TECHNOLOGICAL INNOVATIONS ON MONITORING AND EVALUATION IN SELECTED INFRASTRUCTURAL PROJECTS: A STUDY IN NAIROBI COUNTY, KENYA.

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DECLARATION AND APPROVAL

Declaration

This thesis/project is my original work and has never been presented for any academic award in any institution.

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DEDICATION

This research project is dedicated to my family, friends and my amazing husband, Salah Abdalla Salim, for his words of wisdom and steadfast assistance.

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ABSTRACT

Effective M&E is critical for ensuring the successful implementation of infrastructural projects. However, traditional M&E practices face challenges such as inefficiencies which hinder project accountability and performance. This study explored the influence of technological innovations on M&E in selected infrastructural projects in Nairobi County, Kenya. Specifically, it examined the influence of mobile data collection tools, Big Data analytics, Artificial Intelligence technologies, and crowdsourcing platforms on monitoring and evaluation in infrastructural projects. The study used Diffusion of Innovations Theory and Technology Acceptance Model. The research adopted a convergent parallel mixed-method design. The study targeted 65 participants. Census sampling technique was used to sample participants. The sample size was 65 participants comprising of 20 project managers, 20 M&E professionals, 10 county officers, 10 accounting officers and 5 MEPAK officials. Questionnaire and interview guide were used to collect data. Reliability and validity of the research tools was tested. The data that were obtained from this study was analyzed using SPSS software program version 26. Quantitative data was analyzed using descriptive statistics mainly percentages and frequencies whereas multiple linear regression model statistical tool was used to analyze the relationship between variables. The qualitative data was analyzed thematically. Ethical consideration was observed. The study found that the adoption of mobile data collection tools in monitoring and evaluation practices for infrastructural projects in Nairobi County was moderate. While digital tools significantly enhance M&E effectiveness, their adoption remains inconsistent. Data revealed that only 16.7% of respondents often use mobile data collection tools, despite 68.4% rating them effective particularly for improving accuracy (70.0%), GPS-based tracking (80.0%), and community participation (80.0%). Big data analytics adoption was low at 21.7%, yet 75.0% of users acknowledged improved decision-making, 60.0% noted enhanced visualization, and 80.0% highlighted better transparency. Artificial Intelligence technologies show stronger uptake, with 76.7% of respondents reporting full or large-scale integration. About 65.0% noted a transformative or significant impact on M&E through faster data analysis, predictive insights, and improved accuracy. However, challenges remain: high costs (36.7%), limited expertise (25.0%), and weak infrastructure. Crowdsourcing platforms were used sometimes. While 68.4% found them effective in enhancing stakeholder engagement and feedback, barriers such as sustainability (43.3%), language (30.0%), and digital literacy (15.0%) were cited. The findings imply that while technological innovations hold strong potential to transform M&E practices in infrastructural projects across Nairobi County, their full impact is hindered by financial, technical, and infrastructural constraints. Addressing these barriers through targeted investments in digital capacity building, infrastructure development, and supportive policy frameworks is essential to unlock the transformative power of technology in M&E.

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LIST OF ABBREVIATIONS AND ACRONYMS

M&E: Monitoring and Evaluation

MEPAK: Monitoring and Evaluation Professionals Association of Kenya

AI: Artificial Intelligence

RBV: Resource Based View

OECD: Organization for Economic Cooperation & Development

UNDP: United Nations Development Programme

SDGs: Sustainable Development Goals

RBV: Resource-Based View

TAM: The Technology Acceptance Model

PU: Perceived Usefulness

NACOSTI: National Commission for Science, Technology, and Innovation

NGOs: Non-government organizations

SPSS: Statistical Package for Social Science

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Monitoring and Evaluation (M&E) are fundamental components in management and assessment of development projects worldwide, serving crucial roles in enhancing project effectiveness, ensuring accountability, and measuring impact (Chege & Wang, 2020). Monitoring is a continuous, project-long process aimed at determining whether the plan is being followed, identifying deviations, and implementing timely corrective actions. In contrast, evaluation involves a methodical and impartial appraisal of a program, project, or policy, whether it is continuing or finished, with an emphasis on its planning, execution, and results (Kim, 2020).

In order to guarantee that project objectives are fulfilled, monitoring and evaluation which include the methodical tracking of project progress, resource allocation, and performance metrics are essential components of project management. Maintaining project timelines and budgets depends on the prompt detection and resolution of problems made possible by effective project monitoring and assessment (Vidal, Marle & Bocquet, 2021). Due to their time-consuming nature and vulnerability to human error, traditional project monitoring and assessment techniques, like manual data input and sporadic site visits, are frequently insufficient for infrastructure projects of all sizes (Reja, 2022).

The adoption of technological innovations has revolutionized project monitoring and evaluation by enhancing accuracy, efficiency, and real-time data availability. For instance, the synergy of technological innovations tools such as mobile data collection tools, blockchain, data analytics, cloud computing, and social media/crowdsourcing platforms are increasingly being recognized for their transformative potential in construction projects; enables seamless integration

of various monitoring and evaluation systems, reducing errors and enabling timely corrective actions (Ganda, 2019). Infrastructural projects, such as bridges, highways, and skyscrapers, present unique challenges that require innovative monitoring and evaluation solutions. These projects often involve complex logistics, significant financial investments, and the coordination of multiple stakeholders (Quinci and Bianchi, 2022).

Because of the importance assigned to M&E practices in infrastructural projects, research has been done all over the world which focus on issues that influence their success. In India, for instance, efforts to rejuvenate the infrastructure sector focus on reducing risks, improving project visibility, and enhancing marketability to attract global investments and technological innovations are increasingly being integrated into monitoring and evaluation practices for infrastructural projects (Krishna and Mukherjee, 2021). Despite the rapid digital transformation in India, M&E in infrastructural projects faces challenges including delayed implementation and inadequate real-time data integration (Aiyetan & Das, 2022). While innovations such as mobile data collection tools, blockchain, data analytics, cloud computing, and social media/crowd sourcing platforms have been introduced, their full potential remains underutilized due to limited capacity and infrastructure in rural areas (Kumar & Singh, 2020). These gaps result in inefficient monitoring and reduced accountability in critical infrastructural projects.

Similarly, Canada has been lauded for its progressive adoption of technological innovations in infrastructure monitoring and evaluation. A study conducted by Brown and Taylor (2022) highlights that despite efforts to incorporate blockchain and cloud computing in critical infrastructural projects for transparency, gaps in expertise and integration frameworks slow down its widespread adoption. Other significant barriers including high costs of technological implementation and resistance from traditional sectors to transition fully into digital systems has

remained a challenge. Saina and Sanila (2023) opined that assessing the influence of technological innovations is crucial to enhancing infrastructural project efficiency, ensuring accountability, and accomplishing sustainable development objectives in infrastructural projects.

In Africa's Sub-Saharan region, rapid urbanization and infrastructure development present unique challenges and opportunities for integrating advanced M&E technologies. The adoption, for example, real-time data collection is made possible via mobile data collection tools in remote and resource-constrained environments, facilitating more accurate and timely reporting on project progress (Carroll & Conboy 2020). The adoption of technological innovations is often facilitated by supportive policies, whereas developing countries in Africa may encounter challenges due to inconsistent enforcement of regulations. Oluseye (2023) examined possible political corruption in Nigeria's major infrastructure projects and concluded that corruption hinders the effectiveness of Monitoring and Evaluation by eroding transparency and accountability. Usage of technological innovations M&E tools can enhance the outcome and sustainability of infrastructural projects (Okem, 2022).

In Kenya, although technological innovations on mobile data collection tools, blockchain, data analytics, cloud computing, and social media/crowdsourcing platforms may provide scalable solutions for data storage and management on monitoring and evaluation practices, they face several challenges. One major issue is the difficulty of integrating advanced tools like data analytics software due to limited technical expertise and inadequate training (Kariuki & Muchiri,2020). Additionally, cost constraints pose significant hurdles as the acquisition of hardware, software, and training for personnel often exceeds budget allocations, particularly in public or donor-funded infrastructural projects (Mwangi & Maitha, 2019). Furthermore, insufficient digital infrastructure in remote areas of Kenya limit the efficient use of technology in

M&E practices (Nyangaga, Ombuki & Bosire,2021). Hence, the influence of technological innovations on monitoring and evaluation practices in infrastructural projects in Kenya is unknown.

Thiong'o and Gitau (2019) evaluated the contribution of monitoring and evaluating how well sustainable development goals are being met in a few Kenyan projects and asserted that resistance to change among staff and stakeholders is a barrier, with many professionals reluctant to adopt new technologies for fear of redundancy or lack of confidence in their digital skills leading to failure in order to stay up with the rapid advancement of technology is causing uncertainty in its use of innovative tools like blockchain systems. These challenges may be hindering the understanding on the influence of technological innovations in improving M&E efficiency and outcomes in Kenya's infrastructural projects. Makau and Gakuru (2020) opined that technological innovations tools such as data analytics can be use by organizations and development agencies in analyzing large datasets. Cloud computing infrastructure provides scalable solutions for data storage and management, enabling seamless collaboration and access to project information from anywhere in the world (Makau & Gakuru, 2020).

As the Kenyan capital, Nairobi County, serves as a pivotal hub for economic, social, and infrastructural development initiatives. The county hosts a myriad of projects including transportation infrastructure expansion projects, provision of healthcare, education infrastructure, and waste management infrastructure. These projects are essential for addressing urban challenges exacerbated by rapid population growth and urbanization trends. However, infrastructure deficits remain a pressing issue. Despite ongoing efforts, the city's road networks are often congested and inadequate, impacting transportation efficiency and economic productivity. The some of the areas in Nairobi County often lack proper sanitation infrastructure creating disparities in service delivery

that require targeted interventions and sustained efforts (Ndungu & Karugu 2019). Addressing these challenges requires technological innovations that enhance transparency, accountability, and the overall effectiveness of infrastructural projects.

Technological innovations such as mobile data collection tools, blockchain technology, data analytics, cloud computing, and social media/crowdsourcing platforms offer promising solutions to improve procedures for monitoring and evaluating in Nairobi County's selected infrastructural projects (Oiriga, & Ngari, 2019). By leveraging these innovations, stakeholders can enhance infrastructural projects efficiency, transparency, and community engagement, ultimately contributing to effectiveness of infrastructural projects in Nairobi County. Although technological innovations have significantly advanced monitoring and evaluation practices across various sectors, their precise influence on infrastructure projects has not been thoroughly studied. Although the broad significance of technological advancements in project management has been extensively studied, limited information has been established about how they influence monitoring along with evaluation in particular infrastructure projects in Kenya. By examining how technological advancements have affected monitoring and evaluation procedures in a few chosen infrastructure projects in Nairobi County, Kenya, the objective of this study was to bridge this gap.

1.2 Statement of Problem

Effective monitoring and evaluation practices that guarantee accountability, transparency and the achievement of intended goals has a significant effect on infrastructure projects' success. Technological innovations such as mobile data collection tools, blockchain, data analytics, cloud computing, and crowdsourcing platforms have revolutionized M&E processes globally, offering enhanced efficiency in data collection, analysis, and reporting (UNDP, 2020). These advancements

provide opportunities to streamline decision-making, forecast project outcomes, and optimize resource allocation (Yin, Wang, & Zhu, 2020).

Despite these global advancements, the influence of such innovations on M&E practices in infrastructural projects within Nairobi County, Kenya, remains underexplored. Traditional M&E practices in the county face significant challenges, including limited capacity for data delays, real-time data analysis, and predictive insights processing due to reliance on manual methods, and fragmented data across project phases and stakeholders (World Bank, 2018; OECD, 2021). These challenges compromise the timeliness of decision-making, leading to inefficiencies and suboptimal project outcomes.

For instance, a World Bank (2023) report indicated that only 21% of infrastructural projects in Nairobi County were completed effectively, with 49.21% failing due to inadequate M&E frameworks and resource misallocation. Furthermore, a study on infrastructure projects revealed that 62.4% of respondents cited insufficient financial resources for M&E as a primary cause of poor infrastructural project oversight and prolonged timelines. The integration of technological innovations in M&E practices presents a transformative opportunity to address the identified shortcomings and enhance the effectiveness of selected infrastructural projects in Nairobi County. Despite the growing emphasis on technological innovations transformation, there is limited empirical evidence on how specific technologies, such as mobile data collection tools, big data analytics, artificial intelligence (AI), and crowdsourcing platforms, influence M&E practices in selected infrastructural projects in Nairobi County. Therefore, this study investigated influence of technological innovations on monitoring and evaluation practices in selected infrastructural projects in Nairobi County, Kenya.

1.3. The Purpose of this Study

The intent of this research was to determine the influence of Technological Innovations on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya.

1.4. Research Objectives

i. To determine the influence of mobile data collection tools on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya.

ii. To assess the influence of Big Data analytics on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya.

iii. To establish influence of Artificial Intelligence (AI) technologies on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya.

iv. To assess the influence of utilization of crowdsourcing platforms on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya.

1.5. Research Questions

i. How have mobile data collection tools been integrated into the M&E frameworks in selected infrastructural projects in Nairobi County, Kenya.

ii. What are the specific contributions of Big Data analytics in improving the accuracy and timeliness of M&E data analysis across different selected infrastructural projects in Nairobi County, Kenya.

iii. In what ways has Artificial Intelligence been utilized to automate data processing and enhance decision-making in M&E practices in selected infrastructural projects in Nairobi County, Kenya.

iv. How effective are crowdsourcing platforms in gathering community feedback and improving stakeholder engagement in M&E practices of selected infrastructural projects in Nairobi County, Kenya.

1.6. Significance and Justification of the Study

The significance of this study on the influence of technological innovations on Monitoring and Evaluation (M&E) practices in selected infrastructural projects in Nairobi County, Kenya is multifaceted and pivotal for several reasons. Firstly, Nairobi County serves as a microcosm of urban development challenges prevalent across many rapidly growing cities in developing countries. Understanding how technological advances like as mobile data collection tools, big data analytics, artificial intelligence (AI), and crowdsourcing can enhance M&E practices is crucial for addressing these challenges effectively.

Second, the findings of this research will contribute to the body of knowledge presently available on M&E methodologies by demonstrating practical applications of innovative technologies in real-world development contexts. This contribution is particularly valuable as it aligns with global efforts as the Sustainable Development Goals (SDGs) are pursued, where effective M&E is essential for measuring progress and ensuring accountability.

Additionally, the study will offer useful information to development professionals, legislators, and stakeholders involved in planning, implementing, and evaluating development projects in Nairobi County and beyond. By highlighting the advantages and obstacles involved with adopting technological innovations in M&E, the study is to provide information for strategic decision-making procedures that could lead to improved community involvement, resource allocation, and project outcomes.

This study's justification comes from the pressing necessity to solve inefficiencies in traditional monitoring and evaluation practices in Nairobi County's infrastructural projects. Nairobi, with its dynamic urban growth and diverse projects, provides a relevant context to investigate how innovations like mobile data collection tools, big data analytics, AI, and crowdsourcing platforms can improve M&E processes. These technologies have the potential to resolve issues such as data fragmentation, delayed reporting, and limited stakeholder engagement. The study aligns with global trends in digital transformation and data-driven decision-making in development sectors. It addresses a significant research deficiency by concentrating on the use of cutting-edge technologies in M&E frameworks for urban development, thereby contributing to both knowledge and practice in this field. Practically, the findings will offer tailored recommendations to enhance M&E effectiveness, addressing specific challenges and opportunities in Nairobi County, and guiding local stakeholders and policymakers toward better outcomes in project implementation.

1.7. Scope of the Study

This study's scope was centred on selected infrastructural projects in Nairobi County, Kenya, spanning various infrastructure development sectors such as, healthcare, education, and environmental sustainability. The study will specifically examine how mobile data collection tools, big data analytics, AI, and crowdsourcing platforms are currently being used or can potentially be integrated into existing M&E practices.

In terms of methodology, the research employed qualitative as well as quantitative approaches to collect information from community people, government representatives, project managers, and development professionals. Key areas of investigation included the adoption rates

of technological innovations, perceived benefits and challenges, impact on data quality and timeliness, and implications for project management and decision-making.

The geographic scope encompasses urban areas within Nairobi County, with a focus on both public and private sector-led development initiatives. The study explored case studies and examples of successful implementation of technological innovations in M&E, as well as barriers hindering their adoption and scalability. The study's scope had been expected to give a thorough grasp of how technological advancements can change M&E procedures in Nairobi County, Kenya, development projects. In order to produce insights that might guide policy changes, increase project efficiency, and ultimately contribute to sustainable urban development outcomes, the study looked at these innovations within a particular urban setting.

1.8 Limitation of the Study

Although there were several constraints to this investigation, deliberate steps were taken to mitigate their effects and safeguard the validity and reliability of the findings. Confidentiality posed a major challenge, especially in handling data collected through mobile data tools and digital platforms. Although there were inherent risks of cybersecurity breaches and accidental data exposure, the study mitigated these threats by using encrypted tools, password-protected systems, and restricted access protocols. Informed consent processes were carefully followed to assure participants of data security and ethical compliance.

Lack of cooperation from some stakeholders also posed a potential limitation. Certain individuals and institutions hesitated to fully participate or provide accurate information due to concerns about transparency, project outcomes, or unfamiliarity with technological innovations in monitoring and evaluation. This was addressed through continuous engagement, clear communication regarding the objectives of the study, and by illustrating how their involvement

could enhance project performance. Building rapport and trust significantly improved cooperation and data accuracy.

Technological infrastructure constraints presented another limitation, especially in places where access to essential digital tools is restricted or internet connectivity is erratic. In order to get around this, the study employed offline-capable data collection tools and adopted flexible upload strategies to ensure that data could still be captured and later synchronized. Enumerators were equipped with basic technical support and trained to handle such limitations effectively.

Concerns related to data quality were also significant. Despite leveraging technological tools, challenges such as incomplete, inaccurate, or inconsistent data arose during integration of diverse data sources, including those processed by AI algorithms. The research team employed rigorous data cleaning, cross-checking, and validation processes to guarantee the data's dependability. Triangulation from multiple sources and continuous quality assurance reviews further strengthened the validity of the findings.

Resource constraints, including limited time and budget, posed challenges to the study's scope and complexity. To address this, the research design focused on high-impact development projects and utilized purposive sampling to maximize resource efficiency. Data collection and analysis were streamlined through parallel processing to ensure timely completion without compromising quality.

Resistance to change from some stakeholders, particularly within government agencies and development organizations, was also encountered. This resistance was mitigated by involving key stakeholders in the research process, presenting evidence of successful use of digital M&E tools, and creating an inclusive dialogue that promoted innovation. These measures helped reduce

institutional inertia and facilitated broader acceptance of technological solutions in monitoring and evaluation practices.

1.9. Delimitations

This study focused specifically on urban development projects within Nairobi County, Kenya, excluding rural areas and other regions of the country. By delimiting the geographic scope to urban contexts, the study sought to offer specific insights into the use and consequences of technological innovations in M&E practices within densely populated and rapidly developing urban environments.

1.10 Assumptions of the Study

Assumptions of the research according to Creswell (2017) are foundational beliefs that are presumed to be true and guide the research. Assumptions provide a basis for conducting the study and framing research methodology and objectives. In this study on the influence of technological innovations on monitoring and evaluation practices in infrastructural projects in Nairobi County, the following assumptions could apply.

i. It was assumed that stakeholders in selected infrastructural projects in Nairobi County had adopted or are in the process of adopting technological innovations such as mobile data collection tools, Big Data analytics, Artificial Intelligence, and crowdsourcing platforms.
ii. The study assumed that respondents who took part in this research were willing to provide honest, accurate, and comprehensive responses during data collection.
iii. It was assumed that sufficient and reliable data on M&E practices and infrastructural project outcomes in Nairobi County are accessible and that the data accurately reflects the current state of M&E practices.

iv. It was assumed that the existing challenges in M&E practices, such as resource misallocation, delays, and data fragmentation, are prevalent and acknowledged by the stakeholders involved in the projects.

v. It was believed that the selected sample size and the participants were represented the broader population involved in infrastructural project M&E in Nairobi County.

vi. It was assumed that the data analysis methods used was objectively and accurately evaluate the influence of technological innovations on M&E practices.

1.11 Operational Definition of Key Terms

Monitoring and Evaluation: This alludes to a systematic process comprising the collection, analysis, and interpretation of data. Its primary objective is to assess the progress, performance, and impact of projects.

Technological Innovations: This refers to various advancements that enhance Monitoring and Evaluation practices. These innovations include mobile data collection tools, which facilitate data capturing in the field in real-time using smartphones or tablets.

Mobile Data Collection Tools: Using mobile devices like smartphones and tablets, these digital tools and applications collect data in real time. In this case, it refers to their incorporation into M&E frameworks in order to enhance the effectiveness and precision of data collecting for Nairobi County development programs.

