental parameters of EVM: Planned Value (PV), Earned Value (EV) and Actual Cost (AC)- before demonstrating how these parameters are used to calculate variances and indices. Similarly, Kim *et al*. (2003) emphasizes the role of these parameters in leading performance measures such as schedule and cost indices, as well as performance forecasting tools. In addition, PMI (2023) distinguishes between the basic data elements (PV, EV and AC) and the derived measures (variances, indices and forecasts). Accordingly, by synthesizing across theses sources, EVM can be understood as comprising two categories, which are Key Metrics for Performance and Progress Measures. Table 1-2 present summarized terminologies, their questions and interpretations and Figure 6 illustrates the main EVM concepts across a time-based framework.

*Table 1 Key Metrics of EVM (based on PMI 2008)*

| A. Basic EVM Metrics | | |
|---|---|---|
| **Metrics** | **Alternative designations** | **Interpretation** |
| Planned value = (PV) | Budgeted cost of work scheduled = (BCWS) | Indicates the approved budget for work scheduled to be completed by a specific date. |
| Earned value = (EV) | Budgeted cost of work performed = (BCWP) | Indicates the value of work performed expressed in terms of the approved budget assigned to that work. |
| Actual Cost = (AC) | Actual cost of work performed = (ACWP) | Indicates the total costs that have actually incurred in each time to accomplish a certain amount of work. |

*Source:* Novinsky *et al. (2018).*

*Table 2 Performance indicators and variances in the EVM technique*

| B. Performance indicators and variances in the EVM technique | | |
|---|---|---|
| **Indicator** | **Equation** | **Interpretation** |
| Schedule Variance (SV) | $SV = EV - PV$ | Variance indicating whether a project is under (positive) or over (negative) budget. |
| Cost Variance (CV) | $CV = EV - AC$ | Variance indicating whether a project is ahead of (positive) or behind (negative) schedule. |
| Schedule Performance Index (SPI) | $SPI = \frac{EV}{PV}$ | SPI measures efficiency in the use of time. If it is less than 1, the project is behind schedule; if it is equal to 1, the project is on schedule, and if it is greater than 1, the project is head of schedule. |
| Cost Performance Index (CPI) | $CPI = \frac{EV}{AC}$ | CPI measures the efficiency with which economic resources are used. If it is less than 1, the project has a higher actual cost than budgeted cost overrun); if it is equal to 1, the project has an actual price equal to the projected cost; and if it is greater than 1, the project has a lower actual cost than budgeted. |

*Source:* Novinsky *et al. (2018).,*

*Table 3 Forecast indicators in the EVM technique*

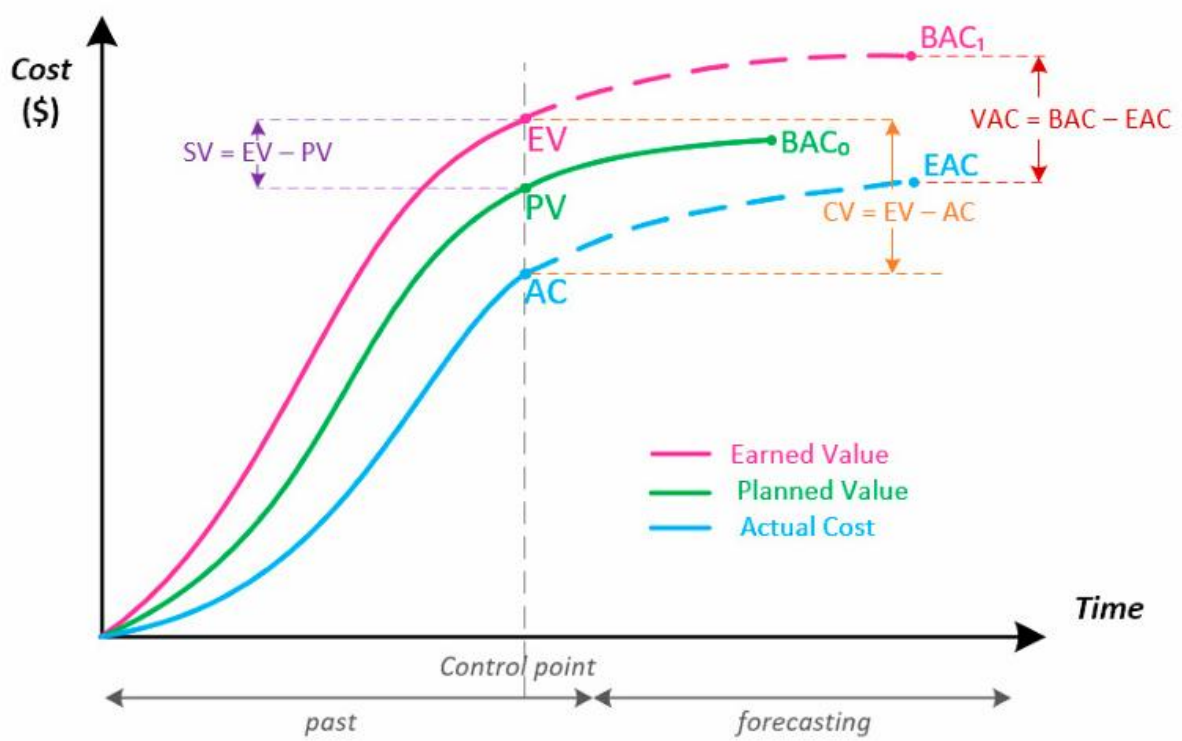
| ***C.* Forecast indicators in the EVM technique** | | |
|---|---|---|
| **Indicator** | **Equation** | **Interpretation** |
| Estimated cost at project completion (EAC) | $EAC = \frac{AC + (BAC - EV)}{CPI}$ | cost in the end if the cost performance index (CPI) remains the same. Indicates how much the project will cost in the end if the cost performance index (CPI) remains the same. |
| Estimated cost to complete the project (ETC) | $ETC = \frac{(BAC - EV)}{CPI}$ | Estimated cost required to complete the remainder of the project. |

*Source: Novinsky et al.* (2018),

| **Additional forecast indicators in the EVM technique** | | |
|---|---|---|
| **Indicator** | **Equation** | **Interpretation** |
| Budget at Completion (BAC) | | BAC represents total budget at completion; at completion PV = BAC. |
| Estimate at Completion (EACt) | $EAC_t = \frac{BAC/SPI}{BAC/months}$ | The estimated completion time for the project if the work continues at the current Performance. |
| Variation at Completion (VAC) | $VAC = BAC - EAC$ | Cash balance at completion |
| To-complete Performance Index (TCPI) | $TCPI = \frac{BAC - EV}{BAC - AC}$ | CPI to recover cost variances from the moment EV and AC are evaluated up to project completion |

*Source: (Huang et al., 2014; Kerzner, 2017; Wauters & Vanhoucke, 2015; Wysocki, 2019).*

*Figure 6 The core EVM concepts over and a specific point of analysis, including Cost Variance.*




*Source: Proaño-Narváez, et al (2022).*

### 2.2.4 EVM: Project performance scenarios

Considering time and schedule along with their possible variance (zero, positive and negative), Vanhoucke (2012) identified nine possible project performance scenarios, which include:

- Scenario 1: late project, over budget
- Scenario 2: late project, on budget
- Scenario 3: late project, under budget
- Scenario 4: on time, over budget
- Scenario 5: on time, on budget
- Scenario 6: on time, under budget
- Scenario 7: early project, over budget
- Scenario 8: early project, on budget
- Scenario 9: early project, under budget

Accordingly, where scenarios occur “on time” and/or “on budget”, they are excluded. Figure 7 below demonstrates the three EVM key primers and the SV and CV metrics under the four-remaining time/cost scenarios. Depending on the SV values, the project could be early or late. The

CV values determine whether the project is over or under budget. Figure 8 displays the three EVM key parameter and the SV(t) metric for an early and a late project scenario.

*Figure 7 The EVM key metrics for early and late projects with cost under- and overruns (Vanhoucke, 2015)*

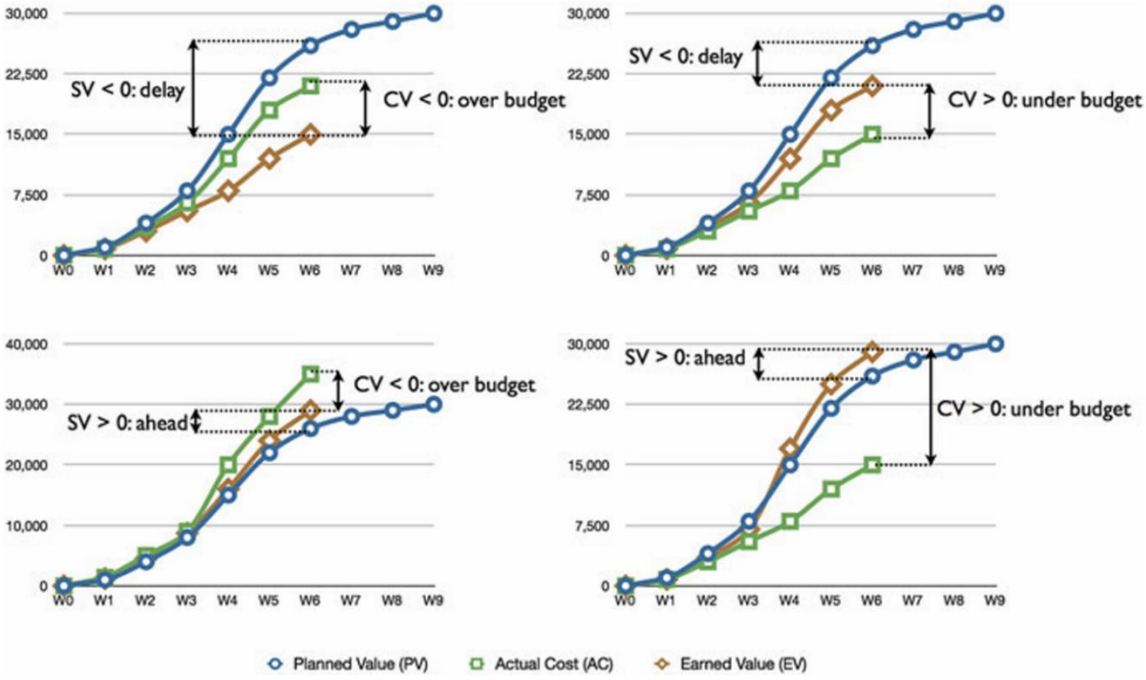
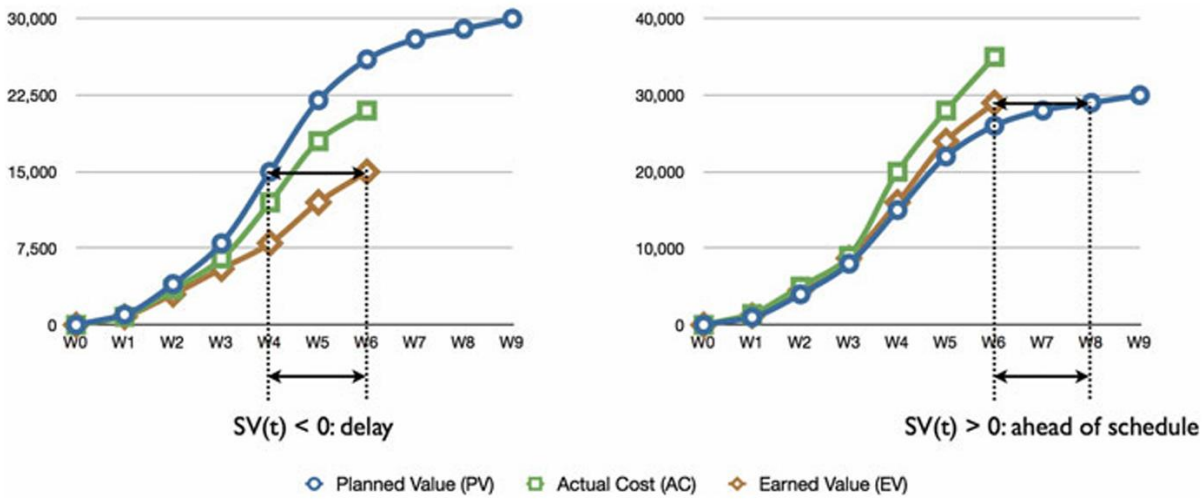


*Figure 8 The PV and EV metrics for a late (left) and early (right) project (Vanhoucke, 2021).*




*Source: Vanhoucke (2021).*

In this study, CV, SV, CPI, SPI and forecasting measures will be used as indicators of cost and schedule performance.

### 2.2.5 Earned Value Management integration

EVM integration in project control system involves drive in Earned Value Management deeply into project processes, including the alignment of scope, schedule and cost baselines, routine calculation of key metrics like Earned Value (EV), Planned Value (PV) and Actual Cost (AC), and the use of EVM indicators in decision making (Chou *et al*., 2010; Colin *et al*. (2015). Integration also extends to linking EVM with digital system such as Building Information Modeling (BIM) and Enterprises Resource Planning (ERP), which enhances the data visualization, cost management and risk/reward sharing among project stakeholders (Chou *et al*., 2010; Elghaish & Abrishami, 2020). Studies show that integrating quality, cost, schedule and risk control through EVM provides more accurate and comprehensive project monitoring, enabling better decision making while maintaining simplicity (Khesal *et al*., 2019). Web based and centralized management system that incorporate EVM facilitates real time access to project data, improving tracking and updating of cost and schedule information (Chou *et al*., 2010; Elghaish & Abrishami, 2020). Furthermore, advanced approaches combine EVM with statistical and multivariate models to improve schedule control and forecasting accuracy, further embedding EVM into project control frameworks (Colin *et al*. 2015; Batselier and Vanhoucke, 2017). Overall, effective EVM

integration supports a holistic and data driven project control environment that aligns technical metrics with strategic project goals (Acebes *et al*., 2014; Colin *et al*. 2015; Elghaish & Abrishami, 2020).

