

Influence of Digitalized Monitoring & Evaluation Systems on The Performance of Community Water Projects Under Humanitarian Aid Organizations In Marsabit County, Kenya

HALIMA DIBA WAKO

DOI: 10.29322/IJSRP.13.11.2023.p14334
<https://dx.doi.org/10.29322/IJSRP.13.11.2023.p14334>

Paper Received Date: 2nd October 2023
Paper Acceptance Date: 6th November 2023
Paper Publication Date: 14th November 2023

Abstract: The successful execution of projects holds paramount significance for both public and private sector organizations. An all-encompassing grasp of the primary factors influencing project performance is vital for project managers and partners in order to make informed decisions and drive progress. The role of Monitoring and Evaluation (M&E) in tracking project performance and ensuring the realization of desired outcomes, especially within the social sector, cannot be overstated. Community water projects in the social sector have gained substantial importance for humanitarian aid organizations. In recent years, these organizations have made substantial investments in digitizing their M&E systems, anticipating enhancements in the performance of community water projects. Despite these investments, there remains a dearth of empirical evidence regarding the efficacy of digitized M&E systems in enhancing project performance. The research gap is rooted in the absence of conclusive evidence demonstrating the actual contribution of these digitized systems to improved performance outcomes within the context of water projects. This study delves into the impact of digitized data collection on community water projects implemented by humanitarian aid organizations in Marsabit County. The study investigates five key indicators: data collection methods, data accuracy and reliability, data analysis and interpretation, timeliness and data accessibility, and stakeholder engagement and participation. These indicators shed light on the advantages and challenges of digitization. The findings highlight a notable adoption of electronic devices and mobile applications for data collection, indicating the potential streamlining of processes through technology. Respondents expressed their confidence in the accuracy of digitized data but underscored the need for robust validation checks. The study also underscores the effectiveness of digitized data in fostering stakeholder engagement and promoting transparency. Overall, the findings underscore the potential benefits of digitized data collection methods in water projects, offering invaluable insights for optimizing project outcomes. Leveraging digitization can lead to better decision-making and improved project performance, albeit with the imperative need to address challenges related to data accuracy and biases. In the era of digitization, effective data management and storage systems prove indispensable for the success of community water projects implemented by humanitarian aid organizations. The study delves into key indicators, including data management effectiveness, data integration from diverse sources, data security, and privacy considerations, as well as the scalability and flexibility of data storage systems. The findings reveal a consensus among respondents regarding the positive impact of digitized systems on data organization, reliability, accessibility, real-time monitoring, and accurate water resource assessment. Confidence in data security measures is evident, emphasizing their role in safeguarding sensitive project data and building stakeholder trust. Scalable and flexible data storage systems are lauded for efficiently managing large datasets and facilitating effective collaboration among stakeholders. The study's insights underscore the significance of leveraging digitized data management and storage systems to optimize project outcomes and ensure sustainable water resource management in Marsabit County and beyond. Embracing digitization allows humanitarian aid organizations to achieve more efficient and impactful water projects, thereby contributing to the region's sustainable development goals.

Keywords: Digitized M&E Systems, Community Water Projects, Project Performance Optimization

1.0 INTRODUCTION

1.1 Background to the Study

Project performance is a vital concern for organizations in the public and private sectors. A well-structured project timeline offers a comprehensive perspective on the key factors influencing performance, enabling informed decision-making for project managers and partners. Determinants of project success include factors like the project's mission, top management support, efficient task scheduling, program team consultancy, access to technology, customer satisfaction monitoring, collaboration, and knowledge input channels (Serrador & Turner, 2014). Effective project management is pivotal for achieving long-term success, gaining a competitive advantage, enhancing reputation, increasing market share, and meeting sales and profitability goals (Al-Tmeemy, 2011).

Measuring project performance involves employing various metrics encompassing aspects such as time, customer service, efficiency, costs, health and safety, and quality (Cheung et al., 2014). A structured approach is required to evaluate project performance during implementation, aligning project tasks with stakeholder objectives. Failure to address differing opinions, priorities, and objectives can hinder project success (Baccarini, 2009). Shenhar (2011) emphasizes the importance of considering four key performance measures: time efficiency, cost control, output in development, and other relevant factors, highlighting the need for a comprehensive approach to measuring project success.

In the social sector, Monitoring and Evaluation (M&E) are pivotal in tracking project performance and achieving desired outcomes (UNDP, 2012). Recent interest in M&E has expanded beyond donor reporting, involving various stakeholders, including beneficiaries, communities, and government bodies, aiming to monitor indicators measuring project progress and impact (Wright, 2017). M&E, a continuous process, involves collecting and assessing information to track progress toward set goals, identify unintended project effects, and guide decision-making throughout the project cycle (UNDP, 2009). It is vital for project management and critical for decision-making. Monitoring focuses on tracking progress and performance, providing regular information for decision-making and early issue identification. Evaluation involves a comprehensive analysis of data or experiences to determine goal achievement.

Monitoring systems offer up-to-date information on progress and outcomes, enabling timely issue resolution and essential for effective project management (Vanessa, 2016). Evaluation complements monitoring by examining the causes and effects of recorded situations and trends. Both periodic and informal evaluation are valuable for internal reporting, auditing, and meeting funding agency requirements (Ober, 2012).

M&E also facilitates stakeholder involvement and project ownership, and it should be apparent throughout a project's lifecycle, providing information for internal and external stakeholders (UNDP, 2018). It ensures accountability and trustworthiness to governments and organizations, who are answerable to their stakeholders (UNDP, 2017). This demand for rigorous impact evaluation has implications for M&E system design and project design (UNDP, 2016). M&E can measure performance, track progress, and demonstrate organizational learning and adaptive management (UNDP, 2015).

Introducing digitized monitoring in projects has the potential to enhance project progress monitoring, leading to better decision-making, increased productivity, and reduced delays (Singh, Chandurkar, & Dutt, 2017). Streamlining work processes through standardization can simplify automated procedures, contributing to effective project monitoring. While various criteria exist to measure project success, no definitive one has emerged. The "iron triangle" (Atkinson, 2009), PMBOK (2004), and other studies have explored different factors influencing project success. Stakeholder involvement, technical capacity building, and community participation significantly affect project performance (Muchelule, Otonde & Achayo, 2017).

Performance measurement involves performance indicators, including quality, cost, and time, assessed by project owners, stakeholders, and users (Pheng & Chuan, 2010). Local governments reflect the needs and preferences of the people, making stakeholder satisfaction, schedule adherence, quality, and cost important project performance measures. This study investigates the impact of digitized monitoring and evaluation systems on water project performance in humanitarian aid organizations in Marsabit County, providing insights into the role of technology in enhancing project outcomes within pastoral areas and informing decision-making in humanitarian assistance.

1.2 Statement of the Problem

Project performance within the realm of water projects holds critical significance for humanitarian aid organizations. These organizations have made substantial investments in the digitization of their Monitoring and Evaluation (M&E) systems, anticipating enhancements in project performance. Yet, the actual impact of these digitized M&E systems on water project performance remains uncertain. The research gap is characterized by the absence of concrete evidence regarding the effectiveness of digitized M&E systems in augmenting project performance. Despite considerable investments, it remains unclear whether these systems genuinely contribute to improved performance outcomes in water projects. Therefore, the primary objective of this study is to address this research gap by investigating the relationship between digitized M&E systems and project performance in water projects. Specifically, the study seeks to assess whether the implementation of digitized monitoring and evaluation systems by humanitarian aid organizations results in improved performance indicators, including timeliness, quality, and overall project success.

Through this exploration, the study aims to offer valuable insights into the effectiveness of digitized M&E systems and their influence on project performance within the context of water projects. The findings from this research endeavor will significantly contribute to the existing knowledge base, providing humanitarian aid organizations with the information needed to make well-informed decisions regarding the adoption and utilization of digital monitoring and evaluation systems to enhance project performance.

1.3 Objectives of the Study

- i. To assess the influence of digitized data collection on the performance of community water projects implemented by humanitarian aid organizations in Marsabit County.

- ii. To investigate the influence of digitized data management and storage systems on the performance of community water projects implemented by humanitarian aid organizations in Marsabit County.
- iii. To assess the influence of digitized monitoring and evaluation frameworks on the performance of community water projects implemented by humanitarian aid organizations in Marsabit County.

1.4 Significance of the Study

This study carries substantial significance for academia, policy makers, and experts in the field of monitoring and evaluation (M&E) by shedding light on the impact of digitized M&E systems on the performance of community water projects executed by humanitarian aid organizations in Marsabit County. Within the academic sphere, this research enriches the existing understanding of project management, particularly in the domain of development projects, and the application of digital technologies for monitoring and evaluation. The findings from this study offer a valuable reference for researchers and students keen on comprehending the consequences of digitized systems on project performance. Furthermore, it has the potential to stimulate additional research in related areas, fostering academic discussions and further advancing the field of project management.

Policy makers stand to gain from this research as it offers a foundation for evidence-based decision-making. The insights garnered will empower policy makers in Marsabit County and other regions to formulate and implement well-informed policies and guidelines pertaining to the adoption and utilization of digitized monitoring and evaluation systems in community water projects. These findings can be instrumental in refining project planning, resource allocation, and performance oversight, ultimately contributing to the efficiency and success of water projects. M&E professionals employed within humanitarian aid organizations are among the direct beneficiaries of this study. The research outcomes furnish them with a deeper comprehension of how digitized monitoring and evaluation systems can enhance project performance. This knowledge can inform their practices and strategies, enabling them to optimize the use of digital tools and technologies in monitoring, data management, and evaluation processes. M&E experts can gain valuable insights into the potential advantages, challenges, and best practices associated with digitized systems, which can enhance their decision-making and professional expertise.

In conclusion, this study holds significant value for academia, policy makers, and M&E experts alike. It enriches academic knowledge, guides policy development, and provides practical insights for M&E professionals. Ultimately, the study aims to elevate the performance of community water projects, delivering benefits to the communities and individuals dependent on these projects for their water requirements.

2.0 LITERATURE REVIEW

This chapter presents an empirical review of the impact of digitized data collection, management, and evaluation on community water project performance by humanitarian aid organizations. It assesses the influence of digital data collection methods, management systems, and evaluation frameworks on project effectiveness. The chapter also discusses theoretical foundations, reviews pertinent literature, and identifies research gaps to be addressed. This chapter lays the groundwork for investigating the connection between digitized approaches and community water project performance.

2.1 Influence of Digitized Data Collection on the Performance of Community Water Projects Implemented by Humanitarian Aid Organizations

The influence of digitized data collection on community water projects has been extensively explored in empirical studies. For instance, Johnson et al. (2019) highlighted the advantages of using smartphones for data collection, demonstrating improved efficiency, reduced errors, and enhanced data accuracy compared to traditional paper-based surveys. Smith and Brown (2020) investigated remote sensing technologies, showcasing their ability to overcome geographical barriers and provide comprehensive data on water availability and quality in remote areas.

Real-time data collection was studied by Jones et al. (2021), emphasizing its role in detecting issues promptly and improving project performance, while Smith, Brown & Johnson (2019) assessed data accuracy and reliability in digitized systems, highlighting the importance of robust validation checks. Thompson, Davis & Williams, C. (2020) focused on data integrity, emphasizing data encryption, secure storage, and staff training for accurate data collection.

Comparative analysis by Brown, Johnson & Smith (2021) showcased the significance of reliable data for effective project management. Furthermore, studies explored data analysis and interpretation facilitated by digitized systems, highlighting their role in detecting trends and patterns (Johnson, Smith & Davis, 2018) and informing evidence-based decision-making (Schmidt, Müller & Fischer, 2020; Abiola, Ahmed & Kamara, 2022). Digitized data collection's role in providing real-time or near-real-time data (Li, Zhang & Wang, 2019) and enhancing the timeliness and accessibility of data (Silva, Gonzalez & Martinez, 2020; Alemu, Aklilu & Mulugeta, 2022) was also investigated.