Big Data Analytics: This is how advanced analytical techniques in processing and analyzing big and intricate datasets. Within the parameters of this research, Big Data analytics contributes to improving the accuracy and timeliness of M&E data analysis across different development projects.

Artificial Intelligence: AI encompasses the usage of a device learning algorithms and other computational methods to execute functions typically necessitating human cognition. In this study, AI is utilized to mechanize data processing and improve decision-making in M&E practices within development projects in Nairobi County.

Development Projects: It refers to initiatives aimed at improving infrastructure, public services, healthcare, education, and environmental sustainability within Nairobi County. These projects are designed to address societal needs and enhance the well-being of local communities.

Urban Development: It refers to the planning and implementation of projects and policies aimed at enhancing quality of life and economic opportunities within urban areas, specifically Nairobi County. It involves strategies to manage urban growth, improve infrastructure, provide essential services, and create sustainable environments.

Crowd Sourcing: It is the technique of acquiring information, ideas, services, or contributions from a huge group of individuals, generally via the internet, instead of relying solely on traditional sources or internal resources.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter devolved into the existing body of knowledge on the integration of advanced of technological tools in Monitoring and Evaluation practices, specifically in selected in fractural projects in Nairobi County, Kenya. The review was segmented into four key areas: the adoption of mobile data collection tools, the influence of big data analytics on M&E processes, the role of artificial intelligence in analysis of data and decision-making, and the utilization of crowdsourcing platforms for community engagement. The aim of this literature review was to give a thorough grasp of the advantages, difficulties, and current trends related to these technological advancements through examining empirical studies and case examples from global, regional, and local contexts. The insights gathered informed the subsequent chapters of this research, focusing on how these tools could improve effectiveness of M&E practices in Nairobi County, thereby contributing to more impactful and sustainable development outcomes.

2.2 Empirical Literature

The review of empirical literature in this section was arranged according to four major thematic categories that match the goals of the study: the adoption of mobile data collection tools, the influence of big data analytics on M&E processes, the role of artificial intelligence in data analysis and decision-making, and the utilization of crowdsourcing platforms for community engagement. These thematic areas provide a focused framework for examining how emerging technologies are transforming M&E practices and enhancing project performance across diverse development settings.

2.2.1. Adoption of Mobile Data Collection Tools and Monitoring and Evaluation Practices

In order to ensure accountability, effectiveness, and efficiency, monitoring and evaluation are essential elements in the successful execution of infrastructure projects (Kier & Huemann, 2022). By improving real-time data collecting, analysis, and decision-making, mobile data collection systems have revolutionized traditional M&E procedures (Wairimu & Wanjala, 2021). With an emphasis on infrastructure projects, this section examines the influence literature on the impact of mobile data gathering methods in M&E (UNDP, 2019).

Mobile data collecting solutions have been crucial in improving M&E procedures in a number of industries worldwide, including infrastructure, health, and agriculture. Studies indicate that mobile technologies improve data accuracy, timeliness, and accessibility, addressing key challenges in traditional paper-based systems (Guerrero et al., 2021). For instance, a World Bank analysis in 2022 highlights the use of KoBoToolbox and Open Data Kit in infrastructure development projects, leading to enhanced real-time monitoring and reduced data collection costs (UNDP, 2019).

In order to track project progress, evaluate impact, and enhance decision-making, mobile solutions like SurveyCTO, CommCare, and ArcGIS have become frequently used (Tran, 2022). Boyd (2021) used a descriptive survey methodology with quantitative approaches in a research on transport infrastructure projects in Europe. The study focused on a group of 20,125 individuals, and the sample size of 379 was estimated using the Morgan and Krejcie table. Data collected through teacher and student surveys was cleaned, coded, and analysed using SPSS version 26.

The results showed that mobile data gathering facilitated real-time reporting, reduced human error, and ensured compliance with project timelines (Kariuki & Wambua, 2020). However, while Boyd's (2021) study demonstrated the value of mobile tools, it lacked a mixed-

method approach incorporating qualitative insights from project managers, government officials, and technology experts to offer a more comprehension of mobile data tools in Nairobi's infrastructure sector (Ochieng & Muriuki, 2021).

In order to create sustainable and circular cities in Bologna, Italy, Benedetti, Ghisellini, and Ulgiati (2022) studied the digitisation of the urban environment. The study, employed a descriptive survey research design with 350 participants and was informed by Classical Liberal Theory, used purposive sampling to choose significant respondents. Big data analytics and AI-powered technology made it possible for data-driven decision-making through digitalisation, which aided stakeholders in evaluating project performance, identifying inefficiencies, and implementing evidence-based changes (Marongiu & Spanu, 2020).

Similarly, in Nairobi's infrastructural projects, mobile data collection tools such as KoBoToolbox and CommCare have demonstrated the potential to optimize decision-making by improving access to real-time and accurate data (World Bank, 2021). The complete implementation of evidence-based project management was, however, constrained by the lack of integration of cutting-edge technology like artificial intelligence and predictive analytics into Kenya's M&E systems (Wairimu & Wanjala, 2021).

In Ghana, research indicates that the integration of smart technologies in infrastructure projects enhances stakeholder collaboration and project efficiency, yet implementation is hindered by resistance from traditional engineers and public officials accustomed to manual systems (Ejidike & Mewomo, 2023). Agyeman and Nyarko (2021) found that despite the proven benefits of mobile-based monitoring and evaluation tools, poor digital literacy among government personnel significantly slowed down their adoption in public infrastructure monitoring. Similarly, Danso and Boateng (2022) observed that infrastructural projects incorporating mobile data

collection tools experienced faster decision-making cycles, but noted that inconsistent institutional support and lack of incentives impeded long-term usage. These findings collectively suggest that while digital innovations hold clear potential, systemic reluctance to adopt them requires deliberate change management interventions, including capacity-building, user training, and policy reform to support M&E transformation in contexts such as Nairobi.

The study by Otundo (2024) on creative monitoring and evaluation techniques in Kenyan sustainability initiatives offers important new information about how digital tools and community engagement might improve M&E procedures. In order to gather thorough viewpoints on the adoption of digital M&E, the research used a mixed-approaches strategy, integrating quantitative surveys (N=200 stakeholders, including project managers, field officers, community leaders, and beneficiaries) with qualitative techniques (comprehensively conversations in focus groups and interviews).

The results showed a strong great connection between the efficacy of M&E procedures and the use of digital technologies like mobile applications and Geographic Information Systems (GIS). Otundo (2024) recommends using digital tools like geographic information systems and mobile applications to increase the efficacy of M&E in infrastructure projects. These tools can promote stakeholder involvement, improve data accuracy, and enable real-time reporting. Wairimu and Wanjala (2021) recommend expanding the utilising mobile devices to gather data to improve accountability and minimize delays in decision-making processes, particularly in decentralized project contexts. Mwangi and Muthoni (2022) further propose tailoring digital M&E tools to meet the specific demands of large-scale infrastructure initiatives, emphasizing the need for capacity-building, cost-effective implementation strategies, and technical support systems. These recommendations highlight the importance of contextualizing mobile M&E solutions to address

infrastructure-specific challenges in Nairobi County, including long project durations, complex datasets, and resource constraints.

2.2.2 Big Data Analytics and Monitoring and Evaluation Practices

Over the past few years, there has been an increase in interest in incorporating Big Data analytics into the monitoring and assessment procedures of infrastructure projects. Numerous international studies have shown how Big Data tools and technology facilitate better decision-making, increase operational effectiveness, and promote more efficient use of resources when building infrastructure.

For instance, York and Bamberger's (2024) study on the using big data to improve evaluation was carried out in the United States. Descriptive survey design was used in the research. To choose people, the researcher employed purposive sampling. Descriptive statistics and content analysis were employed in the data analysis. In order to improve project assessments and guarantee more significant development effects, the researcher found that Big Data is revolutionizing M&E procedures in several regions and provided tips for successfully integrating new data sources.

York and Bamberger (2024) recommended leveraging big data technologies to transform M&E practices, particularly through the integration of non-traditional data sources to improve the accuracy and depth of project assessments. Similarly, Hatry (2020) suggests that adopting real-time data analytics can significantly improve responsiveness and learning in government-funded infrastructure programs by providing timely insights for course correction. Kettunen and Schedler (2021) also propose embedding digital feedback loops and predictive modeling tools into public project evaluation systems to increase transparency and efficiency. While these approaches offer valuable guidance, their direct applicability to Kenya may be limited due to differences in

technological infrastructure, institutional capacity, and resource availability. Therefore, contextual adaptation is essential for effective implementation in Nairobi's infrastructure M&E systems.

In their study "Optimising Development Project Outcomes through Big Data Analytics in development projects across India and Bangladesh," Kumar and Gupta (2023) examined how big data analytics are being used in Asia. Understanding how advanced analytics tools like predictive models, data processing methods, and data visualisation platforms have been used to improve the tracking and assessment of development initiatives in these nations was the goal of the study. 481 respondents participated in in-depth interviews, focus groups, and self-administered questionnaires as a component of the research's mixed-methods methodology. To increase the pace and calibre of M&E in development projects, particularly in data-intensive environments, Kumar and Gupta (2023) advise implementing big data analytics techniques including predictive modelling and sophisticated data visualisation systems.

Similarly, Zhang and Li (2021) suggest that incorporating AI-driven analytics in infrastructure monitoring in China has enabled better forecasting, reduced resource wastage, and improved stakeholder reporting mechanisms. In a related study, Ahmed and Rahman (2022) advise that in Bangladesh, the use of mobile-based M&E platforms, integrated with cloud computing, helped decentralize decision-making and improved the responsiveness of public infrastructure programs. While these strategies offer valuable innovations, their applicability in Kenya depends on overcoming structural challenges such as limited digital infrastructure, inadequate data governance frameworks, and inconsistent technical capacity within public agencies.

An investigation on the application of big data analytics to development projects in Ghana was conducted by Mensah and Owusu in 2023. 317 respondents in managerial roles in the technology sector provided primary data using a structured questionnaire, which was then

subjected to both inferential and descriptive analysis. According to the survey, the real-time insights gained from Big Data analytics allowed for the development of adaptive management strategies. Mensah and Owusu (2023) suggest that leveraging big data analytics enables project managers to adopt adaptive management strategies, allowing for real-time decision-making and more responsive project adjustments. Asiedu and Tetteh (2022) recommend incorporating predictive analytics into public infrastructure projects to forecast risks and optimize resource allocation, resulting in improved project execution and accountability.

Likewise, Ofori and Adjei (2021) advise that integrating cloud-based mobile M&E platforms enhances collaboration among stakeholders, minimizes delays in reporting, and promotes transparency in large-scale development initiatives. These suggestions indicate the transformative potential of digital and data-driven M&E frameworks. However, in Kenya, applying similar strategies would require addressing gaps in digital infrastructure, technical expertise, and data integration policies within public sector projects.

In Nigeria, Ogundipe (2024) conducted a study titled "Transformative Effects of Big Data Analytics on M&E in Nigerian Development Projects." The research focused on various sectors, including environmental conservation and public health. Ogundipe found that advanced analytics have enabled proactive risk management and targeted interventions. Ogundipe (2024) suggests that employing advanced big data analytics in M&E can facilitate proactive risk management and enable more targeted development interventions across sectors such as environmental conservation and public health. Similarly, Eze and Okonkwo (2022) advise that integrating cross-platform data sources through interoperable systems enhances decision-making efficiency, though they caution that low digital literacy levels can impede tool utilization. In addition, Adebayo and Salami (2021) recommend investing in ICT infrastructure and stakeholder capacity-building to support the

scalable implementation of mobile and big data tools in infrastructure project monitoring. These insights are valuable for Kenya's context, where similar infrastructural and skill limitations exist. A strategic approach involving infrastructure investment, harmonized data systems, and stakeholder training would be essential to replicate such outcomes.

Studies focused on the particular uses of big data analytics in Kenya for monitoring and assessing a range of industries. Njoroge and Mwangi's (2024) study on the use of big data analytics in Nairobi's urban development projects. Twelve schools participated in the study, which used a correlational survey technique. The technique of gathering data involved the use of questionnaires. Pearson correlation and hierarchical regression analysis were used to analyse the data. The results showed that these instruments made it possible for more targeted interventions and improved programmatic impact assessments, making it easier for project managers to identify issues early and adapt to changing circumstances. In Kenya, scholars have recommended the integration of Big Data analytics in monitoring and evaluation to enhance evidence-based decision-making in urban development initiatives. Njoroge and Mwangi (2024) suggest that using tools such as predictive analytics and geospatial data enables project managers to identify emerging issues earlier and adjust interventions accordingly, improving programmatic impact.

Similarly, Kimani and Otieno (2023) advise that real-time data processing through big data systems supports better resource allocation and responsiveness in infrastructure projects. Additionally, Chege and Wanjiru (2022) emphasize the value of combining traditional M&E with big data techniques to improve accuracy and stakeholder reporting, though they caution that challenges such as data privacy and analytic capacity still need to be addressed. These suggestions point to the importance of adapting big data technologies within Nairobi's urban development sector to foster more responsive, efficient, and accountable project management.

2.2.3 Artificial Intelligence in Data Analysis and Monitoring and Evaluation Practices

Artificial Intelligence facilitating quicker, more precise, and data-driven decision-making, revolutionizing monitoring, assessment, and data analysis processes. The quality of program evaluations, data processing efficiency, and forecasting and trend analysis accuracy might all be greatly improved by incorporating AI into M&E (Yitmen & Alizadehsalehi, 2021).

Bamberger and Kirk (2020) advocate for the adoption of AI in program evaluations to improve the accuracy of forecasting, streamline large dataset processing, and generate actionable insights in real time. Meanwhile, Kankam and Boateng (2022) emphasize that AI-enabled systems can support predictive monitoring in development projects, helping stakeholders anticipate risks and allocate resources more effectively.

In United State, Johnson, Smith and Lee (2023) did a study on the AI applications in development projects in Monitoring and Evaluation. Both qualitative and quantitative approaches were used in the investigation. Purposive sampling was the method used to select the study participants. The total number of project managers was fifteen. A questionnaire served as the main data collection tool. According to the poll, enhancing decision-making and automating data analysis require artificial intelligence capabilities like machine learning, natural language processing, and predictive analytics. Similarly, Patel and Rogers (2021) emphasize the value of AI-enabled systems for identifying performance gaps and generating real-time insights in U.S. development programs. Moreover, Thompson (2020) advocates for embedding AI tools into federal M&E systems to streamline reporting, reduce administrative workload, and enable predictive modeling for future interventions. These suggestions offer compelling strategies for improving M&E practices, though their application in contexts like Kenya would require adaptations to address infrastructure, data security, and capacity-building challenges.

In Asia, Tanaka and Yamada (2023) explored Leveraging AI for Sustainable Development in Asia: Case Studies and Innovations. After choosing the sample from a population of 500 using basic random sampling, the researchers employed a descriptive research survey approach and sent a questionnaire to 217 respondents. The research focused on the application of AI-driven platforms in Japan and South Korea, where AI technologies have been employed to detect patterns, automate repetitive tasks, and enhance predictive accuracy in development projects. The study emphasized that these AI applications have enabled adaptive management strategies and contributed to more efficient decision-making processes, significantly improving the overall effectiveness of development projects. Chen and Liu (2022) propose the use of machine learning and AI-based forecasting tools in China's infrastructure programs to improve data analysis, reduce inefficiencies, and accelerate decision-making timelines.

In addition, Park (2021) suggests that AI-assisted M&E frameworks in South Korea enable real-time adjustments in project implementation, thus increasing responsiveness and reducing delays. These recommendations highlight the transformative role of AI in development monitoring; however, successful application in Kenya would require tailored investments in digital infrastructure, data governance systems, and technical training to overcome contextual limitations.

In 2022, the World Bank conducted a study on how Burundi's monitoring and evaluation practices are affected by digital infrastructure. Both qualitative and quantitative approaches were used in the investigation. Purposive sampling was the method used to select the study participants. Twenty government representatives and ICT specialists participated in all. The primary instrument for gathering data was a questionnaire. The findings revealed that the AI and Emerging Technologies Lab in in Burundi has been actively engaged in projects that leverage AI for monitoring and managing infrastructural projects. The research includes developing machine

learning models and IoT-based systems to predict and enhance project performance, particularly in the agricultural sector. These efforts highlight the growing trend of integrating AI into M&E practices to improve project efficiency and effectiveness.

A research on the creation of monitoring and evaluation assessing government projects in Tanzania's Ministry of Health was carried out by Mleke and Dida (2020). In order to solve issues with manual project monitoring, like delays and inaccurate data, the study used an evolutionary prototyping approach to design the system. After being tested and assessed in relation to user needs, the designed system was approved for implementation inside the Ministry. The study established the relationship between project monitoring dimensions practices, enabling factors, and tools and project success attributes, assessed by time, cost, and quality. Msuya and Mrema (2021) advocate for the integration of digital dashboards in public infrastructure M&E, noting that these tools enhance transparency and provide stakeholders with real-time performance updates. Additionally, Kweka (2019) suggests that strengthening institutional capacity for digital data management in Tanzanian M&E systems is essential for ensuring consistent reporting and informed decision-making across development sectors. These proposals offer critical guidance for Kenya's own infrastructure projects, where similar digital transformations could bridge persistent gaps in efficiency and accountability.

In Kenya, Ogutu and Kamau (2024) conducted a study on the emerging trends in Artificial Intelligence for Monitoring and Evaluation in Nairobi, focusing on the influence of international best practices on local initiatives. A cross-sectional research design was employed, targeting adults aged 35 years and above, with data collected through questionnaires. The study found that AI technologies significantly improved data processing speed and the accuracy of predictive models, thereby enhancing responsiveness to community needs. But the report also brought attention to

issues like high implementation costs, data usage ethics, and a lack of specialised technical knowledge.

While Ogutu and Kamau's (2024) study provides critical insights into AI applications in M&E within Kenya, several knowledge gaps remain, particularly in the context of Nairobi County's infrastructural projects. The study broadly explored AI use in M&E but did not specifically examine the implications of technological innovations for large-scale infrastructural projects such as roads, bridges, and housing developments in urban areas like Nairobi. As noted by Mwangi and Njoroge (2022), Nairobi's rapid urbanization and infrastructural pressures demand context-specific technological solutions to enhance planning and accountability. Additionally, a report by UN-Habitat (2021) emphasizes that informal settlements in Nairobi present unique data and governance challenges that AI-driven M&E systems must be tailored to address. Moreover, Wambua (2023) argues that while AI has transformative potential in infrastructure monitoring, most existing models are not yet optimized for the complexities of urban environments in developing countries.

2.2.4 Utilization of Crowdsourcing Platforms and Monitoring and Evaluation Practices

The utilization of crowdsourcing platforms in Monitoring and Evaluation has gained increasing attention as organizations seek innovative ways to enhance data collection, stakeholder engagement, and decision-making processes (Hossain & Kauranen, 2021). Crowdsourcing, which involves outsourcing tasks to a large, distributed group of people via digital platforms, has revolutionized how data is gathered, processed, and analyzed in M&E practices (Brabham, 2023; Estelles, 2022).

Srivastava and Mostafavi (2021) examined the potential and difficulties of crowdsourcing and participatory planning in the construction of smart city infrastructure systems in India.

According to their research, crowdsourcing could greatly increase public involvement by allowing people to actively participate in infrastructure planning and construction, guaranteeing that projects were more in line with local requirements. Large-scale, real-time data collecting was also made easier by the method, which enhanced monitoring and assessment procedures and decreased expenses generally related to conventional data collection techniques. The study did, however, identify certain difficulties, such as worries about the accuracy and dependability of the data because information gathered from crowdsourcing may not necessarily be representative or correct.

Although these results provide insightful information, it's possible that they won't be entirely applicable in Kenya especially in Nairobi, where infrastructural projects face distinct challenges including high population density, informal settlements, and rapid urbanization (UN-Habitat, 2021). There is a significant knowledge gap regarding how crowdsourcing platforms can be effectively adapted to address these urban complexities in Nairobi. Specifically, data collection in informal settlements may be hindered by limited internet access, low digital literacy, and mistrust toward official systems (Wamuyu, 2020). Furthermore, as noted by Musyoka and Ndungu (2022), existing participatory mechanisms in Kenya often fail to reach marginalized communities, indicating the need for more inclusive and context-aware technological interventions.

In China, Bott and Young (2022) explored the role of crowdsourcing in enhancing governance within the realm of international development. The findings demonstrated that crowdsourcing can significantly enhance governance outcomes by promoting transparency, accountability, and responsiveness to the needs of marginalized communities. Although China has made considerable progress in expanding internet access and mobile connectivity, the digital divide remains a key barrier to inclusive participation in some regions. Liu and Zhou (2021) noted

that while urban areas in China have broadly adopted digital platforms, rural and low-income communities continue to face access and literacy challenges that reduce their capacity to engage in crowdsourced governance activities. Additionally, Zhang and Li (2020) investigated the application of crowdsourcing in China's smart city initiatives, highlighting its usefulness in collecting citizen feedback on public infrastructure services such as transport, sanitation, and utilities. Their findings reinforced the idea that crowdsourcing can contribute valuable data to M&E processes. However, they also warned about the inconsistency and potential bias of crowdsourced contributions, which can be influenced by uneven digital literacy, demographic factors, and participation fatigue.