Accordingly recent studies conceptualize integration as:

***a. Alignment of scope, schedule, cost baselines***

Fully integrated EVM requires alignment of project scope, schedule and cost baseline within a unified performance measurement Baseline (PMB); this means that the Work Breakdown Structure (WBS), activity duration and budget duration distribution must be coordinated to create a single baseline that supports consistent performance measurement and control (Zhang and Minchin, 2022). Thus, it is essential to ensure that project control activities are based on consistent and integrated data, enabling reliable forecasting and control (Lohman *et al*., 2004; Robson, 2004).

***b. Routine calculation of EV, PV and AC***

The integration Earned Value Management refers to the regular computation of earned value (EV), planned value (PV), and actual cost (AC), often weekly or monthly basis, based on actual project progress and updated cost (Naeni *et al*., 2011; Mahmoudi *et al*., 2021). Elghaish *et al*. (2019) explain that such routine calculation allows variances to be detected early, enabling proactive decision making rather than reactive correction. Integrated practice requires that these calculations are embedded in project reporting cycle.

***c. The use of EVM indicators in decision making***

Integration goes beyond calculation; it extends to how results (CPI, SPI, CV, SV, EAC and ETC) are used to influence managerial decision-making process. EVM provides early warning of cost and schedule variance, enabling project managers to take timely corrective actions that optimized resource allocation and improve the likelihood of completing project on time and within budget (Koke and Moehler, 2019; Chauhan, 2025).

Zhang and Minchin (2022) explain that in highly integrated environment, EVM indicators are discussed in management meetings, used for corrective actions and influence planning adjustment. When organizations fail to use EVM metrics for decisions, EVM becomes a “mechanical reporting actives” rather than a true control mechanism.

### *d. Integration with digital systems*

Modern EVM integration requires that EVM data support ties to digital platform capable of managing baselines, tracking progress and automating calculation. In contemporary construction projects, most widely used software tools that facilitate EVM implementation are Mycroft Project and Primavera P6 and various project management information softwares (PMIS) (Abubakar *et al*, 2020; Al-Jibouri *et al*, 2021).

According to Elghaish *et al*. (2019), integrating EVM with digital technologies automates progress tracking, enhances data reliability, improves visualization of performance and reduces manual errors. Digital integration is increasingly viewed as a foundation for accurate EVM adaption in the contemporary of construction projects.

### *e. Cost performance*

Cost performance in project management is objectively measured using metrics such as CV, Cost CPI and EAC, which show the extent to which actual cost deviate from the planned budget in relation to project progress (Chauhan, 2025; Widyarso *et al*., 2025). Effective cost performance is achieved when a budget remains within budget while meeting planned progress targets, which is essential for overall project success and supported by continues monitoring and timely corrective actions (Ronald and Lumbantoruan, 2019; Nazaruddin *et al*., 2025; Widyarso *et al*., 2025).

## 2.2.6 Schedule performance

Schedule performance compares actual work progress against the planned schedule, typically measured by Schedule Variance (SV), Schedule Performance Index (SPI) and schedule forecast (Estimate at completion) (Vandevoorde *et al*., 2006; Panchal, 2023) and good schedule performance implies timely completion or minimal slippage (Vanhoucke, 2021).

## 2.2.7 The function of Earned Value Management (EVM)

To mitigate the persistent problem of budget overruns and schedule delays, a robust monitoring and controlling mechanism is essential (Nejatyan *et al*., 2023). Earned Value Management is a widely accepted project management approach that provides a quantitative, objective framework for monitoring project performance (Deng and Jian, 2022; Proaño-Narváez *et al*., 2022). According to Netto *et al*., (2020), EVM is important because it combines project scope, schedule and cost into a single integrated set of metrics, commonly known as the “iron triangle” or triple

constraint (Netto *el al*., 2020). It evaluates PV, EV and AC at any point in time, enabling project managers to:

**Timely Detect Variance:** EVM functions as an early warning mechanism that enables timely detection of cost and schedule performance before they develop into major problems (Elghandour *et al*., 2021).

**Performance Forecasting:** EVM utilizes key performance indicators like the Cost Performance Index and Schedule Performance Index (SPI) to accurately forecast the project's final cost and duration (Deng and Jian, 2022; Proaño-Narváez *et al*., 2022).

**Facilitate Corrective Action:** The clear and objective data provided by EVM enables project managers to make timely and informed administrative decisions to bring the project back in line with its baseline, thus improving the probability of project success (Proaño-Narváez *et al*., 2022).

While the benefits of EVM are clear, its effective application requires addressing barriers such as a lack of knowledge or expertise and ensuring top management support for the process (Netto *et al*., 2020). Nevertheless, incorporating EVM provides a vital link between acknowledging the construction sector critical economic role and proactively managing the project level issues that threaten its success.

In addition, a thorough study by Fleming and Koppelman (2010), found that after undertaking 20% into a project, it is possible to use current performance to estimate the project s future with a plus or minus 10% variation. Thus, EVM is one of the strongest project cost control measures accessible because of its strong predictive capability. EVM provides information for proactive management actions, by linking technical, time and cost performance and gives managers a summary of successful decision making. In also provides basis for evaluating work progress against a baseline plan.

According to Netto *et al*. (2020), EVM offers more data than standard project tracking does. By responding to the query *"Have we reached where we want to be in the project?"* it goes one step further and "*when will this project be completed?",* it makes it easier to pinpoint the current position in the project and determine when it will be successfully completed. To respond to problems early on and keeping the project on schedule, the value-added strategy creates greater

visibility and control over the project operations. It promotes project visibility and accountability and enables clear communication of the tasks involved.

### 2.2.8 The role of EVM in the integration of Schedule Control & Cost Control

According to Hasan *et al*. (2021a) and Proaño-Narváez *et al*. (2022), effective integration of EVM in schedule and cost control provides comprehensive project performance insights, enabling early detection and for timely correction to keep projects on track and within budget. This, integration enhances decision making by combining cost and schedule data into unified performance indices, such as CP) and SPI, which helps to track progress and project outcomes more accurately (Hasan *et al*., 2021b) and (Proaño-Narváez *et al*., 2022). Studies indicate that EVM in construction project helps control schedule and cost deviations, thereby improving resource management and project effectiveness (Oliveira, 2019; Bahrudin *et al*., 2025).

Overall, effective EVM integration fosters proactive management, reducing uncertainty and increasing the like hood of successful project completion on time and within budget (Hasan *et al*., 2021b; Proaño-Narváez *et al*., 2022).

### 2.2.9 Factors that affect EVM

Aramali *et al*., (2021) conducted a large-scale survey and validate and ranked the EVM environment factors based on their perceived impact on EVMs effectiveness. This analysis yielded a set of five paramount critical EVMs Environmental factors essential for achieving a high performing EVMS. These factors are summarized into the Table-5. below:

*Table 4 Critical factors of EVMs environment*

| Rank | Critical Factor | Description |
|---|---|---|
| 1 | Organizational Culture | The inherent organizational culture, in which includes fostering essential values such as trust, honesty and shared accountability. |
| 2 | Efficient EVMS development process and tools | The presence of a formal and structured process of preparing the EVMs and the effective implementation of suitable planning tools. |
| 3 | Leadership's past EVMs experience | The prior experience of leadership in the planning, design and execution of an EVMs on projects or programs of comparable size and complexity |
| 4 | Define, effective and accountable leadership | Clearly definition of role, demonstrable effectiveness and established accountability mechanism with the leadership structure. |
| 5 | Quality and level of data | The crucial requirement for accurate and timely data availability to feed the EVMs and support subsequent analysis. |

*Source: Aramali* et al. *(2021).*

These critical factors underscore that the success of EVMS is less dependent on the mathematical model of Earned Value itself. It is rather heavily reliant on the socio technical components of people, processes and organization commitment that support the systems deployment and utilization (Aramali *et al*., 2021).

## 2.3. Empirical Literature Review

This part critically examines the empirical studies that are directly relevant to the research topic/objective, which is the effectiveness of EVM integration in construction projects, and the measured the impact of EVM on cost and schedule control performance. The review is structured from global evidence to regional (developing countries) to local Ethiopian studies.

Many international studies shows that structured and routine uses of EVM improves early detection of cost and schedule variances and accordingly they support more accurate forecasting, which in turns reduces cost overrun and schedule delays when corrective action follows the indicators. The studies also show that projects with integrated baseline and routine EVM reporting

achieve more timely corrective decisions (Anbari, 2023; Fleming & Koppelman, 2010; Vanhoucke, 2009).

In addition, Wahyudiono & Utari (2025), Proaño-Narváez et al. (2022) supports that EVM improves project control by providing reliable metrics, which helps optimize budgets and resource allocation, particularly in construction and maintenance project.

Recent quantitative work extends these findings, for example, Vanhoucke's (2009) emphasizes that adopting EVM based schedule and forecasting tools reduces schedule uncertainty and improves predictive accuracy (measured by reduce forecast error), particularly when Earned Schedule variations are used alongside CPI/SPI metrics. Proaño-Narváez (2022) and Yalçın (2024) show that refined EVM metrics and machine learning enhanced EVM forecasting can significantly increase the reliability of cost estimates in contexts with large datasets. These advanced confirms that EVM is effective where data quality, baseline discipline and analytical capability.

Sunarti *et al*. (2018) reported that 52% of respondents in their study utilized EVM. Within this group, 6% applied it to minor projects, 28% reserved it for critical activities, and 18% adopted it as an organizational standard for all project monitoring. Conversely, 48% of respondents didn't use EVM. The study by Kim *el al*. (2003) examined EVM adoption among public and commercial building projects. Their findings revealed that 82% of respondent endorsed EVM use, with 52 % representing the public sector. Furthermore, a majority of these professionals maintained that EVM provides considerable benefits to both large and small-scale projects.

To understand how Colombian public project managers perceive and use EVM, Proaño-Narváez et *et al*., (2022) analyzed survey of public project managers in the region of Latin America. The findings showed that just around 33% of EVMs were used; and the progress report and other conventional ideas were more popular. Because they hadn't established control procedures, about 19% of managers didn't use any performance measurement systems in many instances.

Sunarti *el al*., (2018) identified three primary barriers to implementing EVMs; these are lack of experience and expertise, reported by 14% of respondents, followed by a lack of top management support (12%) 11% and the tedious nature of data collection (11%).

Additionally, Mahmoudi *et al*., (2021) identified barriers to EVM adoption in construction, including high implementations costs, subjective on-site progress assessment, and challenges in

integrating cost and time data. Ultimately, this limits widespread use, as many practitioners lack familiarity with the tool. To address these hurdles, Netto *et al*. (2020) recommended educating project participants, establishing clear work protocols, and using software for data capturing. In addition, Kim and Reinschmidt (2011) emphasized that strict discipline in data collection and information management is crucial for EVM effectiveness. Although maintaining this discipline raises initial operating costs, the long-term project benefits easily offset the investment.

Research by Valle et al. (2004) illustrates that implementing EVM significantly improved project cost control, ultimately ensuring it was delivered on schedule and within financial constraints. The authors identified three primary factors driving this success: the alignment of the work breakdown structure with the chart of accounts, the use of performance indices to facilitate negotiations and scope adjustments, and the meticulous cleansing of data used for analysis. Furthermore, López *et al*., (2019) noted that the success of the method during the project execution project, despite early warnings from performance metrics, relied primarily on the proactive decisions made by project leaders to keep costs and schedules on track.

Similarly, Aramali *et al*., (2021) suggest that the EVM approach can serve as a valuable tool for project ovesight. However, its practical application heavily depends on several variables, with the most critical being organizational culture that fosters active stakeholder participation. An effective EVM implementation can enhance processes like planning, scheduling and change control by generating early warnings for potential cost deviations or delaying.

Alemayehu (2018) evaluated the control tools and techniques used by grade one contractors against those outlined in the PMBOK. The study found limited uses of many construction control methods, especially EVM. However, experienced practitioners frequently use project management software. The researcher recommended that contractors adopt control techniques best suited to their projects.

Mulugeta (2017) calculated project variance, efficiency and forecast indicators, and compared the effectiveness of EVM approach with traditional methods. The author suggested that the construction company can improve project performance by adopting EVM.

Getahun *et al*. (2025) evaluated EVM in Amara Water Works projects and found that while EVM metrics could be computed for a subset of projects, the sample revealed serious gaps in a baseline availability, inconsistent updates and limited managerial uses of CPI/SPI for corrective action.

Similarly, Demere (2023) examined the EVM practices in a single Ethiopia firm and found that partial adoption produced modest improvements in monitoring but that it's inconsistent documentation and lack of standardization procedures limit its usefulness.

The review of exiting studies reveals that while project monitoring and controlling practices have been examined in the country, specific role and effectiveness of EVM integration on Schedule & Cost Control, however, has not been adequately addressed.