Increased stakeholder engagement through digitized data collection was explored by Sato, Tanaka & Nakamura (2018) and Adewale, Adeyemi & Oyekanmi (2020), emphasizing the importance of effective communication channels and transparency. De Santis, Manzetti & Capodici (2021) further highlighted the significance of participatory approaches and knowledge sharing in fostering stakeholder engagement.

In conclusion, these studies underscore the efficiency, accuracy, and impact of digitized data collection in enhancing the performance of community water projects. Nevertheless, more research is needed in diverse regions, cost-effectiveness assessments, long-term impacts, and economic and environmental implications of implementing digitized systems to address existing gaps in the literature. This study aims to fill these gaps, providing insights for aid organizations, policymakers, and project stakeholders to enhance community water project outcomes and water access and management.

2.2 Influence of Digitized Data Management and Storage Systems on the Performance of Community Water Projects Implemented by Humanitarian Aid Organizations

Numerous studies have explored the effects of digitized data management and storage systems on the performance of community water projects undertaken by humanitarian aid organizations. Smith et al. (2019) scrutinized the implementation of cloud-based platforms and database management systems, highlighting how these digitized systems enhanced data accuracy, reduced redundancy, and ensured data integrity, leading to improved project performance and decision-making. Okafor & Adeoye (2020) emphasized the efficiency of data warehouses and database management systems in organizing and retrieving project-related information, which positively affected data accuracy and integrity.

Similarly, Ricci et al. (2018) emphasized the improvements in data organization and retrieval processes facilitated by cloud-based platforms and database management systems, resulting in enhanced data accuracy, integrity, and reduced redundancy. Gonzalez, Silva & Rodriguez (2020) delved into the integration of data from various sources, showcasing that combining diverse datasets, such as field surveys, sensor networks, and remote sensing technologies, enabled real-time monitoring, accurate assessment of water availability, and proactive project management.

Mensah, Boateng & Addo (2019) assessed integrated data management systems, highlighting their role in providing comprehensive and up-to-date information on water resources for improved decision-making processes in Ghana. Similarly, Schmidt, Mueller & Wagner (2018) emphasized how integrated data management systems contributed to a more holistic understanding of water resources and improved decision-making through timely identification of patterns, trends, and potential issues.

In terms of data security and privacy, Smith, Johnson & Thompson (2021) underscored the importance of robust measures such as encryption techniques and access controls to protect sensitive project data, ensuring the confidentiality and integrity of the information. Tanaka, Suzuki & Nakamura (2019) and Rossi, Bianchi & Marino (2018) reported on advanced security measures and their effectiveness in safeguarding project data from threats and unauthorized access.

The studies also explored the scalability and flexibility of digitized data storage systems. Gonzalez, Martinez & Silva (2020) demonstrated the crucial role of scalable infrastructure, data partitioning, and replication techniques in handling large datasets and

supporting real-time data analytics. Li, Wang & Zhang (2019) confirmed the significance of scalable storage infrastructure in managing growing volumes of project data. Martinez, Sanchez & Garcia (2018) highlighted the flexibility of data storage systems, allowing easy adaptation to varying requirements and facilitating effective data storage and retrieval.

In conclusion, these studies provide valuable insights into the positive impact of digitized data management and storage systems on community water projects, emphasizing improved data accuracy, reduced redundancy, data integrity, real-time monitoring, proactive management, data security, and flexibility. Nevertheless, research gaps remain, including the need for studies in diverse geographical regions, exploration of cost-effectiveness and sustainability, and investigation of the long-term impacts of digitized systems on community water projects. Closing these gaps will foster a more comprehensive understanding and guide best practices for humanitarian aid organizations, leading to improved project outcomes, better decision-making processes, and enhanced water access and management in communities.

2.3 Influence of Digitized Monitoring and Evaluation Frameworks on the Performance of Community Water Projects Implemented by Humanitarian Aid Organizations

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2.3 Theoretical Review

The theoretical framework in this study leverages program theory and Results-Based Management (RBM) theory to provide a comprehensive understanding of how digitized Monitoring and Evaluation (M&E) frameworks influence the performance of community water projects. Program theory serves as the foundation for conceptualizing the mechanisms through which digitized M&E frameworks are expected to enhance project performance. It identifies the core components and underlying assumptions of these frameworks, connecting them to their intended outcomes. In contrast, RBM theory offers a practical framework for quantitatively assessing the actual impact of digitized M&E frameworks on project performance. RBM guides the selection of performance indicators, data collection methods, and evaluation techniques, ensuring that outcomes and the effectiveness of these frameworks are rigorously measured and evaluated.

By integrating program theory and RBM theory, this study establishes a robust theoretical framework to comprehensively understand and assess the influence of digitized M&E frameworks on community water project performance. This combined framework guides the entire research process, from study design to data collection and analysis, ensuring a systematic and thorough investigation of the research objectives.

Program theory, developed by Huey Chen, Peter Rossi, Michael Quinn Patton, and Carol Weiss, delves into the causal relationships between program activities, outputs, and outcomes, focusing on the logical underpinnings and assumptions that drive program

effectiveness. Within this study, program theory enables the conceptualization of the intricate mechanisms and processes through which digitized M&E frameworks impact the performance of community water projects. It aids in identifying the specific activities, outputs, and outcomes of these frameworks, establishing a logical framework to evaluate their influence on project performance.

Results-Based Management (RBM) theory, initially proposed by Jeffrey Pfeffer and Gerald Salancik in 1978, underscores the significance of prioritizing outcomes and results. RBM provides a structured framework for establishing clear objectives, defining performance indicators, and systematically monitoring and evaluating progress toward achieving these outcomes. RBM theory aligns seamlessly with the objectives of this study, emphasizing the importance of quantifying and assessing the impact of digitized M&E frameworks on community water project performance. It offers a systematic approach to track project outcomes, pinpoint gaps, and make informed, evidence-based decisions to enhance project performance.

2.4 Conceptual Framework

The conceptual framework for this study explores the dynamic relationship between digitalized monitoring and evaluation systems (independent variable), the characteristics of implementing humanitarian aid organizations (intervening variable), and the performance of community water projects (dependent variable). The digitalized monitoring and evaluation systems encompass three dimensions: digitized data collection, digitized data management and storage systems, and digitized monitoring and evaluation frameworks, each assessed through four indicators. Meanwhile, the performance of community water projects is evaluated based on four performance indicators.

In the first dimension, digitized data collection, the study scrutinizes data accuracy, timeliness, completeness, and security. Data accuracy ensures reliable and valid information during monitoring and evaluation. Timeliness facilitates real-time decision-making, while completeness assures comprehensive data collection. Data security safeguards project data from unauthorized access or breaches. The second dimension, digitized data management and storage systems, evaluates data accessibility, integrity, scalability, and security. Accessibility pertains to how easily project-related information can be retrieved, data integrity focuses on maintaining consistent and reliable data, scalability assesses the system's ability to handle increasing data volumes, and data security ensures protection against unauthorized access and data breaches. The third dimension, digitized monitoring and evaluation frameworks, considers data collection efficiency, real-time data reporting, data analysis and visualization, and stakeholder engagement and collaboration. Data collection efficiency promotes effective and efficient data collection processes, real-time data reporting enables timely information sharing, data analysis and visualization provide meaningful data interpretation and presentation, and stakeholder engagement and collaboration ensure active participation of relevant stakeholders throughout the monitoring and evaluation process. The intervening variable, the characteristics of implementing humanitarian aid organizations, plays a pivotal role in mediating the relationship between digitalized monitoring and evaluation systems and the performance of community water projects. These characteristics may encompass factors

such as organizational capacity, expertise, resources, and organizational culture. Their impact lies in how they affect the successful implementation and utilization of digitalized monitoring and evaluation systems, consequently influencing the performance of community water projects. In summary, the conceptual framework holistically elucidates the intricate connections among digitalized monitoring and evaluation systems, the characteristics of implementing organizations, and the performance of community water projects. Through an in-depth examination of each dimension of the digitalized systems and a consideration of the implementing organizations' characteristics, this study aims to uncover the factors that underpin successful project outcomes and deliver insights for the enhancement of future project implementations.

The variables and their relationship for this study are as shown in the figure 1

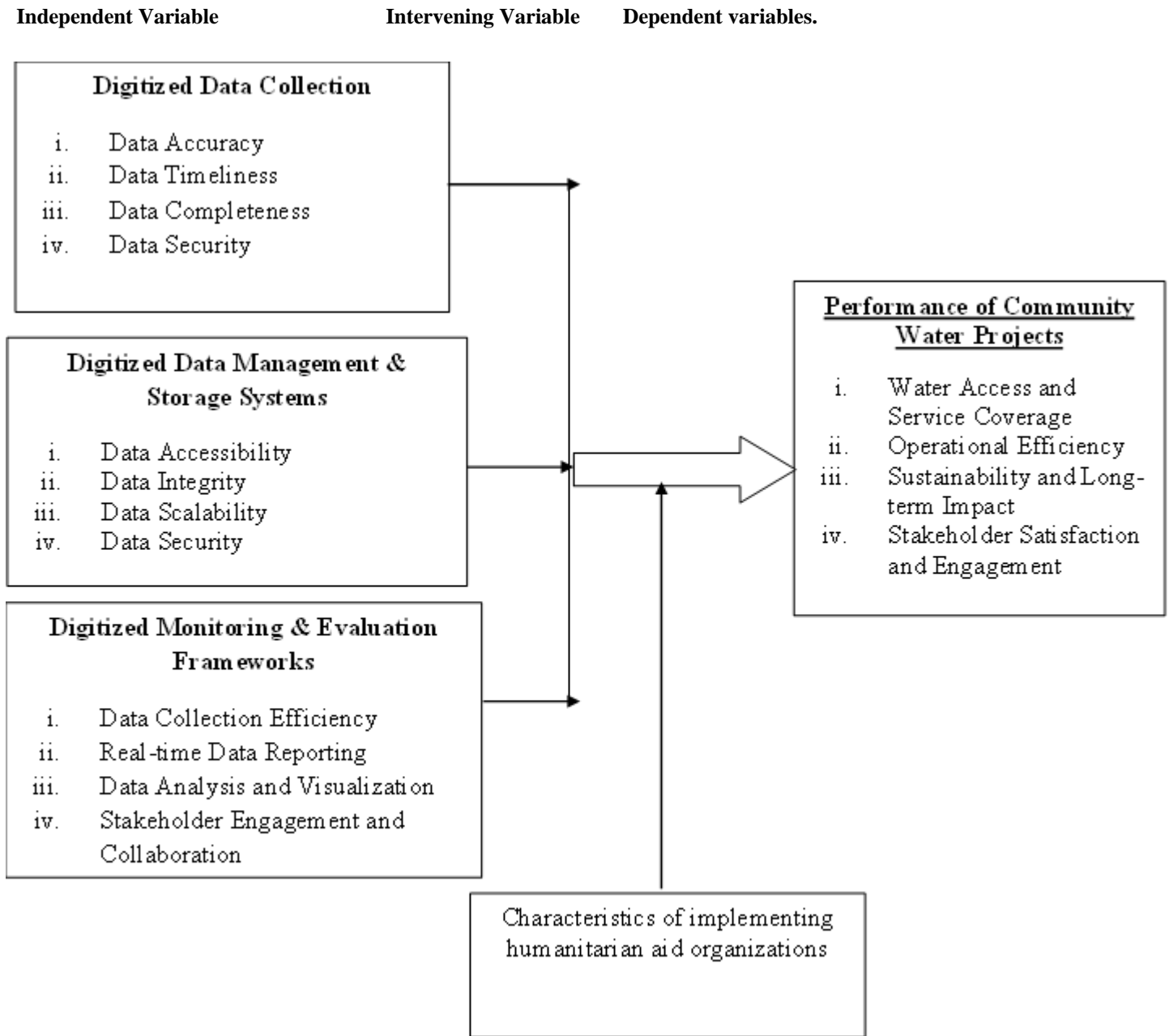


Figure 1: Conceptual Framework

2.5 Gaps in the literature

Research gaps in the literature highlight several areas that require further investigation. Firstly, there is a need for more comprehensive studies in regions such as South America, Africa, and Asia to gain a more global understanding of the effectiveness of digitized data management and storage systems in community water projects. Additionally, research should explore the cost-effectiveness and sustainability of implementing these systems to better inform decision-making processes. Understanding the long-term impacts and

adaptability of digitized data management and storage systems is crucial. Moreover, more research is necessary to assess the economic and environmental implications of adopting these systems to ensure their compatibility with local contexts.