In his research paper, Enhancing Road Safety Awareness in Africa via Crowdsourcing the Road Safety Observatory of Africa, Usami (2020) emphasises how crowdsourcing can improve road safety by combining data from several stakeholders, such as communities around it, pedestrians, and drivers. The study found that crowdsourcing enables the collection of granular, real-time data often inaccessible through traditional monitoring methods, thereby offering a more accurate understanding of safety issues. However, Usami also identified difficulties pertaining to the reliability and consistency of the data, as contributions can be biased or incomplete depending on the participants. While informative, this study reveals a knowledge gap regarding the use of crowdsourcing in monitoring and evaluation of broader infrastructure projects such as roads, housing, and utilities in urban centers like Nairobi County, Kenya.

This gap aligns with findings by Bott and Young (2022), who explored how crowdsourcing supports transparency and accountability in governance but also warned of inclusivity challenges in underserved regions of China, and by Chen and Xu (2019), who reported that uneven digital

access and low participation rates among rural populations in China limit the effectiveness of crowdsourced data in public infrastructure monitoring.

In Kenya, Njuki (2019) did a study on Crowdsourcing as a Platform for Operational Performance in Manufacturing Firms. The study investigates how crowdsourcing can be used to improve various aspects of manufacturing operations, such as product development, process optimization, and quality control. Key findings from Njuki's dissertation highlight that crowdsourcing has the potential to reduce costs and improve decision-making by providing real-time feedback and generating innovative ideas from a broad base of participants. The study found that manufacturing firms that adopted crowdsourcing platforms were able to optimize their production processes, improve product quality, and increase customer satisfaction. However, the study also acknowledged challenges including data management, security, and the reliability of crowdsourced contributions in manufacturing firms.

The study focused on manufacturing firms, which are distinctly different from infrastructure development projects in Nairobi. Infrastructure projects, such as road construction, housing, and public utilities, involve complex logistical challenges that differ significantly from the manufacturing sector. The knowledge gap exists in understanding how crowdsourcing can be specifically applied to the M&E of large-scale infrastructure projects in an urban context like Nairobi.

2.3 Theoretical Literature

The main theories that guide the investigation are presented in this part. These consist of the Resource-Based View, the Technology Acceptance Model, and the Diffusion of Innovations Theory. These theories offered a foundation for comprehending how technical advancements are adopted and impact monitoring and evolution practices.

2.3.1 Diffusion of Innovations Theory

Everett Rogers established the Diffusion of Innovations Theory in 1962. This theory was developed by prominent sociologist and communication expert Rogers to explain how, why, and how quickly new concepts and technology spread throughout various social systems (Rogers, 2003). Rogers described how people move through the phases of awareness, interest, appraisal, trial, and adoption of ideas in his seminal work Diffusion of ideas. The idea highlights the significance of time, the social system's structure, communication channels, and the innovation's unique features (Dearing & Cox, 2018). The idea was first used to the study of agricultural innovations, but it has subsequently been modified for use in a variety of fields, such as education, health, and the adoption of technology in development initiatives (Kebede et al., 2014).

The five stages of innovation adoption include knowledge, persuasion, decision-making, execution, and confirmation, according to Rogers (Rogers, 2003). According to Lee, Hsieh, and Hsu (2011), the theory also highlights a number of characteristics of innovations that influence their acceptance, including relative benefit, trialability, observability, complexity, and compatibility. Innovations are more likely to be adopted if they have obvious benefits, fit in with users' current requirements and values, are simple to use, can be tested before being widely implemented, and provide observable outcomes. Researchers have used this framework to analyze the uptake of a wide range of technologies, from mobile platforms to sophisticated data analytics systems (Jansen et al., 2020). However, critics have noted that the theory’s linear and individual-centric approach may inadequately capture the complex organizational and institutional dynamics of innovation adoption, especially in public-sector contexts (Oliveira & Martins, 2011).

Despite its limitations, the Diffusion of Innovations Theory remains highly relevant to this study on the influence of technological innovations on Monitoring and Evaluation practices in

infrastructural projects within Nairobi County. The theory offers a strong foundation for comprehending how M&E technologies such as mobile data collection tools**,** cloud-based systems**,** blockchain for transparency**,** GIS mapping**,** and real-time data dashboards are adopted and utilized in urban development contexts (Kamau & Mohamed, 2022). Specifically, the constructs of compatibility**,** complexity, and trialability offer insights into why certain technologies are more successfully integrated into M&E systems than others. For example, if mobile-based M&E tools are seen as compatible with existing workflows and easy to trial on a pilot basis, their chances of adoption increase (Achieng & Oboko, 2020). By applying Rogers' framework, this study aims to identify the important enablers and obstacles to the adoption of M&E technologies and generate evidence-based recommendations for enhancing the efficiency**,** transparency**,** and sustainability of infrastructural project monitoring in Nairobi County.

2.3.2. Technology Acceptance Model

Fred Davis developed the Technology Acceptance Model (TAM) in 1989 as a theoretical framework to forecast and explain users' adoption of new technology in work environments. According to Davis's 1989 concept, perceived usefulness (PU) and perceived ease of use (PEOU) are the two primary elements that affect users' opinions about the adoption of technology. Venkatesh and Davis (2000) define perceived utility as the extent to which a person thinks that implementing a certain technology will enhance their performance at work, while perceived ease of use is the extent to which a person believes that using a system would be effortless. Users' behavioural intentions and, eventually, how they actually utilise the technology is directly influenced by these two ideas (King & He, 2006). Because of its simplicity and explanatory strength, numerous researches examining a range of technologies have made extensive use of TAM (Chuttur, 2009).

Since its creation, TAM has been improved in several ways to make it more resilient and applicable in a variety of settings. Other constructs have been incorporated into extensions like TAM2, TAM3, and the Unified Theory of Acceptance and Use of Technology (UTAUT), such as social impact, enabling situations, and system compatibility, to better capture the range of factors affecting adoption behavior (Venkatesh & Bala, 2008). These extensions have helped address the model's limitations in complex technological and organizational environments (Legris, Ingham, & Collerette, 2003). A key strength of TAM is its structured yet adaptable approach, which enables researchers and practitioners to analyze user acceptance across technologies such as mobile applications, cloud-based systems, and digital monitoring tools (Wirtz & Göttel, 2016). This broad applicability has solidified TAM's role as a fundamental paradigm in the study of behavioural technology and information systems.

However, TAM has faced criticism for its perceived over-simplification of technology adoption dynamics. Scholars argue that by focusing primarily on cognitive factors like PU and PEOU, TAM neglects critical social, cultural, and organizational variables that can significantly shape user acceptance (Bagozzi, 2007). Additionally, the model's static nature limits its adaptability in fast-changing technological contexts, where new features and user expectations rapidly evolve (Lai, 2017). Moreover, TAM has shown varying levels of predictive power in different cultural and sectoral contexts, raising concerns about its generalizability and cross-cultural relevance (McCoy et al., 2005). These limitations suggest the need for continuous empirical testing and theoretical expansion to maintain the model's relevance.

Despite these criticisms, TAM remains highly relevant to this study on the influence of technological innovations on Monitoring and Evaluation practices in Nairobi County. In the M&E domain, where the efficiency of data collection**,** real-time reporting**,** and evidence-based decision-

making are vital, TAM offers a practical lens for evaluating the extent to which users accept and integrate new technological tools (Gitonga & Kihara, 2020). By examining how M&E practitioners perceive the practicality and usability of instruments like mobile data collection apps, cloud dashboards, and GIS mapping systems, this study can identify key adoption barriers and enablers**.** These insights will inform the design of targeted training**,** user-centered interfaces, and organizational support mechanisms to increase uptake. Therefore, while recognizing its limitations, the Technology Acceptance Model remains a valuable framework for guiding the integration of innovations into M&E systems and fostering broader organizational development in digital governance contexts.

2.3.3. Resource Based View Theory

Jay Barney and Birger Wernerfelt developed the Resource-Based View (RBV) of the firm in the late 1980s and early 1990s. It offers a strategic framework for comprehending how businesses gain and maintain a competitive edge. RBV asserts that a firm's internal resources and capabilities when they are valued, rare, unique, and non-substitutable form the basis of long-term strategic success, in contrast to traditional models that place an emphasis on external industry factors (Barney, 1991). These resources may include proprietary technologies, skilled personnel, organizational culture, or knowledge systems that are difficult for competitors to imitate (Barney & Clark, 2007). As such, RBV highlights the importance of leveraging unique internal strengths as a means of gaining sustainable advantage in the marketplace.

The concept of dynamic capabilities, which emphasises an organization's ability to combine, enhance, and reorganise internal and external competencies to manage rapidly changing environments, has been incorporated into RBV over time (Eisenhardt & Martin, 2000). This evolution extends the VRIN framework by recognizing that adaptability and innovation are critical

in volatile markets (Barreto, 2010). RBV's integration with dynamic capabilities theory has enhanced its relevance in various sectors, including technology, healthcare, education, and public service delivery (Ambrosini & Bowman, 2009). By emphasizing both static resource attributes and the dynamic processes through which they are transformed, the RBV offers a comprehensive view of how firms can build and maintain unique competitive positions over time (Newbert, 2007).

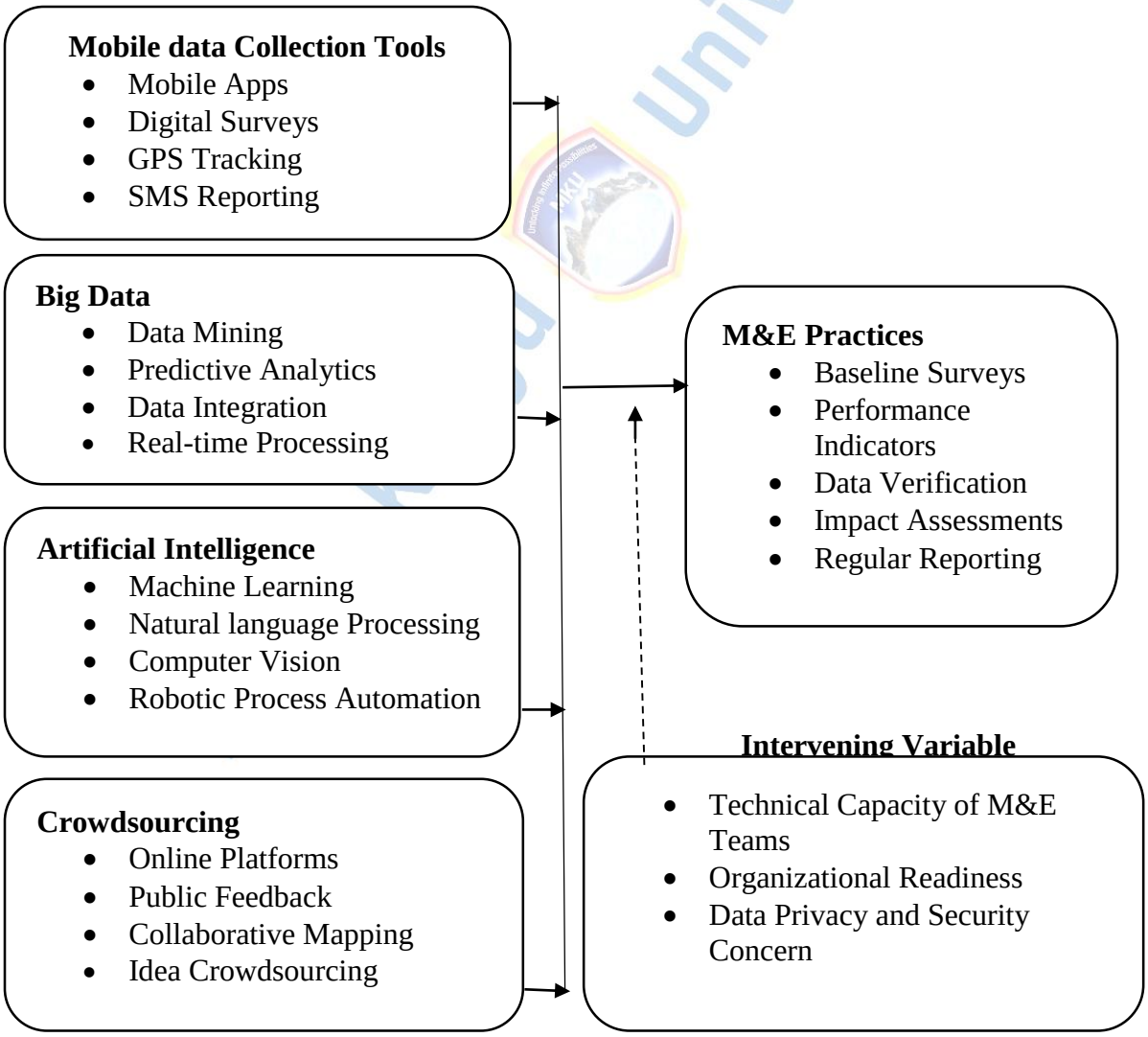
Despite its strengths, RBV has also faced criticism. One key limitation is its underestimation of external factors such as technological shifts, market volatility, and regulatory changes, which can significantly affect a firm's strategic positioning (Foss & Knudsen, 2003). Another concern is the subjectivity in assessing whether a resource truly meets VRIN criteria, particularly in fast-evolving sectors where competitive advantages are increasingly temporary (Kraaijenbrink, Spender, & Groen, 2010). Additionally, critics argue that the RBV's static perspective may limit its usefulness in explaining how firms acquire or develop new capabilities over time to stay ahead in dynamic environments (Arend & Lévesque, 2010). These critiques suggest that RBV is most powerful when combined with complementary frameworks that account for change, complexity, and environmental uncertainty.

In the context of development projects in Nairobi County, the RBV offers a valuable lens to examine how technological innovations function as strategic resources within Monitoring and Evaluation systems. Tools such as mobile data collection apps, GIS platforms, and real-time data dashboards may offer functionalities that are valuable, rare, and difficult to replicate, making them critical assets for enhancing project effectiveness and accountability (Achieng & Oboko, 2020). By applying the RBV framework, practitioners and policymakers can better assess which technologies warrant investment and capacity building due to their potential to deliver sustainable advantages in service delivery and decision-making. Understanding the strategic value of internal

technological assets can support better resource allocation, partnership formation, and innovation planning, thereby contributing to more impactful and competitive development outcomes in Nairobi's rapidly evolving urban landscape.

2.4. Conceptual Framework

According to Soviadan (2019), conceptual frameworks are organized from a collection of general theories and ideas that help researchers formulate their questions, appropriately define the subject matter to be studied, and choose the best techniques for gathering and analyzing data. Figure 1 shows the relationship between the independent, dependent, and intervening variables.



Source (Researcher 2024)

Figure 4.1: Conceptual Framework

Technological innovations (independent variable) in terms of mobile data collection tools (mobile apps, digital surveys, GPS tracking and SMS reporting), big data (data mining, predictive analytics, data integration and real-time processing), artificial intelligence (machine learning, natural language processing, computer vision and robotic process automation) and crowdsourcing (online platforms, public feedback, collaborative mapping and idea crowdsourcing) influence monitoring and evaluation practices, that is, baseline surveys, performance indicators, data verification, impact assessments and regular reporting (dependent variables) in selected infrastructural projects in Nairobi County, Kenya. The success of the influence of technological innovations on monitoring and evaluation in selected infrastructural projects in Nairobi County requires intervening variables **(**technical capacity of M&E teams, organizational readiness and data privacy and security concern).

2.5 Recap of Literature Review

The existing literature highlights the growing potential of technological innovations, particularly crowdsourcing platforms and AI technologies**,** in improving Monitoring and Evaluation practices across various sectors, including infrastructure development. Studies such as those by Srivastava and Mostafavi (2021) and Usami (2020) illustrate how crowdsourcing can enhance governance, improve decision-making, and foster community participation in smart city projects and road safety initiatives. However, these studies tend to focus on specific sectors such as governance, road safety, and manufacturing, with limited attention to their application in large-scale urban infrastructure projects like those in Nairobi County, Kenya. Research by Njuki (2019) on crowdsourcing in manufacturing firms sheds light on its potential to optimize operations but does not address its role in infrastructure M&E. Additionally, studies like Ogutu and Kamau

(2024) emphasize the challenges of integrating AI technologies into M&E systems, highlighting issues like high implementation costs, data ethics, and the need for specialized expertise. These challenges, while relevant, were not specific to Nairobi's unique urban infrastructure context.

The literature also revealed gaps in the applicability of crowdsourcing and AI technologies to Nairobi's infrastructure projects. For example, the reliability of crowdsourced data and its integration into M&E frameworks remains an underexplored area. Moreover, issues such as digital exclusion**,** particularly among marginalized communities in Nairobi's informal settlements, present a significant barrier to effective crowdsourced data collection. The existing studies fail to address how digital participation can be ensured across diverse socio-economic groups, a critical factor in urban infrastructure M&E**.** Furthermore, the integration of crowdsourced data into local government policies and governance structures for infrastructure planning remains an unexplored challenge in the literature. These gaps underscored the need for further research to establish the influence of Technological Innovations on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The research design, study site, target population, sampling processes and methodologies, sample population, data collection tools, and validity and reliability testing of the research instruments are all covered in this chapter. It also describes the procedures and methods for gathering data, data analysis methodologies, and ethical considerations.

3.1. Research Methodology

Research methodology is the fundamental framework that guides a study (Dawson, 2019). A mixed research approach was used in this study. This approach was selected because it focuses on gathering a comprehensive set of data that could both quantify the influence of technological innovations on Monitoring and Evaluation practices and provided deeper insights into the perceptions and experiences of stakeholders involved in infrastructural projects.

The quantitative aspect of the study focused on numerical data, such as the prevalence of technological tools like AI and crowdsourcing platforms in M&E practices. This allowed the researcher to measure the frequency, effectiveness, and influence of these technologies in improving the efficiency and accuracy of M&E in infrastructure projects.

The qualitative aspect was captured the experiential insights**,** opinions**,** and perceptions of stakeholders, including project managers**,** M&E professionals, government officials**,** and technology experts**.** Through interviews, the qualitative data provided a deeper understanding of the influence**,** opportunities, and real-world applications of these technological innovations in M&E practices.

3.2. Research Design

Research design is an approach to successfully addressing the research challenge is known as research design (Tenny, Brannan, and Brannan, 2022). This study combined qualitative and quantitative approaches using a convergent parallel research design and mixed-methods approach. This design ensured a complete understanding of the influence of technological innovations on Monitoring and Evaluation practices in selected infrastructural projects in Nairobi County, Kenya. Using both quantitative and qualitative data allows for a triangulation of results, where the numerical data can be cross-validated with the experiential insights**,** leading to more robust findings (Hoffding, Martiny & Roepstorff, 2022).

Through analyzing quantitative and qualitative data separately and then integrating the findings, will ensures a thorough exploration of both measurable trends and contextual distinctions. Patton (2020) opined that convergent parallel mixed research design provides a balanced perspective, where the quantitative data highlights patterns and relationships, while the qualitative data offers deeper understanding and explanations, ultimately enhancing the study's validity and practical implications.

3.3. Location of the Study

The location of the study is the particular area or territory where the researcher carries out the examination on a given subject (Bloomfield & Fisher, 2019). In this instance, Nairobi County, Kenya, was the site of the study. Key institutions involved in infrastructure development, including the Ministry of Transportation, Infrastructure, Housing, Urban Development, and Public Works, as well as a large number of private sector companies and non-governmental organisations that carry out or supervise such projects, are located in Nairobi, the country's capital. Advanced technological ecosystem, characterized by higher levels of ICT penetration and digital

infrastructure in Nairobi compared to other regions in Kenya, makes it an ideal location for investigating the use of innovative tools in M&E practices. This combination of diverse projects, advanced technological infrastructure, and access to stakeholders makes Nairobi County a representative and practical setting for this study.

3.4. Target Population

A target population refers to a clearly defined group of individuals or elements relevant to a specific research study (Baldwin, 2019). The target population for this study was 65 participants drawn from stakeholders involved in the planning, implementation, and evaluation of infrastructural projects within Nairobi County. These individuals were selected from five key departments under the Ministry of Transport, Infrastructure, Housing, Urban Development, and Public Works, as well as relevant oversight bodies such as MEPAK (Monitoring and Evaluation Professionals Association of Kenya). The targeted participants included project managers, M&E professionals, county officers, accounting officers, and MEPAK officials. These groups were selected due to their direct or indirect engagement in monitoring and evaluation practices within development projects.