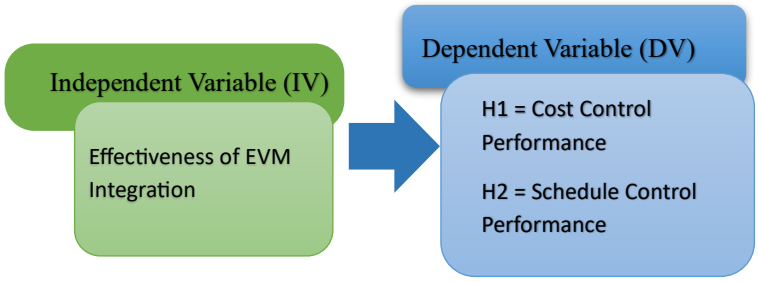
## 2.4 Conceptual Framework

The study's conceptual framework was synthesized by the researcher from recognized EVM practices and supporting empirical findings. It integrates theoretical insights from the Project Management Institute (2021), performance measurement concept from Anbari (2023) and validated constructs from international studies on EVM benefits and critical success factors (Aramali et al., 2021; Naizghi et al., 2025; Netto et al., 2020). Conceptual findings from Ethiopian construction research used to further strengthen the framework (Demere, 2023; Reda et al, 2025).

The framework posits that key factor influencing the EVM integration in private building projects. EVM integration, in turns, expected to enhance project performance outcomes, specifically cost control and schedule control.

By grounding the framework in internationally recognized EVM theory (PMI, 2021; Anbari, 2023; Fleming & Koppelman, 2010), validated empirical studies on adoption barriers and critical success validated empirical studies on adoption barriers and critical success factors (Aramali et al., 2021; Naizghi et al., 2025; Netto et al., 2020), and adapting it to the Ethiopian context (Mulugeta, 2017; Demere, 2023; Reda et al, 2025), the study ensures both theoretical rigor and contextual relevance.

*Figure 9 Conceptual Framework*




*Source: Developed by the researcher based on Anbari (2003), PMI (2021), Netto et al. (2020), Aramali et al. (2021), Naizghi et al. (2025), Abel Demere (2023), and Reda et al. (2025).*

# CHAPTER THREE

# 3. RESEARCH METHODOLOGY

## 3.1 Description of the Study Area

The research was conducted in Addis Ababa, the country's major commercial, financial and construction hub. Building construction in Addis Ababa is rapidly expanding, with most growth in private sector projects such as real estates. The construction industries in the city are characterized by high project volume, increased competition and frequent challenges on budget escalation, document inefficiencies and scheduled delay and limited adoption of modern project control system such as Earned Value Management (EVM) (Mulugeta, 2017; Demere, 2023; Getahun *et al*., 2025).

The choice of the location for study area is justified by the concentration of private building constructions which are actively undertaken from medium to large scale building projects. Accordingly, these projects provide a relevant context to assess and evaluate EVM integration, since cost and schedule variances are frequently reported, making the environment suitable for examining the effectiveness of EVM as a performance control tool.

## 3.2 Research Philosophy and paradigm

This study was based on epistemology philosophy in which it focuses on how knowledge about the effectiveness of EVM integration can be obtained objectively. Since the research seeks measurable, observable facts, like the extent of EVM application, cost variance performance and schedule variance performance, epistemology philosophy is considered appropriate.

The study adopted a positivism paradigm in which it assumes that the reality is objective and measurable, and it is independent of the researcher. Positivism is consistent with the quantitative nature of this study. It collects structured data through questionnaires and applies statistical techniques to test the hypotheses. Under this paradigm, the researcher remains detached and unbiased, by ensuring the findings are based solely on empirical evidence.

## 3.3 Research Design and Approach

There are numerous research designs applicable for assessing building projects (Deb, 2019; Kothari, 2004). Assessing construction projects can use quantitative (surveys, experiments), qualitative (interviews, observations), or mixed methods approaches, focusing on criteria like time, cost, quality, safety, and sustainability. This study deployed a descriptive and correlational research design. The descriptive components identifies the current extent of EVM integration and key challenges that limit the effective adoption of EVM in private building construction projects. On the other hand, the correlational component examines statistically whether EVM integration significantly influence cost and schedule control performances.

The research followed a survey design, in which it used standardized questionnaires to collect quantifiable data from professionals engaged in private building projects in Addis Ababa. The time dimension is cross sectional. The design is appropriate because cost and schedule control performance levels of EVM can be measured numerically and analyzed statistically.

The study followed a deductive approach, in which it moved from theory to empirical observation. Deductive approach is considered appropriate because the study seeks to validate theoretical relationship through measurable variables.

## 3.4 Type and Sources of Data

### Primary Data

Structured questionnaire was administered to project managers, office engineers, resident engineers, cost and contract engineers, consultant in supervision firms and planning and monitoring engineers working on private building projects in Addis Ababa. Primary data are appropriate because the variables such as EVM integration level and the key challenges that limit the effectiveness in adoption and utilization of EVM must be directly assessed from practitioners.

## 3.5 Sampling

### 3.5.1 Population, sampling frame and sampling unit

The population consists of professionals that are involved in private building construction project in Addis Ababa, including:

- Project managers

- Project office engineers
- Planning and monitoring engineers
- Cost and contract engineers
- Resident engineers
- Consultant in supervision firms

These individuals are decision makers and practitioners responsible for monitoring cost and schedule performance.

Since Addis Ababa Construction Permit & Administration Office do not maintain a publicly available or comprehensive registry of all active private building construction projects, it was not possible to construct a complete formal sampling frame. Therefore, a practical frame was developed by identifying accessible organizations actively involved in private building construction. These included:

- Major private contractors (Grade 1 to Grade 4) engaged in real estate projects.
- Private real estate developers that are undertaking medium to high-rise building projects
- Engineering consulting firms that supervise or manage private building projects.

This sampling frame was considered appropriate, given the absence of a centralized project database in Addis Ababa and ensures that the sample reflects professionals with relevant roles and experience applicable to the study.

The unit of analysis is projects, each project is represented by individual professional working on current private Real Estate building projects who provides project level data on cost and schedule performance.

### 3.5.2 Sampling size determination

For this research since the total population size is unknown, the sample size was determined using Green's Rule of Thumb for regression analysis, which is widely acceptable for explanatory studies. Green (1991) recommends a minimum sample of $N \geq 50 + 8m$ where m is number of predictor variable.

This study examines EVM integration, or the model testing EVM integration's effect on cost and schedule performance controls, which likely involve $m = 1$ predictors. For $m = 1$ predictors, the

recommended minima are $N \geq 58$ (Green, 1991). However, only 54 were obtained and included in the study. While large sample improves generalizability, this threshold ensures sufficient statistical power for regression analysis.

Although the initial target followed Green's (1991) rule for regression ($N \geq 30$), the final analytical sample of 35 is statistically justified. According to Hogg and Tanis (2009), a sample size exceeding 30 satisfies the Central Limit Theorem for normality. Furthermore, Hair et al. (2010) suggests that a ratio of at least 15:1 observation per predictor is adequate for multivariate analysis; this study maintains a robust 35:1 ratio. The use of a multistage purposive sampling technique is further necessitated by the lack of a centralized sampling frame in Addis Ababa, a condition supported by Kothari (2004) for research in environments where formal registries are unavailable."

### 3.5.3 Sampling technique and procedure

Given the absence of a complete and formally published sampling frame of active private building construction projects in Addis Ababa, this study adopted a multistage nonprobability sampling approach with elements of controlled randomness to ensure relevance, analytical rigor and practical feasibility.

**Stage 1: Project stratification**

To ensure coverage of diverse private building project characteristics, projects were first classified into strata based on functional type.

- Residential apartment and real estate development projects.

This stratification has been applied to enhance analytical representation across major private building project categories, rather than to achieve statistical representativeness of the entire population.

**Stage 2: Project Selection**

Within each project category, active private building projects was identified purposively based on accessibility and the presence of formal cost and schedule control practices. This ensures that only projects with sufficient exposure to project control activities relevant to Earned Value Management (EVM) will be included in the study.

**Stage 3: Respondent Selection**

At the selected project site, simple random sampling was applied to select individual respondents (such as a project manager, office engineers…) from the pool of professionals directly involved in cost and schedule management. This step was employed to reduce selection bias at the respondent level and to enhance internal validity of the data collected.

In general, this multistage sampling procedure was adopted to ensure analytical coverage across key private building project types, to include respondents with direct and relevant project control experiences and to maintain practical feasibility under time and resource constraints.

Given the probability nature of project selection, findings from this study were interpreted as analytically generalizable to similar private building project context rather than statistically generalizable to the entire population of construction projects in Addis Ababa.

## 3.6 Data Collection, Sources, Types and Instruments

This study has employed a quantitative data collection approach to address the research objectives and test the stated hypothesis. Data was collected using primary and secondary source, in which the primary data served as the main basis for analysis.

### 3.6.1 Primary data collection method

Data was collected through a structured self-administered questionnaire (Annex 1). The questionnaire was selected because it enables the systematic collection of standardized data from a relatively large number of constructions professionals within a limited time and budget. This method was appropriate for measuring practices, perceptions and performance indicators related to EVM integration and project performance.

The questionnaire items were adapted from validated instruments and empirical studies related to EVM, project control and construction performance. Adaption was undertaken to ensure contextual relevance to private building construction project in Addis Ababa. The original source of measurement scales was clearly acknowledged and cited.

The adaption processes involved:

- Aligning item wording with the local construction context
- Maintaining the original conceptual meaning of constructs

- Ensuring consistency with the objectives and hypothesis

To ensure the validity of the questionnaire, its items were developed based on established practices in prior empirical studies of EVM in construction projects. The constructs measured current practice of EVM integration, effects on cost and schedule control, and challenges in adoption are consistent with instruments used in Ethiopian and international research.

For example, Reda et al. (2025) employed questionnaires and interviews to evaluate EVM adoption and project performance in Amhara Water Works projects, confirming the suitability of survey instruments for measuring EVM effectiveness. Similarly, Alemayehu (2016) applied structured questionnaires to assess EVM application in building projects at Jimma University, demonstrating the relevance of survey-based data collection in the Ethiopian construction context. Ayalew and Ayalew (2024) integrated survey instruments into their fuzzy-based EVM performance model, highlighting the importance of organizational readiness and digital maturity, which are reflected in the background section of this study's questionnaire. Furthermore, Naizghi *et al*. (2025) identified barriers such as lack of training, weak management commitment, and policy gaps using questionnaires, supporting the inclusion of Section E on challenges in EVM adoption. Finally, the Project Management Institute (2021) was considered, which provides standardized definitions of EVM metrics (CPI, SPI, CV, SV, EAC, ETC), which underpin the measurement items in Section A.

By adopting constructs and items validated in these previous studies, the questionnaire attempted to achieve both content validity (covering all relevant aspects of EVM practice, effects, and barriers) and construct validity (ensuring that the items measure recognized EVM concepts). This alignment with prior research strengthens the reliability of the instrument and ensures that the findings can be meaningfully compared with existing literature.

The survey questionnaire has been pretested to ensure that it is valid, reliable, and clear by identifying confusing questions, technical glitches, and biased answers before full deployment, using expert reviews and small-scale data collection to refine wording, logic, and design for better quality data.

Furthermore, structured interview has been undertaken with 12 respondents, including project managers, project office engineers, planning and monitoring engineers, cost and contract engineers, resident engineers and consultant in supervision firms, one each from private real estate

building projects. For semi-structured interviews in building projects, common recommendations for a single study range from 5 to 30 participants, depending heavily on the study's specific context and goals. Creswell (1998) recommendation also ranges between 5 and 25 interviews for a phenomenological study and 20-30 for a grounded theory study. To Kuzel (1992), taking sample heterogeneity and research objectives under consideration, 6-8 interviews are suggested to be enough for a homogeneous sample and 12 to 20 when trying to achieve maximum variations. According to Bernard (2013) there is growing support that 10-20 key research participants are enough to uncover and understand the major issues in any study of lived experience.

### 3.6.2 Data collection procedure

Data was collected by distributing questionnaires to randomly selected respondents working on active private building construction projects. Respondents were briefed on the purpose of the study and participation on voluntary basis. Completed questionnaires have been checked for completeness before data entry to minimize error and missing responses.

## 3.7 Data Validity and Reliability

Ensuring validity and reliability of data is essential for producing credible and trustworthy generalizable research findings. In this study, several measures were adopted to enhance the quality, accuracy and consistency of the collected data.

### 3.7.1 Validity

Validity is the extent to which a measuring instrument accurately captures the specific concept it is designed to evaluate, confirming that the collected data reflects true variations among subjects (Dubey & Kothari, 2022). Content Validity is ensured by developing the questionnaire items based on well-established concept, frameworks and empirical studies related to EVM and construction project cost & schedule control performance. Thus, measurements were adopted from previous validated instruments used in construction management and project control research. This ensures adequate coverage of key dimensions of the research objectives in this study.

Construct Validity was addressed by clearly operationalizing all study variables and align them with the conceptual framework and research hypothesis. Each construct was measured using multiple items to capture its theoretical dimensions comprehensively. The use of regression

analysis further supports construct validity by examining whether the observed relationship between IV and DV conforms to theoretical expectations.

Face validity was considered through careful questionnaire design to study objective and the construction industry context. Ambiguous, leading or technically complex wording were avoided to minimize respondent misunderstanding.

### 3.7.2 Reliability

Reliability as defined by Dubey & Kothari (2022) refers to how consistent and dependable a measurement or scale is. It is considered reliable when the outcome of measuring process is reproducible across repeated measurements.

After data collection was employed, the internal consistency of each construct was evaluated using Cronbach's alpha coefficient (Table 7). A Cronbach's (1951) alpha ($\alpha$) value of 0.70 or higher was considered acceptable, indicating that items within each construct reliable measure the same underlying concept.

Accordingly, the alpha value of the constructs is shown in Table 7.

