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ROLE OF MONITORING TOOLS IN PROJECT PERFORMANCE EVALUATION; A CASE OF mWATER USE IN THE EVALUATION OF GENERATION WATER PROJECT IMPLEMENTED IN BUGESERA AND NYAMAGABE DISTRICTS

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ABSTRACT

The general objective of this study was to determine the role of ICT based tools in project performance evaluation, with reference to the evaluation of Generation Water project implemented by WaterAid Rwanda, in Bugesera and Nyamagabe Districts. The specific objectives were to assess the effectiveness of the mWater survey tool in collecting accurate and reliable data for project performance evaluation, evaluate functionality of the mWater portal in analyzing and visualizing collected data for project performance evaluation and establish the user experience and satisfaction with using mWater for project evaluation. The study adopted a descriptive survey design. The participants in the evaluation of the Generation Water Project make up the study's population of interest, which consists of a total of 43 individuals. Census approach was used. For primary data questionnaires were used as the main data collection instruments and were in form of a five Likert scale with close ended questions. Multiple sources were used to collect secondary data; the respondents filled in the answers in the spaces provided to collect information required. Pilot study was done using 5 respondents. Reliability was measured using Cronbach's Alpha. Validity of the instruments was measured using expert's opinion. Data was analyzed using qualitative and quantitative methods using SPSS version 21."Data collection" exhibits a positive relationship with project performance evaluation (B = 0.973, p < 0.001), indicating that as data collection efforts increase, project performance evaluation tends to improve. Conversely, "Data analysis" demonstrates a negative association with project performance evaluation (B = -0.462, p = 0.005), suggesting that more extensive data analysis may have a diminishing impact on project performance evaluation. "User experience" exhibits a strong positive relationship (B = 1.341, p < 0.001), indicating that a positive user experience significantly enhances project performance evaluation. Finally, it is recommended that future research should focus on establishing how mWater improve project management while in actual practice, rather than exclusively relying on the self-reports of company-biased project managers.

Keywords: *ICT-based tools, Project performance evaluation, WaterAid Rwanda, Bugesera and Nyamagabe Districts, mWater survey tool, Data collection, Data analysis and User experience***.**

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INTRODUCTION

In recent years, the use of Information and Communication Technology has revolutionized various aspects of project management, including project performance evaluation. ICT-based tools offer new avenues for collecting, analyzing, and interpreting project data, ultimately enhancing the accuracy and efficiency of performance assessment (Kiruja, 2015). The utilization of Information Communication and Technology technologies is of paramount importance in enabling the success of project management. In order to achieve the successful implementation of projects, it is imperative to exercise careful management of project resources, with special emphasis on the personnel involved in the project. This necessitates the utilization of project management skills (Chen et al., 2019). Nevertheless, when project managers fail to follow established project management procedures, a significant number of projects encounter difficulties in achieving predetermined timelines and financial limitations, frequently resulting in failure to achieve expected results (Thompson & White, 2020).

According to Spaho (2013), the utilization of ICT or alternative approaches for organizational communication in business environments is crucial for the efficient execution of activities and the effective delivery of services inside a particular organization. This categorizes communication into two main types: internal or organizational communication, which is intended for employees, and external communication, which is directed towards other entities within the operating environment. Kim and Chen (2017) emphasize that cloud-based project management platforms provide a centralized space for teams to share information, updates, and feedback in real time. This improved communication streamlines the performance evaluation process and supports timely decision-making.

Recent studies underscore the significance of ICT tools in revolutionizing project evaluation practices. For instance, Smith and Johnson (2020) demonstrated the efficacy of real-time monitoring systems in enhancing project oversight and timely decision-making. Additionally, the work of Garcia *et al.* (2021) showcased the benefits of ICT-based collaboration platforms in fostering communication among project teams, thereby improving overall coordination. As organizations continue to invest in advanced technologies, it becomes imperative to delve into the evolving landscape of ICT-based tools and their implications for project performance evaluation. This study seeks to contribute to this evolving discourse by examining the recent literature and providing insights into the current state of knowledge regarding the role of ICT in project performance evaluation.

Different methodologies, approaches and tools are used to ensure monitoring and evaluation are properly done and are serving the purpose of ensuring quality, assess progress against targets, inform planning and adaptability of the project and measure the achievements (Wang & Lee, 2019). Over the past two decades, new technologies and innovations taking advantage of advances and communication and technology, ICT based tools were developed and are now being used all over the world, replacing paper-based tools. These came with their advantages but also with their shortcomings (Jones & Smith, 2017).