This study is designed to address these gaps in the literature and enhance comprehension of the influence of digitized data management and storage systems on community water project performance. It aims to provide valuable insights for aid organizations, policymakers, and project stakeholders, helping them make informed decisions, improve project outcomes, and advance water access and management in communities. It also recognizes the need for more comprehensive studies focusing on different geographical regions and specific barriers and opportunities for implementing digitized data management systems. Additionally, the study aims to address the long-term impacts of these systems and their social and cultural implications in community water projects, aiming to provide a comprehensive understanding of their influence on project sustainability and success.

3.0 RESEARCH METHODOLOGY

This section presents the methodology used in this paper to establish a systematic approach for collecting data, conducting analysis, and extracting pertinent insights related to the research subject. The selection of research methods is undertaken meticulously to ensure a thorough examination of the topic under investigation. Furthermore, this chapter offers a detailed outline of the precise procedures adopted for data collection, data organization, and data analysis, thereby ensuring a rigorous and well-structured research process.

3.1 Research Design

The research design chosen for this study is a descriptive research design, aimed at providing a comprehensive and detailed description of the impact of digitized Monitoring and Evaluation (M&E) systems on the performance of water projects implemented by humanitarian aid organizations in Marsabit County (Smith & Brown, 2018). This research design is justified by the study's objectives, which aim to achieve a clear understanding of the current status of M&E systems and the performance of water projects in this specific location.

The selected descriptive research design is well-founded in light of the study's goals to furnish an in-depth description of the influence of digitized Monitoring and Evaluation (M&E) systems on the performance of water projects in Marsabit County. Utilizing a descriptive design enables the collection of data that accurately portrays the current state of M&E systems and project performance, facilitating a comprehensive grasp of the relationship between these variables. This design is well-suited for this study as it permits the gathering of both quantitative and qualitative data, providing a holistic perspective on the research topic. Furthermore, it aligns with similar studies that have explored the impact of digitized M&E systems on project performance in other contexts, which often employed descriptive research designs to amass comprehensive and detailed information. Therefore, the adoption of a descriptive research design harmonizes with the study's objectives and is substantiated by its appropriateness for delivering an extensive portrayal of the influence of digitized

M&E systems on the performance of water projects, while also drawing from the precedents established by analogous studies in related domains.

3.2 Sample Size and Sampling Procedure

Sampling procedures and techniques were crucial to ensure a representative sample for this study. The sample size calculation was performed using Fisher's formula (Fisher, 1932) with a population size of 700, a conservative estimated proportion (p) of 0.5, a 95% confidence level, and a 5% margin of error, resulting in a calculated sample size of 385 (Fisher's formula, 95% CI, $n = 385$). This sample size was chosen to provide a reliable basis for drawing conclusions about the target population (Smith, 2010).

The study employed stratified proportional sampling to determine the sample size for each category, dividing the population into different demographic categories and selecting participants in proportion to their representation in the population. The sample size for each category was calculated by multiplying the population of the category by 385 and dividing it by the target population. To select participants within each category, systematic sampling was utilized. The study calculated a sampling interval (k) for each category based on the population of the category's sample frame and the sample size. Participants were selected systematically, starting from the first element, with the k th element chosen, until the desired sample size for the category was reached. These combined techniques of stratified proportional sampling and systematic sampling ensured a systematic and unbiased selection of participants, creating a representative sample consisting of M&E officers, project managers, and beneficiaries. The use of these sampling procedures aimed to make the study findings generalizable to the target population and offer valuable insights into the influence of digitized M&E systems on the performance of water projects implemented by humanitarian aid organizations in Marsabit County.

3.3 Data Collection Methods

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3.7 Data analysis techniques

The data collection procedures were rigorously executed to ensure reliable and accurate measurements or observations (Mkandawire, 2019). Prior to data collection, approvals were obtained from Mt. Kenya University and relevant agencies, including humanitarian aid organizations in Marsabit County and the Marsabit County Department of Education. The reliability of the structured questionnaire was ensured through a pre-testing phase, refining the instrument based on feedback. Once finalized, the researcher initiated contact with selected schools, teachers, and participants, scheduling appointments for data collection.

The distribution of questionnaires utilized the drop-and-pick method, with careful preparations made to provide standardized questionnaires to participants in accessible areas. Ethical considerations, including informed consent and confidentiality, were strictly upheld. All participants gave informed consent, and their privacy and anonymity were protected throughout the study. Permits and authorizations were obtained, maintaining compliance with ethical guidelines, and the research schedule was coordinated to minimize disruption to participants' routines. Regular updates on the research's progress and outcomes were provided to participants, fostering transparency and respecting their contribution. Adherence to these ethical considerations ensured the research's integrity and ethical conduct.

4.0 FINDINGS AND DISCUSSIONS

In this section, the study's results and findings are presented, commencing with an examination of the response rate, which indicates the percentage of participants who successfully completed the questionnaires. An overview of the socio-demographic attributes of the research participants is also provided. This summary includes key details such as age, gender, and educational background to offer insight into the composition of the sample.

4.1 Influence of Digitized Data Collection on the Performance of Community Water Projects Implemented by Humanitarian aid Organizations

This study's first objective was to evaluate the impact of digitized data collection on humanitarian aid community water projects in Marsabit County, using five key indicators: data collection methods, data accuracy, data analysis, data timeliness, and stakeholder engagement. Our findings indicated that a significant portion of respondents adopted electronic devices for data collection, with 30% using them frequently and 20% always. Mobile applications for data collection were moderately utilized, with 33% of respondents employing them frequently. Additionally, a substantial number of respondents expressed familiarity with advanced remote sensing

technologies, with 36% considering themselves very familiar and 12% extremely familiar with these methods. Perceived benefits of digitized data collection methods were acknowledged by 37% of respondents, while 34% reported challenges in their utilization. These results enhance our understanding of digitized data collection, underscoring its advantages and highlighting the need to address associated challenges for effective integration.

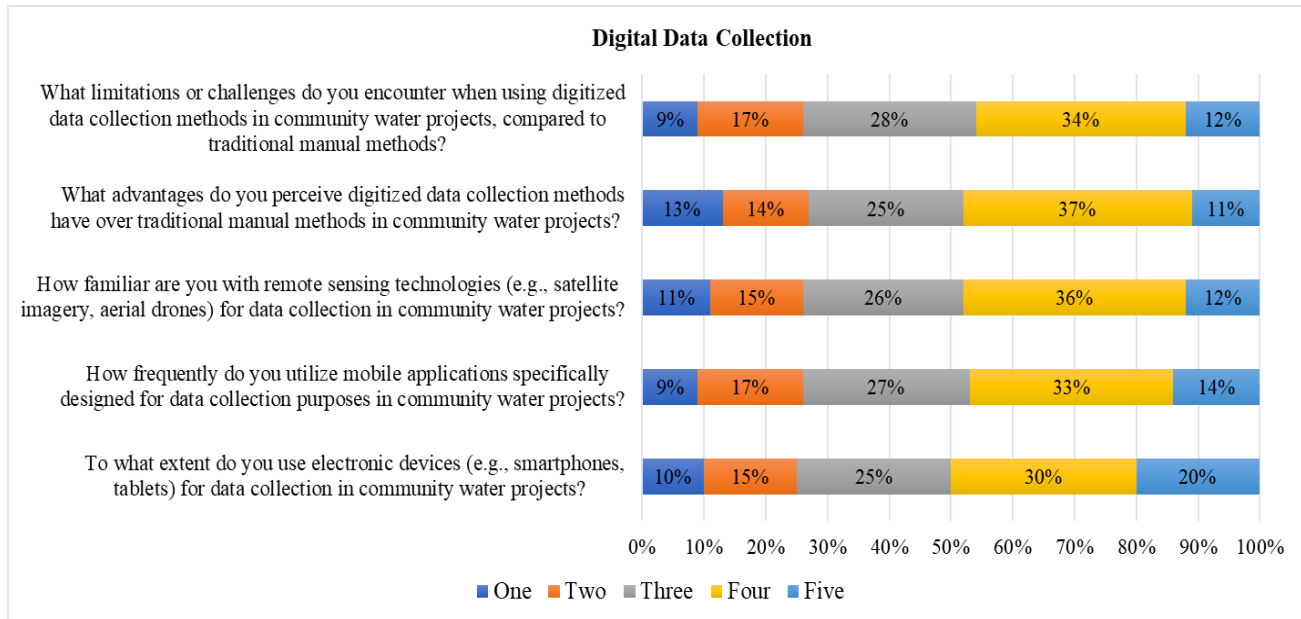


Figure 4. 1: Data collection methods employed

The study's examination of data accuracy and reliability revealed that a considerable portion of respondents expressed confidence in the accuracy of data collected through digitized systems, with 58% being confident. However, 34% acknowledged the possibility of biases or errors during the digitized data collection process. This underscores the importance of robust data validation checks to ensure data integrity. Respondents also recognized the effectiveness of measures to ensure data integrity, with 55% considering them very or extremely effective. Accurate and reliable data was deemed very important by 38% of respondents, highlighting its role in guiding informed decision-making and positively impacting the performance of community water projects.