*Table 5 Cronbach's alpha values*

| Item No. | Variables | Cronbach's Alpha |
|---|---|---|
| 1 | Earned Value Management (EVM) Integration | .937 |
| 2 | Effect of EVM on Cost Control | .726 |
| 3 | Effect of EVM on Schedule Control | .717 |
| 4 | Challenge in EVM Adoption | .877 |

### 3.7.3 Data quality control

To enhance data quality and minimize potential errors, the following procedures were implemented:

- Questionnaires were checked for completeness before data entry
- Data cleaning, coding and entry was carefully performed to avoid errors

- Inconsistent or extreme response was screened during data cleaning
- Missing data were addressed using appropriate statistical techniques.

### 3.7.4 Methods of data analysis

Data collected were coded, cleaned and analyzed using IBM SPSS version 27 statistical software.

Descriptive statistical analysis was used to summarize respondent characteristics and key study variables as follows:

- Frequencies and percentage to describe respondent profiles and project characteristics.
- Mean value to assess the level of EVM application and key challenges that limit the effective adoption of EVM.
- Standard deviation to examine the variability of responses

Inferential statistical analysis was conducted using Correlation and simple linear regression models to test the study hypotheses and examine causal relationship among variables. Specifically:

- Regression analysis was used to assess the effect of EVM integration on cost control performance
- Analysis also examined the effect of EVM integration on schedule control performance

Regression analysis allows estimation of the magnitude, direction and statistical significance of relationships while controlling other variables.

## 3.8 Ethical Consideration

The researcher ensured that participation was entirely voluntary. Individuals were informed that they could withdraw at any time without prejudice and were treated with dignity and respect.

In addition, the participants received total anonymity to guarantee that they got complete secrecy, and identifying codes were used instead of name. Prior to data collection, respondents received detailed information regarding the research objectives and expectations. Finally, collected data was kept confidential, used exclusively for the study purpose, and restricted from third-party for any other use.

# CHAPTER FOUR

# 4. RESULTS AND DISCUSSION

This chapter presents the empirical findings, analysis and interpretation of data collected to evaluate the effectiveness of EVM integration in the cost and schedule control of private real estate building projects in Addis Ababa. The primary objective is to interpret the collected data in a manner that address the core research questions and test the hypotheses formulated in the first chapter.

The chapter is organized into subsections: it begins with the presentation of repose rate and demographic characteristic of respondents, followed by descriptive statistic of the study variables. Finally inferential statistical analysis is conducted to estimate relationship and effect between EVM integration and project control in terms of cost and schedule control.

## 4.1 Response Rate

To ensure the reliability of findings, the response rate was calculated against number of questionnaires distributed. Structure questionnaires was employed to a purposively selected sample of 58 construction projects from 31 different organizations and given to randomly selected project professionals working in the project (i.e. Project Managers, Project Office Engineers, Mentoring and Controlling Engineers). Out of the 58 distributed questionaries, 54 were successfully completed and returned, representing a response rate of 93.1%. According to academic standards for social science and management research, a response rate above 70% is generally considered excellent (Mugenda, 2003). This high level of participation significantly minimizes the potential for non-response bias which ensured that the findings of the research are repetitive of the targeted population within Addis Ababa, Ethiopia construction industry. Consequently, the data collected is deemed to robust and sufficient for performing subsequent descriptive and inferential analyses.

## 4.2 Demographic Profile of Respondents

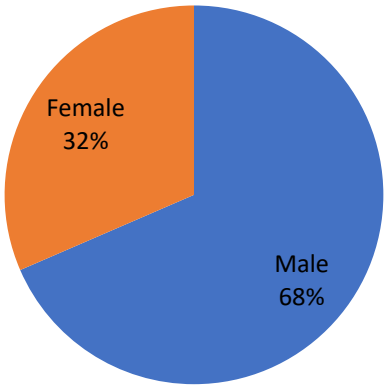
The research assessed demographic characteristics to contextualize the results of the study. Accordingly, the demographic characteristics of the respondents and sampled project were computed. Demographic information provides insight into the background of participant and

project, which ensures that the results are interpreted within the realities of the construction industry. Variables such as company grade classification, gender, level of educational of respondents, years of professional experience, role of respondents in the industry, company size and others help to know representativeness of the sample. This descriptive analysis not only highlights the diversity of respondents but also strengthens the credibility of the following inferential statistics, as it demonstrates that the participants reflect the actual workforce engaged in construction project management in Addis Ababa real-estate development projects.

### 4.2.1 Gender and educational background

Figure 10 shows the distribution of respondents by sex. The majority were male (68.5%), whereas females accounted for 31.5% of the sample. This pattern reflects the proportion of men and women within the workforce. In agreement with this work, studies on sex distribution in Ethiopia's construction sector reveal a strong male dominance, especially in management roles across both public and private projects (Elizabeth, 2022; Hailu, 2019). Several barriers limit women's entry into construction management in Ethiopia, rooted in cultural, institutional, and workplace factors. These challenges persist despite growing female participation in lower-level construction roles. Gender stereotypes portray construction as a male domain, discouraging women from pursuing related education or careers; families and communities often reinforce this bias (Macabodbod *et al.*, 2017).

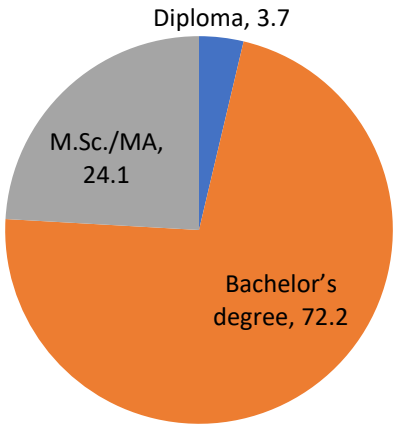
*Figure 10 Proportion of respondents by sex.*




Likewise, the educational profile reveals that the majority of respondents hold first degree (72.2%), followed by those with master's degree (24.1%), while a small proportion (3.7%) reported holding

a diploma (Figure 11). This distribution aligns with the academic requirement and professional standards within the Ethiopia construction sector. Studies on educational profiles in Ethiopia's construction sector confirm a predominance of bachelor's degrees among professionals, aligning with the current data (Tewodros, 2023).

*Figure 11 Proportion of respondents by educational level.*




### 4.3.2 Professional role and experience

Table 6 shows the distribution of respondents by organizational role. Project office engineers (37.0%) and project managers (29.6%) account for the majority of the sample, a finding that that underscores the central involvement of these roles in project execution and management. This is particularly relevant for cost and schedule control activities, where Earned Value Management (EVM) is most applicable. Planning and monitoring staff (16.7%) and resident engineers (9.3%) also represent significant proportion of the respondents. By contrast, cost and contract engineers (5.6%) and Consultant in supervision engineer (1.9%) represent smaller segments. Overall, the respondent profile reflects a concentration of expertise within project management and monitoring, thereby bolstering the applicability of the study's findings to EVM integration in real estate development projects (Adham and Sukkar, 2024; Tewodros, 2023).

*Table 6 Distribution of respondents and their role in their organization*

| Respondents | Frequency | Percent |
|---|---|---|
| Consultant in supervision engineer | 1 | 1.9 |
| Cost and contract engineer | 3 | 5.6 |
| Planning and monitoring engineer | 9 | 16.7 |
| Project manager | 16 | 29.6 |
| Project office engineer | 20 | 37.0 |
| Resident Engineer | 5 | 9.3 |
| Total | 54 | 100.0 |

As presented in Table 7, the distribution of respondents by organizational work experience shows that nearly half (46.3%) have less than five years of experience, indicating a young and emerging workforce in the construction industry. Meanwhile, a quarter of the respondent reported five to ten years of experience (24.1%) and another quarter (24.1%) reported ten to fifteen years. These data indicate that a significant portion of the sample comprises mid-career professionals with substantial exposure to project management practices. Only a small portion (5.6%) possessed more than fifteen years of experience, reflecting a limited pretense of senior professionals. This composition highlights that the study primarily captures the perspectives of early to mid-career practitioners. This aligns with the dynamic nature of real estate development project in Addis Ababa, where younger professionals are increasingly engaged in cost and schedule control activities (Hana, 2024; Hani, 2023; Tewodros, 2023).

*Table 7 Distribution of respondents by organizational work experience*

**Work Experience in the Organization**

| | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| 0 – 5 Years | 25 | 46.3 | 46.3 |
| 5 – 10 Years | 13 | 24.1 | 70.4 |
| 10 to 15 Years | 13 | 24.1 | 94.4 |
| Above 15 Years | 3 | 5.6 | 100.0 |
| Total | 54 | 100.0 | |

### 4.3.3 Company category and digital maturity

As indicated in Figure 12, the analysis show that majority of the participants (70.4%) were from Grade-1 (GC-1) companies, a heavy, yet intentional bias toward higher-grade contractors representing the highest classification in the Ethiopian construction sector. This concentration reflects the central role of large, established contractors in high-value project execution and management. An additional 25.9% were affiliated with GC-4, while 3.7% came from GC-3 firms. The strong representation of top-tier contractors aligns with the reality of the Addis Ababa construction market, where major projects are dominated by GC-1 firms. These are heavily involved in massive projects and high-rise developments (Ministry of Urban and Infrastructure), 2025. Consequently, this sample composition strengthens the relevance of the findings; given their extensive experience in cost and schedule control, GC-1 companies provide robust insights into the effectiveness of Earned Value Management (EVM) integration.

*Figure 12 Proportion of respondents by building grade (GC) classification (a) and company size (b)*

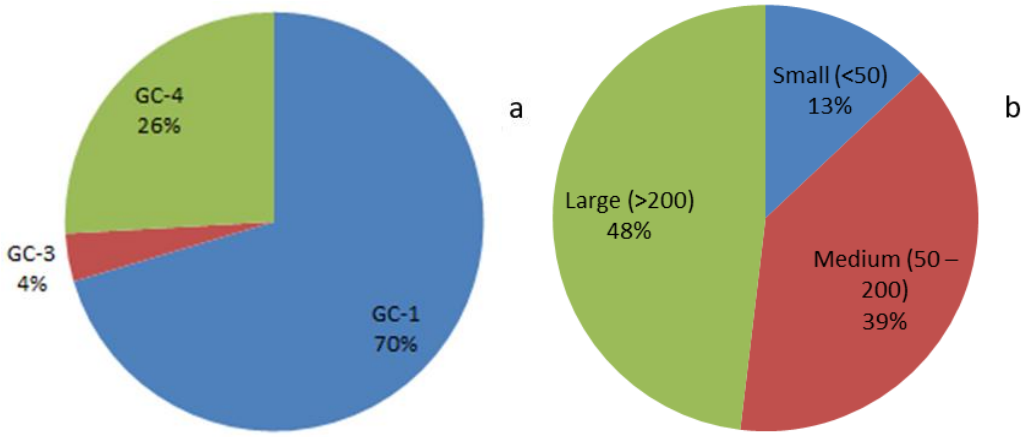



Table 8 below illustrates the findings reveal that Microsoft project is the most commonly used project monitoring and controlling software among the respondent, with 75.9% reporting its use. This dominance shows its accessibility and practicality in real estate development projects, where managing cost and schedule is critical. In contrast, a smaller proportion of the respondent (14.8%) relied on Excel or manual reporting, suggesting that while the traditional approaches persist, they are less favored compared to specialized software's. Only 9.3% of respondents reported using primavera, a tool often associated with large scale and complex projects, indicating limited

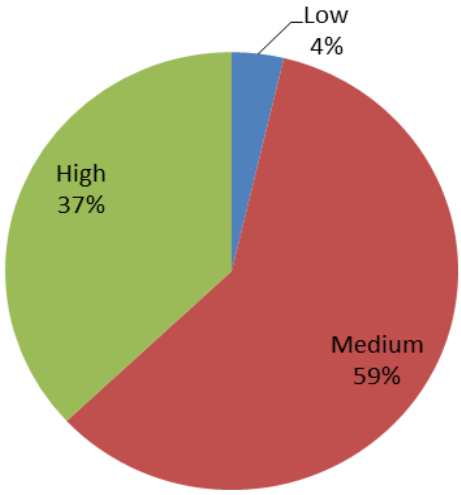
adoption in the local context. In alignment with findings from similar construction and project management studies, there is a clear preference for user friendly and accessible solutions like Microsoft Project over complex alternatives (Bethelehem, 2019). While software like Primavera offers superior resource management, the high reliance on manual methods and flexible, accessible tools demonstrates a diverse and evolving approach to monitoring and controlling project performance in Addis Ababa.

*Table 8 Distribution of respondents by project monitoring software/tool*

| **Software/Tool Used for Project Monitoring** | | | |
|---|---|---|---|
| Type | Frequency | % | Cumulative (%) |
| Excel/manual | 8 | 14.8 | 14.8 |
| Microsoft Project | 41 | 75.9 | 90.7 |
| Primavera (P6) | 5 | 9.3 | 100 |
| Total | 54 | 100 | |

Results presented in Figure 13 depicts the distribution of respondent by level of digital maturity indicates that most organization fall within the medium category (59.3%). This suggests that while digital tools and practices are being adopted, many companies are still in a traditional stage of integrating advanced digital solutions into project management. A significant portion (37.0%) reported high digital maturity, reflecting organizations that have embraced modern technologies and are likely to benefit more from advanced project monitoring system such as EVM. Only a small fraction (3.7%) exhibited low digital maturity, highlighting that traditional, non-digital practices are becoming less common in the sector is progressing toward digital transformation, with most firms positioned between moderate and advance level of maturity.

*Figure 13 Distribution of respondents by level of digital maturity.*




## 4.4 Descriptive Statistic

The study applied established Likert scale ranges, which allows means into meaningful categories of argument of significance. A score between 1.00 to 1.80 is considered as strongly disagreed' 1.81 to 2.60 as 'Disagree', 2.61 to 3.40 as 'Neutral', 3.41 to 4.20 as 'Agree' and 4.21 to 5.00 as 'Strongly 'Agree'. Specifically, EVM integration was measured using the frequency scale ranging from 1 (Never to 5 (Always), whereas cost control and schedule control were assessed using a standard agreement scale ranging from 1 = (Strongly disagree,) to 5 (Strongly Agree) (Sullivan & Artino, 2013).