Table 3.1: Target Population

Category	Department/Organization	Number of Individuals
Project managers	Ministry of Transport and Infrastructure	20
M&E professionals	Ministry of Housing and Urban Development	20
County officers	Nairobi County Government (Urban Planning and Development Unit)	10
Accounting officer	Department of Public Works	10
MEPAK officials	Monitoring and Evaluation Professionals Association of Kenya	5
Total		**65**

Source: **County Government of Nairobi (2025)**

3.5. Sampling Procedures and Techniques

To choose participants for this study, census sampling was used. By using this method, researchers can concentrate on a particular segment of the population that has the knowledge, experiences, or traits necessary to answer the study question. Purposive sampling, as noted by Andrade (2021), allows researchers to focus on those who are most likely to supply the pertinent and thorough data required for the study. Studies where specialised knowledge or unique experiences are essential to comprehending the research challenge benefit greatly from this approach.

3.6. Sample Size

Verma and Verma (2020) define sample size as a subset of the population that is representative of the larger group and is selected based on specific traits or standards pertinent to the research project. The proposed study intends to have a total sample population of 65 participants comprising of 20 project managers, 20 M&E professionals, 10 county officers, 10 accounting officers and 5 MEPAK officials. Therefore, the sample size of this study was 65 as shown in Table 3.2.

Table 3.2: Target Population, Sample Size and Sampling Techniques in Proposed Research

Young adults Population	**Target population**	**Sample Size**	**Sampling Technique**
Project managers	20	20	Purposive sampling
M&E professionals	20	20	Purposive sampling
County officers	10	10	Purposive sampling
Accounting officer	10	10	Purposive sampling
MEPAK officials	5	5	Purposive sampling
Total	**65**	**65**	

Source: **Researcher (2025)**

3.7. Research Instrument

A data collecting instrument is a tool used to gather information from research participants (Mwanje, 2021). Both questionnaires and interview guides were used to gather data for this investigation. One kind of research instrument is a questionnaire, which consists of a series of pre-planned questions or prompts meant to extract information from participants. It enables the researcher to gather a large amount of data from a large number of participants in a short period of time and supports a full analysis of the research subject (Lavrakas, 2019). An interview guide, on the other hand, is a list of questions or topics used to steer conversations in qualitative studies, allowing for deeper insights and context-specific responses. Project managers, M&E professionals, county officers, and accounting officers were given questionnaires, and MEPAK officials were interviewed using interview guides to gather qualitative information.

3.8. Testing for Validity and Reliability of Research Instruments

3.8.1. Validity of Research Instruments

The precision with which a research tool measures what it is supposed to measure is known as validity (Sürücü & Maslakçi, 2020). It evaluates how accurately an instrument captures the essence of the subject under study (Sürücü & Maslakçi, 2020). Content validity was assessed in this study. The degree to which the data gathered is indicative of the idea being studied is examined by content validity (Connell et al., 2018). The contents of the questionnaire and interview guide was reviewed and discussed with supervisors and peers before the actual research begins. This process ensures that the questions items are clear, vague items are removed, and the instruments maintain coherency, comprehensiveness, and face validity. This was considered as the expert rating of the questionnaire and interview guide.

3.8.2. Pilot Study

Pilot testing, as described by Kothari (2019), is a small-scale pilot study carried out prior to the primary investigation. Its goal is to evaluate the research design's viability, time, expense, risks, and possible difficulties. Before moving forward with the full-scale study, researchers can make the required adjustments thanks to pilot testing, which helps find any problems or defects in the study design, data collection tools, and methods.

A preliminary test of the questionnaire was carried out before the actual study began. This improved the questionnaire's efficacy, relevance, and feasibility. The study's pilot test included six participants, or 10% of the target population. The researcher clarified the ambiguous questions and created plain, intelligible language for the responders with the assistance of the piloted participants' answers.

Peers assisted in pilot testing the interview guide to ensure that the questions aligned with the study's research question. This gave the procedure more scrutiny and rigour, which significantly raised the interview guide's calibre and efficacy.

3.8.3. Reliability of Research Instruments

The degree to which the findings of a study may be applied to different situations, environments, or eras is known as reliability in research (Sürücü & Maslakçi, 2020). In order to assess the interview guide's reliability, the researcher reviewed and critiqued it with the supervisor and peers as experts, making the required changes in response to their feedback. To assess the reliability of the questionnaire, the test-retest method was used. The instrument was administered to participants twice, with a two-week interval between tests. Reliability tests was involved 6 participants, representing 10% of the target population. These participants did not take part of the actual study but shared similar characteristics, such as knowledge of technological innovations and

monitoring and evaluation practices in selected infrastructural projects. The same respondents completed the questionnaire twice, and the data was analyzed for reliability.

A two-week delay is usually needed for instrument piloting (Mugenda & Mugenda, 2018). By calculating the Cronbach Alpha Coefficient from the two sets of scores obtained during the pilot test, the internal consistency of the items was determined. A Cronbach's Alpha (α) score of 0.7 or above, on a scale of 0 to 1, indicates a high degree of reliability (Clark, 2018). The reliability of the tests was evaluated using the Cronbach's Alpha formula. According to Gupta (2017), a conventional minimum value of 0.6 to 0.9 is recommended to ensure perfect reliability. The reliability test results were analysed using SPSS version 26. If the responses in both rounds demonstrate consistency and a reliability score of at least 0.70 at a significance level of 0.05, the instrument was considered internally consistent and reliable for data collection.

3.9. Data Collection Methods and Procedures

Prior to data collection, the researcher obtained a research permit from the National Commission for Science, Technology, and Innovation (NACOSTI) for self-introduction to sample departments. After getting the research permit, the researcher booked appointments with respective group targeted for this study. The researcher then found out the appropriate time to administer the questionnaires as well as conducting interview. Quantitative data was collected in the first phase by administering questionnaires while qualitative data was collected in the second phase. While interviewing, the researcher took notes on the responses.

The main technique of gathering data for this study was the distribution of questionnaires to participants. Six weeks were allotted for the collecting of data. Following completion of the surveys, the data was processed and examined. Interviews will also be done to confirm and add to the data gathered from the questionnaires. A thorough grasp of the research issue was made

possible by the combination of these two approaches. Data was loaded into SPSS software version 26 for analysis following data collection.

3.10. Data Analysis Techniques and Procedures

The process of removing irrelevant information from data by filtering and transformation is known as data analysis (Moreira et al., 2019). The Statistical Package for Social Science (SPSS) version 26 software was used to analyse the quantitative and qualitative data that had been collected. Raw collected data was analysed using descriptive statistics to assist make the data easily comprehensive. Descriptive statistics, namely percentages and frequencies, were used to analyse quantitative data before being shown in tables, charts, and graphs for simpler comprehension.

To find recurrent themes, patterns, and categories pertaining to the application and effects of technical developments in M&E, thematic analysis was used to examine the interview data that had been transcribed. To make it easier for participants to interpret and compare, themes were coded and arranged in a hierarchical structure. The model that was employed was multiple linear regression, as can be seen below.

A statistical method for examining the relationship between one dependent variable and two or more independent variables is the multiple linear regression model. Predictions or suggestions can be made in light of the results, and it can assist in determining which independent variables significantly affect the dependent variable:

The basic regression model is $Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + e$

Where, Y – is the dependent variable (Monitoring and Evaluation Practices)

X_1- Mobile Data Collection Tools

X_2- Big Data

X_3- Artificial Intelligence

X_4- Crowdsourcing

β_0 – is the constant, ϵ is the error of prediction.

β_1-n = the regression coefficient or change included in Y by each χ,

ϵ = error term

The coefficient of correlation was computed to determine the relationships between the variables. To ascertain the level of correlation between the variables, a variance analysis was also carried out.In order to give a thorough grasp of the study issues, quantitative and qualitative findings were triangulated. This allowed for the validation and enrichment of results by bringing together various data sources. Cross-checking data and drawing stronger conclusions regarding influence of technological innovations on M&E practices.

3.11. Ethical Considerations

Considerations are crucial for maintaining the integrity of the research process and protecting the rights of participants (Belen-Saglam et al., 2022). Every participant in this study provided their informed consent, ensuring that they fully understood the objectives, methods, and possible consequences of the investigation. People might withdraw at any time without facing any repercussions because participation was entirely voluntary. All responses and personal information were securely stored and utilised only for the research, ensuring confidentiality.

Anonymity was guaranteed in all reports and publications, ensuring that no identifiable information about participants is disclosed. Furthermore, the study was conducted in a manner that minimizes harm or discomfort, and participants was treated with respect and professionalism. Transparency and honesty will be upheld throughout the research process, with findings presented truthfully and shared with stakeholders. Cultural sensitivity was also be a priority, as the study involves a diverse group of participants, and their beliefs and values were respected. Finally, ethical approval was sought from the relevant institutional review board or ethics committee to

ensure compliance with established ethical standards. These ethical considerations aim to protect participants' dignity, rights, and welfare while ensuring the research's validity and credibility.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.0 Introduction

This chapter contains respondents' feedback, data presentation, analysis and discussions from the data obtained through the use of questionnaires and interview guide assessing the influence of Technological Innovations on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya. Findings were elaborated through qualitative and quantitative data analysis. Tables, charts, and graphs were utilized to present the data after descriptive statistics. The findings were organized based on the research objectives of the study.

4.1 Rate of Response

The study established all respondents in total who participated actively in the study through answering and submitting the questionnaires and those who participated in interview, analysis of the response rate has been presented in Table 4.1.

Table 4.1: Response Rate

Respondents	Administered	Response	Response Rate in Percentage
Project managers	20	20	**30.7**
M&E professionals	20	20	**30.7**
County officers	10	10	**15.4**
Accounting officer	10	10	**15.4**
MEPAK officials	5	5	**7.7**
Total	**65**	**65**	**100**

Source: Field data, 2025

From the Table 4.1, there were 60 questionnaires distributed to project managers, M&E professionals, county officers and accounting officer. All (60) questionnaires were correctly filled, returned, and considered appropriate for analysis which translated to 100% response rate on

questionnaire. Also, key respondents, that is, 5 MEPAK officials who were interviewed in this study responded 100%. Cooper and Schindler (2011) noted that return rates exceeding 50% are considered acceptable for analysis and publication, with rates over 60% deemed good, over 70% very good, and over 80% exceptional (Mugenda & Mugenda, 2008; Daikeler et al., 2020).

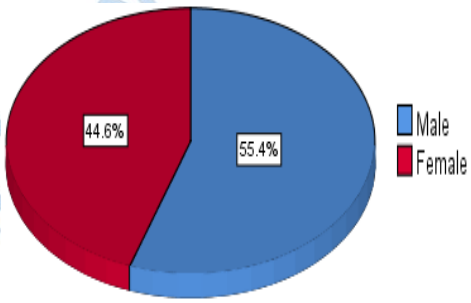
4.2. Demographic Characteristics of Respondents

In this section, demographic information about the respondents is presented, covering aspects such gender, age bracket, position, year of experience in their role and department the respondents were working in. The results from this section was illustrated in the accompanying Figures.

4.2.1. Gender Distribution of the Respondents

The respondents were asked to identify their gender. The results are visually represented in Figure 4.1, allowing for an easier interpretation of the data.

Figure 4.1: Gender Distribution of the Respondents who participated in the Study



Source: Field Data, 2025

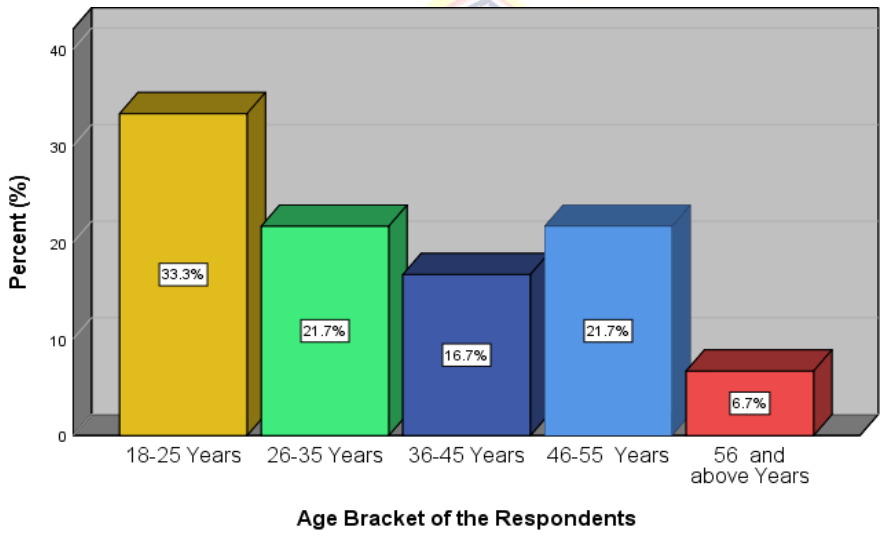
Most of the respondents who participated in this study were male, comprising 36(55.4%)**,** while 29(44.6%) were female. This gender distribution not only reflects the demographic composition of professionals involved in monitoring and evaluation within development projects in Nairobi County, but also aligns with findings by Kier and Huemann (2022), who observed that

gender disparities persist in project management and related technical fields, often influencing access to roles involving technological innovation. The observed imbalance suggests that men may have more frequent exposure to or control over the adoption of digital tools in M&E, potentially shaping both usage patterns and decision-making authority. Therefore, this demographic variable was significant, as gender-based differences could influence how technological innovations are perceived, adopted, and effectively utilized in M&E processes across development projects.

4.2.2. Age Bracket

The researcher established age distributions of respondents who participated in this study. The findings were presented in Figure 4.2 in terms of percentage and frequency.

Figure 4.2: Age Distribution of the Participants



Source: Field Data, 2025

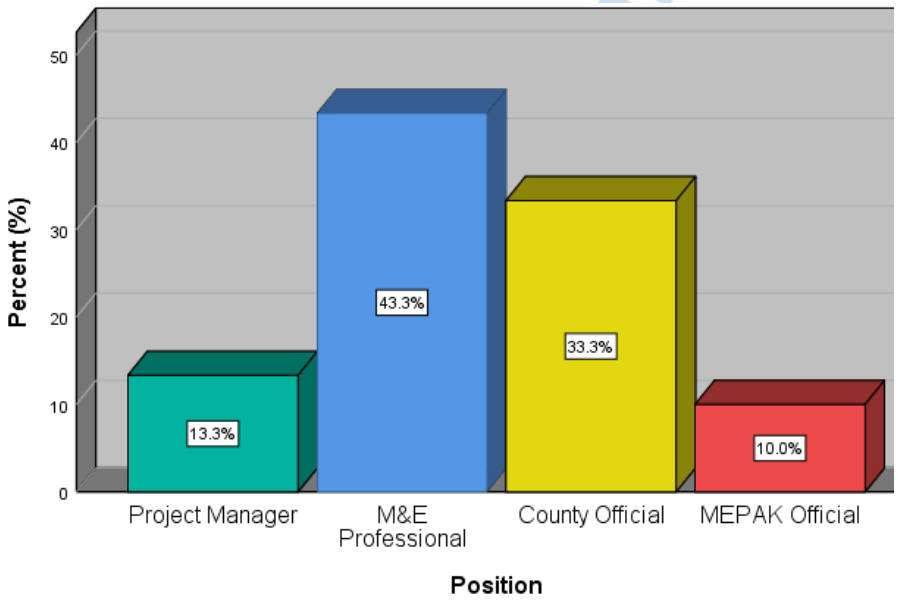
According to the age distribution shown in Figure 4.2, the largest proportion of respondents (33.3%) falls within the 18–25 years age group, followed by those aged 26–35 years and 46–55 years**,** each accounting for 21.7%**.** Respondents aged 36–45 years make up 16.7%**,** while the smallest representation (6.7%) is from individuals aged 56 and above**.** This demographic distribution suggests that younger individuals constitute a significant portion of the workforce or

stakeholder base engaged in M&E processes. As noted by Ejidike and Mewomo (2023), younger professionals tend to be more familiar with and receptive to digital innovations. Consequently, the strong presence of youth in this sector may enhance the likelihood of successful adoption and utilization of technological tools in monitoring and evaluation, contributing to improved efficiency and innovation within development projects.

4.2.3. Position

Respondents were asked to specify their position/role in their state of work in their respective department. Findings were presented in Figure 4.3.

Figure 4.3: Position of the Respondents



As illustrated in Figure 4.3, the distribution of respondents by professional role reveals that the majority (43.3%) were Monitoring and Evaluation professionals**,** followed by county officials at 33.3%**.** Project managers constituted 13.3%**,** while MEPAK officials accounted for 10.0% of the sample. According to Kumar and Gupta (2023), the successful adoption of technological innovations in M&E largely depends on the expertise, roles, and engagement levels of professionals within relevant departments. The high representation of M&E professionals and

county officials in this study suggests a favorable institutional context for the integration of modern digital tools in M&E. Their involvement is likely to support more efficient project tracking, enhanced data-driven decision-making, and strengthened accountability mechanisms within Nairobi County's infrastructure

4.2.4. Years of Experience

The study sought to determine the respondents' years of experience was presented in Table 4.2.

Table 4.2: Years of Experience

Years of Experience	Frequency	%
Less than 1 year	7	11.7
1-3 years	14	23.3
4-7 years	26	43.3
8-10 years	12	20.0
More than 10 years	1	1.7
Total	**60**	**100.0**

Source: Field Data, 2025

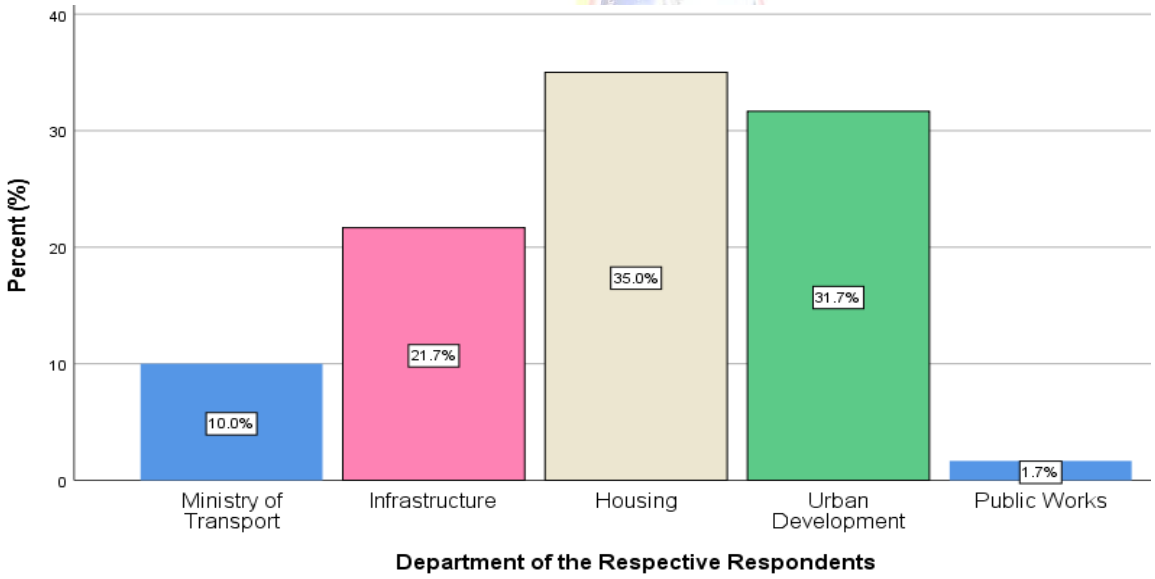
The findings presented in Table 4.2 show that the largest proportion of respondents 26(43.3%) had between 4 to 7 years of experience in their current roles, followed by 14(23.3%) with 1 to 3 years of experience. Additionally, 12(20.0%) had 8 to 10 years of experience, 7(11.7%) had less than one year**,** and only 1(1.7%) reported having over 10 years of experience. According to Mensah and Owusu (2023), professionals with moderate levels of experience are often more open to adopting innovative technologies, as they balance foundational knowledge with a willingness to embrace change. In this context, the dominance of respondents with 4 to 7 years of experience suggests that many participants were likely familiar with both traditional and emerging M&E practices. This positions them well to understand the benefits of digital tools in enhancing efficiency, accuracy, and responsiveness in project monitoring. The minimal representation of respondents with over 10 years of experience may reflect a generational shift toward more

technologically driven approaches, highlighting the growing need for adaptability and continuous upskilling in the M&E sector.

4.2.5. Department

This section presents the distribution of respondents based on the departments they serve in, highlighting the institutional diversity involved in infrastructural projects within Nairobi County, Kenya. Understanding the departmental affiliation of respondents was crucial, as it reflects the specific sectors engaged in Monitoring and Evaluation processes and the potential scope for technological innovation within each. The study aimed to identify which departments the respondents were drawn from to assess the extent of participation and technological adoption across various sectors. The findings are illustrated in Figure 4.4.