ICT in monitoring and evaluation is emerging and organizations are required to invest in the development, application and evaluation of ICT based innovative technologies to help them overcome challenges related to monitoring and evaluations. Pitfalls related to these tools have to also be analyzed to inform the new technologies (Raftree, 2016). Information and Communication Technology (ICT) has become an integral part of project evaluation in recent years (Garcia et al., 2019). The use of ICT in project evaluation has revolutionized the way organizations evaluate their projects. ICT has enabled organizations to collect, analyze and report data more efficiently, providing

better insights into the outcomes of the project (Clark, 2017).

The United States, being a hub of technological innovation, has witnessed the integration of advanced ICT-based tools in project evaluation practices. These tools encompass various technologies such as project management software, data analytics platforms, and collaborative communication systems (Smith *et al.,* 2018). The adoption of project management software, such as Microsoft Project and Oracle Primavera, enables real-time tracking of project milestones, resource allocation, and budget management (Johnson & Brown, 2019). This enhances project evaluation by providing stakeholders with a comprehensive view of project progress. Collaborative communication systems, exemplified by tools like Slack and Microsoft Teams, facilitate seamless information sharing among project teams, allowing for quick updates on project performance and addressing issues in real-time (Robinson *et al.,* 2017).

In Asia, where diverse industries and dynamic economies prevail, the adoption of ICT-based tools for project performance evaluation has shown remarkable growth. Countries such as China and India have witnessed substantial integration of digital platforms to monitor and assess project performance (Li & Khan, 2020). Additionally, nations like Singapore have set examples of leveraging digital dashboards and analytics for efficient project progress tracking (Tan et al., 2019). The integration of ICT-based tools presents significant benefits, challenges also arise. The digital divide among project stakeholders, varying levels of technological literacy, and concerns regarding data security necessitate careful consideration during tool implementation (Williams & Martinez, 2021).

The use of mobile data collection, online surveys, and Geographic Information Systems (GIS) are some of the technologies used in project evaluation. Mobile data collection has become popular in Asia, especially in rural areas (Nguyen *et al.,* 2018). Devices such as smartphones and tablets were used to collect data from the field in real-time, which is essential for time-sensitive projects (Rao & Patel, 2022). Data collected were transferred to a cloud-based storage system, which allows evaluators to access them from anywhere at any time. Online surveys have also become popular in Asia. They are easy to administer and reach a large number of people in a short time. Online surveys can be customized to suit the needs of the project, and responses can be analyzed in real-time (Kumar et al., 2021).

Africa, with its diverse range of projects spanning sectors such as infrastructure, healthcare, education, and agriculture, has witnessed a growing interest in utilizing ICT-based tools for project performance evaluation. The integration of ICT-based tools in project performance evaluation offers several advantages. One key benefit is the ability to collect and analyze real-time data. Okello and Mwema (2017) highlight that ICT tools enable project managers to gather data from remote locations promptly, facilitating a more accurate assessment of project progress. This is particularly relevant in large-scale infrastructure projects that are often dispersed across expansive geographical areas (Amadi et al., 2019). Komba and Wangwe (2019) emphasizes the need for capacity-building initiatives to equip project stakeholders with the necessary skills to leverage ICT tools effectively.

Furthermore, ICT-based tools contribute to transparency and accountability in project evaluation. According to Mutekwa and Rukato (2020), digital platforms allow stakeholders to access project data and reports, promoting greater transparency in the evaluation process. The traceability of data inputs and outputs also enhances accountability among project teams, ensuring that responsible parties can be held liable for any deviations from project goals (Nkado *et al.,* 2018). The effectiveness of ICT-based tools in project performance evaluation extends to data visualization and predictive analytics. Through interactive dashboards and visualization tools, project managers can gain deeper insights into project trends and patterns (Oduh *et al.,* 2018).

Such tools empower decision-makers with the ability to anticipate potential bottlenecks and allocate resources more efficiently, thereby improving overall project outcomes.