In addition, the descriptive statistic section begins by assessing the organization current EVM adoption Respondent answering "Yes" proceed to questions regarding EVM integration, cost control and schedule control. Conversely, those answering "NO" were directed to identify challenges in EVM Adoption, which were analyzed using frequency and percentage distributions. This contextual information complements the main variables by showing barriers to EVM adoption and explaining difference in implementation rates across organizations. Thus, the section is structured in the following order: EVM adoption status, EVM integration, cost control, schedule control and finally challenges in EVM Adoption.

### 4.4.1 Current Level of EVM Adoption Status

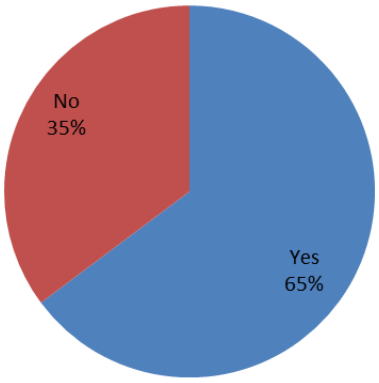
The finding indicates that most projects (64.8%) reported that they utilize EVM for project monitoring and control while 35.2% stated that they do not currently apply the method (Figure

14). This finding shows that EVM has achieved considerable penetration in the real-estate projects in Addis Ababa; however, the fact that more than one third of the projects have not adopted EVM underscores ongoing challenges in institutionalizing modern project management practices. Previous report by Abel, (2023), Ayalew and Ayalew (2024) and Shumet *et al*. (2025) also indicate that the adoption rate of EVM is relatively low and considered to be in its early stages compared to global standards.

While specific large-scale megaprojects in the city incorporate elements of EVM, full-scale implementation across the broader construction sector remains limited. Assessment by Shumete *et al*, (2025) showed about 61.4% moderate implementation of EVM by Amhara waterworks construction enterprise. On the other hand, Wontango *et al.* (2024) reported that 56.2% have never used, 22.5 % frequently applied, 12.4 % rarely applied while only 9 % used EVM in Construction Projects in Sidama Region, Ethiopia.

The relatively higher percentage of EVM use in this study could be attributed to the data source, which comprised mainly GC-1 contractors with higher likelihood of implementing EVM in their management system, although these figures do not fully reflect the depth of EVM application, a subject explored in subsequent sections provide a foundation for interpreting the study's descriptive statistics. Respondents who answer "Yes" proceeded to EVM Integration section, cost control and schedule control while those who answered "No" were directed to EVM adoption challenges.

*Figure 14 Distribution of respondents by EVM adoption status.*



### 4.4.2 EVM Integration

Table 9 demonstrates that the organization assessed implement moderate to high levels of EVM Value Management (EVM) integration. Respondent confirmed that they are generally familiar with EVM (M = 3.77, SD = 1.285) and apply it in project monitoring and control (M 3.69, SD = 1.388). Thus, EVM metrics such as CV, CPI, SPI, EAC and ETC were reported 'Often' (M = 3.49, SD = 1.314), However, the overall depth of EVM integration across projects was rated lower, averaging only 'Sometimes' (M = 3.06, SD = 1.162). Remarkably, the use of specialized project management software integration with EVM was relatively stronger, with a mean of 3.69 ("Often"). These results suggest that while awareness and basic application exist, the depth of integration particularly in terms of advanced software support are not fully realized.

Qualitative interviews highlighted a clear implementation gap between theoretical knowledge and site-level practice. For instance, Project Managers PM-01 and PM-03 noted that they implement EVM primarily for weekly and monthly checks against the baseline. However, this is not a standard requirement: Project Office Engineer- OE-01 and OE-02 reported that they include EVM only "sometimes" for progress report purposes and do not integrate into daily controlling and monitory activity. This difference explains the quantitative "implementation Gap" between theoretical awareness and actual project site level practices.

Furthermore, the technical nature of the integration is mainly reliant on manual processes. Although, PM-02 stated that they use Primavera (P6) for regular checks, the vast majority of respondent including PME-01 Cost Engineers-, CE-01 and OE-04 confirmed that Excel remains the primary tool for final control and monitory. This widespread reliance on manual spreadsheet supports that low quantitative mean average for Digital Software usage (M = 3.00).

In agreement with the present result, previous reports indicate that EVM integration in Addis Ababa construction projects is limited, often manual, and underutilized, despite its proven ability to improve cost and schedule performance (Medihanit *et al*., 2021; Shumet *et al.* 2025). In general, these finding align with existing literature emphasizing the necessity of digital transformation for effective project management. For example, Kim et al. (2003) argued that without a shift from manual process to digital integration. EVM functions remain merely a reactive reporting tool rather than a proactive management strategy. Locally, the feedback from PM-02, one of the few

respondents to implement EVM on a day- to- day basis, represent the best practice and target for project success advocated by global authorities such as Fleming and Koppelman (2010).

*Table 9 Descriptive statistics for EVM integration variables.*

| **EVM integration variables** | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| My organization is familiar with Earned Value Management | 35 | 1 | 5 | 3.77 | 1.285 |
| My organization applies EVM in project monitoring | 35 | 1 | 5 | 3.69 | 1.388 |
| We use EVM metrics such as CV, SC, CPI, SPI, EAC & ETC] | 35 | 1 | 5 | 3.49 | 1.314 |
| The level of EVM integration in our projects is high] | 35 | 1 | 5 | 3.06 | 1.162 |
| Our organization uses specialized project management software integrated with EVM] | 35 | 1 | 5 | 3.00 | 1.350 |
| EVM results are regularly communicated to stakeholders (Weekly, Monthly/Quarterly reports)] | 35 | 1 | 5 | 3.69 | 1.345 |
| Valid N (listwise) | 35 | | | | |

### 4.4.3 Effectiveness in cost and schedule control

**Cost Control**

Table 10 below explains that the respondents observe EVM as highly effective in cost control. The strongest agreement was shown for the role of EVM in identifying cost overrun early (M = 4.54, SD = 0.505) and guiding budget adjustment through metrics such as CPI and CV (M = 4.43, SD = 0.698), both rated as 'Strongly Agree'. Respondents also strongly agree that EVM improves cost predictability compared to traditional methods (M = 4.29, SD = 0.622) and also strongly agree in enhancing client's confidence in cost predictability (M = 4.26, SD = 0.701). Furthermore, respondents agreed that results are used to adjust procurement and resource allocation decisions by (M = 4.11, SD = 0.758). Overall, these findings highlighted that EVM is widely recognized as a valuable monitoring and controlling tool for proactive cost management. The result aligns with previous works that demonstrates a statistically significant positive relationship between EVM

implementation and overall project success across both cost and schedule metrics (Kim *et al.,* 2013; Vanhoucke, 2015).

The statistical confidence in EVM's cost controlling capacities is strongly supported by the qualitative data. According to PM-01 and PM-02 (Project Manager -01 and Project Manager-02), EVM allows them to check "actual cost performance by performing against the baseline cost" by using EVM metrics (i.e. CV, CPI). PM-01 (Project Manager -01) noted that the negative CV acts as an alert for cost overruns that helps the project team to "adjust the project expenses early on".

However, the interview also revealed why regression analysis was less effective to predict cost overruns than schedule control. PM-01 and PM-02 both highlighted that while EVM provides early warning, it cannot account for external factors such as price escalation and deficiencies in estimating the project cost. In line with this, Fleming and Koppelman (2010) acknowledge that EVM was designed for environments with relatively stable costs, and they argue that in high-inflation environments, the Actual Cost (AC) **is** inflated by external factors.

*Table 10 Descriptive statistics for cost control variables.*

| ***Cost control variables*** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
|---|---|---|---|---|---|
| EVM helps identify cost overruns early | 35 | 4 | 5 | 4.54 | .505 |
| EVM metrics (CPI, CV) guide budget adjustments | 35 | 3 | 5 | 4.43 | .698 |
| EVM improves cost predictability compared to traditional methods. | 35 | 3 | 5 | 4.29 | .622 |
| EVM results are used to adjust procurement and resource allocation decisions | 35 | 2 | 5 | 4.11 | .758 |
| EVM improves client's confidence in cost predictability | 35 | 3 | 5 | 4.26 | .701 |
| Valid N (list-wise) | 35 | | | | |

**Schedule Control**

The descriptive statistic indicates that Earned Value Management (EVM) is highly effective in enhancing schedule control (Table 11). Respondents strongly agreed that EVM helps identify schedule delays early (M = 4.49, SD = 0.612) and guides schedule adjustment through metrics like SPI and SV (M = 4.43, SD = 0.655). Similarly, respondents agree on EVM improves schedule predictability compared to traditional methods (M = 4.17, SD = 0.923) and that EVM improves early detection of schedule risk compared to traditional Gantt Chart monitoring (M = 4.34, SD = 0.725), both falling the 'agree' to 'strongly agree, categories. However, the critical path method (CPM) schedule (M = 3.94, SD = 0.838) fall within the agreed category but indicates 'moderate' application.

Overall, this finding is in line with previous claims that EVM is widely recognized as a valuable tool for proactive schedule management (PMI, 2021). It strengthens project monitoring by enabling early detection of delays and risks, guiding corrective action and enhancing predictability, through its iteration with advance scheduling techniques such CPM appears to be less consistently applied (Fleming and Koppelman, 2010; Vanhoucke, 2012).

For schedule also the triangulation confirms a more robust link between management action and project outcome. PM-01, PM-02 and OE-04 (Project Manager-01, Project Manager -02 and Project Office Engineer-04) all emphasized that schedule Variance (SV) and Schedule Performance Index (SPI) are critical for checking the performance of project timeline by calculating the current performance of the project with Project baseline time or master schedule. Similarly, OE-02, PME-01 and PME-02 (Project Office Engineer-02, Planning and Monitoring Engineer-01 and Planning and Monitoring Engineer-02) added that EVM helped them with "future perdition" and forecasting using EVM metrics and which it allows for better management of critical tasks.

The quantitative survey data result indicates an R-Square Value (34.9%) for the regression analysis on schedule control. Unlikely cost, which is affected by external price hikes, schedule performance is more directly controlled by the "technical rigor" of the project team, as suggested by Kerzner (2017). PM-02 (Project Manager-02) also noted that this real time accuracy "increases client confidence".

*Table 11 Descriptive statistics for schedule control variables.*

| Schedule control variables | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| EVM helps identify schedule delays early | 35 | 3 | 5 | 4.49 | .612 |
| EVM metrics (SPI, SV) guide schedule adjustments | 35 | 3 | 5 | 4.43 | .655 |
| EVM improves schedule predictability compared to traditional methods | 35 | 1 | 5 | 4.17 | .923 |
| EVM metrics are integrated with critical path method (CPM) scheduling | 35 | 2 | 5 | 3.94 | .838 |
| EVM improves early detection of schedule risk compared to traditional Gantt Chart monitoring | 35 | 2 | 5 | 4.34 | .725 |
| Valid N (list-wise) | 35 | | | | |

### 4.4.4 Challenges in EVM Adoption

As illustrated in Table 12, the study revealed several critical barriers on adoption of EVM. The most significant challenges identified were lack of technical expertise and training (M = 4.20, SD = 1.016), weak management commitment (M = 4.19, SD = 0.779), and lack of standardized procedures or policies (M = 4.17, SD = 0.818). Fragmented documentation (M = 4.15, SD = 1.023) and the cost of implementation (M = 3.91, SD = 1.033) were observed as notable but slightly less serve. The lowest mean score was recorded for unclear regulatory requirement (3.52, SD = 1.128), which was interpreted as moderator challenge. Collectively, the finding suggests that structural, cultural, and technical barriers impede the successful integration of EVM within real estate developments in Addis Ababa. Addressing these barriers is essential for improving adoption rates and ensuring the effectiveness use of EVM in project monitoring and control.

*Table 12 Descriptive statistics for challenges in EVM adoption.*

| Challenges | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Lack of technical expertise/training limits EVM Adoption | 54 | 1 | 5 | 4.20 | 1.016 |
| Low digital maturity (Software/tools) limits EVM adoption | 54 | 1 | 5 | 3.96 | 1.045 |
| Weak management commitment limits EVM adoption | 54 | 2 | 5 | 4.19 | .779 |
| Fragmented documentation limits EVM adoption | 54 | 1 | 5 | 4.15 | .960 |
| Resistance to change limits EVM adaption | 54 | 1 | 5 | 3.83 | 1.023 |
| Cost of implementation limits EVM adoption | 54 | 1 | 5 | 3.91 | 1.033 |
| Lack of standardized procedures/policies limits EVM adoption | 54 | 2 | 5 | 4.17 | .818 |
| Unclear regulatory requirements hinder systematic EVM adoption | 54 | 1 | 5 | 3.52 | 1.128 |
| Valid N (listwise) | 54 | | | | |

In the summary, out of the total data collected from the projects (N=54), 64.8% of organizations reported that they currently use EVM Value Management (EVM). The while 35.2% indicated they do not use EVM. While those applying EVM, the overall mean value of EVM integration was 3.45 (SD = 1.14), reflecting a moderate level of practice among real estate development projects in Addis Ababa. With contrast of both cost control (M = 4.33, SD = 0.4578) and schedule control (M = 4.27, SD = 0.52) were rated within the 'agree' to 'strongly agree' categories, suggesting that EVM is observed as highly effective in enhancing project monitoring and controlling in this area. For all full sample (N = 54). The mean score for challenges in EVM adoption was 3.99 (SD = 0.72), confirming the significance barrier remain. The most frequently cited challenges include lack of technical expertise, inefficient management commitment and absence of standardization procedures. Taken together, these results highlighted that while EVM is evaluated for its contribution to cost and schedule management, its integration is still partial across the project. And adoption is constrained by organizational and systematic challenge.