Figure 4.4: Distribution of the participants from the Department



Source: Field Data, 2025

The data presented in Figure 4.4 indicates that the Housing sector had the highest representation among respondents at 35.0%**,** followed closely by Urban Development at 31.7%, and Infrastructure at 21.7%**.** The Public Works department had the lowest representation at 1.7%**.**

According to Mleke and Dida (2020), sectors such as housing and urban development are increasingly reliant on advanced M&E technologies, including Geographic Information Systems (GIS), remote sensing, and automated progress tracking tools. The high representation of these sectors suggests a growing relevance and potential for the adoption of such innovations to enhance monitoring efficiency and responsiveness. In contrast, the limited representation of Public Works may highlight a lag in technological integration, pointing to a gap that, if addressed, could significantly improve inter-departmental coordination, project oversight, and data-driven decision-making across Nairobi County's infrastructure development projects.

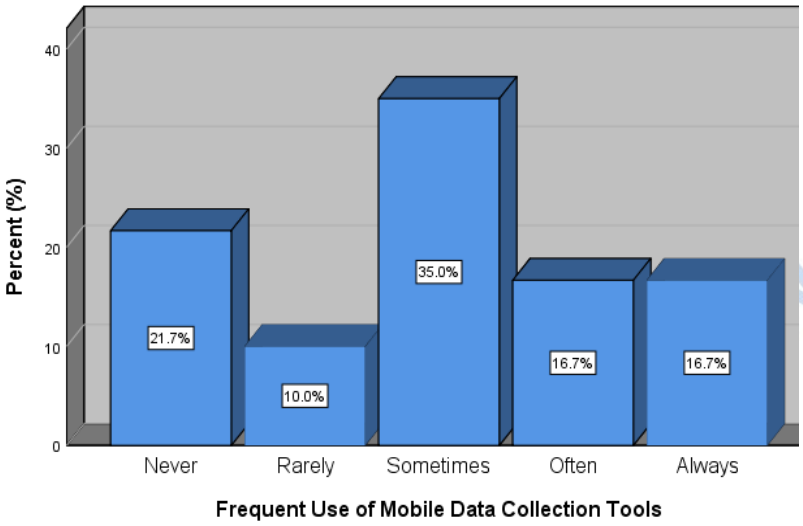
4.4. Findings According to Research Objectives

This section present findings of the study based on the research objectives which were the influence of mobile data collection tools, Big Data analytics, Artificial Intelligence technologies, and utilization of crowdsourcing platforms on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya.

4.4.1. Adoption of Mobile Data Collection Tools and Monitoring and Evaluation Practices

In this section the study sought to establish the influence of mobile data collection tools on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya. Participants were asked how frequently do their project use mobile data collection tools. Findings were presented in Figure 4.5.

Figure 4.5: Frequent Use of Mobile Data Collection Tools



Source: Field Data, 2025

The data in Figure 4.5 indicates that while 35.0% of respondents use mobile data collection tools sometimes, a significant portion (21.7%) never use them, and 10.0% rarely do. Only 16.7% use them often or always. This suggests a moderate adoption of mobile data tools in M&E practices for infrastructural projects in Nairobi County, a finding that aligns with Njoroge and Mwangi (2024), who reported that while mobile technologies are increasingly utilized in project monitoring, their integration remains uneven across departments. Similarly, York and Bamberger (2024) emphasize the importance of capacity-building and digital infrastructure in realizing the full potential of real-time project tracking. Together, these findings underscore the ongoing need for targeted investments in digital integration to enhance efficiency and responsiveness in M&E practices.

Table 4.3: Rating the Effectiveness of Mobile Data Collection Tools

Effectiveness of Mobile Data Collection Tools	Frequency	%
Very Ineffective	5	8.3
Ineffective	11	18.3
Neutral	3	5.0
Effective	13	21.7
Very Effective	28	46.7
Total	**60**	**100.0**

Source: Field Data, 2025

As shown in Table 4.3, regarding the effectiveness of mobile data collection tools, the majority of respondents, 28 (46.7%) indicated that they were very effective, while 13 (21.7%) found them effective. Meanwhile, 3 (5.0%) remained neutral, 11 (18.3%) found them ineffective, and 5 (8.3%) stated they were very ineffective. This reflects a strong perception among respondents that mobile data collection tools enhance data accuracy, reliability, and the overall efficiency of decision-making. These findings are consistent with York and Bamberger (2024) and Kumar and Gupta (2023), who emphasize that mobile technologies contribute significantly to real-time data capture and responsive project management. Similarly, Mensah and Owusu (2023) noted that mobile tools improve transparency and reduce manual errors in large-scale development projects.

These findings support Njoroge and Mwangi (2024), who pointed out that successful implementation of mobile M&E tools depends on adequate training, infrastructure, and stakeholder engagement. Ogundipe (2024) further emphasized that without proper integration and user buy-in, even the most advanced tools may underperform. Therefore, addressing these barriers through structured capacity-building, improved ICT infrastructure, and policy support is essential for maximizing the effectiveness of mobile data tools in M&E. This will strengthen project tracking, accountability, and evidence-based decision-making in infrastructural development.

Table 4.4: Challenges Encounter when Using Mobile Data Collection Tools

Challenges	Frequency	Percentage (%)
Stable internet connectivity	20	33.3
Data security concerns	26	43.3
Technical issues with devices	7	11.7
Lack of training	6	10.0
Total	**60**	**100.0**

Source: Field Data, 2025

The study investigated challenges that limit mobile data collection tools in enhancing monitoring and evaluation practices. As presented in Table 4.4, the majority of respondents, 26

(43.3%), identified data security concerns as the most significant issue, citing risks such as unauthorized access and data breaches. Additionally, 20 (33.3%) reported unstable internet connectivity as a major obstacle that hampers real-time data transmission and accessibility. Meanwhile, 7 (11.7%) cited technical issues with devices, and 6 (10.0%) pointed to a lack of training. These findings support York and Bamberger (2024)**,** who emphasized that while digital tools enhance monitoring and evaluation processes, their effectiveness is often undermined by technological and human limitations. Therefore, the study reinforces the view that investing in secure systems, reliable connectivity, and user training is critical to realizing the full potential of technological innovations in M&E practices.

Respondents were further asked to indicate the extent to which they agreed or disagreed with the statement in rating the influence of mobile data collection tools on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya on a Likert scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4=Agree, 5= Strongly Agree. Findings were presented in Table 4.5.

Table 4.5: Response on Influence of Mobile Data Collection Tools on M&E

N=60

Statements	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	F	%	F	%	F	%	F	%	F	%
The use of mobile applications reduces data entry errors during M&E processes.	31	51.7	11	18.3	8	13.3	3	5.0	7	11.7
GPS tracking ensures accurate location data for M&E in infrastructural projects	41	68.3	7	11.7	4	6.7	3	5.0	5	8.3
SMS reporting ensures timely communication of project updates for M&E	26	43.3	21	35.0	7	11.7	2	3.3	4	6.7
The simplicity of SMS reporting makes it suitable for use in diverse infrastructural projects.	33	55.0	15	25.0	3	5.0	3	5.0	6	10.0
The adoption of mobile data collection tools increases transparency in M&E processes	20	33.3	27	45.0	6	10.0	3	5.0	4	6.7
The use of SMS reporting encourages community participation in project monitoring.	29	48.3	19	31.7	4	6.7	7	11.7	1	1.7
The use of digital surveys enhances the standardization of data collected for M&E	26	43.3	24	40.0	3	5.0	5	8.3	2	3.3

Source: Field Data, 2025

Table 4.5 presents respondents' views on the influence of mobile data collection tools on monitoring and evaluation processes. A majority of respondents, 31 (51.7%), strongly agreed and 11 (18.3%) agreed that the use of mobile applications reduces data entry errors during M&E, reinforcing the reliability and accuracy of collected information. However, 7 (11.7%) strongly disagreed, 3 (5.0%) disagreed, and 8 (13.3%) remained neutral. On the role of GPS tracking, 41 (68.3%) strongly agreed and 7 (11.7%) agreed that it ensures accurate location data in infrastructural projects. A smaller proportion, 4 (6.7%), were neutral, while 3 (5.0%) disagreed and 5 (8.3%) strongly disagreed. Regarding SMS reporting, 26 (43.3%) strongly agreed and 21

(35.0%) agreed that it ensures timely communication of project updates, whereas 7 (11.7%) were neutral, 2 (3.3%) disagreed, and 4 (6.7%) strongly disagreed. In terms of its suitability, 33 (55.0%) strongly agreed and 15 (25.0%) agreed that the simplicity of SMS reporting makes it appropriate for diverse infrastructural projects. Meanwhile, 3 (5.0%) were neutral, 3 (5.0%) disagreed, and 6 (10.0%) strongly disagreed. Furthermore, 20 (33.3%) strongly agreed and 27 (45.0%) agreed that the adoption of mobile data collection tools increases transparency in M&E processes. A total of 6 (10.0%) remained neutral, while 3 (5.0%) disagreed and 4 (6.7%) strongly disagreed. When asked about community participation, 29 (48.3%) strongly agreed and 19 (31.7%) agreed that SMS reporting encourages community involvement in project monitoring. Only 4 (6.7%) were neutral, 7 (11.7%) disagreed, and 1 (1.7%) strongly disagreed. Moreover, 26 (43.3%) strongly agreed and 24 (40.0%) agreed that the use of digital surveys enhances the standardization of data collected for M&E. A minority, 3 (5.0%) were neutral, 5 (8.3%) disagreed, and 2 (3.3%) strongly disagreed.

The findings revealed that mobile data collection tools play an important role in improving Monitoring and Evaluation practices by enhancing data accuracy, transparency, efficiency, and community involvement. These tools facilitate real-time tracking and more responsive decision-making processes in infrastructural project monitoring. However, persistent challenges such as digital literacy gaps, unreliable network connectivity, and data security concerns continue to limit their full potential.

These results support the findings of York and Bamberger (2024), who emphasized that while mobile technologies can significantly streamline M&E functions, their success hinges on the availability of digital infrastructure and stakeholder capacity. Similarly, Njoroge and Mwangi (2024) observed that without adequate training and systems integration, mobile tools may fall short of delivering the expected improvements in project oversight. Addressing these limitations was

therefore essential to maximizing the effectiveness of technological innovations in the M&E of infrastructural projects.

The study sought the opinion of the MEPAK official respondents on the influence of mobile data collection tools on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, individual actors gave their views as follows:

"Mobile data collection tools have significantly improved the efficiency of Monitoring and Evaluation (M&E) practices by enabling real-time data gathering and transmission. With these tools, we can access project updates instantly and make swift decisions," said one MEPAK official (MEPAK Official Interview 1, March 13, 2025).

Another respondent highlighted the benefits of transparency and accuracy, stating, *"Using mobile data collection tools ensures that the information we receive is more accurate and accessible to all stakeholders. This has greatly improved project monitoring and accountability."* (MEPAK Official Interview 2, March 13, 2025).

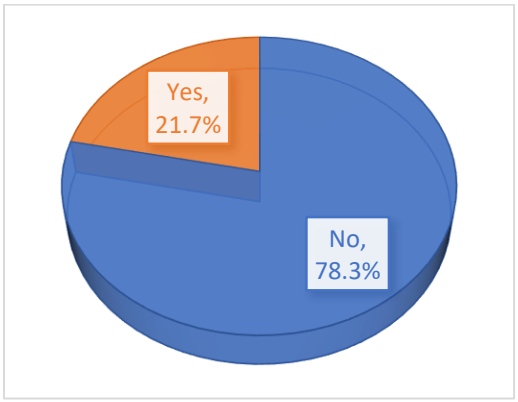
However, some officials pointed out challenges in implementation. *"We sometimes face internet connectivity issues and system downtimes, which can delay data collection and reporting,"* noted one MEPAK official (MEPAK Official Interview 3, March 14, 2025).

Another respondent emphasized the need for training, saying, *"Not all staff members are well-versed in using mobile data collection tools. There is a need for continuous training to maximize their effectiveness in M&E."* (MEPAK Official Interview 4, March 14, 2025).

4.4.2. Big Data Analytics and Monitoring and Evaluation Practices

The second objective of the study sought to examine the influence of big data analytics on Monitoring and Evaluation practices in selected infrastructural projects in Nairobi County, Kenya. Respondents were asked whether their project use Big Data analytics for M&E purposes. This included software such as Tableau, Power BI, SAS, R, Python, Stata, NVivo and Google Data Studio. Findings were presented in Figure 4.6.

Figure 4.6: Use Big Data Analytics for M&E Purposes



Source: Field Data, 2025

The findings in Figure 4.6 revealed that the majority (78.3%) of respondents indicated that their infrastructural projects do not utilize big data analytics for Monitoring and Evaluation (M&E) purposes. This indicates a continued reliance on traditional M&E approaches rather than advanced digital analytics tools. Only 21.7% confirmed the use of big data analytics, referencing platforms such as Tableau, Power BI, SAS, R, Python, Stata, NVivo, Google Data Studio, and QlikView. This limited adoption may stem from factors including a shortage of technical expertise, financial limitations, or a lack of awareness about the value of data-driven decision-making. These findings align with Ogutu and Kamau (2024), who observed that while big data analytics offer immense potential to transform M&E in infrastructure projects, uptake remains minimal due to capacity constraints and institutional inertia.

Similarly, Yitmen and Alizadehsalehi (2021) highlight that despite global progress in data integration for smart infrastructure management, many developing regions still face systemic barriers to technological adoption. Thus, the study underscores the need for targeted investments in digital literacy, infrastructure, and policy frameworks to encourage broader integration of big data tools in M&E practices within Nairobi County.

The respondents were asked how has Big Data analytics improved the accuracy and timeliness of their M&E data analysis. Findings were presented in Table 4.6.

Table 4.6: Data Analytics, Accuracy and Timeliness

Contribution of Data Analytics	Frequency	Percentage (%)
Improved forecasting accuracy	6	10.0
Enhanced data visualization	36	60.0
Better resource allocation	7	11.7
Improved trend analysis	11	18.3
Total	**60**	**100.0**

Source: Field Data, 2025

The findings in Table 4.6 indicate that big data analytics had contributed to improvements in the accuracy and timeliness of Monitoring and Evaluation data analysis in various ways. The majority 36(60.0%) of respondents reported that big data analytics enhances data visualization, making it easier to interpret complex datasets and derive meaningful insights. Additionally, 11(18.3%) of respondents noted that big data analytics improves trend analysis, allowing project managers to track progress over time and make data-driven decisions.

Furthermore, 7(11.7%) of respondents highlighted better resource allocation as a key benefit, suggesting that data analytics helps optimize the distribution of financial and human resources for effective project implementation. A smaller proportion 6(10.0%) indicated that big data analytics improves forecasting accuracy, enabling more precise predictions about project outcomes and potential risks.

These findings revealed that big data analytics is highly effective in improving Monitoring and Evaluation practices through enhanced data accuracy, visualization, trend identification, and efficient resource management. This aligns with Johnson, Smith and Lee (2023), who emphasized that big data technologies enable real-time monitoring and predictive analysis, improving project

responsiveness and accountability. The World Bank (2022) further supports this by noting that integrating big data into M&E systems helps streamline data flows, reduce reporting delays, and support evidence-based decision-making in infrastructure development.

However, the relatively low adoption rate of big data tools observed in this study may hinder the full realization of these benefits in infrastructural projects within Nairobi County. To unlock the full potential of big data in M&E, efforts must focus on addressing barriers such as limited technical expertise, infrastructure gaps, and organizational resistance.

Respondents were further asked to indicate the extent to which they agreed or disagreed with the statement in rating the influence of Big Data analytics on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya on a Likert scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4=Agree, 5= Strongly Agree. Findings was presented in Table 4.7.

Table 4.7: Influence of Big Data analytics on Monitoring and Evaluation Practices

N=60

Statements	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	F	%	F	%	F	%	F	%	F	%
Data mining enhances the identification of key patterns in project data for effective M&E.	13	21.7	28	46.7	11	18.3	5	8.3	3	5.0
The integration of data mining into M&E enhances decision-making processes.	38	63.3	7	11.7	8	13.3	5	8.3	2	3.3
The adoption of predictive analytics improves the accuracy of project evaluation.	18	30.0	24	40.0	7	11.7	6	10.0	5	8.3
The use of real-time data processing enhances the accuracy of monitoring activities.	25	41.7	18	30.0	5	8.3	9	15.0	3	5.0
Big Data analytics enable better tracking of infrastructural project milestones and outcomes.	12	20.0	31	51.7	9	15.0	6	10.0	2	3.3
Big Data analytics enhance collaboration among stakeholders involved in M&E activities.	18	30.0	29	48.3	5	8.3	3	5.0	5	8.3
The use of Big Data analytics promotes transparency and accountability in M&E processes.	22	36.7	26	43.3	6	10.0	3	5.0	3	5.0

Source: Field Data, 2025

As illustrated in Table 4.7 shows the response on the influence of Big Data analytics on monitoring and evaluation practices. A majority of respondents, 28 (46.7%) agreed and 13 (21.7%) strongly agreed that data mining enhances the identification of key patterns in project data, improving the effectiveness of M&E. Meanwhile, 11 (18.3%) remained neutral, 5 (8.3%) disagreed, and 3 (5.0%) strongly disagreed. In terms of decision-making, 38 (63.3%) strongly agreed and 7 (11.7%) agreed that integrating data mining into M&E processes enhances decision-

making. However, 8 (13.3%) were neutral, while 5 (8.3%) disagreed and 2 (3.3%) strongly disagreed.

Regarding predictive analytics, 18 (30.0%) strongly agreed and 24 (40.0%) agreed that it improves the accuracy of project evaluation. In contrast, 7 (11.7%) were neutral, 6 (10.0%) disagreed, and 5 (8.3%) strongly disagreed. When asked about real-time data processing, 25 (41.7%) strongly agreed and 18 (30.0%) agreed that it enhances the accuracy of monitoring activities. Meanwhile, 5 (8.3%) were neutral, 9 (15.0%) disagreed, and 3 (5.0%) strongly disagreed. Additionally, 31 (51.7%) agreed and 12 (20.0%) strongly agreed that Big Data analytics enable better tracking of infrastructural project milestones and outcomes. However, 9 (15.0%) were neutral, 6 (10.0%) disagreed, and 2 (3.3%) strongly disagreed. On collaboration, 29 (48.3%) agreed and 18 (30.0%) strongly agreed that Big Data analytics enhance collaboration among stakeholders involved in M&E. A small portion, 5 (8.3%), were neutral, while 3 (5.0%) disagreed and 5 (8.3%) strongly disagreed. Finally, 26 (43.3%) agreed and 22 (36.7%) strongly agreed that Big Data analytics promote transparency and accountability in M&E processes. Only 6 (10.0%) were neutral, with 3 (5.0%) disagreeing and another 3 (5.0%) strongly disagreeing.

The findings indicated a high level of agreement among respondents that Big Data analytics positively influence various dimensions of M&E, including decision-making, accuracy, collaboration, and transparency. This aligns with Tanaka and Yamada (2023)**,** who argue that Big Data tools not only streamline M&E workflows but also facilitate early detection of project deviations and promote accountability. Similarly, Mleke and Dida (2020) emphasize that Big Data applications contribute to greater efficiency and strategic insights in managing infrastructure projects. However, the presence of respondents expressing neutrality or disagreement suggests that gaps in technical capacity, insufficient investment, and low awareness still exist. Addressing these

challenges through targeted training, stakeholder sensitization, and infrastructural support is necessary to fully harness the potential of Big Data in enhancing M&E effectiveness.

The study further sought the respondents' opinion on the specific contributions of Big Data analytics in improving the accuracy and timeliness of M&E data analysis across different selected infrastructural projects in Nairobi County. The study revealed the following:

"Big Data analytics has revolutionized how we handle Monitoring and Evaluation (M&E) data. It allows us to process large volumes of information quickly, ensuring that project evaluations are based on real-time and comprehensive data," stated one MEPAK official (MEPAK Official Interview 5, March 13, 2025).

Another respondent emphasized the role of predictive analytics, saying, *"With Big Data, we can identify trends and predict potential risks in infrastructural projects. This helps in proactive decision-making and enhances project efficiency."* (MEPAK Official Interview 2, March 13, 2025).