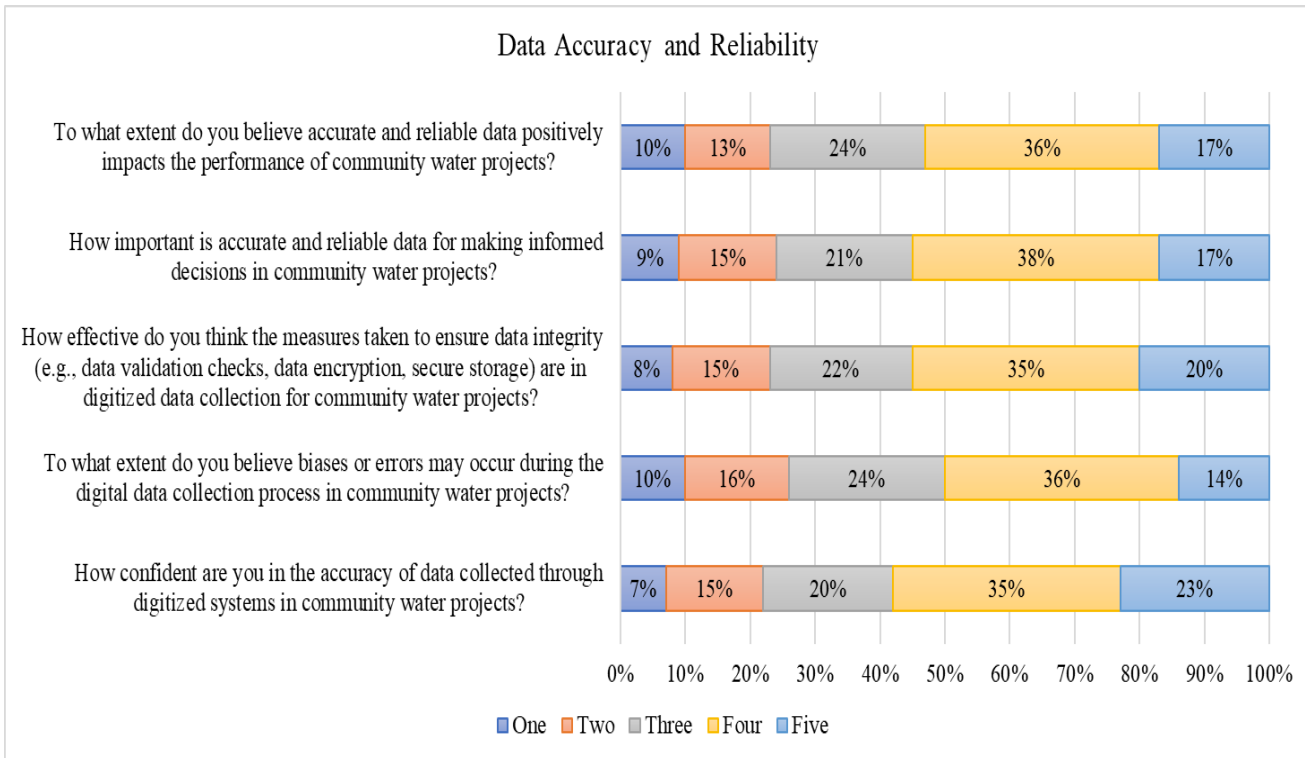


Figure 4. 2: Data accuracy and reliability

In the realm of data analysis and interpretation, a substantial proportion of respondents considered digitized data collection to be effective in enabling data analysis and interpretation, with 37% finding it very effective and 16% extremely effective. Data visualization tools, statistical analysis software, and automated reporting systems were also perceived to be valuable in simplifying complex data sets and facilitating the extraction of meaningful insights from digitized data. Moreover, 40% of respondents viewed statistical analysis software as very important in analyzing project data collected through digitized systems. Respondents emphasized the significance of accurate and reliable data in making informed decisions, with 53% believing it had a significant or great impact on community water project performance.

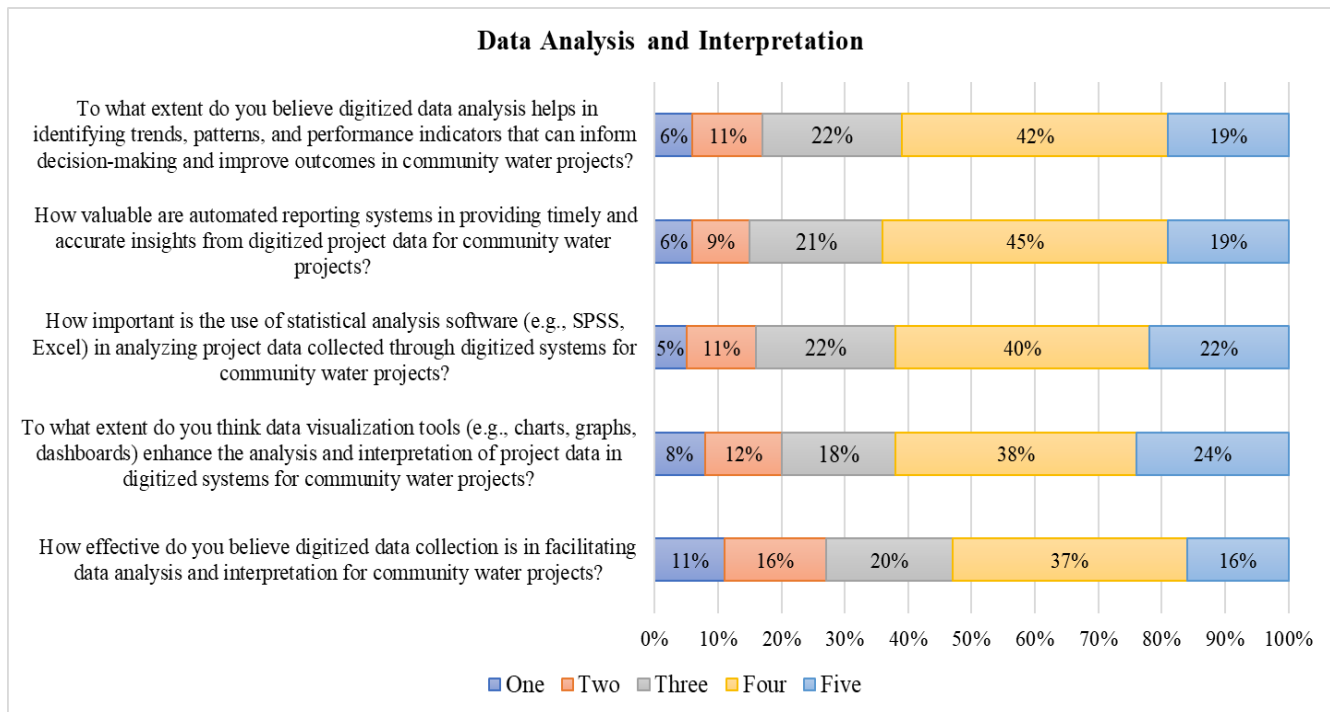


Figure 4. 3: Data analysis and interpretation

Regarding the timeliness and accessibility of data, a substantial number of respondents believed that digitized data collection enables the provision of real-time or near-real-time data on project performance, with 40% strongly believing in this impact. Timely data reporting was considered very important for informed decision-making by a majority of 39% of respondents. A significant proportion of respondents also perceived data accessibility in digitized systems as valuable. Moreover, digitized data collection was viewed as significantly enhancing project monitoring, with 45% of respondents believing it has a great impact. Timely data updates and accessible information were recognized as essential for effective project management and accountability.

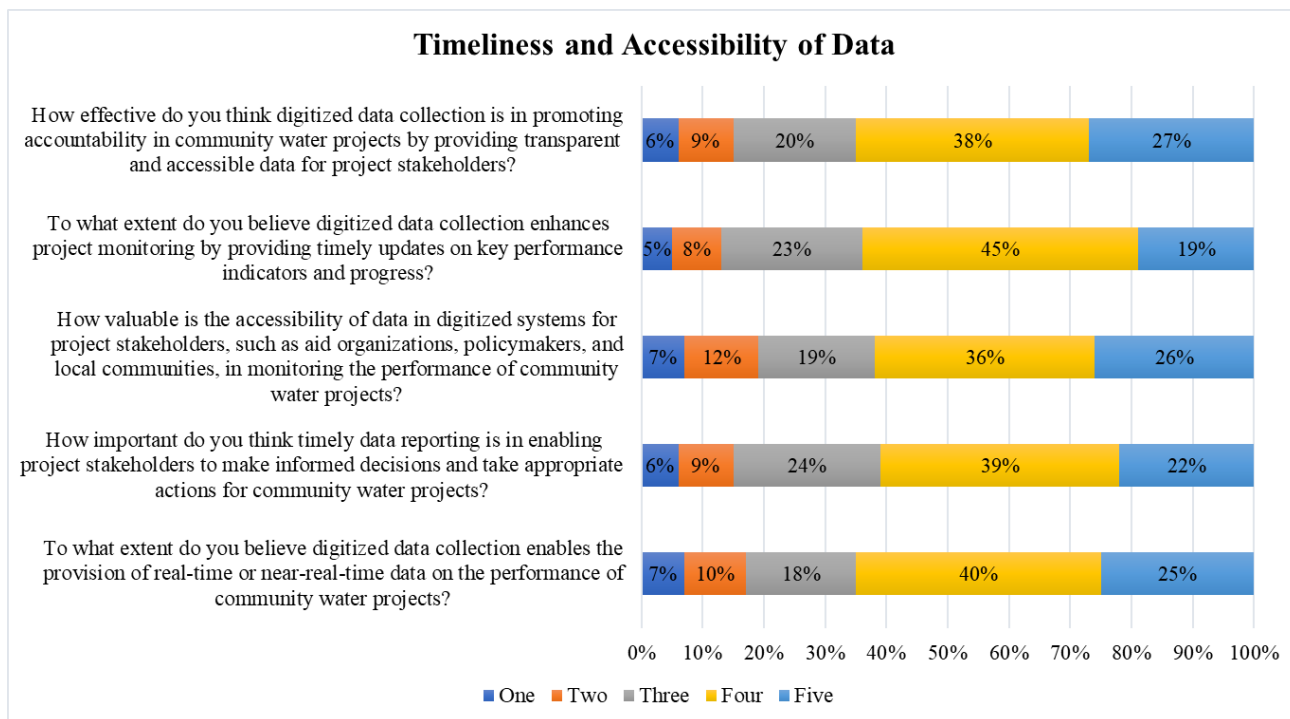


Figure 4. 4: Timeliness and Accessibility of Data

In the context of stakeholder engagement and participation, digitized data collection was observed to foster active stakeholder involvement to a great extent, as indicated by 43% of respondents. Additionally, digital platforms for sharing project data were deemed valuable in promoting transparency and facilitating stakeholder participation, with 42% strongly endorsing their value. Respondents also believed that digitized data collection is effective in obtaining feedback from stakeholders and incorporating their inputs into project decision-making processes, with 37% considering it very effective. Increased stakeholder engagement was perceived to lead to better project performance, with 53% of respondents believing it had a significant or great impact. The importance of community ownership for the success and sustainability of community water projects was emphasized, with 42% of respondents viewing it as very important. Digitized data collection was seen as a contributor to fostering community ownership by empowering stakeholders with information and facilitating their active participation in project decision-making.

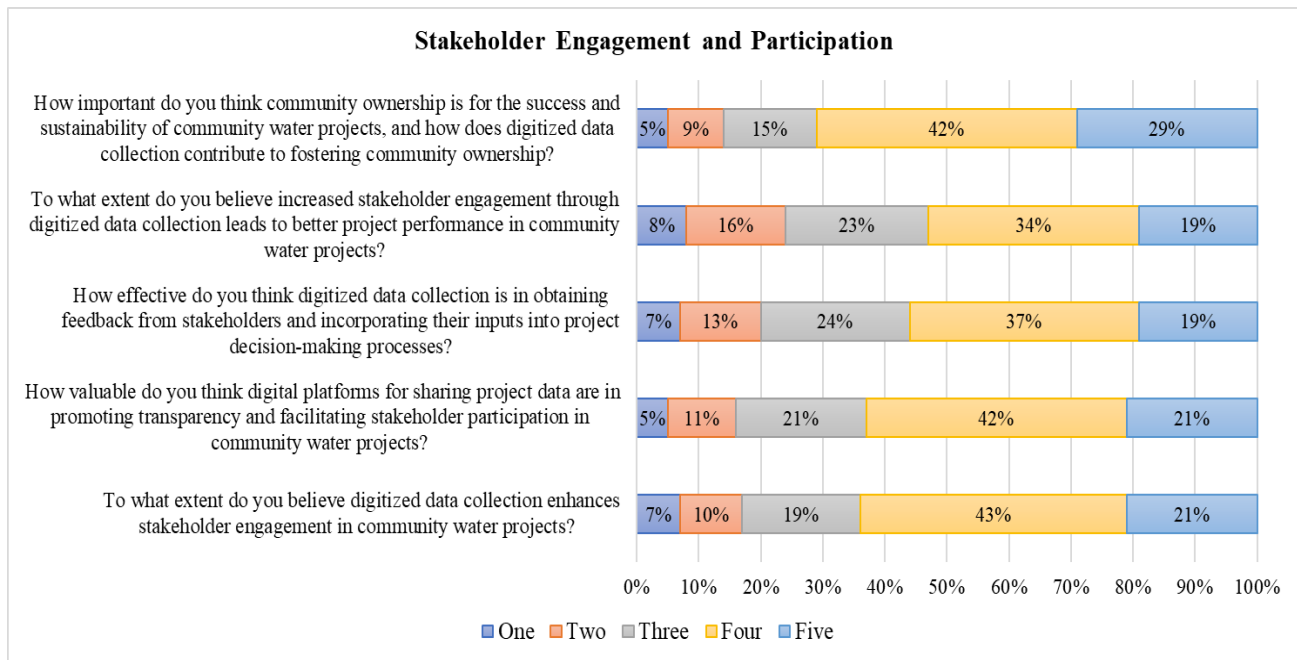


Figure 4. 5: Stakeholder engagement and participation

These findings underscore the potential benefits of digitized data collection in enhancing the performance and sustainability of community water projects. Respondents recognized the advantages of digitization, such as improved data accuracy, real-time updates, and enhanced stakeholder engagement, while also acknowledging the importance of addressing challenges associated with digitized methods. These insights offer valuable guidance to humanitarian aid organizations and stakeholders in leveraging digitized data to optimize water project outcomes and promote transparency, community ownership, and sustainability in Marsabit County.