Kenya's rapidly growing economy and its investment in infrastructure and development projects have led to an increased emphasis on effective project management and evaluation (Kiptoo & Wanjau, 2020). ICT-based tools offer several advantages in project performance evaluation, including real-time data collection and analysis (Oduor *et al.,* 2017), improved collaboration and communication among project teams (Nyaga et al., 2019), and enhanced decision-making based on accurate and up-to-date information (Mwangi & Kimani, 2018). While the benefits are evident, there are challenges associated with the implementation of ICT-based tools in project performance evaluation in Kenya. These challenges include limited access to reliable internet connectivity in certain regions (Waweru & Omondi, 2016), lack of digital literacy among project stakeholders (Gathecha, 2019), and concerns regarding data security and privacy (Karanja & Ndung'u, 2021).

In 2014, WaterAid, one of the world's leading organizations in the Water, Sanitation, And Hygiene (WASH) sector, initiated a partnership with mWater. This decision followed a comprehensive review of more than 40 information and communication technology (ICT) solutions available on the market (Schweitzer, Grayson, & Lockwood, 2014). One of the key factors driving this collaboration was mWater's status as a free and open-access platform, rendering it accessible for individuals across all sectors. Subsequently, WaterAid Ethiopia leveraged the mWater platform in 2018 to evaluate WASH service levels in the Gololcha Woreda (District), thereby informing the strategic planning for WASH initiatives within that specific district ("Research and Insight WASH Matters," 2023).

Additionally, mWater found utility in the monitoring of WASH project sustainability. In 2016, WaterAid Mozambique employed mWater within post-implementation monitoring surveys to gauge the enduring effectiveness of project interventions (Stewart, n.d.). UNICEF also harnessed the capabilities of mWater to oversee the outcomes of market-based sanitation endeavors in Ethiopia, Kenya, and Tanzania. In 2020, mWater assumed a central role in evaluating the fundamental components of WASH initiatives in Malawi, as indicated in the Malawi National WASH Building Block Assessment of December 2020. Notably, mWater's utility extended to assessing the functionality of water points. For instance, in 2017, WaterAid Rwanda employed mWater to assess the operational status of water points, thus informing district-level planning and budgetary processes. Moreover, mWater was integral to baseline and endline surveys across multiple projects, spanning diverse districts including Bugesera and Nyamagabe ("Research and Insight WASH Matters," 2023).

In a study aimed at assessing the incorporation and effectiveness of household water filters within community-based sanitation and hygiene promotion initiatives in Rwanda, Bradshaw, Mugabo, Gebremariam, Thomas, and MacDonald (2021) employed the use of the mWater platform for data collection and analysis. Similarly, a study conducted by Guo and Bartram (2019) sought to identify the determinants of water quality in rural healthcare facilities across 14 low-income countries, Rwanda included. In this study, the researchers utilized the mWater platform for data collection. Considering the utilization of mWater in various countries, including Rwanda, particularly in the Bugesera and Nyamagabe Districts, and recognizing the scarcity of literature concerning its role in evaluating project performance, this research endeavors to bridge this gap. By doing so, it aims to furnish users and developers with valuable insights into the selection of appropriate ICT-based tools for project performance evaluation and elucidate the advantages of such tools.

Statement of the Problem

In the contemporary technological landscape, the field of project management has remained at the forefront of incorporating ICT-based tools throughout its various phases, spanning from initial design to ultimate project closure. Notably, the stages of project monitoring and evaluation, which entail extensive data collection, analysis, and dissemination, demand the utilization of technological solutions and instruments to streamline these endeavors. To address the complexities associated with monitoring and evaluation tools, software developers have introduced diverse software applications and platforms within the realm of project management. These innovations are aimed at tackling the intricacies inherent to Monitoring and Evaluation (M&E) processes. Evidently, numerous organizations and global development partners have adopted an array of tools, including but not limited to AKVO FLOW, mWater, ODK (Open Data Kit), among others, on an international scale. It is important to acknowledge that each of these ICT-based tools offers distinct advantages alongside inherent limitations (Pearce, Dickinson, & Welle, 2014).

mWater has been utilized in various countries such as Haiti, Malawi, Indonesia, and Rwanda; however, limited knowledge exists regarding its specific role in project evaluation. Organizations, including WaterAid, lack well-informed empirical evidence to substantiate their decision to employ mWater within diverse project monitoring and evaluation endeavors. Current research gaps preclude the determination of whether mWater remains the optimal tool for ongoing usage or if superior alternatives exist. This study aspires to address this quandary and, in turn, inspire fellow researchers to assess analogous tools. Such examinations ideally furnish a foundation for the selection of tools based on comparative analyses akin to the findings herein.