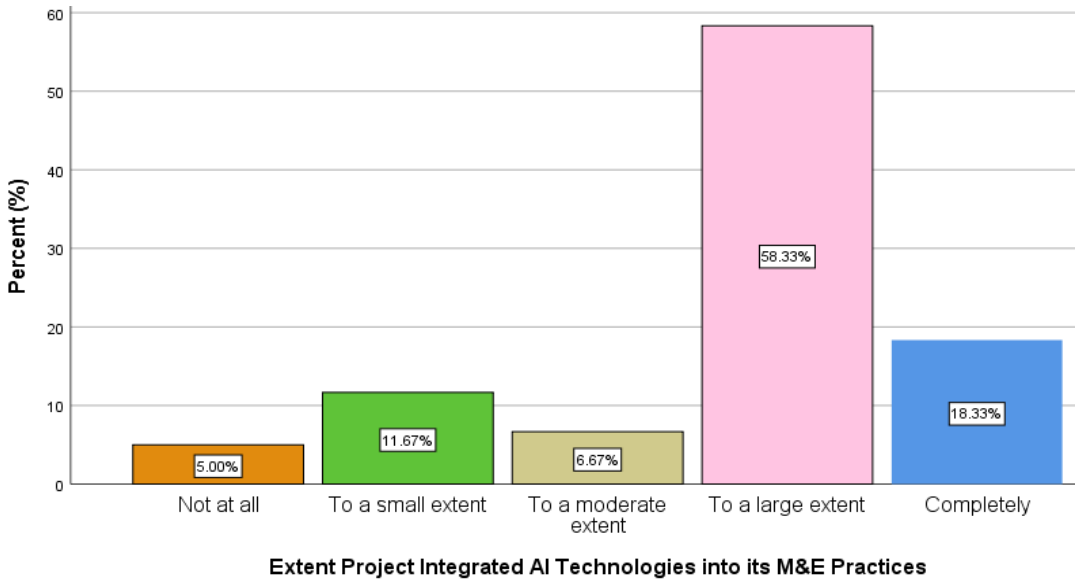
Highlighting the accuracy of data analysis, one official noted, *"Big Data analytics minimizes human errors in data interpretation, leading to more precise and reliable reports. This has improved the credibility of M&E findings."* (MEPAK Official Interview 4, March 14, 2025).

However, some challenges were pointed out. *"While Big Data offers numerous advantages, data security and privacy remain major concerns. We must ensure that sensitive project information is well protected,"* remarked another respondent (MEPAK Official Interview 3, March 14, 2025).

4.4.3. Artificial Intelligence in Data Analysis and Monitoring and Evaluation Practices

This section examines the extent to which AI technologies are integrated into M&E practices in selected infrastructural projects in Nairobi County, Kenya. Respondents were asked the extent their project integrated AI technologies into its M&E practices. Findings was presented in Figure 4.7.

Figure 4.7: Extent Project Integrated AI Technologies into M&E Practices



The findings in Figure 4.7 show that the majority, 35 (58.33%) reported that their projects had integrated AI technologies into monitoring and evaluation practices to a large extent. Additionally, 11 (18.33%) indicated that AI technologies were fully integrated into their M&E processes. Conversely, 7 (11.67%) stated that AI was used only to a small extent, while 4 (6.67%) reported a moderate level of integration. A minority of 3 respondents (5.00%) noted that AI technologies were not integrated at all in their M&E practices.

These results suggest that Artificial Intelligence technologies are playing a significant role in enhancing Monitoring and Evaluation practices in infrastructural projects, with the majority of projects adopting them to a considerable extent. This concurs with Yitmen and Alizadehsalehi (2021)**,** who assert that AI applications in infrastructure projects enhance predictive accuracy, streamline data analysis, and support proactive decision-making. However, the presence of some projects with minimal or no AI integration reflects the concerns raised by Tanaka and Yamada (2023) regarding the barriers of high implementation costs, lack of skilled personnel, and

resistance to technological change. Addressing these issues is important for the full realization of AI's potential in improving M&E effectiveness and accountability.

The study assessed how AI technologies influenced decision-making in M&E practice, findings from the respondents was presented in Table 4.8.

Table 4.8: How AI Technologies Impacted Decision-Making in M&E Practice

Impacts of AI Technologies	Frequency	Percentage (%)
No impact	6	10.0
Minimal impact	8	13.3
Moderate impact	7	11.7
Significant impact	14	23.3
Transformative impact	25	41.7
Total	**60**	**100.0**

Source: Field Data, 2025

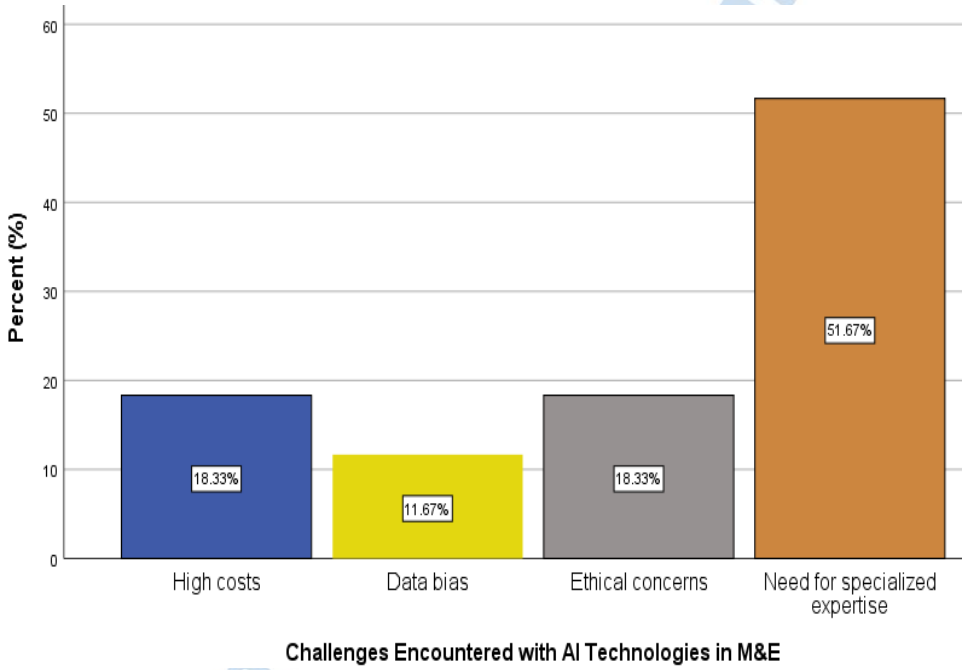
The findings in Table 4.8 show that the majority of respondents, 25 (41.7%), indicated that AI technologies had a transformative impact on decision-making in monitoring and evaluation practices. Additionally, 14 respondents (23.3%) reported a significant impact**,** underscoring AI's role in enhancing data-driven decision-making processes. A smaller number, 7 (11.7%), noted a moderate impact**,** while 8 (13.3%) stated that AI had only a minimal impact on their M&E decision-making. Notably, 6 respondents (10.0%) reported that AI technologies had no impact on their decision-making processes.

These results suggest that Artificial Intelligence technologies are increasingly influencing Monitoring and Evaluation practices, with most infrastructural projects reporting substantial benefits, including enhanced efficiency, improved predictive capabilities, and increased data accuracy. This concurs with World Bank (2022)**,** which highlights the transformative role of AI in optimizing project performance and accountability. Similarly, Mleke and Dida (2020) and Ogutu and Kamau (2024) affirm that AI integration leads to real-time data analysis, early detection of

project risks, and streamlined reporting processes. However, the observation that some projects experienced minimal or no impact points to persistent challenges such as inadequate infrastructure, limited technical expertise, and resistance to technological change issues that must be addressed to unlock the full potential of AI in M&E.

The study also investigated the challenges encountered with AI technologies in M&E in selected infrastructural projects in Nairobi County, Kenya. Figure 4.8 show the findings.

Figure 4.8: Challenges Encountered with AI Technologies in M&E



As shown in Figure 4.8**,** the most cited challenge was the high cost of AI tools and infrastructure**,** reported by 22 respondents (36.7%), indicating financial barriers to adoption. Additionally, limited technical expertise was identified by 15 respondents (25.0%), highlighting the need for skilled personnel to effectively operate AI systems in M&E processes.

Data privacy and security concerns were raised by 10 respondents (16.7%), reflecting apprehensions about unauthorized access and potential data breaches. A further 7 respondents (11.7%) noted the lack of supportive policies**,** while 6 respondents (10.0%) cited inadequate

internet connectivity as a hindrance to effective AI integration. These findings implied that while AI technologies have significant potential for enhancing M&E practices, infrastructural, financial, and ethical constraints must be addressed to maximize their effectiveness. The findings align with Ogutu and Kamau (2024), who observed that the most significant challenge in adopting AI technologies in M&E is the shortage of specialized expertise.

In assessing the influence of Artificial Intelligence technologies on Monitoring and Evaluation practices in selected infrastructural projects in Nairobi County, participants were asked to rate various statements on a Likert scale of 1 to 5, where 1 represented Strongly Disagree and 5 represented Strongly Agree. The findings revealed that AI technologies play a significant role in enhancing M&E practices, with most respondents expressing positive perceptions about their impact. Findings was presented in Table 4.9.

Table 4.9: Influence of Artificial Intelligence Technologies on M&E

N=60

Statements	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	F	%	F	%	F	%	F	%	F	%
Computer vision technologies help identify potential structural issues in projects during M&E.	18	30.0	29	48.3	8	13.3	3	5.0	2	3.3
AI technologies (e.g., machine learning, NLP, computer vision, and RPA) have improved the overall quality of M&E practices.	14	23.3	33	55.0	6	10.0	3	5.0	4	6.7
The integration of AI into M&E systems is sustainable for future infrastructural projects.	23	38.3	27	45.0	4	6.7	4	6.7	2	3.3
AI technologies facilitate the timely identification and resolution of project challenges.	9	15.0	40	66.7	4	6.7	4	6.7	3	5.0
The use of Robotic Process Automation ensures consistent data entry and processing during project monitoring.	19	31.7	24	40.0	8	13.3	6	10.0	3	5.0
Natural Language Processing tools enhance understanding of stakeholder feedback for effective M&E.	22	36.7	24	40.0	3	5.0	6	10.0	5	8.3
Machine learning reduces human error in monitoring and evaluation processes.	9	15.0	39	65.0	5	8.3	6	10.0	1	1.7

Source: Field Data, 2025

As shown in Table 4.9, regarding the influence of computer vision technologies on identifying potential structural issues in projects during M&E, the majority of respondents, 18 (30.0%) strongly agreed and 29 (48.3%) agreed. Meanwhile, 8 (13.3%) remained neutral, 3 (5.0%) disagreed, and 2 (3.3%) strongly disagreed. On whether AI technologies such as machine learning, NLP, computer vision, and RPA have improved the overall quality of M&E practices, 14 (23.3%)

strongly agreed and 33 (55.0%) agreed. In contrast, 6 (10.0%) remained neutral, while 3 (5.0%) disagreed and 4 (6.7%) strongly disagreed.

Concerning the sustainability of integrating AI into M&E systems for future infrastructural projects, 23 (38.3%) of respondents strongly agreed and 27 (45.0%) agreed. A smaller number, 4 (6.7%), remained neutral, while another 4 (6.7%) disagreed, and 2 (3.3%) strongly disagreed. With regard to whether AI technologies facilitate the timely identification and resolution of project challenges, 9 (15.0%) strongly agreed and 40 (66.7%) agreed. In comparison, 4 (6.7%) remained neutral, 4 (6.7%) disagreed, and 3 (5.0%) strongly disagreed.

On the use of Robotic Process Automation (RPA) to ensure consistent data entry and processing during project monitoring, 19 (31.7%) of respondents strongly agreed and 24 (40.0%) agreed. Meanwhile, 8 (13.3%) were neutral, 6 (10.0%) disagreed, and 3 (5.0%) strongly disagreed. Regarding whether Natural Language Processing (NLP) tools enhance understanding of stakeholder feedback for effective M&E, 22 (36.7%) of respondents strongly agreed and 24 (40.0%) agreed. In contrast, 3 (5.0%) remained neutral, 6 (10.0%) disagreed, and 5 (8.3%) strongly disagreed. Moreover, Concerning the statement that machine learning reduces human error in M&E processes, 9 (15.0%) strongly agreed and 39 (65.0%) agreed. Meanwhile, 5 (8.3%) were neutral, 6 (10.0%) disagreed, and 1 (1.7%) strongly disagreed.

The study findings indicate that Artificial Intelligence technologies have had a significant and transformative influence on Monitoring and Evaluation practices in infrastructural projects within Nairobi County. A majority of respondents reported that AI tools such as machine learning, computer vision, robotic process automation and natural language processing have enhanced the accuracy, efficiency, and effectiveness of project monitoring and evaluation processes.

Specifically, a substantial proportion of respondents strongly agreed that AI technologies contribute to timely identification and resolution of project challenges, reduce human error, and ensure consistent data entry and processing during M&E activities. AI was also seen to facilitate better interpretation of stakeholder feedback**,** enabling more responsive and informed decision-making. Tools like computer vision were acknowledged for their capacity to detect potential structural issues early**,** thus improving risk management in infrastructure projects.

Additionally, the majority of respondents viewed AI as a sustainable and viable solution for future M&E practices, with many citing its transformative impact on data-driven decision-making. The integration of real-time data processing and predictive analytics was also seen as enhancing the accuracy and relevance of project evaluations. However, a small portion of respondents reported moderate to minimal impact**,** and a minority noted no impact**,** pointing to challenges such as lack of full integration, technical limitations, or insufficient training and resources to effectively deploy AI technologies. The findings support Johnson, Smith and Lee (2023) and the World Bank (2022)**,** who argue that AI technologies significantly improve Monitoring and Evaluation efficiency, data precision, and the sustainability of project outcomes.

The study objective three sought the opinion of the respondents on the ways Artificial Intelligence been utilized to automate data processing and enhance decision-making in M&E practices in selected infrastructural projects in Nairobi County. The study revealed the following:

"Artificial Intelligence has significantly improved the speed and accuracy of data processing in Monitoring and Evaluation (M&E). AI-powered tools automate data collection, reducing manual entry errors and ensuring real-time reporting," stated one respondent (MEPAK Official Interview 4, March 13, 2025).

Another official highlighted AI's role in decision-making, saying, *"AI algorithms analyze vast datasets and generate insights that help us make informed decisions. This has enhanced the efficiency of project monitoring and evaluation."* (MEPAK Official Interview 7, March 13, 2025).

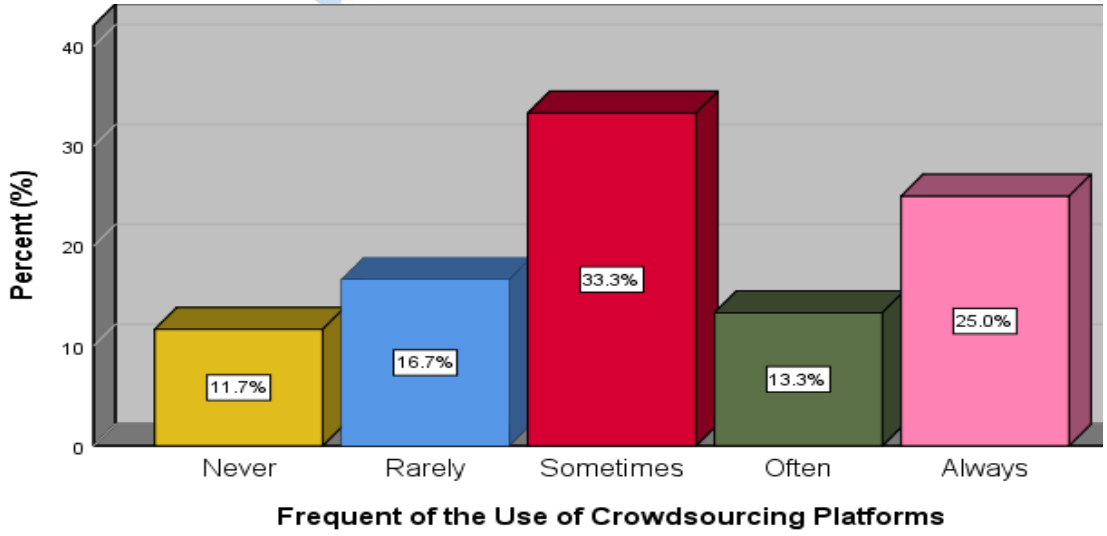
On predictive analytics, a respondent explained, *"With AI, we can predict project risks and delays based on historical data. This proactive approach allows us to take preventive measures before issues escalate."* (MEPAK Official Interview 11, March 14, 2025).

However, some concerns were raised. *"Despite AI's benefits, there is still a need for human oversight to interpret complex data patterns and ensure that automated decisions align with project goals,"* noted one official (MEPAK Official Interview 15, March 14, 2025).

4.4.4. Utilization of Crowdsourcing Platforms and Monitoring and Evaluation Practices

The fourth objective of this study sought to examine the influence of utilization of crowdsourcing platforms on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya. The study sought to determine how frequently crowdsourcing platforms such as SurveyMonkey, Crowd Signal, Google Forms, Idea Scale, Qualtrics, Zoho Survey, Crowd Spring, User Voice, crowdsource used to gather community feedback for M&E. Figure 4.9 has the findings.

Figure 4.9: Frequently of the Use of Crowdsourcing Platforms



Based on Figure 4.9, the study findings indicate varying levels of frequency in the use of crowdsourcing platforms for gathering community feedback in Monitoring and Evaluation practices. Regarding the use of crowdsourcing platforms in Monitoring and Evaluation, the majority of respondents, 20 (33.3%), indicated that they sometimes use these platforms, while 15 (25.0%) stated they always use them. Meanwhile, 8 (13.3%) reported using them often, 10 (16.7%) said they rarely use them, and 7 (11.7%) noted that they never use crowdsourcing platforms in their M&E practices.

These findings revealed that while crowdsourcing platforms are utilized in M&E, their adoption was not yet universal, with a considerable proportion of respondents using them inconsistently. This observation is supported by Srivastava and Mostafavi (2021), who noted that although crowdsourcing technologies have the potential to improve stakeholder engagement and data collection in project monitoring, their implementation remains fragmented across many developing contexts due to limited awareness and infrastructure. Similarly, Bott and Young (2022) found that the inconsistent use of crowdsourcing platforms in development projects is often linked to a lack of institutional frameworks, technological capacity, and trust in citizen-generated data, thereby limiting their full potential in M&E processes.

Table 4.10: Crowdsourcing Platforms in improving Stakeholder Engagement in M&E

Crowdsourcing Platforms	Frequency	Percentage (%)
Very Ineffective	6	10.0
Ineffective	6	10.0
Neutral	7	11.7
Effective	25	41.7
Very Effective	16	26.7
Total	**60**	**100.0**

Source: Field Data, 2025

The findings, as shown in Table 4.10, regarding the effectiveness of crowdsourcing platforms in improving stakeholder engagement in Monitoring and Evaluation, the majority of

respondents, 25 (41.7%), rated them as effective, while 16 (26.7%) considered them very effective. Meanwhile, 7 (11.7%) remained neutral on the matter. A smaller proportion of respondents, 6 (10.0%), found the platforms ineffective, and another 6 (10.0%) rated them as very ineffective. These findings highlight that while crowdsourcing platforms were largely beneficial for stakeholder engagement, challenges such as digital literacy, accessibility, or data reliability could affect their overall effectiveness. This is supported by Usami (2020), who emphasized that although crowdsourcing improves participatory monitoring and evaluation, its impact is often constrained by disparities in digital access and varying levels of user competence. Similarly, Njuki (2019) observed that while these platforms enhance transparency and feedback mechanisms, concerns over data validation and inclusivity continue to hinder their optimal use in development projects.

The study also sought to identify the key barriers to the effective use of crowdsourcing platforms in Monitoring and Evaluation practices for infrastructural projects in Nairobi County, Kenya. Findings was presented in Table 4.11.

Table 4.11: Barriers to Using Crowdsourcing Platforms

Barriers to Crowdsourcing Platforms	Frequency	Percentage (%)
Language barriers	18	30.0
Digital literacy issues	9	15.0
Data verification challenges	7	11.7
Sustainability of platforms	26	43.3
Total	**60**	**100.0**

Source: Field Data, 2025

As presented in Table 4.11, the most significant challenge reported was the sustainability of platforms as indicated by majority, 26(43.3%) of the respondents, indicating concerns about the long-term viability, maintenance, and funding required to keep these digital tools operational. Additionally, language barriers 18(30.0%) were cited as a major impediment, suggesting that

multilingual communication gaps may hinder effective stakeholder participation and data collection. Digital literacy issues 9(15.0%) were also highlighted, reflecting difficulties faced by some stakeholders in navigating and utilizing these platforms efficiently. Furthermore, data verification challenges 7(11.7%) were noted, pointing to concerns about ensuring the reliability and accuracy of user-generated data in M&E processes.

These findings underscore the practical barriers affecting the widespread and effective use of crowdsourcing platforms in M&E. The reported concerns about platform sustainability, language barriers, digital literacy, and data verification align with the observations made by Bott and Young (2022), who noted that long-term sustainability and inclusivity remain core challenges in the deployment of digital participatory tools. Similarly, Srivastava and Mostafavi (2021) emphasized that while crowdsourcing can enhance transparency and stakeholder engagement, technical and linguistic limitations, along with the lack of mechanisms for verifying crowd-sourced data, often reduce its effectiveness in project monitoring and evaluation.