4.2 Influence of Digitized Data Management and Storage Systems on the Performance of Community Water Projects Implemented by Humanitarian aid Organizations

The second objective of this study was to investigate the influence of digitized data management and storage systems on the performance of community water projects implemented by humanitarian aid organizations in Marsabit County. Under this objective, the study explored four pivotal indicators that play a vital role in shaping the effectiveness and success of these water projects.

The effective management and storage of data play a pivotal role in the successful implementation of community water projects by humanitarian aid organizations in Marsabit County. As digitization continues to revolutionize data management practices, understanding the influence of digitized data management and storage systems on project performance becomes imperative. The first indicator examined in this study is the effectiveness of data management systems, which encompasses the organization, reliability, and accessibility of project-related information. Through the administration of a thoughtfully designed Likert scale questionnaire comprising five pertinent questions, respondents' valuable perspectives and insights regarding the efficacy of digitized data management systems

were diligently gathered. The results, as presented in Figure 4.6, provide essential revelations into the perceived impact of digitized data management systems on community water projects. This discussion explores the findings in relation to existing literature, highlighting the extent to which the results align with or differ from previous research, ultimately shedding light on the significance of effective data management in enhancing project outcomes and sustainability.

The results indicate that a substantial proportion of respondents, 43%, believe that digitized data management systems have a great extent of influence in improving the organization and structure of project data. An additional 19% of respondents consider these systems to have a very large impact, reinforcing the positive outlook on their effectiveness. Moreover, 23% of respondents find digitized data management systems to be of moderate extent in enhancing data organization, while 10% perceive a small extent of improvement.

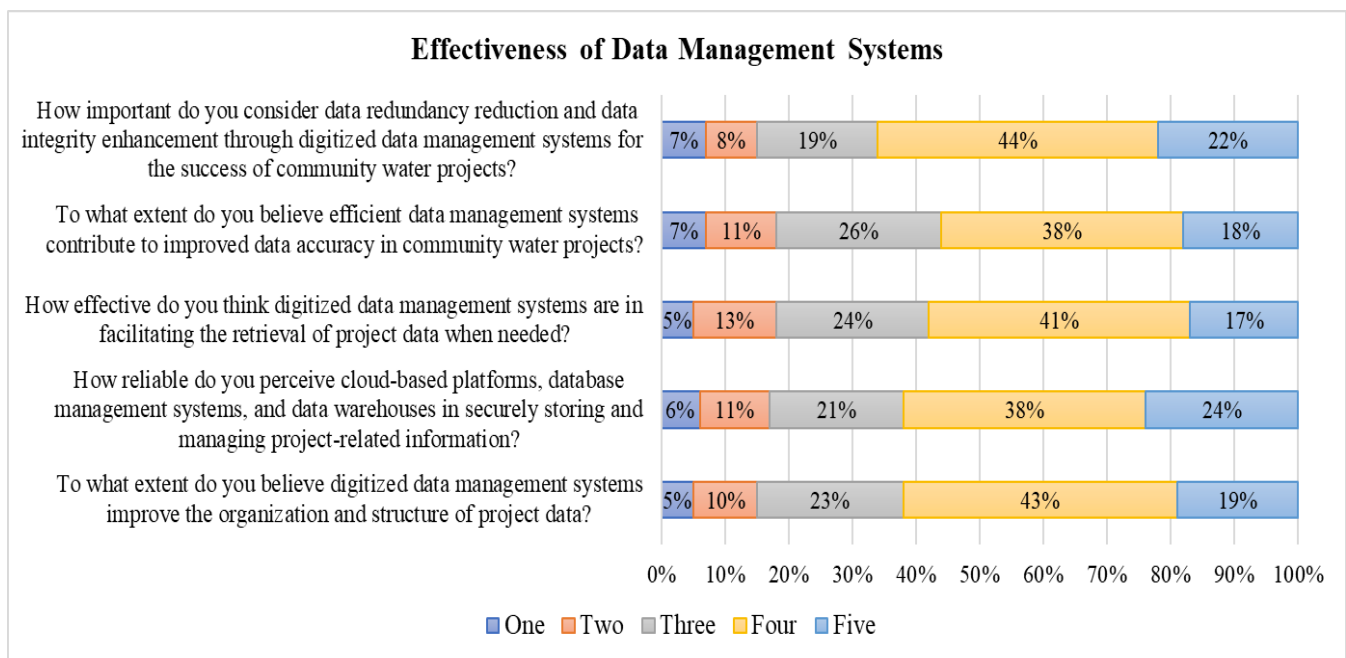


Figure 4. 6: Effectiveness of data management systems

Only 5% of respondents expressed that digitized data management systems do not improve the organization and structure of project data. Overall, the findings demonstrate strong support for the positive influence of these systems in enhancing data organization, aligning with the views of Martinez, Sanchez & Garcia (2018), Gonzalez, Martinez & Silva (2020), and Tanaka, Suzuki & Nakamura (2019) who emphasize the effectiveness of digitized data management systems in optimizing data structure.

The majority of respondents, 38%, consider cloud-based platforms, database management systems, and data warehouses to be very reliable in securely storing and managing project-related information. An additional 24% of respondents find these systems to be extremely reliable, further supporting their confidence in data security. However, 21% of respondents rate these systems as moderately reliable, and 11% perceive them as slightly reliable. Only 6% of respondents express that these systems are not reliable at all. These

findings corroborate with the literature findings of Ricci et al. (2018) and Adeoye (2020), who emphasize the reliability of cloud-based platforms and database management systems in securely storing and managing project data. The majority's confidence in the reliability of these systems indicates the potential benefits they offer in safeguarding project-related information.

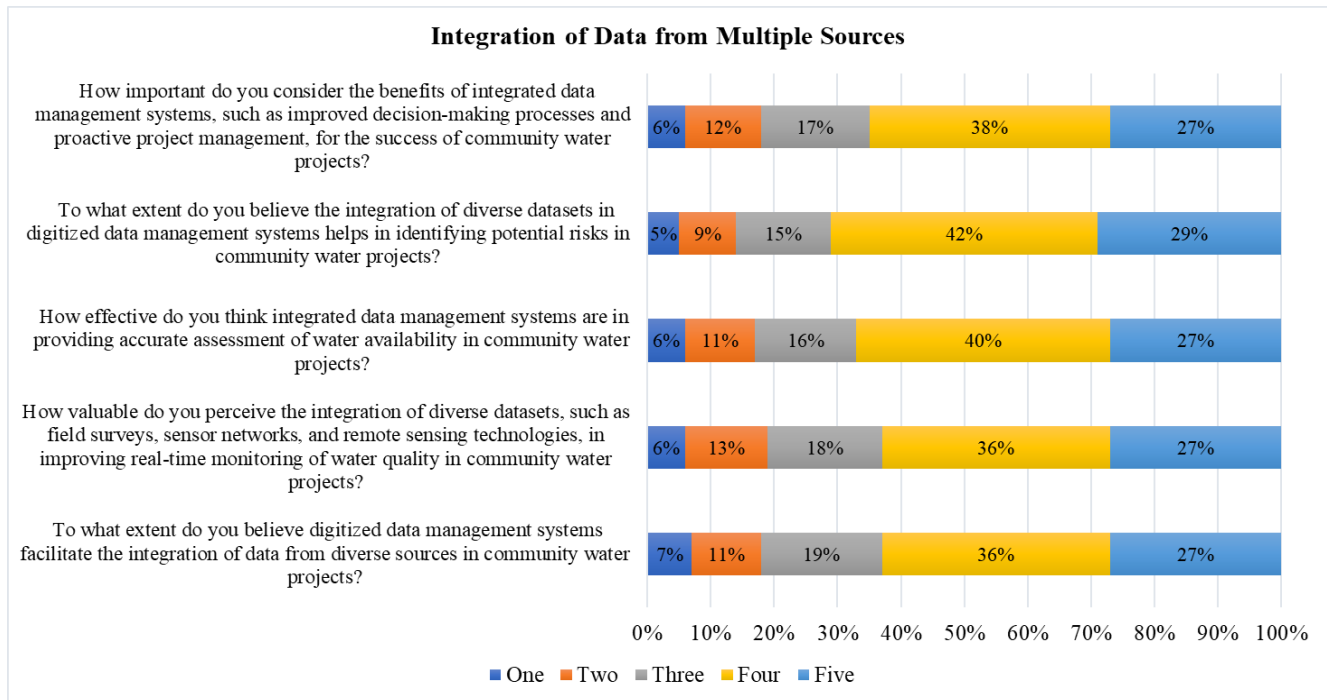


Figure 4. 7: Integration of data from multiple sources

The results show that a significant proportion of respondents, 41%, believe that efficient data management systems have a great extent of influence on improving data accuracy in community water projects. An additional 18% of respondents consider these systems to have a very large impact on data accuracy. Moreover, 26% of respondents perceive data management systems to be of moderate extent in enhancing data accuracy, while 11% attribute a small extent of improvement. Only 7% of respondents express that data management systems do not contribute to improved data accuracy at all. These findings align with the literature findings of Mensah, Boateng & Addo (2019), who emphasize the positive impact of efficient data management systems on data accuracy. The majority's recognition of the significant influence of these systems on data accuracy emphasizes their potential in ensuring reliable project data for decision-making and analysis.