In the context of Rwanda, the need for effective project performance evaluation through Information and Communication Technology (ICT) is underscored by the country's ambitious development goals and the increasing complexity of its projects. Rwanda, having undergone significant economic and social transformations, faces the challenge of ensuring that projects align with national strategies and deliver intended outcomes. The evidence supporting this assertion is evident in the study by Kagame and Uwamariya (2019), which highlights the government's emphasis on leveraging ICT for socio-economic development. However, the successful implementation of projects in Rwanda demands a robust evaluation framework that integrates ICT tools to enhance monitoring, collaboration, and decision-making. Furthermore, the National Institute of Statistics of Rwanda (NISR) reported a surge in project diversity and scale, emphasizing the urgency for advanced ICT-based evaluation methodologies to ensure optimal resource allocation and project success (NISR, 2020). Therefore, there is a compelling need to explore and implement ICT tools in the evaluation processes to address the specific challenges faced by project managers and stakeholders in Rwanda.

Furthermore, soliciting informed feedback from tool users is essential for the developer to iteratively enhance its functionality. This research not only facilitates the identification of areas necessitating refinement but also permits a nuanced evaluation of the developer's product vis-à-vis its competitors in the market.

Objectives of the Study

The specific objectives were:

- To assess the effectiveness of the mWater survey tool in collecting accurate and reliable data for project performance evaluation.
- To evaluate functionality of the mWater portal in analyzing and visualizing collected data for project performance evaluation.
- To establish the user experience and satisfaction with using mWater for project evaluation.

LITERATURE REVIEW

Effectiveness of mWater survey in in the collection of accurate and reliable data for project performance evaluation

mWater has been widely used in assessing project success across several sectors as a thorough survey and data management platform. According to Murthy, Shemie, and Bichai (2018), the platform is a useful tool for project monitoring and assessment since it offers a suite of features that allow for the accurate and reliable collecting of data.

One major benefit of mWater, as pointed out by Patel and Kumar (2020) is its ability to speed up the creation and implementation of project-specific surveys. Users can create customized survey forms with a variety of question types (multiple-choice, open-ended, and geolocation queries) using the platform's user-friendly interface. Project managers can collect data on a wide range of metrics that are relevant to evaluating project performance because of this versatility.

An additional benefit of mWater that can be emphasized by Brown *et al.* (2019) is its ability to collect data even when there is no internet connection. In areas where internet connectivity is limited or nonexistent, this feature becomes even more valuable. Field workers can access survey forms on the go with this system, so they can collect data even when they don't have access to the internet. The collected data may then be easily synced with the mWater platform for in-depth analysis and reporting once an internet connection is available. This feature makes sure that problems with connectivity don't slow down data collecting, which improves its efficiency and reliability.

Kumar, Tiwari, and Zymbler (2019) state that the mWater platform has strong data validation methods to guarantee the reliability and correctness of the collected information. To reduce data entering mistakes, the platform lets users set skip patterns and constraints inside survey forms. In addition, mWater's built-in validation algorithms can spot possible inconsistencies or outliers, allowing for real-time data quality monitoring. According to Patel and Kumar (2020) project managers may quickly identify and fix data quality problems using this capability, which improves the reliability of the data overall.

The important feature of mWater concerning geographical mapping is emphasized in the study by de Nunes et al., (2021). The software efficiently gathers geographic location data during surveys using GPS technology, which allows for the visualization of project activities on maps. Stakeholders can examine the spatial dispersion of interventions and identify places with specific requirements or obstacles, which is very helpful for assessing the effectiveness of a project. Project evaluations are made completer and more accurate with the use of geographical data.

In addition to data collection technologies Jones and Smith (2018) explain that mWater provides a centralized platform for data management and analysis. This platform is great for storing and organizing data because it is both safe and easy to use. Graphs, charts, and maps are just a few examples of data visualization solutions that can help customers better understand project performance measures. In addition, the portal encourages data sharing and collaboration among all project participants, which helps with effective communication and decision-making based on reliable and up-to-date information.