The qualitative data across the interviewees strongly supports the quantitative findings that weak management commitment is bottleneck followed by Lack of technical expertise. PM-01, PM-02 and OE-02 (Project Manager -01, Project Manager-02 and Project Office Engineer-02) all identifies “weak management commitment” as main reason why EVM is not integrated into day-to-day practices. PM-01 and OE-01 (Project Manager-01 and Project Office Engineer-01) further explained that if leadership is not “fully committed” or does not “push to monitoring practice” EVM remains a mere reporting requirement rather that a decision-making process,

Likewise, OE-01 (Project Office Engineer) specifically stated that in firms where the “leadership commitment is zero”, the adoption of EVM tool remains low. Furthermore, PM-01 and OE-06 (Project Manager-01 and Project Office Engineer-06) emphases that a “Lack of technical expertise/training” as major barriers to fully integration.

Beyond individual skill, PM-01, PM-02 and PME-02 (Project Manager-01, Project Manager-02 and Planning and Monitoring Engineer-02) all stressed that the “Lack of standardization procedures/ polices” within their firms limits how EVM is adopted. PM-03 further noted that “Fragmented documentation” often make the data collection requirement for EVM difficult sustain. While the cost of implementation was noted by CE-01 (Cost Engineer-01), the consensus focused on the low digital maturity of firms or projects. Most respondents, including OE-01 and CE-01 (Project Office Engineer-01 and Cost Engineer-01) stated explicitly linked low digital maturity to the failure of full EVM adoption.

To overcome this, PM-01 and PM-02 (Project Manager-01 and Project Manager-02) recommended that companies must “Make sure they use digital platform regularly” (such as MS project or Primavera P6) and establish an “EVM integrated policy” as their main monitoring and controlling practice with their projects. Accordingly, these findings align with Fleming and Koppelman (2010), who argue that EVM cannot succeed without “management commitment” and structure environment. In addition, locally, the evidence supports Abebe and Teklu (2020), Hussein and Moradinia (2020) and Moges (2019) who identified that organizational, technical, and cultural factor collectively hinder the integration of EVM in real estate projects in Addis Ababa. Specifically, lack of standardized policies, lack of top management support, shortage of technical expertise, and a general resistance to change among project teams are the main bottleneck for preventing modernization of project control system.

## 4.5 Inferential Statistic

While the descriptive analysis provided a foundational overview of EVM within the sample projects, this section utilizes inferential statistics methods to rigorously the study's core hypotheses. The primary aim is to establish if there is statistically significant conection between EVM integration and project management functions (specifically Cost Control & Schedule Control) and to quantify the strength of the relationship between the variables.

By moving beyond a simple average, inferential analysis allows for conclusions to be drawn regarding the broader population of private real estate building projects in Addis Ababa. This study utilizes structured statistical approaches like Pearsons Correlation Analysis which helps to assess the degree of association and direction of the relationship between the variables and Lnear Regression Analysis to determine the predictive power of EVM integration. These tests quantify the extent to which it accounts for the variance in the project cost and schedule control outcomes. Therefore, by conducting these tests, the data was screened for the fundamental assumption of parametric test including normality, linearity and homoscedasticity to ensure the mathematical validity and reliability of the resulting coefficient.

### 4.5.1 Correlation Analysis

A parametric method, Pearson's correlation coefficient, was employed as it is appropriate for continuous variables measured on Likert scales, and the data were normally distributed. The relationship between the variable is described with figure from the range of -1.00 to +1.00. Accordingly, a positive sign points correlation while negative sign points negative correlation, thereby establishing the statistical foundation for the subsequent regression analysis.

Prior to the employing correlation analysis, the data normality assumption was tested to ensure the validity of the parametric approach.

#### *4.5.1.1 Assumption and test*

**Normality Test**

To ensure the validity of the analysis, data normality assumption must be rigorously established. The next section discusses this assumption in detail:

The Shapiro-Wilk test for the cost control variable showed a P-value of 0.068 (Table 13). Similarly, the Kolmogorov-Smirnov test gave a p value of 0.103, also above the 0.050 threshold. Since both values exceed 0.05, the assumption for the parametric analysis including correlation and regression analysis is, therefore satisfied.

*Table 13 Normality of test for Cost Control Variable*

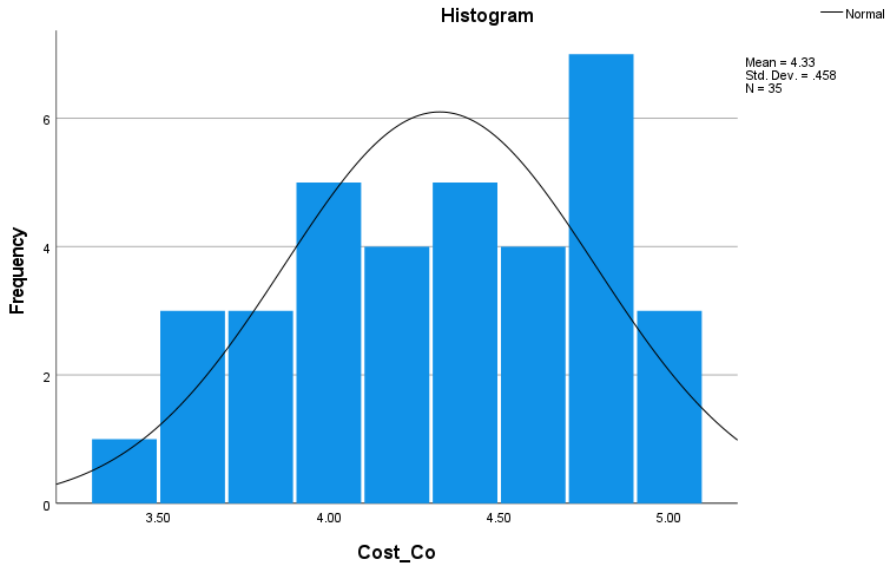
**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | Df | Sig. | Statistic | df | Sig. |
| Project Cost Control | .136 | 35 | .103 | .943 | 35 | .068 |

a. Lilliefors Significance Correction

Source: survey Data, 2026

*Figure 15 Histogram Chart for Cost Control Variable*




Source: survey Data, 2026

Similarly, as shown in Table 14, the Shapiro-Wilk test for the schedule control variable produced p-value of 0.066 and the Kolmogorov-Smirnov test yielded a p-value of 0.088, both values being the 0.050 threshold. Therefore, that assumption for the parametric analysis including correlation and regression analysis test is satisfied.

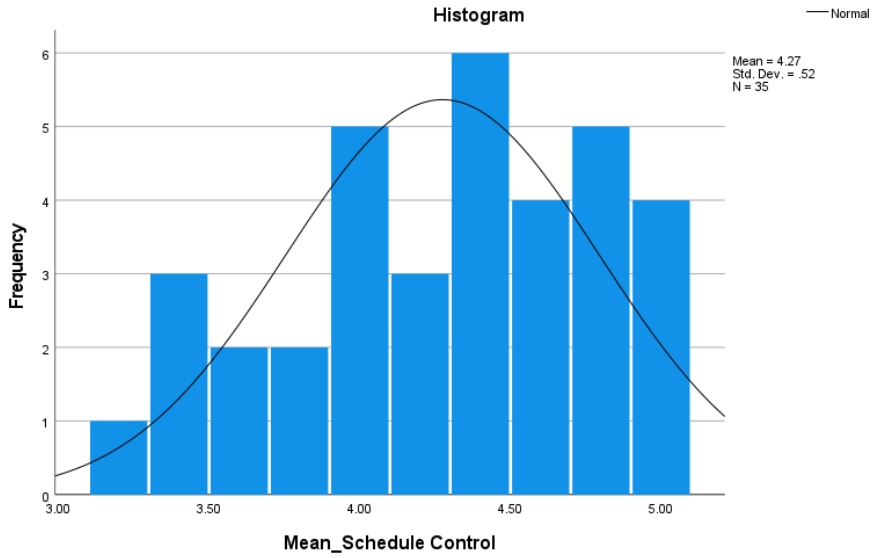
*Table 14 Normality of test for Schedule Control Variable*

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Project Schedule Control | .138 | 35 | .088 | .942 | 35 | .066 |

a. Lilliefors Significance Correction

*Figure 16 Histogram Chart for Schedule Control Variable*




Source: survey Data, 2026

As depicted in Table 15, the test provides a correlation coefficient (r) that indicates both the direction (positive or negative) and the strength of linear relationship. According to Field (2013) r value between 0.30 and 0.49 represents a moderate relationship whereas a value of 0.50 or higher indicates a strong relationship. Accordingly, the EVM integration with cost control, with value of $r = .442$ and $p = .008$, shows a moderate and statistically significant positive relationship. This indicates that higher level of EVM integration is associated with stronger cost control. Similarly, the EVM integration with schedule control, with the value of $r = .591$, $p < .001$, shows a moderate to strong, statistically significant positive relation. This suggest that projects with greater EVM

integration tends to achieve better schedule control, and the evidence also is highly reliable given the very low p-value as described by Kim et al. (2003).

As for cost control with schedule control (r = .681, p = .001), the result shows that improvement in Cost control is strongly associated with improvement in Schedule control, reflecting the interdependency of these two dimensions of the project management. Ultimately, the correlation for schedule control is significantly stronger and this suggest that in current Addis Ababa Private real estate building project constructions, EVM is more predictive of time outcomes than monitory value (Medihanit *et al.* 2020; Shumet *et al*. 2025;).

This statistical strength is explained by the internal logic used by firms in Addis Ababa Private real estate firms. PM-01 and PM-02 (Project Manager-01 and Project Manager-02) specifically mentioned that they rely on CPI and SPI metrics to check the "efficiency of budget" and "work executed against the master schedule". The higher correlation for schedule suggested that tracking time is more systematic than tracking costs in the context. Even in lower grade firms, OR-02 and PM-01 (Project Office Engineer-02 and Project Manager 01) noted that EVM is essential for the "future prediction" and forecasting schedule performance.

*Table 15 Correlation analysis result*

**Correlations**

| | | EVM Integration | Mean Cost Control | Mean Schedule Control |
|---|---|---|---|---|
| EVM Integration | Pearson Correlation | 1 | .442** | .591** |
| | Sig. (2-tailed) | | .008 | .000 |
| | N | 35 | 35 | 35 |
| Project Cost Control | Pearson Correlation | .442** | 1 | .681** |
| | Sig. (2-tailed) | .008 | | .000 |
| | N | 35 | 35 | 35 |
| Project Schedule Control | Pearson Correlation | .591** | .681** | 1 |
| | Sig. (2-tailed) | .000 | .000 | |
| | N | 35 | 35 | 35 |

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

### 4.5.2 Regression Analysis

Building up on the initial correlation analysis, a regression analysis was conducted to evaluate the predictive capacity of EVM integration (independent variable) and the two dependent variables: cost control and schedule control. Two simple linear regression analysis model developed to test EVM integration significantly predict improvement in cost and schedule control (Al-Zwainy, 2020; Genet *et al.* 2023). This approach provides insight into the extent to which EVM integration contributes to project monitoring and controlling effectiveness.

#### *4.5.2.1 Assumption Testing*

1. **Normality of residuals Test**

Normality of residual as part of correlation analysis was verified and reconfirmed for the regression models. Both Shapiro-Wilk and Kolmogorov Smirnov test yielded p-value which is greater than 0.05 and visual inspection of histograms indicated approximate normal distribution (Figures 17 and 18). Therefore, the normality assumption was satisfied for both regression models. The P-P/Q-Q plot below indicates a normal distribution of the data.