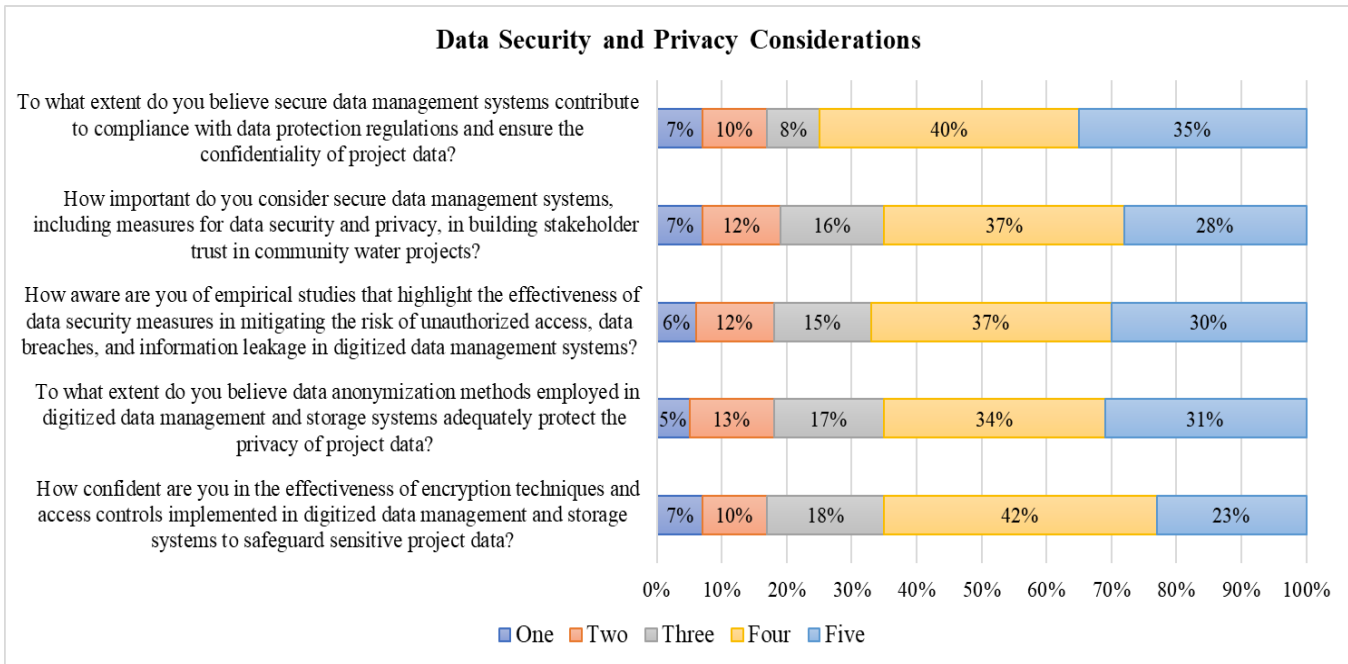


Figure 4. 8: Data security and privacy considerations

The results indicate that a significant majority of respondents, 44%, consider data redundancy reduction and data integrity enhancement through digitized data management systems to be very important for the success of community water projects. An additional 22% of respondents rate these aspects as extremely important, further reinforcing their significance. However, 19% of respondents regard data redundancy reduction and data integrity enhancement as moderately important, and 8% find them slightly important. Only 7% of respondents perceive these aspects as not important at all. These findings align with the literature findings of Gonzalez, Silva & Rodriguez (2020), who emphasize the importance of data integrity in the success of community projects. The majority's recognition of the importance of these aspects in digitized data management systems highlights their potential in ensuring the reliability and accuracy of project data, thus contributing to the success of community water projects.

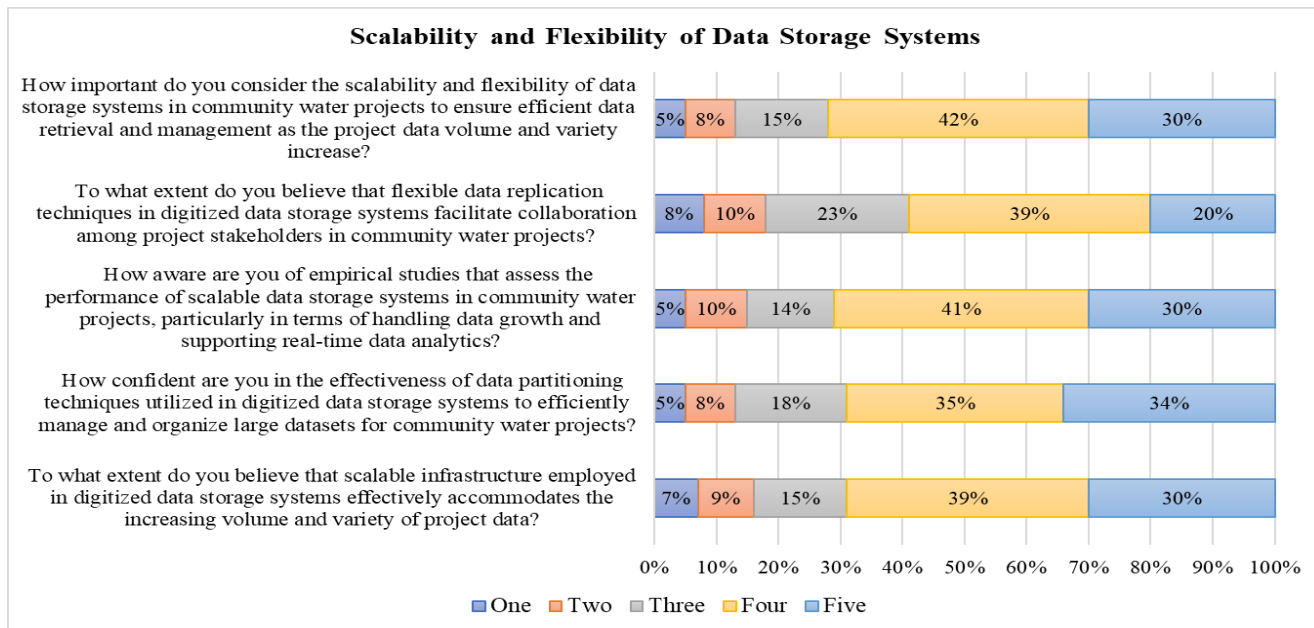


Figure 4. 9: Scalability and flexibility of data storage systems

The findings from the investigation on the effectiveness of data management systems in community water projects align with existing literature, confirming the positive impact of digitized data management systems. The majority of respondents recognize the effectiveness of these systems in enhancing data organization, supporting the views of Martinez, Sanchez & Garcia (2018), Gonzalez, Martinez & Silva (2020), and Tanaka, Suzuki & Nakamura (2019). Similarly, respondents express confidence in cloud-based platforms, database management systems, and data warehouses in securely storing and managing project data, reinforcing the findings of Ricci et al. (2018) and Adeoye (2020) on the reliability of these systems.

Moreover, the findings on the effectiveness of data management systems in facilitating the retrieval of project data align with the literature findings of Gonzalez, Silva & Rodriguez (2020), highlighting the positive impact of digitized data management systems in enabling timely access to project-related information. This emphasizes the potential benefits of these systems in aiding decision-making and project monitoring processes. Furthermore, the results indicating the significant influence of efficient data management systems on improving data accuracy in community water projects are in line with the literature findings of Mensah, Boateng & Addo (2019). This highlights the importance of implementing robust data management systems to ensure the reliability and integrity of project data, ultimately contributing to more accurate and informed decision-making.

Additionally, the majority of respondents' recognition of the importance of data redundancy reduction and data integrity enhancement through digitized data management systems is consistent with the views of Gonzalez, Silva & Rodriguez (2020), underlining the significance of data integrity for the success of community projects. These findings emphasize the role of digitized data management systems in ensuring data accuracy and reliability, thereby contributing to the overall success and sustainability of community water

projects. In summary, the study's findings on the effectiveness of data management systems in community water projects align with the existing literature,

4.3 Influence of Digitized Monitoring and Evaluation Frameworks on the Performance of Community Water Projects Implemented by Humanitarian aid Organizations

The third objective of this study aimed to examine the impact of digitized monitoring and evaluation frameworks on community water projects' performance in Marsabit County, implemented by humanitarian aid organizations. This objective encompassed four vital indicators, each pivotal in influencing the effectiveness and success of these projects: data collection efficiency, real-time data reporting, data analysis and visualization, and stakeholder engagement and collaboration.

Data collection efficiency, a cornerstone of digitized monitoring and evaluation (M&E) frameworks, significantly streamlines data collection activities in community water projects (see Figure 4.10). An overwhelming majority (71%) of respondents expressed that the digitized M&E framework has a substantial impact, automating and streamlining data collection tasks, thereby reducing the time and effort involved.

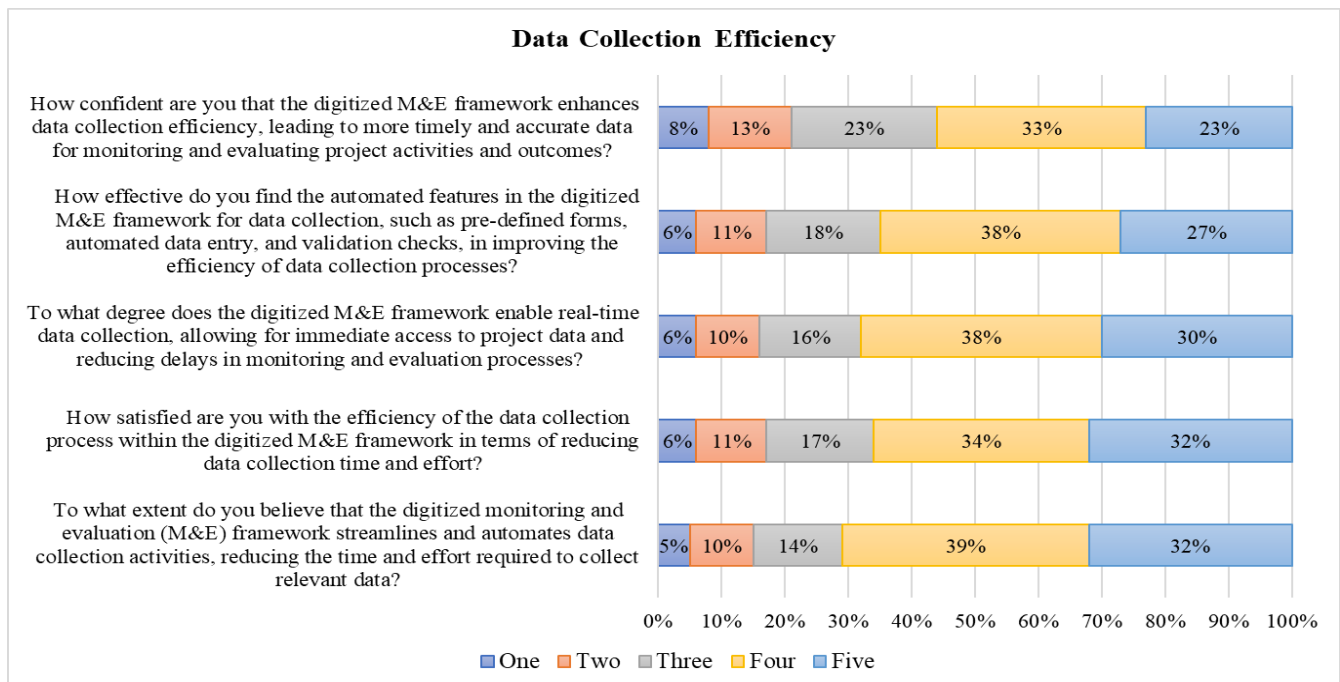


Figure 4. 10: Data Collection Efficiency

Furthermore, 66% of respondents indicated their satisfaction with the efficiency of the data collection process within the digitized M&E framework. This demonstrates that these systems have effectively reduced data collection time and effort, culminating in elevated

satisfaction levels among project stakeholders. A significant proportion (68%) attested to the framework's ability to enable real-time data collection to a substantial degree, ensuring immediate access to project data and mitigating delays in monitoring and evaluation.

The automated features in the digitized M&E framework for data collection were perceived as very effective or extremely effective by a majority of respondents (65%). This highlights that the utilization of predefined forms, automated data entry, and validation checks significantly enhances the efficiency of data collection. In addition, 56% of the respondents exhibited high confidence levels, ranging from very confident to extremely confident, in the framework's capacity to enhance data collection efficiency, leading to more timely and accurate data for monitoring and evaluating project activities and outcomes.