The study sought to assess the influence of utilization of crowdsourcing platforms on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County. Participants were asked to rate various statements on a Likert scale of 1 to 5, where 1 represented Strongly Disagree and 5 represented Strongly Agree. Findings was presented in Table 4.12.

Table 4.12: Utilization of Crowdsourcing Platforms on M&E Practices

N=60

Statements	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	F	%	F	%	F	%	F	%	F	%
The integration of online platforms into M&E practices ensures timely dissemination of project updates.	34	56.7	8	13.3	6	10.0	6	10.0	6	10.0
Online platforms provide a user-friendly interface for reporting and accessing project data.	28	46.7	16	26.7	5	8.3	5	8.3	6	10.0
Feedback from the public helps identify potential challenges during project implementation.	25	41.7	14	23.3	9	15.0	7	11.7	5	8.3
Crowdsourcing public opinions ensures that stakeholder concerns are addressed in M&E practices.	29	48.3	12	20.0	6	10.0	7	11.7	6	10.0
Incorporating mapping technologies ensures accurate monitoring of geographically dispersed projects.	23	38.3	19	31.7	6	10.0	6	10.0	6	10.0
Crowdsourcing platforms are a sustainable tool for future infrastructural project evaluations.	32	53.3	13	21.7	3	5.0	6	10.0	6	10.0
Crowdsourcing platforms have significantly improved the efficiency of M&E practices in infrastructural projects.	20	33.3	22	36.7	5	8.3	5	8.3	8	13.3

Source: Field Data, 2025

As illustrated in Table 4.12, regarding the integration of online platforms into M&E practices, the majority of respondents, 34 (56.7%) strongly agreed and 8 (13.3%) agreed that it ensures timely dissemination of project updates. Meanwhile, 6 (10.0%) were neutral, 6 (10.0%) disagreed, and 6 (10.0%) strongly disagreed.

On whether online platforms provide a user-friendly interface for reporting and accessing project data, 28 (46.7%) strongly agreed and 16 (26.7%) agreed. A smaller number, 5 (8.3%), remained neutral, while 5 (8.3%) disagreed and 6 (10.0%) strongly disagreed. When asked whether feedback from the public helps identify potential challenges during project implementation, 25 (41.7%) strongly agreed and 14 (23.3%) agreed. Additionally, 9 (15.0%) were neutral, 7 (11.7%) disagreed, and 5 (8.3%) strongly disagreed.

Regarding whether crowdsourcing public opinions ensures stakeholder concerns are addressed in M&E practices, 29 (48.3%) strongly agreed and 12 (20.0%) agreed. Meanwhile, 6 (10.0%) were neutral, 7 (11.7%) disagreed, and 6 (10.0%) strongly disagreed. In terms of the role of mapping technologies in ensuring accurate monitoring of geographically dispersed projects, 23 (38.3%) strongly agreed and 19 (31.7%) agreed. The remaining respondents were split evenly across neutral (6, 10.0%), disagree (6, 10.0%), and strongly disagree (6, 10.0%).

With regard to crowdsourcing platforms being sustainable tools for future infrastructural project evaluations, 32 (53.3%) strongly agreed and 13 (21.7%) agreed. Fewer respondents were neutral 3(5.0%), disagreed 6(10.0%), or strongly disagreed 6(10.0%). Finally, on whether crowdsourcing platforms have significantly improved the efficiency of M&E practices in infrastructural projects, 20 (33.3%) strongly agreed and 22 (36.7%) agreed. However, 5 (8.3%) were neutral, 5 (8.3%) disagreed, and 8 (13.3%) strongly disagreed.

The study revealed that crowdsourcing platforms play a significant role in enhancing Monitoring and Evaluation practices in infrastructural projects within Nairobi County. A majority of respondents acknowledged that the integration of online platforms into M&E processes ensures timely dissemination of project updates and provides user-friendly interfaces for reporting and accessing project data. This contributes to improved accessibility, responsiveness, and efficiency

in M&E tasks. Furthermore, the findings showed that public feedback collected through crowdsourcing is instrumental in identifying potential challenges during project implementation. This feedback loop was also perceived as essential in addressing stakeholder concerns, thereby fostering greater stakeholder engagement and participation in the evaluation process. Additionally, the use of mapping technologies was widely accepted as enhancing the accurate monitoring of geographically dispersed infrastructural projects.

Respondents also agreed that crowdsourcing platforms are sustainable tools for future project evaluations, highlighting their relevance in long-term M&E planning and execution. Despite these strengths, a small proportion of respondents remained skeptical, citing challenges such as the effectiveness of the platforms in improving M&E efficiency and barriers including language, digital literacy, and sustainability concerns**.**

These findings align with Srivastava and Mostafavi (2021), who found that while crowdsourcing enhances participatory monitoring and stakeholder interaction, its effectiveness depends heavily on the reliability of crowdsourced data and sustained user engagement. Similarly, Bott and Young (2022) supported these observations, emphasizing that although crowdsourcing improves transparency and inclusivity in M&E processes, challenges related to data validation, technological access, and long-term maintenance persist.

The study objective four sought the opinion of the respondents on how effective were crowdsourcing platforms in gathering community feedback and improving stakeholder engagement in M&E practices of selected infrastructural projects in Nairobi County. The study revealed the following:

"The open nature of crowdsourcing platforms sometimes leads to misinformation or duplicate reports, which require additional verification efforts before they can be used for decision-making." (MEPAK Official Interview 1, March 13, 2025).

"Before the adoption of crowdsourcing, we relied on periodic field visits, which were time-consuming. Now, we receive instant data from multiple sources, allowing us to detect delays or inefficiencies early and take corrective measures." (MEPAK Official Interview 5, March 13, 2025).

Another respondent highlighted inclusivity, stating, *" Crowdsourcing platforms have given a voice to marginalized groups who were previously left out of the M&E process. Now, even those in remote areas can contribute insights about project progress through mobile-based reporting systems."* (MEPAK Official Interview 4, March 14, 2025).

Discussing transparency, one official noted, *"With crowdsourcing, project updates are openly shared, and the community can track progress in real-time. This level of transparency has built trust and accountability between stakeholders and project implementers."* (MEPAK Official Interview 1, March 14, 2025).

"Before the adoption of crowdsourcing, we relied on periodic field visits, which were time-consuming. Now, we receive instant data from multiple sources, allowing us to detect delays or inefficiencies early and take corrective measures." (MEPAK Official Interview 5, March 14, 2025).

4.4.5. Findings on the Relationship Between Technological Innovations and M&E

To assess the relationship between technological innovations and Monitoring and Evaluation practices in infrastructural projects, a multiple linear regression analyses were conducted using the model:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+e$$

Where:

Y represents Monitoring and Evaluation Practices (Dependent Variable)

$\mathbf{X_1}$ = Mobile Data Collection Tools

$\mathbf{X_2}$ = Big Data

$\mathbf{X_3}$ = Artificiel Intelligence

$\mathbf{X_4}$ = Crowdsourcing

$\boldsymbol{\beta_0}$ = Constant

$\boldsymbol{\beta_1 - \beta_4}$ = Regression Coefficients (indicating the effect of each independent variable on M&E practices)

e = Error term

Table 4.13: Regression Model Summary

Model	R	R^2	Adjusted R^2	Std. Error
1	0.832	0.692	0.675	0.345

As illustrated in Table 4.14, the regression model summary, the analysis yielded an R-value of 0.832**,** indicating a strong positive correlation between technological innovations and Monitoring & Evaluation (M&E) practices. Additionally, the R^2 value of 0.692 suggests that approximately 69.2% of the variance in M&E practices is explained by the four technological innovations: Mobile Data Collection Tools, Big Data, Artificial Intelligence, and Crowdsourcing**.** This implied that these technological innovations significantly contribute to the effectiveness of M&E practices in infrastructural projects.

Table 4.14: ANOVA Results

Model	Sum of Squares	df	Mean Square	F	Sig. (p-value)
Regression	12.340	4	3.085	21.472	0.000
Residual	5.500	55	0.100		
Total	**17.840**	**59**			

Further, the ANOVA results confirmed that the overall regression model was statistically significant ($F = 21.472$, $p < 0.001$), meaning that technological innovations had a significant influence on M&E practices. The sum of squares for the regression model is 12.340, with a mean square of 3.085**,** while the residual sum of squares was 5.500**,** reinforcing the model's explanatory power.

Table 4.15: Regression Coefficients

Variable	Unstandardized Coefficients (B)	Standard Error	Standardized Coefficients (Beta)	T	Sig. (p-value)
(Constant)	1.204	0.342		3.520	0.001
Mobile Data Collection Tools (X1)	0.428	0.091	0.312	4.703	0.000
Big Data (X2)	0.382	0.085	0.280	4.494	0.000
Artificial Intelligence (X3)	0.295	0.080	0.198	3.688	0.002
Crowdsourcing (X4)	0.340	0.078	0.267	4.359	0.000

The regression coefficients provide further insights into the impact of each technological innovation on M&E practices. Mobile Data Collection Tools ($\beta = 0.428$, $p = 0.000$) had the highest influence, indicating its critical role in enhancing efficiency and accuracy in M&E processes. Big Data ($\beta = 0.382$, $p = 0.000$) also showed a strong positive effect, highlighting its importance in data-driven decision-making. Crowdsourcing ($\beta = 0.340$, $p = 0.000$) significantly contributed to M&E improvements, emphasizing the role of collective intelligence and stakeholder engagement in project monitoring. Moreover, Artificial Intelligence ($\beta = 0.295$, $p = 0.002$), although having the lowest coefficient, still exhibited a statistically significant effect, showcasing its growing potential in automating and optimizing M&E functions.

4.4.5.1. Interpretation of Findings

The findings of this study suggested that technological innovations play a critical role in enhancing Monitoring and Evaluation practices in infrastructural projects within Nairobi County, Kenya. The strong predictive power of Mobile Data Collection Tools and Big Data Analytics highlights their essential contribution to real-time data acquisition and advanced analysis. This aligns with the assertions of Johnson, Smith, and Lee (2023) and the World Bank (2022), who emphasized that mobile and big data technologies are transforming M&E through improved data reliability and decision-making efficiency.

Furthermore, Crowdsourcing emerged as a significant factor, underlining its value in promoting stakeholder participation and transparency in M&E activities. This finding resonates with the work of Srivastava and Mostafavi (2021) and Bott and Young (2022), who noted that crowdsourcing fosters inclusivity and community ownership in development projects. However, your study provides new, localized evidence on its underutilization and inconsistent application, thus identifying an actionable gap.

Although Artificial Intelligence recorded the lowest coefficient among the variables, it still demonstrated a statistically significant positive effect. This supports Tanaka and Yamada's (2023) suggestion that AI is an emerging innovation in M&E with the potential to automate data analysis and improve predictive monitoring, albeit its adoption remains limited due to infrastructure and expertise constraints.

The study confirms that Mobile Data Collection Tools, Big Data Analytics, Artificial Intelligence, and Crowdsourcing each contribute significantly to improving M&E practices. The high R^2 value (69.2%) underscores the collective influence of these innovations and validates the theoretical framework underpinning technological integration in M&E systems. These findings were largely congruent with existing literature but also extend the knowledge base by offering empirical evidence specific to Nairobi County, thereby filling critical contextual and policy-practice gaps.

4.5. Chapter Summary

In chapter four of this study presenting the findings on the influence of Technological Innovations on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya. The presentation of the findings was categorized into four thematic areas guided

by research objectives. This study considered both qualitative and quantitative data analysis, and it finally provided findings on the statistical analysis.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter contain summary, conclusion and recommendations based on this study's research objectives. The recommendations, suggestions for further research based on the study's findings was presented afterwards. Study examined the influence of Technological Innovations on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya.

5.1. Summary of the Findings

In chapter four the study gave a presentation of the findings. This was also presented thematically, in accordance to the study research objectives. From data analysis in chapter four, the study established that mobile data collection tools enhance real-time data gathering, reduce paperwork, and improve the accuracy of field data. Big data analytics was found to improve the timeliness and accuracy of data analysis, enabling better decision-making. Artificial intelligence had been increasingly used to automate data processing and predictive analytics, optimizing resource allocation and improving project monitoring. Furthermore, crowdsourcing platforms had facilitated stakeholder engagement by enabling real-time feedback collection, increasing transparency, and ensuring that community concerns are addressed promptly. The discussion was made thematically as below.

5.1.1 Mobile Data Collection Tools and Monitoring and Evaluation Practices

The study found that the utilization of crowdsourcing platforms significantly influences Monitoring and Evaluation practices in selected infrastructural projects in Nairobi County. The study found that the adoption of mobile data collection tools in monitoring and evaluation practices for infrastructural projects in Nairobi County was moderate, with only 16.7% of respondents using

them often or always, while 35.0% use them sometimes and 21.7% never use them. Despite this, 68.4% rated the tools as effective or very effective, citing improvements in data accuracy, reliability, and decision-making. Key benefits identified included reduced data entry errors (70.0%), enhanced location accuracy through GPS (80.0%), improved transparency (78.3%), and increased community participation (80.0%). However, challenges such as data security concerns (43.3%), unstable internet connectivity (33.3%), technical issues (11.7%), and lack of training (10.0%) were noted.

Most respondents indicated that these platforms facilitate timely feedback collection, stakeholder participation, and collaborative decision-making**,** thus enhancing the effectiveness and responsiveness of M&E processes. A substantial proportion of respondents acknowledged that crowdsourcing contributes to transparency, real-time reporting, and public involvement**,** which are crucial for tracking project progress and addressing emerging issues during implementation.

Additionally, the study revealed that mapping technologies integrated within crowdsourcing tools improve geographical tracking and monitoring accuracy, particularly for widely dispersed projects. Crowdsourcing was also viewed as a sustainable solution for future evaluations, especially when community engagement is prioritized. However, despite these positive perceptions, the study uncovered that the frequency of use remains relatively low, with many respondents using crowdsourcing tools only occasionally or not at all. This points to inconsistent adoption and integration across projects, which could limit the full benefits of these technologies.

The findings also highlighted several barriers, with sustainability of platforms (43.3%)**,** language barriers (30.0%), and digital literacy challenges (15.0%) emerging as key obstacles. These challenges hinder inclusive participation and reduce the reliability of collected data.

Concerns about data verification were also raised, suggesting a need for systems that ensure accuracy and credibility in user-generated content.

Qualitative insights from Monitoring and Evaluation officers supported the quantitative data, emphasizing that crowdsourcing platforms offer cost-effective ways of collecting real-time data**,** increase stakeholder ownership, and allow for greater transparency in project implementation**.** Respondents stressed that while crowdsourcing adds value to M&E, its success depends on user training, data quality assurance mechanisms, and consistent platform management**.**

5.1.2. Big Data Analytics in Improving the Accuracy and Timeliness of M&E Data Analysis

The study examined the influence of big data analytics on Monitoring and Evaluation practices in selected infrastructural projects in Nairobi County, Kenya. The study revealed low adoption of big data analytics in M&E practices, with only 21.7% of respondents using tools like Tableau, R, Power BI, or NVivo, while 78.3% still rely on traditional methods. Despite this, those using big data reported clear benefits 60.0% cited improved data visualization, 18.3% better trend analysis, and 11.7% noted enhanced resource allocation. Additionally, the majority of respondents agreed that big data enhances decision-making (75.0%)**,** pattern identification (68.4%)**,** project tracking (71.7%)**,** and transparency (80.0%)**.** However, technical barriers, skills gaps, and data security concerns continue to hinder wider use. The findings suggest that targeted training, digital infrastructure investment, and policy reforms are necessary to fully harness big data's potential in Nairobi's infrastructural M&E systems.

The findings revealed that Big Data analytics significantly influence Monitoring and Evaluation practices in selected infrastructural projects in Nairobi County. Despite their potential, most respondents indicated that their projects do not currently use Big Data analytics, with only a

small proportion reporting utilization of tools such as Tableau, Power BI, and Python. This suggested that traditional M&E approaches remain dominant due to limited technical capacity, financial constraints, and lack of awareness of the benefits of data-driven decision-making.

For projects that have adopted Big Data analytics, the tools were reported to enhance data visualization, improve trend analysis, enable better forecasting, and support more effective resource allocation. These capabilities contributed to improved accuracy and timeliness in M&E processes, making it easier for project managers to monitor progress and respond quickly to emerging issues.

A majority of respondents agreed that Big Data analytics enhance the identification of patterns in project data, improve the accuracy of evaluations, and support informed decision-making. They also noted that these tools improve milestone tracking, stakeholder collaboration, and overall transparency and accountability within M&E systems. However, the study also revealed that the full potential of Big Data analytics is not being realized due to challenges such as limited digital infrastructure, inadequate technical skills, and organizational resistance to change. Concerns were raised regarding data privacy and security, highlighting the need for protective measures to safeguard sensitive project information. The study concluded that while big data analytics has the potential to revolutionize M&E practices by improving efficiency, accuracy, and decision-making, its adoption in Nairobi's infrastructural projects remains relatively low.

5.1.3. Artificial Intelligence Technologies and Monitoring and Evaluation Practices

The study examined the integration of Artificial Intelligence technologies into Monitoring and Evaluation practices in selected infrastructural projects in Nairobi County, Kenya. The study found that 76.7% of respondents reported either full or large-scale integration of AI technologies into M&E practices in infrastructural projects, showing strong adoption levels. AI was perceived

to significantly enhance decision-making, with 65.0% reporting a transformative or significant impact. Key benefits included faster data processing**,** real-time reporting**,** predictive analytics, and improved accuracy and risk detection, especially through tools like machine learning, computer vision, and NLP. However, challenges persist, with 36.7% citing high costs, 25.0% noting limited technical expertise, and others concerned about data privacy, weak policies, and poor internet infrastructure. Despite these barriers, most respondents agreed that AI offers sustainable and scalable solutions for future M&E, aligning with global trends and reinforcing its role in enhancing transparency, efficiency, and accountability in project evaluation.

The findings revealed that Artificial Intelligence play a significant role in enhancing Monitoring and Evaluation processes in infrastructural projects across Nairobi County. A majority of respondents reported either large-scale or complete integration of AI in M&E, indicating growing adoption. However, some projects still demonstrated minimal or no integration, suggesting that while progress had been made, full implementation was hindered by challenges such as high costs, limited technical expertise, and resistance to new technologies.

In terms of decision-making, most respondents acknowledged that AI had a transformative or significant impact. AI was recognized for enhancing data-driven decision-making, improving predictive capabilities, and increasing operational efficiency. Nonetheless, a minority of respondents reported only moderate or minimal influence, indicating that some projects had yet to fully leverage the benefits of AI, likely due to inadequate infrastructure or insufficient technical knowledge.

The study also identified several challenges to AI integration in Monitoring and Evaluation practices in selected infrastructural projects in Nairobi County. The most pressing issue was the shortage of skilled personnel, with a majority of respondents citing the need for specialized

expertise. Other key concerns included the high cost of AI implementation and ethical considerations in automated decision-making. Data bias was also mentioned as a challenge, raising concerns about the fairness and accuracy of AI-generated insights.

Despite these challenges, respondents highlighted numerous benefits of AI in improving M&E practices. AI technologies, including machine learning, natural language processing, computer vision, and robotic process automation, were credited with enhancing the overall quality of M&E. Computer vision was especially valued for identifying structural issues in projects, while RPA was noted for ensuring consistent and accurate data entry. Natural language processing tools were recognized for their role in improving stakeholder engagement and understanding of feedback, and machine learning was seen as effective in reducing human error.

Furthermore, AI was widely viewed as a sustainable solution for future infrastructural projects. It was reported to facilitate the timely identification and resolution of project challenges, improve data accuracy, and enable real-time reporting. AI-powered predictive analytics were particularly useful in anticipating potential risks and delays, thereby supporting proactive decision-making.

While AI has clearly begun to transform M&E practices, the study emphasizes that its full potential can only be realized by addressing existing barriers. This includes investing in technical training, ensuring ethical frameworks are in place, and providing the necessary financial and infrastructural support to scale AI adoption across all projects.

5.1.4. Utilization of Crowdsourcing Platforms on Monitoring and Evaluation Practices

The study examined the influence of crowdsourcing platforms on Monitoring and Evaluation practices in selected infrastructural projects in Nairobi County, Kenya. The study found that crowdsourcing platforms moderately support M&E practices, with 33.3% using them

sometimes and 25.0% always. Most respondents found them effective in stakeholder engagement and timely feedback. Key challenges include sustainability (43.3%), language barriers (30.0%), and digital literacy (15.0%). Despite these, the platforms improve transparency, data access, and inclusivity, though concerns over data accuracy and misinformation remain.

Findings revealed that the use of these platforms in M&E was moderate, with a majority of respondents indicating occasional or inconsistent use. Only a small proportion reported consistent usage, suggesting that while the platforms are recognized, their adoption across infrastructural projects remains limited.