*Figure 17 P-P/Q-Q Normality Test for Cost Control*

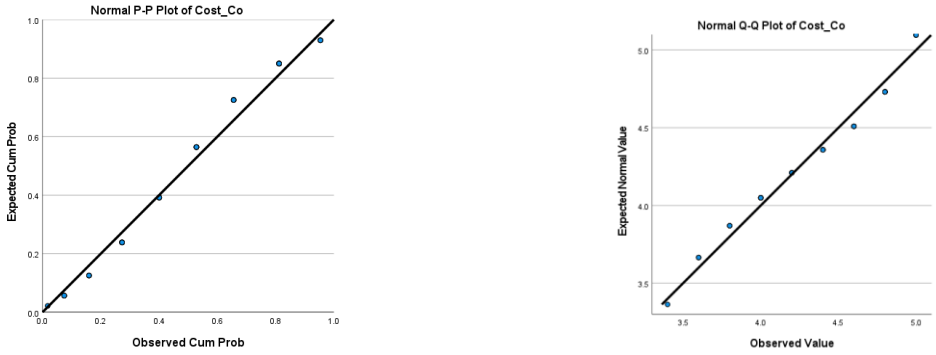
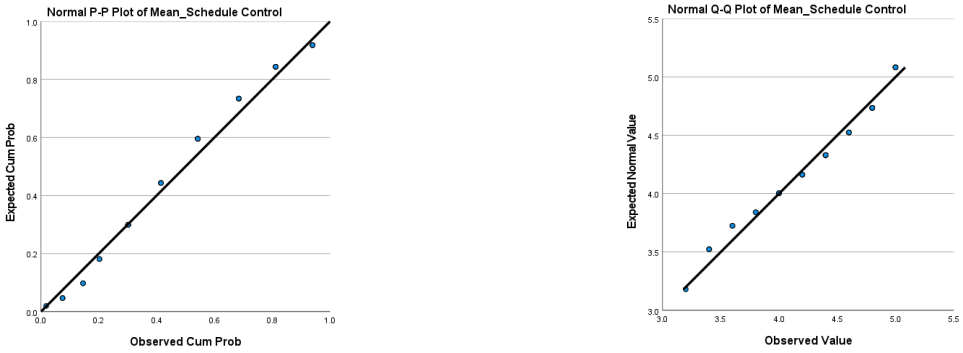


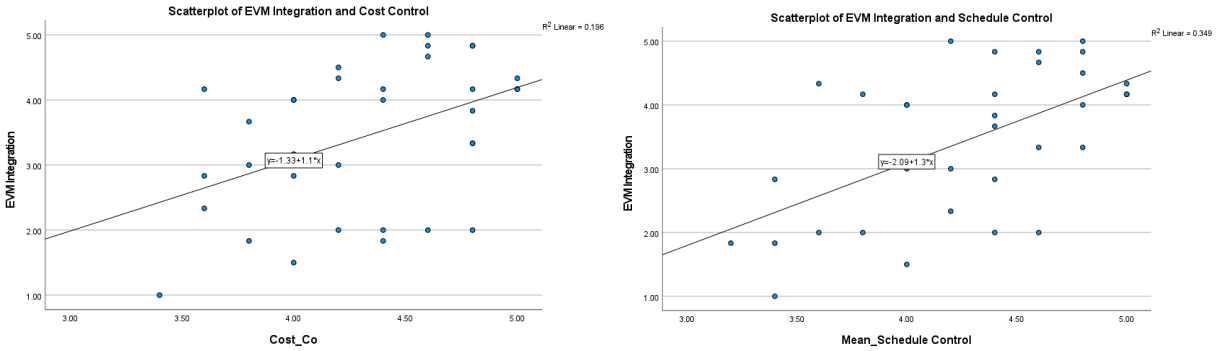
*Figure 18 P-P/Q-Q Normality Test for Schedule Control*




## 2. Linearity Test

Linearity was examined using scatterplot of standardized residual against predicted values. The plot showed no curvilinear pattern, confirming that the relationship between EVM integration and both cost control and schedule control are linear, as shown in Figure 19.

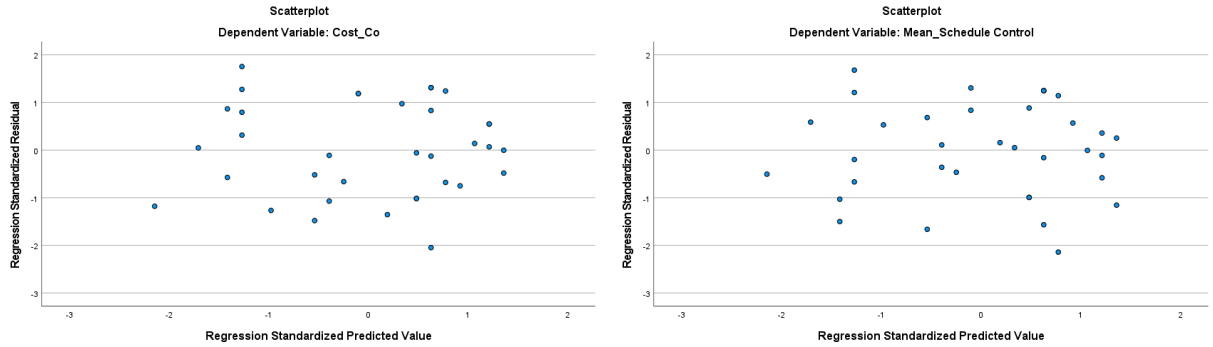
*Figure 19 EVM integration and both cost control and schedule control scatterplots with regression line*




## 3. Homoscedasticity Test

Homoscedasticity was also tested by inspecting residual scatterplots (Figure 20). The residuals were evenly distributed around zero across predicted values, with no funnel shaped patterns, indicating constant variance, thus the homoscedasticity assumption was satisfied (Gupta *et al.,* 2017).

*Figure 20 Homoscedasticity Scatterplot for both regression model*




### 4. Independent of Errors

Independence of errors was assessed using the Durbin-Watson Static. For the cost control model, the value was 1.7010 and for the schedule control model 2.172, both values are close to 2, indicating no autocorrelation (Williams *et al.* 2013). Therefore, the independence of error assumption was satisfied.

The cost control and schedule control model summaries are presented as follows:

*Table 16 Cost Control Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .442[a] | .196 | .171 | .41675 | 1.710 |

a. Predictors: (Constant), EVM Integration

b. Dependent Variable: Project Cost Control

*Table 17 Schedule Control Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .591[a] | .349 | .329 | .42613 | 2.172 |

a. Predictors: (Constant), EVM Integration

b. Dependent Variable: Project Schedule Control

**Model 1: The Effect of EVM Integration on Project Cost Control**

The perspective relationship between independent variable and dependent variables is revealed by an R value which is equal to .442 (Table 18). Accordingly, R Square value is .196 and that the $R^2$ value show 19.6% of variance in cost control is explained by EVM integration. Accordingly, to Cohen's (1988) guidelines, an $R^2$ around .20 represents a small to moderate effect size, meaning EVM integration has a meaningful but most dominant influence on cost control. In addition, adjusted $R^2$ (.171) confirms that the explanatory power remains stable when accounting for sample size.

*Table 18 Model Summary for Model 1*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .442[a] | .196 | .171 | .41675 |

a. Predictors: EVM Integration

b. Dependent Variable: Project Cost Control

The Model 1 ANOVA (Table 19) show that in this model F (1,33) = 8.033, p = .008. The regression model is statistically significant, meaning EVM integration reliably have significant effect on predicting cost control. The p-value (<0.05) confirms that the observed relationship is unlikely due to chance. Accordingly, according to Hair et al. (2019), a significant F-test validates the overall usefulness of the regression model.

*Table 19 Model 1: ANOVA result*

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1.395 | 1 | 1.395 | 8.033 | .008[b] |
| | Residual | 5.732 | 33 | .174 | | |
| | Total | 7.127 | 34 | | | |

a. Dependent Variable: Project Cost Control

b. Predictors: EVM Integration

**Model 2: The Effect of EVM Integration on Project Schedule Control**

The strength and direction of the association between the independent and dependent variables are indicated by an (R)-value of (0.591), pointing to a moderate positive correlation (Table 20). Accordingly, R Square value is 0.349 in the model summary and that the $R^2$ value indicated that 34.9% of variance in schedule control is explained by EVM integration. In accordance, to Cohen's (1998) guidelines, an $R^2$ value represents a moderate to strong effect size, meaning EVM integration has a substantial influence on schedule control. In addition, adjusted $R^2$ (.349) confirms that the explanatory power remains stable when accounting for sample size.

*Table 20 Model Summary for Model 2*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .591[a] | .349 | .329 | .42613 |

a. Predictors: (Constant), EVM Integration

b. Dependent Variable: Project Schedule Control

The ANNOVA results for Modiel:2 (Table 21) demonstrate that the regression model is statistically significant F (1,33) = 17.703, p < 0.001, This indicates that EVM integration is a strong predictor for schedule control and provides strong evidence to reject the null hypothesis (Hair *et al*., 2019).

*Table 21 Model 2: ANOVA result*

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 3.215 | 1 | 3.215 | 17.703 | .000[b] |
| | Residual | 5.992 | 33 | .182 | | |
| | Total | 9.207 | 34 | | | |

a. Dependent Variable: Project Schedule Control

b. Predictors: (Constant), EVM Integration

### 4.5.3 Result of Linear Regression

**The Effect of EVM Integration on Project Cost Control**

Table 22 presents Regression result that shows the effect of EVM integration on Project Cost Control. The regression model showed a significant relationship, with a Constant (B) of 3.714 ($p < .001$) and unstandardized coefficient for EVM Integration of .177. The positive standardized coefficient ($\beta = .442$, $t = 2.834$, $p = 0.008$) indicates that higher EVM Integration is associated with stronger Project Cost Control, thus supporting the Hypothesis 1 (H1).

Therefore, for every one unit increase in EVM integration, Cost Control increases by .177 units on average. This finding aligns with project management theory, which emphasizes that integrated monitoring improves financial control (PMI, 2017).

*Table 22 Unstandardized and standardized Regression Coefficients for the Effect of EVM integration on Cost Control*

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 3.714 | .227 | | 16.359 | .000 |
| | EVM Integration | .177 | .063 | .442 | 2.834 | .008 |

a. Dependent Variable: Project Cost Control

**The Effect of EVM Integration on Project Schedule Control**

Table 23 presents Regression Result of the Effect of EVM Integration on Project Schedule Control. The regression analysis result indicates a statistically significant effect of EVM integration on project schedule control. With p-value ($p < .001$) well below the 0.05 threshold, the result confirms a reliable and significant relationship. The unstandardized coefficient (B=0.269) suggests that for every one-unit increase in EVM integration, project schedule control increases by an average of 26.9% units. The standardized coefficient ($\beta = .591$) demonstrates that higher levels of EVM) integration are strongly associated with improved project schedule control. Accordingly, the standardization coefficient indicates moderate to strong positive effect of EVM Integration on Project schedule Control. The result confirms statistical significance. Hypothesis 2 (H2) is accepted. This finding aligns with established project management literature, which emphasizes

that integrating EVM enhances control over schedule and cost (Genet *et al*., 2023; PMI, 2017; Sparrow. 2002; Vanhoucke, 2021).

Overall, both regression models, EVM integration predicting Cost Control and EVM integration predicting Schedule Control, confirms that EVM integration is meaningful predictor of Project monitoring and controlling dimensions. However, the strength of the predictive relationship differs between the two models.

The schedule control model demonstrates stronger explanatory power, with $R^2 = .349$, compared to $R^2 = .196$ for the cost control model. This means that EVM integration explains approximately 35% of the variance in schedule control, while it explains about 20% of variance I cost control. Accordingly, to Cohen's (1988) guidelines, the effect size for schedule control is moderate strong, whereas for cost control it is small to moderate.

The higher $R^2$ and standardization coefficient ($\beta = .591$ Vs $\beta = .442$) in schedule control model suggest that EVM integration contributes substantial more to schedule management effectiveness than cost control. This aligns with project management standard (PMI, 2017), which emphasizes that Earned Value Management techniques are particularly effective in tracking and forecasting performance.

*Table 23 Unstandardized and standardized Regression Coefficients for the Effect of EVM integration on Schedule Control*

| | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | Model | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 3.346 | .232 | | 14.413 | .000 |
| | EVM Integration | .269 | .064 | .591 | 4.207 | .000 |

a. Dependent Variable: Project Schedule Control

## 4.6. Summary of Hypothesis

In general, this finding highlights the interdependency of project control dimensions. While EVM integration improves both cost and schedule control, its stronger impact on schedule control suggesting projects adopting EVM may achieve more reliable schedule adherence, which in turn

support cost efficacy. This reflects the principle that schedule performance drives cost outcomes in project management (Kerzner, 2019).

In addition, the qualitative data from the interviewed respondent explains this “predictive Gap”. “PM01 and PM-02 (Project Manager-01 and Project Manager-02) pointed that, while EVM provides “early warnings” for cost, it cannot mitigate external volatility such as “price escalation” or “market inflation”. As for PM-01 (Project Manager-01) noted that, EVM helps with monitoring but may not be enough to “adjust back to track” when the future factors are unknown like material spikes and inflation spikes unexpectedly.

The successful acceptance of both Hypotheses 1 and Hypothesis 2 (Table 24) proves that despite these challenges, the systematic use of EVM remains a statistically valid method for enhancing both cost and schedule outcomes in private real estate building project sector in Addis Ababa.

*Table 24 Summary of Hypothesis*

| Hypothesis | Result | Decision |
|---|---|---|
| H1: the Effect of EVM integration on Project Cost Control is Statistically Significant and Positive. | Significant ($p = .008$), positive ($\beta = .442$) | Hypothesis Accepted |
| H1: the Effect of EVM integration on Project Schedule Control is Statistically Significant and Positive. | Significant ($p < .001$), positive ($\beta = .591$) | Hypothesis Accepted |

Source: Survey Data, 2026

# CHAPTER FIVE

## 5. SUMMARY, CONCLUSSION AND RECOMMENDATION

### 5.1 Summary of Findings

The findings of this study provide a clear assessment of how Earned Value Management (EVM) is currently utilized and the impact it has on the performance of private real estate projects in Addis Ababa. With reference to the demographic and organizational profile, the study revealed a highly educated respondent bases with 40.7% of professionals holding master's degree and a significant majority possessing 5 to 10 years of the industry experience. While 70.4% of these professionals work within Grade 1 (GC-1), the organizational digital maturity is medium level (59.3%) This indicates a technological level where firms possess the human capacity necessary for complex projects management, but lack the integrated digital infrastructure required to fully automate control system.

As for the current level of EVM integration, the study found a moderate cumulative mean of 3.06. A critical gap was observed between theoretical awareness and practical application, where respondent reported a relative high familiarity with EVM concept (M = 3.77), and the depth of project integration (M = 3.06) while the use of specialized software (M = 3.00) were lower. Accordingly, this indicates that EVM is often treated as peripheral reporting tool rather than a central, software driven management system. Despite the moderate integration of EVM the perceived effectiveness of EVM in project control was rated highly, particularly for its diagnostic capabilities. Accordingly, respondents strongly agreed that EVM is exceptionally effective at identifying schedule slippage (M = 4.63) and providing early warnings for cost overruns (M = 4.54), which shows its value as proactive monitoring instrument.