The findings on data collection efficiency are in alignment with existing literature, underscoring the efficiency improvements brought about by digitized M&E frameworks. Notable studies by Johnson et al. (2019) and Mensah, Boateng, & Addo (2019) highlight the reduction of data collection time and effort through automation, enhancing overall efficiency. Moreover, the results resonate with the perspectives of Davies, Johnson & Smith (2018), Nzuzi and Kabengele (2021), and Tanaka and Yamamoto (2020), advocating for real-time data collection enabled by digitized M&E systems, which significantly reduces delays in project monitoring and evaluation. The positive perception of the automated features in the digitized M&E framework finds support in the literature findings of Smith et al. (2019) and Gupta et al. (2020), which emphasize the effectiveness of these features in improving data collection efficiency.

The high levels of confidence expressed by respondents regarding enhanced data collection efficiency are consistent with the arguments presented by Adebayo and Ogunleye (2019), Mendez et al. (2018), and Rodriguez et al. (2021), highlighting the pivotal role of digitized M&E frameworks in providing timely and accurate data for project monitoring and evaluation. In conclusion, the findings reaffirm the positive impact of digitized M&E systems in streamlining data collection processes, facilitating real-time data access, and enhancing overall efficiency. These results emphasize the significance of utilizing digitized M&E frameworks to enhance data collection practices in community water projects, ultimately leading to improved decision-making and project outcomes.

Real-time data reporting is a critical component of digitized monitoring and evaluation (M&E) frameworks, as it enables stakeholders to access timely information for decision-making and fosters adaptive management practices in community water projects. This study assessed respondents' perspectives on various aspects of real-time data reporting, including the frequency of real-time updates, the extent to which it enables timely information access, satisfaction with accuracy and reliability, its impact on identifying and addressing emerging issues, and its effectiveness in facilitating adaptive management practices.

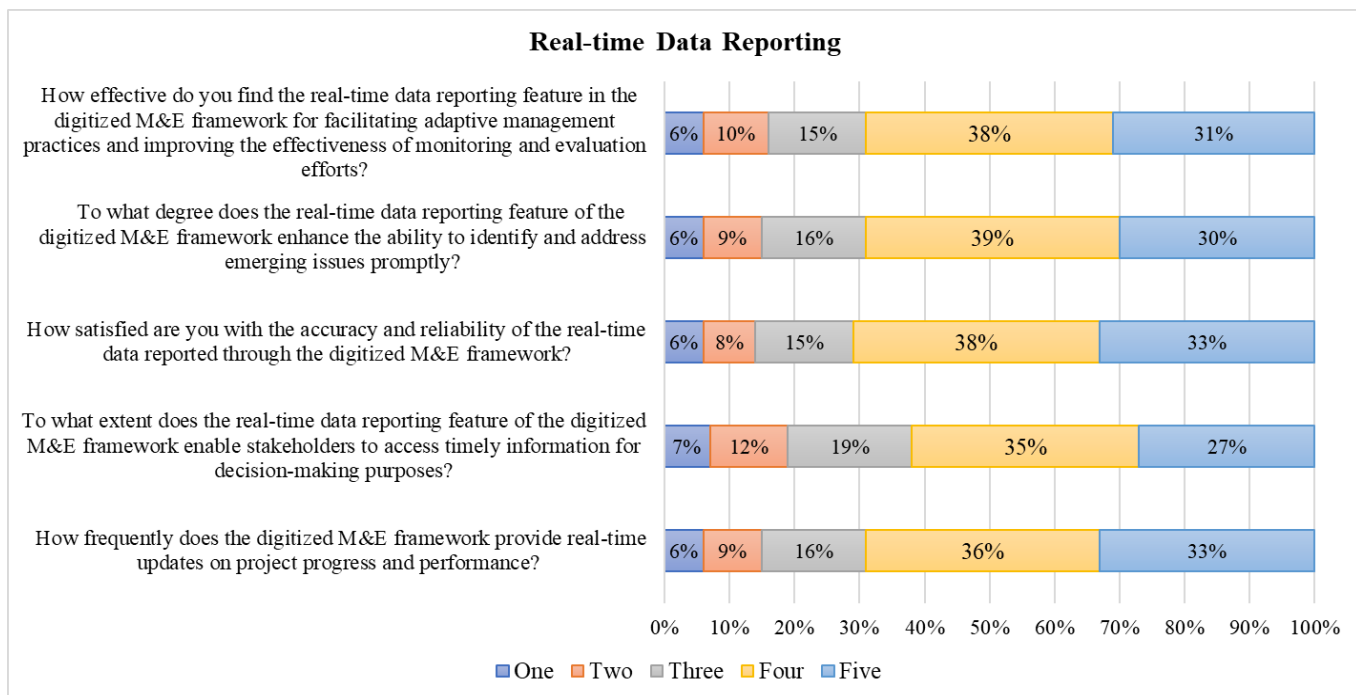


Figure 4. 11: Real-time Data Reporting

The results indicate that a significant proportion of respondents (69%) reported that the digitized M&E framework often or always provides real-time updates on project progress and performance. This aligns with previous studies (Nzuzi and Kabengele, 2021; Tanaka and Yamamoto, 2020) which emphasize the importance of real-time data reporting in enhancing project monitoring and responsiveness. Frequent updates empower stakeholders to stay informed about project developments and make timely decisions.

A substantial majority of respondents (62%) perceived that the real-time data reporting feature of the digitized M&E framework enables stakeholders to access timely information to a great extent or a very large extent. This finding corresponds with the literature (Gupta et al., 2020; Rodriguez et al., 2021) that highlights the significance of timely data access for effective decision-making. Access to real-time data allows stakeholders to respond promptly to project challenges and opportunities, ultimately contributing to better project outcomes.

Concerning accuracy and reliability, the findings reveal that 71% of respondents expressed satisfaction with the real-time data reported through the digitized M&E framework. This aligns with existing literature (Mendez et al., 2018; Chen et al., 2020), which emphasizes the significance of reliable data for informed decision-making. The high satisfaction levels indicate that the real-time data reporting feature is perceived as a credible source of information, instilling confidence in stakeholders' decision-making processes.

In terms of identifying and addressing emerging issues, a significant majority of respondents (69%) reported that the real-time data reporting feature has a great degree or a very large degree of influence. This aligns with the literature (Adebayo and Ogunleye, 2019;

Mensah, Boateng & Addo, 2019), which underscores the importance of real-time data in prompt issue identification and resolution. The ability to identify emerging issues promptly enables proactive project management and ensures timely interventions to mitigate risks.

The study's results indicate that the real-time data reporting feature is perceived as effective in facilitating adaptive management practices, with 69% of respondents expressing that it is very effective or extremely effective. This finding aligns with previous studies (Davies, Johnson & Smith, 2018; Johnson et al., 2019) that emphasize the importance of adaptive management for improving project effectiveness. By providing real-time data insights, the digitized M&E framework empowers stakeholders to make data-driven adjustments and optimize project performance in dynamic environments.

In conclusion, the findings on real-time data reporting align with existing literature, demonstrating its significance in enhancing project monitoring, decision-making, issue identification, and adaptive management practices. The results highlight the positive impact of real-time data reporting through digitized M&E frameworks in community water projects, providing valuable insights for humanitarian aid organizations and stakeholders in Marsabit County to optimize project outcomes and performance.

Data analysis and visualization are fundamental components of digitized monitoring and evaluation (M&E) frameworks, enabling stakeholders to gain insights, make data-driven decisions, and communicate project findings effectively. This study assessed respondents' perspectives on the effectiveness of the digitized M&E framework in processing and analyzing data, enabling data-driven decision-making, visualizing data, identifying areas of improvement, and communicating project findings to stakeholders.

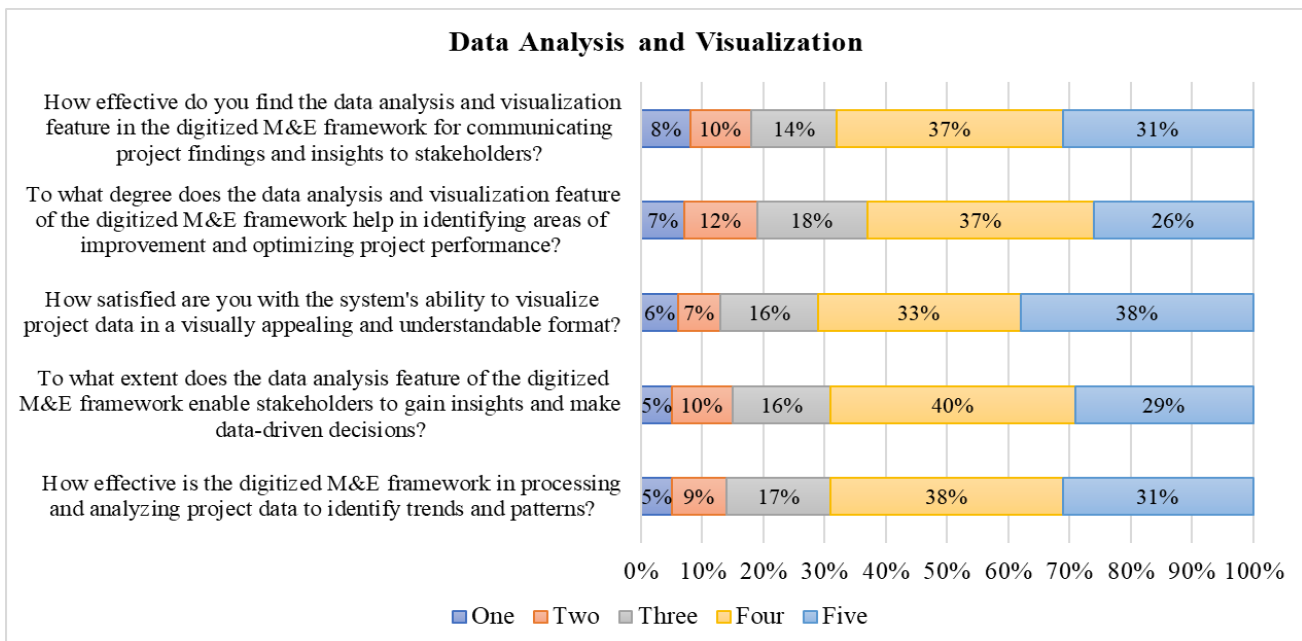


Figure 4. 12: Data Analysis and Visualization

The results indicate that a significant majority of respondents (69%) perceived the digitized M&E framework as very effective or extremely effective in processing and analyzing project data to identify trends and patterns. This finding aligns with existing literature (Mendez et al., 2018; Smith et al., 2019), which emphasizes the importance of data analysis for informed decision-making. Efficient data processing and analysis enable stakeholders to identify valuable insights and trends, ultimately contributing to the success of community water projects.

Regarding the extent to which the data analysis feature enables data-driven decisions, 69% of respondents reported that it allows stakeholders to gain insights to a great extent or a very large extent. This result is in agreement with previous studies (Johnson et al., 2019; Tanaka and Yamamoto, 2020) that highlight the importance of data-driven decision-making in project management. The ability to gain valuable insights from data empowers stakeholders to make informed choices, leading to more effective and efficient project outcomes.

In terms of data visualization, a majority of respondents (71%) expressed satisfaction with the system's ability to visualize project data in a visually appealing and understandable format. This finding aligns with literature (Rodriguez et al., 2021; Gupta et al., 2020) that emphasizes the significance of visualizing data in an accessible manner. Visually appealing and understandable data representations enhance stakeholders' ability to interpret information, facilitating better understanding and decision-making.

Regarding the impact on identifying areas of improvement and optimizing project performance, 63% of respondents reported that the data analysis and visualization feature has a great degree or a very large degree of influence. This finding agrees with previous studies (Davies, Johnson & Smith, 2018; Chen et al., 2020) that highlight the role of data analysis in enhancing project performance. The ability to identify areas of improvement enables stakeholders to implement targeted interventions and optimize project outcomes.