Despite the inconsistent usage, crowdsourcing platforms were widely perceived as beneficial to M&E efforts. Most respondents acknowledged that these tools enhance stakeholder engagement, improve transparency, and facilitate timely feedback from the public. In particular, the platforms were praised for increasing accessibility to project data, enabling real-time data sharing, and fostering inclusive participation in monitoring processes. Additionally, mapping technologies integrated into crowdsourcing systems were recognized as valuable for accurately monitoring projects spread across different geographical areas.

However, the study identified several barriers that limit the full utilization of crowdsourcing platforms in M&E. The most significant challenge was the sustainability of these platforms, which includes issues related to long-term funding, maintenance, and institutional support. Other notable constraints included language barriers that affect communication with diverse communities, digital literacy limitations among some users, and concerns about the reliability and verification of user-generated data.

Despite these challenges, a majority of respondents expressed confidence in the long-term potential of crowdsourcing platforms as sustainable tools for future M&E efforts. Many believed

that the platforms enhance decision-making, increase responsiveness, and promote deeper stakeholder involvement. Practical feedback from respondents reinforced these views, highlighting that crowdsourcing platforms have helped reduce the need for time-consuming field visits, amplified community voices especially from marginalized groups and built trust through greater transparency and accountability in project monitoring.

5.2. Conclusions

The study concluded that Mobile data collection tools have been integrated into M&E frameworks for infrastructural projects in Nairobi County but with inconsistent adoption. While they enhance data accuracy, real-time monitoring, and stakeholder communication, their usage varies across projects. These tools improve M&E practices by reducing data entry errors, enabling GPS tracking for project verification, and facilitating SMS reporting for timely updates. However, challenges such as data security risks, unreliable internet connectivity, technical difficulties, and inadequate training hinder their effectiveness. Despite their potential to enhance transparency and efficiency, full adoption remains limited. Addressing digital literacy gaps, strengthening infrastructure, and improving security measures are key to maximizing their impact on M&E practices.

The study further concluded that the integration of big data analytics into M&E frameworks for infrastructural projects in Nairobi County remains low, with traditional methods still widely used. Limited technical expertise, financial constraints, and lack of awareness contribute to slow adoption. For infrastructural projects that have embraced big data analytics, benefits include improved data visualization, enhanced trend analysis, better resource allocation, and more accurate forecasting. These tools strengthen decision-making, facilitate real-time monitoring, and improve stakeholder collaboration. Despite its potential, challenges such as data security concerns and the

need for capacity building hinder widespread adoption. Addressing these barriers through training, investment in analytics tools, and data protection measures can enhance the effectiveness of M&E practices.

AI technologies have been integrated into M&E frameworks for infrastructural projects in Nairobi County, significantly improving data-driven decision-making, efficiency, and predictive analysis. However, adoption levels vary, with some projects fully leveraging AI while others face implementation challenges due to cost constraints, lack of expertise, and resistance to change. AI-powered tools, including machine learning, NLP, and RPA, enhance M&E by automating data processing, reducing human errors, and enabling real-time reporting. AI also improves project monitoring by identifying structural issues, enhancing stakeholder engagement, and supporting predictive analytics for risk mitigation. Despite these benefits, challenges such as data bias, ethical concerns, and the need for specialized expertise hinder AI's full potential. Addressing these barriers through capacity building, improved infrastructure, and ethical AI frameworks can optimize its effectiveness in M&E practices.

On how effective crowdsourcing platforms in gathering community feedback and improving stakeholder engagement in M&E practices of selected infrastructural projects in Nairobi County, Kenya, it was concluded that crowdsourcing platforms improve transparency, stakeholder engagement, and real-time data collection in M&E. However, inconsistent adoption, sustainability concerns, digital literacy gaps, and data verification challenges hinder their full potential. Addressing these barriers will enhance their effectiveness in infrastructural project monitoring.

5.3. Recommendations

Based on the study findings, the study recommends several practical measures to enhance technological Innovations on Monitoring and Evaluation Practices in selected infrastructural projects.

1. To promote the adoption of mobile data collection tools in M&E, national institutions responsible for infrastructure development such as the Ministry of ICT and the State Department for Public Works should provide targeted digital training and equip field officers with mobile-enabled technologies that support offline data capture and geolocation. Improving ICT infrastructure in remote project sites will further enhance real-time data transmission and accuracy.
2. To boost the use of big data analytics in monitoring practices, public agencies and development authorities should partner with local universities and tech hubs to offer tailored capacity-building programs in data visualization and analytics. Establishing shared data centers and adopting user-friendly platforms like Tableau or Power BI can also empower M&E officers to make evidence-based decisions more effectively.
3. In advancing AI integration, implementing agencies such as the Kenya Urban Roads Authority and National Housing Corporation should prioritize introducing cost-effective AI applications like predictive analytics and robotic process automation. Collaborations with private tech firms can provide both affordable tools and technical support. Additionally, public procurement guidelines should include clear AI integration standards to ensure consistency and transparency in project monitoring.
4. To enhance the effectiveness of crowdsourcing platforms, county governments and civic technology innovators should develop inclusive, multilingual, and mobile-accessible tools

for public reporting and feedback. Sustained investment in platform maintenance and community digital literacy training especially in informal settlements and rural areas which will ensure broader participation and trust in the evaluation of public infrastructure projects.

5.4. Suggestions for Further Study

i. Future research should explore the long-term impact of mobile data collection tools on the efficiency and sustainability of Monitoring and Evaluation in infrastructural projects. A comparative study across different counties in Kenya could provide insights into regional variations in adoption and effectiveness.

ii. Additionally, further studies could assess the challenges and opportunities in the implementation of big data analytics in M&E, focusing on the role of data security, privacy concerns, and cost implications. Investigating how organizations can overcome technical and financial barriers to fully leverage big data in project monitoring would be valuable.

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APPENDICES

Appendix I: Questionnaire

My name is Judy Tuwei, a Master student in Mount Kenya University conducting research on: **influence of technological innovations on monitoring and evaluation in selected infrastructural projects: a study in Nairobi county, Kenya.** You are requested to voluntary participate by responding to all the questions in to the accompanying questionnaire. The information provided will be treated with confidentiality. I look forward to your collaboration in this study. Please don't right your name in this questionnaire.

Section A: Demographic Information

Please give your answer by putting a [√] in the appropriate box or write your answer in the space provided.

1. Gender: Male [ ] Female [ ]
2. Age:

   18-25 Years [ ] 26-35 Years [ ] 36-45 Years [ ] 46-55 Years [ ] 56 and above Years [ ]
3. Position:

   Project Manager [ ]

   M&E Professional [ ]

   County Official [ ]

   MEPAK Official [ ]
4. Years of Experience in Current Role:

   Less than 1 year [ ]
   1-3 years [ ]

   4-7 years [ ]

   8-10 years [ ]

   More than 10 years [ ]
5. Department

   Ministry of Transport [ ]

Infrastructure [ ]

Housing [ ]

Urban Development [ ]

Public Works [ ]

Section B: Mobile Data Collection Tools

6. How frequently does your project use mobile data collection tools?

   Never [ ] Rarely [ ] Sometimes [ ] Often [ ] Always [ ]

7. Rate the effectiveness of mobile data collection tools in improving data accuracy in M&E practices.

   Very Ineffective [ ] Ineffective [ ] Neutral [ ] Effective [ ] Very Effective [ ]

8. What challenges do you encounter when using mobile data collection tools? (Check all that apply).

   Stable internet connectivity [ ]

   Data security concerns [ ]

   Technical issues with devices [ ]

   Lack of training [ ]

   Other (please specify): _____

9. Kindly respond by indicating the extend you agree or disagree with the following statement in rating the influence of mobile data collection tools on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya on a Likert scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4=Agree, 5= Strongly Agree. (Tick √ where appropriate in the spaces provided).

STATEMENT	1	2	3	4	5
The use of mobile applications reduces data entry errors during M&E processes.					
GPS tracking ensures accurate location data for M&E in infrastructural projects					
SMS reporting ensures timely communication of project updates for M&E					
The simplicity of SMS reporting makes it suitable for use in diverse infrastructural projects.					

The adoption of mobile data collection tools increases transparency in M&E processes					
The use of SMS reporting encourages community participation in project monitoring.					
The use of digital surveys enhances the standardization of data collected for M&E					

Section C: Big Data Analytics

10. a) Does your project use Big Data analytics for M&E purposes (These may include software such as Tableau, Power BI, SAS, R, Python, Stata, NVivo, Google Data Studio, QlickView?)

    Yes [ ] No [ ]

    b) If yes, how has Big Data analytics improved the accuracy and timeliness of your M&E data analysis? (Select all that apply)

    Improved forecasting accuracy [ ] Enhanced data visualization [ ]
    Better resource allocation [ ] Improved trend analysis [ ]
    Other (please specify): _____

11. Kindly respond by indicating the extend you agree or disagree with the following statement in rating the influence of Big Data analytics on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya on a Likert scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4=Agree, 5= Strongly Agree. (Tick √ where appropriate in the spaces provided).

STATEMENT	1	2	3	4	5
Data mining enhances the identification of key patterns in project data for effective M&E.					
The integration of data mining into M&E enhances decision-making processes.					
The adoption of predictive analytics improves the accuracy of project evaluation.					
The use of real-time data processing enhances the accuracy of monitoring activities.					
Big Data analytics enable better tracking of infrastructural project milestones and outcomes.					
Big Data analytics enhance collaboration among stakeholders involved in M&E activities.					

The use of Big Data analytics promotes transparency and accountability in M&E processes.					

Section D: Artificial Intelligence (AI) Technologies

12. To what extent has your project integrated AI technologies into its M&E practices?

    Not at all [ ] To a small extent [ ] To a moderate extent [ ]

    To a large extent [ ] Completely [ ]

13. How have AI technologies impacted decision-making in your M&E practices?

    No impact [ ] Minimal impact [ ]

    Moderate impact [ ] Significant impact [ ] Transformative impact [ ]

14. List any specific AI technologies used in your project for M&E purposes:

    _____
    _____
    _____

15. What challenges do you encounter with AI technologies in M&E? (Select all that apply)

    High costs [ ] Data bias [ ] Ethical concerns [ ] Need for specialized expertise [ ]

    Other (please specify):_____

16. Kindly respond by indicating the extend you agree or disagree with the following statement in rating the influence of Artificial Intelligence (AI) technologies on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya on a Likert scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4=Agree, 5= Strongly Agree. (Tick √ where appropriate in the spaces provided).

STATEMENT	1	2	3	4	5
Computer vision technologies help identify potential structural issues in projects during M&E.					
AI technologies (e.g., machine learning, NLP, computer vision, and RPA) have improved the overall quality of M&E practices.					
The integration of AI into M&E systems is sustainable for future infrastructural projects.					
AI technologies facilitate the timely identification and resolution of project challenges.					

The use of Robotic Process Automation ensures consistent data entry and processing during project monitoring.					
Natural Language Processing tools enhance understanding of stakeholder feedback for effective M&E.					
Machine learning reduces human error in monitoring and evaluation processes.					

Section E: Crowdsourcing Platforms

17. How frequently do you use crowdsourcing platforms to gather community feedback for M&E? (Crowdsourcing platforms such as SurveyMonkey, Crowd Signal, Google Forms, Idea Scale, Qualtrics, Zoho Survey, Crowd Spring, User Voice, Crowdsource etc.)
    Never [ ] Rarely [ ] Sometimes [ ] Often [ ] Always [ ]
18. How effective are crowdsourcing platforms in improving stakeholder engagement in M&E?
    Very Ineffective [ ] Ineffective [ ] Neutral [ ] Effective [ ] Very Effective [ ]
19. What are the barriers to using crowdsourcing platforms for M&E in your projects? (Check all that apply)
    Language barriers [ ] Digital literacy issues [ ] Data verification challenges [ ]
    Sustainability of platforms [ ]
    Other (please specify): _____
20. In your opinion, which technological innovation has had the most significant impact on M&E practices in your project? Please explain:
    _____
    _____
    _____
21. Kindly respond by indicating the extend you agree or disagree with the following statement in rating influence of utilization of crowdsourcing platforms on Monitoring and Evaluation Practices in selected infrastructural projects in Nairobi County, Kenya on a Likert scale of 1-5 where 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4=Agree, 5= Strongly Agree. (Tick √ where appropriate in the spaces provided).

STATEMENT	1	2	3	4	5
The integration of online platforms into M&E practices ensures timely dissemination of project updates.					
Online platforms provide a user-friendly interface for reporting and accessing project data.					
Feedback from the public helps identify potential challenges during project implementation.					
Crowdsourcing public opinions ensures that stakeholder concerns are addressed in M&E practices.					
Incorporating mapping technologies ensures accurate monitoring of geographically dispersed projects.					
Crowdsourcing platforms are a sustainable tool for future infrastructural project evaluations.					
Crowdsourcing platforms have significantly improved the efficiency of M&E practices in infrastructural projects.					

Thanks for Your Cooperation

Appendix II: Interview Guide

My name is Judy Tuwei, a Master student in Mount Kenya University conducting research on: **influence of technological innovations on monitoring and evaluation in selected infrastructural projects: a study in Nairobi county, Kenya.** You are requested to voluntary participate by responding to all the questions in to the accompanying questionnaire. The information provided will be treated with confidentiality. I look forward to your collaboration in this study.

Section A: Mobile Data Collection Tools

- ☐ Can you describe your experience with using mobile data collection tools in your project's M&E practices?

_____
_____
_____
_____
_____

- ☐ How have these tools improved data accuracy and timeliness?

_____
_____
_____
_____
_____

- ☐ What specific challenges have you faced in implementing mobile data collection tools, and how have you addressed them?

_____
_____
_____
_____
_____

Section B: Big Data Analytics

- ☐ How is Big Data analytics utilized in your project for M&E purposes?

_____
_____
_____
_____
_____

- ☐ Can you provide specific examples of how Big Data analytics has enhanced decision-making and resource allocation?

_____
_____
_____
_____
_____

- ☐ What are the primary challenges in adopting Big Data analytics, and what strategies have you employed to overcome them?

_____
_____
_____
_____
_____

Section C : Artificial Intelligence (AI) Technologies

- ☐ How have AI technologies been integrated into your M&E practices?

_____
_____
_____
_____
_____

- ☐ What impact has AI had on data processing and decision-making within your project?

_____
_____
_____
_____
_____

- ☐ What challenges related to AI have you encountered, particularly in terms of ethical considerations and data management?

_____
_____
_____
_____
_____

Section D: Crowdsourcing Platforms

- ☐ How do you utilize crowdsourcing platforms to engage the community and gather feedback?

_____
_____
_____

- ☐ Can you share examples of how crowdsourcing has improved stakeholder engagement and project accountability?

- ☐ What barriers have you faced with crowdsourcing platforms, and how have you managed to address these issues?

General

- ☐ Based on your experience, which technological innovation do you believe has had the most significant impact on improving M&E practices in your project?

- ☐ What recommendations would you make to other project managers looking to integrate technological innovations into their M&E practices?

Thanks for Your Cooperation

Appendix III: ERC Certificate

Mount Kenya University

SCHOOL OF POSTGRADUATE STUDIES

MKU/PG/F011: RESEARCH PROPOSAL CERTIFICATE OF CORRECTIONS

(NB: This Research Proposal Certificate of corrections should be submitted to the Dean, School of Postgraduate Studies for clearance before the Student proceeds to collect data)

PART I: CANDIDATE PARTICULARS

Name of candidate Dr./Mr./MsChepleting J Tuwei

Registration No: MAME/2023/47809

Department of study: Department of Social and Development Studies

Cell phone No: +254 717 586 483

School: School of Social Sciences

Degree Title (MA, MED, PhD): Master of Arts in Monitoring and Evaluation

Area of specialization: Master of Arts in Monitoring and Evaluation

Title of Thesis: Influence of Technological Innovations on Monitoring and Evaluation in Selected Infrastructural Projects: A Study In Nairobi County, Kenya.

Date of Presentation:26th of September 2024.

Signature of candidate: ..... Date: 26th November 2024

PART II: DECLARATION OF SUPERVISOR(S) OVERSEEING CORRECTION / REVISION

I/We, the undersigned supervisor(s) overseeing corrections of the research proposal as advised by the candidate's evaluation panel do hereby declare that all the corrections have been effected satisfactorily as required.

Any other remarks ……The study has done the corrections given……

Names of Supervisors Signature Date

1. **Dr. Ibrahim Nyaboga (PhD):** ...**Date:** 02/12/2024

2. …… …… ……

3. …… …… ……

PART III: CONFIRMATION BY THE CAMPUS/ SCHOOL POSTGRADUATE COORDINATOR

I hereby do confirm that the supervisor(s) appointed to oversee the candidate effect the corrections on the research proposal have done so as per the instructions of the candidate's evaluation panel.

Any other remarks

.....

.....Okay.....

.....

Name of Coordinator: .....Dr. Ann Wathaka.....

Signature ..... Date .....15/01/25.....

Stamp .....

Kenya University
School of Social
Postgraduate
Campus

PART IV: CONFIRMATION BY THE DEAN OF THE RELEVANT SCHOOL

I hereby do confirm that the supervisor(s) appointed to oversee the candidate effect the corrections on the research proposal have done so as per the instructions of the candidate's evaluation panel.

Any other remarks

.....

.....Okay.....

Name of Dean .....Prof. Kennedy Mutundu.....

Signature ..... Date .....15/01/25.....

School Stamp 53

Dean, School of Social

PART V: CLEARANCE BY THE UNIVERSITY ETHICAL REVIEW COMMITTEE

The candidate will be issued with a Certificate of Ethical Clearance by the Directorate of Research and Development.

PART VI: COMMENTS BY THE DEAN SCHOOL OF POSTGRADUATE STUDIES

The candidate is granted/not granted permission to proceed to the field to collect data (delete where applicable)

NB: One (1) copy of the corrected/revised research proposal should accompany this certificate of corrections

Name of Dean .....

(School of Postgraduate Studies)

Signature ..... Date .....

School Stamp .....

Appendix IV: Introduction Letter from MKU

Mount Kenya University

REF: **MKU/ISERC/4813** Date: 26 February 2025
TO: **CHEPLETING J TUWEI**
REG: **MAME/2023/47809**

Dear Sir/Madam,

RE: INFLUENCE OF TECHNOLOGICAL INNOVATIONS ON MONITORING AND EVALUATION IN SELECTED INFRASTRUCTURAL PROJECTS: A STUDY IN NAIROBI COUNTY, KENYA.

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **3535.** The approval period is **26/02/2025 - 25/02/2026.**

This approval is subject to compliance with the following requirements:

i. Only approved documents including informed consents, study instruments, MTA will be used
ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

Dr. Alfred Owino, PhD
Chairman, Mount Kenya University ISERC

MOUNT KENYA UNIVERSITY
ETHICS REVIEW COMMITTEE
P. O. Box 342 - 01000,
THIKA

Main Campus, General Kago Road, P.O. Box 342-01000 Thika.
Tel: +254 20 287 8000, Cell: +254 709 153 000
Email: info@mku.ac.ke, Web: www.mku.ac.ke
Chartered and ISO 9001 : 2015 Certified

Appendix V: NACOSTI Research License

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 425528

Date of Issue: 11/March/2025

RESEARCH LICENSE

This is to Certify that Miss. Judy Tuwei of Mount Kenya University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: INFLUENCE OF TECHNOLOGICAL INNOVATIONS ON MONITORING AND EVALUATION IN SELECTED INFRASTRUCTURAL PROJECTS: A STUDY IN NAIROBI COUNTY, KENYA for the period ending : 11/March/2026.

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Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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See overleaf for conditions

Appendix VI: Research Authorization

Republic of Kenya

MINISTRY OF EDUCATION
STATE DEPARTMENT FOR BASIC EDUCATION

Telegrams: "SCHOOLING", Nairobi
Telegrams: Natural SEP633500
[illegible]

When replying please quote

REGIONAL DIRECTOR OF EDUCATION
NAIROBI REGION
NAGES 25030
P.H RPA79828 - 06300
NAIROBI

Ref: ROE/NBR/RES/1/65 Vol.2 (66)

11TH MARCH 2025

Miss Judy Tuwei
Mount Kenya University

RE: <u>RESEARCH AUTHORIZATION</u>

We are in receipt of a letter from National Commission for Science, Technology & Innovation, regarding research authorization in Nairobi County on the topic, **"Influence of Technological Innovations On Monitoring and Evaluation in Selected Infrastructure Projects. A Study in Natrobi County, Kenya"**

For the period ending 11th **March:2026.**

This office has no-objection and authority is hereby granted on the condition that the exercise will be carried out within the ethical and professional standards as required.

A report on the exercise will be required on completion.

HESBON NVAGAKA
FOR: REGIONAL DIRECTOR OF EDUCATION
<u>NAIROBI</u>

NAIR

Appendix VII: Turnitin Report

Judy_Tuwei_Research_Work_18.3.2025UPDATED.docx

ORIGINALITY REPORT

19%	17%	5%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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Appendix VIII: Research Site Map