The inferential statistical analysis provided mathematical confirmation of the research hypotheses. Pearson correlation result shows that EVM integration has a moderate to strong positive relationship for both control performance metrics, though the association with schedule control ($r = .591$, $p < .001$) was significantly stronger that with cost control ($r = .442$, $P < .008$). Furthermore, simple linear regression analysis confirms a cause-and-effect relationship, revealing that EVM integration explains 34.9% of the variance in schedule performance compared to only 19.6% for the cost control. Therefore, theses statistical results prove that EVM integration is twice as

effective at predicting and managing project timelines as it is for project monetary value or budget within Addis Ababa private real estate projects context.

Finally, the analysis of barrier to adoption of EVM integration shows that the primary barrier is human and financial rather than technical. The lack of technical expiries and specialized training (M = 4.20) and Weak management commitment (M = 4.19) were identified as the most significant barriers, followed by the Lack of standardized procedures/policies (M = 4.17).

## 5.2 Conclusion

The empirical finding of this study, several key outcomes regarding the effectiveness and integration of Earned Value Management (EVM) within the private real estate building sector in Addis Ababa.

First and foremost, the study indicates that while there is high level of academic and theoretical awareness among project professionals, a substantial "Implementation Gap". The moderate level of EVM integration, combined with mid-range scores for digital maturity and software usage, indicates that many project firms are not yet leveraging the full technical potential of EVM tool. This suggest that the current application of EVM in private real estate building projects in Addis Ababa is fragmented and manual rather than serving as an integrated, real-time decision-making tool.

Secondly, the statistical analysis shows both hypostases confirms that EVM integration is significant driver of project success. However, there is a disproportionate effect of EVM on schedule and cost control. The fact that EVM explains nearly twice the variance in schedule control performance (34.9%) compared to cost control performance (19.6%), leads to the conclusion that schedule control is more directly influenced by internal management rigor. Conversely, cost control is still improved by EVM, likely subjected to external factors such as market volatilities in Ethiopia context that management tools alone cannot fully mitigate.

Thirdly, the research concludes that the primary barriers to EVM maturity and integration on controlling and monitoring are a structural and educational, not conceptual. The dominance of "Lack of technical Expertise" and lack of specialized training as the top barriers that professionals do not necessary struggle with the logic of EVM, but rather with the tools and specialized training

requires executing it efficiently. Without a change to ward the organizational digital transformation and targeted skilled development, EVM adoption will likely remain at its moderate level.

Finaly the study concludes that the EVM holds its highest value as a diagnostic "Early Warning System". The exceptional, high score for identifying slippage and cost overruns shows that EVM is currently serving as an essential alarm system for project managers, even if the organizational capacity to act on those alarms is still under development.

## 5.3 Recommendations

Based on the conclusion made, the following recommendations are proposed to enhance the effectiveness of Earned Value Management (EVM) and improve project controlling performance in Addis Ababa private real estate building sector.

1. Strategic Investment in Digital infrastructure. Since the study found that even highly graded contractors moderately operated at medium level of digital maturity, construction companies should prioritize the transition from manual level of digital spreadsheet-based tracking to integrated project management information system (PMIS). Real time EVM data processing could substantially reduce the manual burden and improve the accuracy of project performance metrics.
2. Targeted Technical Capacity Building to address the primary barrier of "Lack of Technical Expertise," Accordingly firms should move beyond general managing training. There is a need for specialized, hands-on certifications programs specifically focused on management tools like EVM methodology including data collection, Earned Value Management value calculations and variance analysis.
3. Enhancing Cost Management Resilience. Given that EVM is less predictive of cost success than schedule success, managers should supplement EVM with Scenarios on bases of Cost Planning. This involves integrating EVM metrics with market trend analysis to account for external factors like material price volatility in Ethiopian market. Managers should use cost performance Index (CPI) to trigger early negotiation with the suppliers or to adjust procurement strategies before overruns become amalgamable.
4. Fostering an EVM driven organizational Culture. To overcome resistance to change, senior management in private real estate projects must motivate and support the use of EVM. Instead of using EVM merely as a monthly reporting requirement for clients, it should be

integrated into daily internal site meetings to closely monitor the project performance in terms of cost and schedule control. When leadership uses EVM data driven on day-to-day decision making, it will create a culture of accountability that encourages project and firm staff to maintain accurate and timely data records.

5. Policy integration by regulatory bodies. The Addis Ababa Construction Authority and relevant professional association should consider making basic EVM reporting a standard requirement for large scale private real estate projects. Standardizing the format for progress reporting would simplify the data requirement addressing the complexity barrier and ensure a more uniformed level of project control across industry. In addition, private real estate firms should also make an EVM policy within their projects and internally adapt EVM as major monitoring and controlling tool.

## 5.4 Suggestions for Future Researchers

While this study provides significant evidence of effectiveness of Earned Value Management (EVM) in Addis Ababa private real estate building sector, it also identifies several gaps that warrant further investigation to strengthen the broader project management framework in Ethiopia.

Therefore, the following suggestions are forwarded for future considerations:

1. Longitudinal study that tracks projects from inception to completion. This would provide not only deeper insights into how the effectiveness of EVM fluctuates during project phase but also understand the limitations of EVM in the local contexts.
2. Comprehensive analysis of public vs private sectors would be valuable. Such researchs could identify whether differences in regulatory environment and funding structures influence the success rate of EVM integration.
3. Effect of External Factors: given the moderate correlation observed in this study between EVM integration with cost and schedule control, further research is suggested to determine how specific factors such as foreign exchange fluctuations and construction material inflation moderate the relationship between EVM metrics and actual cost outcomes.
4. Integration of BIM and EVM. As the global industry shifts toward digital transformation, future research should explore the synergy between building information modeling (BIM), to optimize project performance in Ethiopia.

5. Qualitative Exploration of Organizational Culture. To address the ‘resistance to change’ identified in this study, future research could employ a purely qualitative approach. A deep exploration of organizational culture would uncover the underlying psychological and cultural drivers of management skepticism toward data-driven tools, facilitating the development of more effective change management strategies.

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**Annex: Questionnaire for study on "Effectiveness of Earned Value Management (EVM) Integration in Cost and Schedule Control in Private Real Estate Building Projects in Addis Ababa"**

**IMPORTANT NOTE:**

Information provided through the questionnaire will be treated with confidentiality and will be exclusively for academic purpose. All answers will be considered right.

**INSTRUCTION:**

I. Writing your name or phone number is not necessary
II. Please read each question carefully.
III. Please fill in the following questionnaire based on the facts of your company. Kindly answer all the questions by ticking or filling in the spaces provided.
**IV. If your company does not use EVM, please skip Section C and Section D and move directly to Section E.**

**SECTION ONE: Background Information**

1. **Name of The Company:** _____
2. **Building Grade of the Company:**
   I. GC-1 ☐ II. GC-2 ☐
   III. GC-3 ☐ IV. Other: _____
3. **Sex of respondent**
   I. Male ☐
   II. Female ☐
4. **Level of Education of respondent**
   I. Certificate ☐ II. Diploma ☐
   III. Bachelor's degree ☐ IV. M.Sc./MA ☐
   V. Other _____

**5. Work Experience in the Organization**

I. 0 – 5 Years ☐
II. 5 – 10 Years ☐
III. 10 to 15 Years ☐
IV. Above 15 Years ☐

**6. What is your role in the Organization**

I. Project managers ☐
II. Project office engineers ☐
III. Planning and monitoring engineers ☐
IV. Cost and contract engineers ☐
V. Resident Engineers ☐
VI. /Consultant in supervision firms ☐

**7. What is the Company Size**

I. Small (<50 employees) ☐
II. Medium (50 – 200) ☐
III. Large (>200) ☐

**8. What Software/Tool Used for Project Monitoring**

I. Microsoft Project (MS) ☐
II. Primavera (P6) ☐
III. Excel/manual reporting ☐
IV. Other: _____

**9. What is the level of Digital Maturity**

I. Low ☐
II. Medium ☐
III. High ☐

**SECTION TWO:**

**Effectiveness of Earned Value Management (EVM) Integration in Cost and Schedule Control**

**Section A: Current Practice of EVM Integration**

- SA-0: Does your Organization Currently use EVM Value Management (EVM)?
  - Yes, ☐ Continue to Section SA-1 to SA-6 and Section B & C.
  - No, ☐ Skip Section B & C and Move Directly to Section D.

**Scale: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always**

| **EVM Integration** | | | | | | |
|---|---|---|---|---|---|---|
| **Item No.** | **Statement** | **Never** | **Rarely** | **Sometimes** | **Often** | **Always** |
| SA-1 | My organization is familiar with Earned Value Management (EVM) | | | | | |
| SA-2 | My organization applies EVM in project monitoring | | | | | |
| SA-3 | We use EVM metrics such as CV, SV, CPI, SPI, EAC, ETC | | | | | |
| SA-4 | The level of EVM integration in our projects is high | | | | | |
| SA-5 | Our organization uses specialized project management software integrated with EVM | | | | | |
| SA-6 | EVM results are regularly communicated to stakeholders (Weekly, Monthly/Quarterly reports) | | | | | |

**Section B: Effect of EVM on Cost Control**

- Only for respondents who answered "Yes" in SA-0)

**Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree**

| **Effect of EVM on Cost Control** | | | | | | |
|---|---|---|---|---|---|---|
| **Item No.** | **Statement** | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
| SB-1 | EVM helps identify cost overruns early | | | | | |
| SB-2 | EVM metrics (CPI, CV) guide budget adjustments | | | | | |
| SB-3 | EVM improves cost predictability compared to traditional methods. | | | | | |
| SB-4 | EVM results are used to adjust procurement and resource allocation decisions | | | | | |
| SB-5 | EVM improves client's confidence in cost predictability | | | | | |

**Section C: Effect of EVM on Schedule Control**

- (Only for respondents who answered "Yes" in SA-0)

**Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree**

| **Effect of EVM on Schedule Control** | | | | | | |
|---|---|---|---|---|---|---|
| **Item No.** | **Statement** | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
| SC-1 | EVM helps identify schedule delays early | | | | | |
| SC-2 | EVM metrics (SPI, SV) guide schedule adjustments | | | | | |
| SC-3 | EVM improves schedule predictability compared to traditional methods. | | | | | |
| SC-4 | EVM metrics are integrated with critical path method (CPM) scheduling | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| SC-5 | EVM improves early detection of schedule risk compared to traditional Gantt Chart monitoring | | | | | |

**Section D: Challenge in EVM Adoption**

- (All respondents answer this section, regardless of SA-0)

**Scale: 1 = Not Significant, 2 = Minor, 3 = Moderate, 4 = Significant, 5 = Very Significant**

| **Challenge in EVM Adoption** | | | | | | |
|---|---|---|---|---|---|---|
| **Item No.** | **Statement** | **Not Significant** | **Minor** | **Moderate** | **Significant** | **Very Significant** |
| SD-1 | Lack of technical expertise/training limits EVM adoption | | | | | |
| SD-2 | Low digital maturity (Software/tools) limits EVM adoption | | | | | |
| SD-3 | Weak management commitment limits EVM adoption | | | | | |
| SD-4 | Fragmented documentation limits EVM adoption | | | | | |
| SD-5 | Resistance to change limits EVM adaption | | | | | |
| SD-6 | Cost of implementation limits EVM adoption | | | | | |
| SD-7 | Lack of standardized procedures/policies limit EVM adoption | | | | | |
| SD-8 | Unclear regulatory requirements hinder systematic EVM adoption | | | | | |
| SD-9 | Other (s) | | | | | |

**Annex 2: Interview Questionnaire for study on "Effectiveness of Earned Value Management (EVM) Integration in Cost and Schedule Control in Private Real Estate Building Projects in Addis Ababa"**

**IMPORTANT NOTE:**

Information provided through the questionnaire will be treated with confidentiality and will be exclusively for academic purpose. All answers will be considered right.

## Semi-Structured Interview Questionnaire

### Section 1: Familiarity and Practice of EVM

- How familiar are you with Earned Value Management (EVM)?
- How is EVM currently practiced in the projects you have worked on?

### Section 2: Integration and Effectiveness

- What does effective integration of EVM look like in your daily project monitoring activities?
- How has EVM helped you identify or manage cost overruns?
- How has EVM helped you detect or address schedule delays?

### Section 3: Communication and Tools

- How are EVM results communicated to stakeholders, and how do they respond?
- What project management tools or software have you used with EVM, and how effective are they?

### Section 4: Barriers to Adoption

- What challenges have you faced in adopting or sustaining EVM?
- How does leadership commitment and organizational culture affect EVM adoption?

### Section 5: Perceived Value and Recommendations

- What value has EVM added to your projects in terms of cost predictability, schedule reliability, and client confidence?
- What changes, support, or policies would make EVM adoption more effective in Ethiopian private building projects?

## Annex 3. Cover letter accompanying questionnaire/ question




**To: _____**

**RE: Request for Participation in a Research Study**

Dear Respondents

I am attending a post graduate program in Project Management at Addis Ababa University School of Commerce (AAUSC). I'm undertaking a research study on "**The Effectiveness of Earned Value Management (EVM) Integration in Cost and Schedule Control in Private Real Estate Building Projects in Addis Ababa.**" as a part of my degree requirements.

Therefore, I would appreciate it if you could take a few minutes to respond to the following questions about how projects in your business and your project work benefit significantly from the use of project managing tools like Earned Value Management. Your identity will be maintained with the strictest confidentiality, and all the information you supply will be used solely for academic purposes. I sincerely appreciate your help and say thank you in advance.

Thank you for your cooperation in advance!

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