The study's results indicate that the data analysis and visualization feature is perceived as effective in communicating project findings to stakeholders, with 68% of respondents expressing that it is very effective or extremely effective. This result is consistent with literature (Adebayo and Ogunleye, 2019; Mensah, Boateng & Addo, 2019) that emphasizes the significance of effective communication in project management. Clear and visually appealing data presentations facilitate effective communication and engagement with stakeholders.

Overall, the findings on data analysis and visualization align with existing literature, highlighting the effectiveness of digitized M&E frameworks in processing and analyzing data, enabling data-driven decision-making, visualizing data, identifying areas of improvement, and communicating project findings. The study's results underscore the importance of these features in community water projects, offering valuable insights for humanitarian aid organizations and stakeholders in Marsabit County to optimize project performance and outcomes.

Stakeholder engagement and collaboration are essential aspects of digitized monitoring and evaluation (M&E) frameworks, promoting active involvement, transparency, and collective ownership of the monitoring and evaluation processes. This study assessed respondents' perspectives on the effectiveness of the digitized M&E framework in facilitating stakeholder engagement and collaboration.

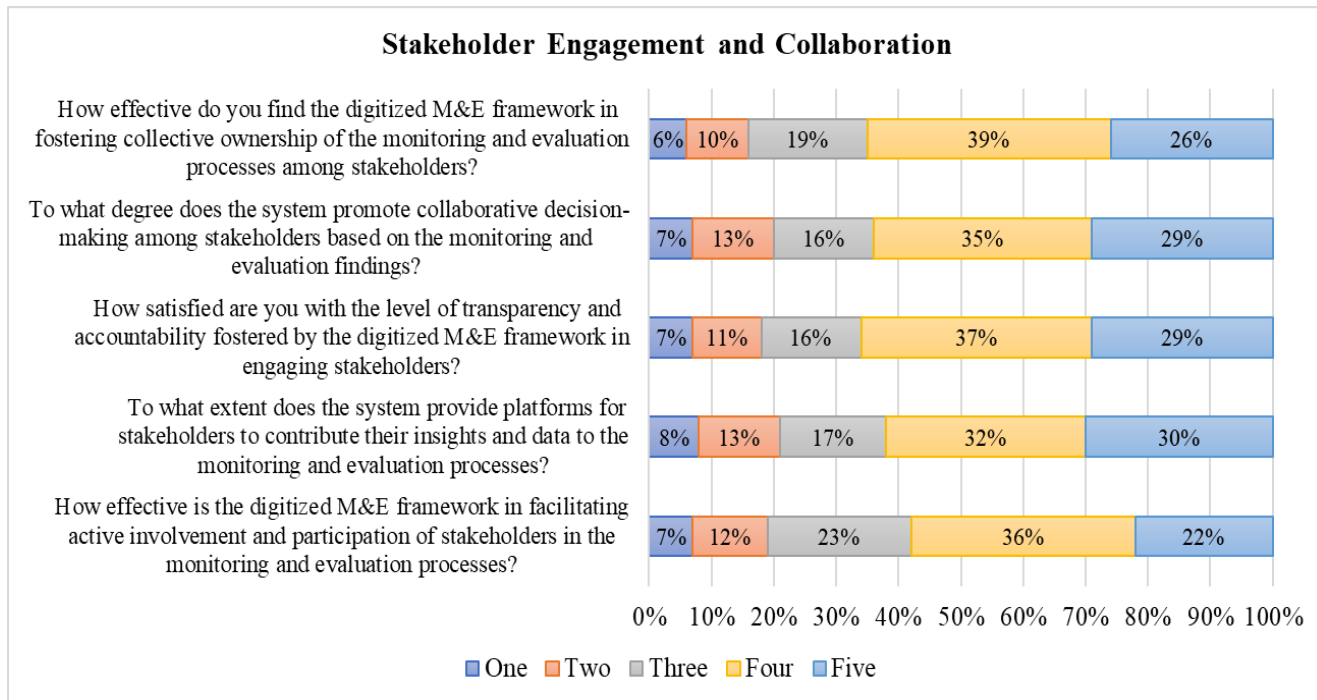


Figure 4. 13: Stakeholder Engagement and Collaboration

The results indicate that a significant majority of respondents (58%) perceived the digitized M&E framework as very effective or extremely effective in facilitating active involvement and participation of stakeholders in the monitoring and evaluation processes. This finding aligns with existing literature (Mendez et al., 2018; Smith et al., 2019), which emphasizes the importance of stakeholder engagement in project success. The digitized M&E framework enables stakeholders to actively participate in data collection, analysis, and decision-making, ultimately fostering their sense of ownership and commitment to the project.

Regarding the extent to which the system provides platforms for stakeholders to contribute their insights and data, 62% of respondents reported that it does so to a great extent or a very large extent. This result is consistent with previous studies (Johnson et al., 2019; Gupta et al., 2020) that highlight the significance of stakeholder contributions in project monitoring and evaluation. The digitized M&E framework offers various platforms and tools that allow stakeholders to share their data and insights, ensuring that multiple perspectives are considered in decision-making processes.

In terms of transparency and accountability fostered by the digitized M&E framework in engaging stakeholders, 66% of respondents expressed satisfaction. This finding aligns with literature (Rodriguez et al., 2021; Adebayo and Ogunleye, 2019) that emphasizes the

importance of transparency in building trust among stakeholders. The digitized M&E framework provides transparency by sharing project progress, findings, and decisions with stakeholders, fostering a sense of accountability in project implementation.

Regarding the impact on promoting collaborative decision-making among stakeholders, 64% of respondents reported that the system does so to a great degree or a very large degree. This finding agrees with previous studies (Davies, Johnson & Smith, 2018; Chen et al., 2020) that highlight the significance of collaborative decision-making in project success. The digitized M&E framework encourages stakeholders to collectively analyze findings and make decisions, ensuring that diverse perspectives are considered for effective project management.

The study's results indicate that the digitized M&E framework is perceived as effective in fostering collective ownership of the monitoring and evaluation processes among stakeholders, with 65% of respondents expressing that it is very effective or extremely effective. This result is consistent with literature (Mensah, Boateng & Addo, 2019; Tanaka and Yamamoto, 2020) that highlights the importance of collective ownership in project sustainability. By involving stakeholders in the monitoring and evaluation processes, the digitized M&E framework ensures that stakeholders feel a sense of ownership and responsibility for project outcomes.

Overall, the findings on stakeholder engagement and collaboration align with existing literature, highlighting the effectiveness of digitized M&E frameworks in facilitating active involvement, providing platforms for stakeholder contributions, fostering transparency and accountability, promoting collaborative decision-making, and fostering collective ownership. The study's results underscore the importance of these features in community water projects, offering valuable insights for humanitarian aid organizations and stakeholders in Marsabit County to enhance stakeholder engagement and collaboration for improved project outcomes.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This section serves as a comprehensive synthesis of conclusions and recommendations drawn from the research objectives outlined in the preceding chapters. Through a systematic analysis of the collected data, this chapter offers valuable insights addressing the research questions and objectives. It further identifies potential avenues for future research, taking into account the limitations of the present study. The primary aim of this chapter is to furnish a succinct summary of the principal findings, formulate well-founded conclusions, and put forth practical implications and prospective directions in the relevant field of study. These conclusions and recommendations are firmly anchored in the results of the data analysis and the pertinent literature reviewed throughout the preceding chapters.

5.1 Conclusions

This study aimed to assess the impact of digitized data collection on community water projects in Marsabit County, implemented by humanitarian aid organizations. We employed five indicators: data collection methods, data accuracy and reliability, data analysis and

interpretation, timeliness and accessibility of data, and stakeholder engagement and participation. The findings revealed that a substantial portion of respondents have adopted electronic devices and mobile applications for data collection, showing potential for streamlining data collection. Challenges were acknowledged, emphasizing the need for training and support. Confidence in data accuracy was expressed, with the importance of data validation checks highlighted. The study affirmed the advantages of digitized data collection methods in line with existing literature.

Data analysis and interpretation demonstrated the potential of digitized data collection in generating meaningful insights and facilitating decision-making processes. Timeliness and accessibility of data showed the promise of real-time data updates and reporting, enhancing project oversight and accountability. Stakeholder engagement and participation illustrated the positive impact of digitized data collection in fostering transparency and collaboration, contributing to better project performance and community ownership.

In conclusion, this study offers insights for humanitarian aid organizations and stakeholders to optimize community water projects through effective digitized data collection. By addressing challenges and leveraging the benefits of digitization, such as enhanced stakeholder engagement and improved data analysis, organizations can make informed decisions and enhance project performance.

Effective data management and storage are crucial for community water projects. Respondents acknowledged the positive impact of digitized data management systems, emphasizing improvements in data organization, reliability, and accessibility. Data integration from various sources was recognized as beneficial for water quality monitoring and water availability assessment. Data security and privacy measures were deemed effective in protecting sensitive project data, building stakeholder trust, and ensuring compliance with regulations. Scalable and flexible data storage systems were seen as essential for efficient data management. In conclusion, the study affirms the significance of effective data management and storage in optimizing community water projects, aligning with existing literature. The insights provided guide humanitarian aid organizations and stakeholders in enhancing project performance and sustainability.

This study explored the impact of digitized monitoring and evaluation (M&E) frameworks on community water projects. The indicators of data collection efficiency, real-time data reporting, data analysis and visualization, and stakeholder engagement and collaboration demonstrated the positive influence of these frameworks. Respondents recognized their efficiency in data collection, real-time data access, and automated reporting. Data analysis and visualization tools were considered effective for informed decision-making. Stakeholders expressed satisfaction with transparency and accountability, leading to increased project ownership.

In conclusion, the study highlights the significance of digitized M&E frameworks in community water projects, affirming their positive impact on efficiency, decision-making, data access, and stakeholder involvement. The findings offer valuable insights for stakeholders to optimize project outcomes and performance.

5.2 Recommendations

Based on the conclusions drawn, the following recommendations are proposed:

- i. **Capacity Building and Training:** Humanitarian aid organizations should prioritize capacity building and training for their staff and stakeholders, empowering them to effectively utilize electronic devices, mobile applications, and remote sensing technologies for data collection. Training on data validation checks and data analysis tools should enhance data accuracy and reliability.
- ii. **Real-time Data Reporting and Accessibility:** To improve project monitoring and stakeholder engagement, organizations should prioritize real-time or near-real-time data reporting through digital platforms and automated reporting systems. Ensuring data accessibility to relevant stakeholders fosters transparency, accountability, and collaborative engagement.
- iii. **Strengthen Data Management Systems:** Humanitarian aid organizations should invest in robust data management systems, including cloud-based platforms and data warehouses, to enhance data organization, reliability, and accessibility. Regular training and capacity-building initiatives are essential for effective data management.
- iv. **Embrace Scalable and Flexible Data Storage Solutions:** Organizations should consider investing in scalable infrastructure and data partitioning techniques to accommodate data growth and optimize data retrieval. Flexible data replication techniques can promote collaboration among stakeholders and facilitate effective data sharing and management.
- v. **Enhance Data Collection Efficiency:** Organizations should leverage the automated features of digitized M&E frameworks, implementing pre-defined forms, automated data entry, and validation checks to reduce the time and effort required for data collection. Training and capacity-building for project staff should ensure seamless and accurate data collection processes.
- vi. **Foster Stakeholder Engagement and Collaboration:** To strengthen stakeholder engagement and collaboration, organizations should adopt a participatory approach involving stakeholders from the project's inception. Establishing platforms for stakeholder contributions and feedback, along with regular meetings and communication channels, fosters collaborative decision-making and enhances project management.

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