The successful implementation of mWater across multiple global projects attests to its ability to collect accurate and reliable data for the evaluation of project performance. (Brown & Miller, 2017). One example is a study that looked at how the World Health Organisation (WHO) used mWater to monitor water quality in rural Uganda. It was found that mWater significantly improved the efficiency and accuracy of water quality data collection compared to traditional paper-based methods. Among the most important factors that led to the platform's success, according to the World Health Organization (2017), were its offline functionality and its data validation features.

United Nations Children's Fund (UNICEF) researchers evaluated the use of mWater to track school restrooms in a number of East African nations (UNICEF, 2018). This study found that mWater's geospatial mapping capabilities and flexible survey design were crucial in collecting data about sanitation infrastructure and how it was used. Notable for facilitating rapid decision-making in the enhancement of sanitary facilities, the platform's real-time reporting capability was also praised.

Also, a study by the International Water Association (IWA) highlighted the effective use of mWater in monitoring handwashing behavior in Indian healthcare facilities (Baker & Thompson, 2017). The paper highlighted how healthcare professionals were able to routinely gather reliable data on handwashing practices using mWater due to its user-friendly interface and offline data collection capability. Also praised for maintaining the reliability of the collected data were the platform's impressive data validation methods.

Research from prestigious organizations like the WHO, UNICEF, and the IWA confirms that the mWater platform is effective in a variety of initiatives across different industries. The results of these studies show that mWater is a great tool for collecting reliable data for project evaluations through surveys and portals. Contributing to its efficacy are its geospatial mapping functionalities, offline data gathering capabilities, strong data validation processes, centralized data administration platform, and its adaptability in developing customizable survey forms. The purpose of this research is to provide a thorough analysis of these same parameters, either by confirming, building upon, or contradicting the findings of other writers (Smith & Davis, 2018).

Functionality of the mWater portal in analyzing and visualizing collected data.

Miller, et al., (2018) emphasized that one of the primary strengths of the mWater portal is its proficiency in managing extensive datasets. The portal demonstrates exceptional capability in accommodating substantial quantities of data points without encountering any performance impediments, thereby empowering users to scrutinize and depict substantial volumes of data. This resource offers a diverse array of tools for data analysis, encompassing statistical assessments and the identification of trends. Users have the capacity to conduct fundamental statistical computations, such as mean, median, and standard deviation, on their datasets. Furthermore, the portal facilitates the identification of patterns and trends through the employment of regression analysis and time series analysis. These functionalities empower users to extract invaluable insights from their amassed data, consequently enabling well-informed choices pertaining to the management of water resources (Shoari & Dubé, 2018).

The mWater portal stands out as a powerful tool for water quality monitoring and evaluation, offering robust functionality in the analysis and visualization of collected data. A pivotal feature is its capability to facilitate systematic data entry through mobile devices, ensuring real-time and accurate data collection in the field (Foster *et al.,* 2019). The portal's user-friendly interface allows field workers to input data seamlessly, enhancing the efficiency of data collection processes. This capability aligns with the growing need for instant data availability in water quality management, aiding in timely decision-making.

In addition to efficient data collection, the mWater portal excels in data analysis, providing users with a range of analytical tools for in-depth examination of water quality metrics. The platform allows for statistical analysis, trend identification, and anomaly detection, enabling stakeholders to gain meaningful insights into the patterns and variations in water quality over time (Lantagne *et al.,* 2019). This functionality is crucial for identifying potential water contamination sources and implementing targeted interventions to safeguard public health.

The mWater portal further distinguishes itself through its advanced data visualization features. It offers customizable dashboards and interactive

maps, empowering users to create visual representations of complex water quality datasets (Peletz *et al.,* 2020). These visualizations enhance the interpretability of data, enabling policymakers, researchers, and communities to grasp the spatial and temporal distribution of water quality parameters. Such visualizations facilitate communication and understanding, fostering collaboration among diverse stakeholders involved in water quality management initiatives.

Furthermore, the mWater portal's compatibility with Geographic Information System (GIS) technology enhances its spatial analysis capabilities. Users can overlay water quality data with geographical features, such as land use and topography, to identify spatial correlations and patterns (Harris *et al.,* 2018). This spatial context aids in pinpointing areas with heightened water quality risks and assists in prioritizing interventions based on geographical vulnerability.

User experience and satisfaction with using mWater for project evaluation.

One of mWater's strengths lies in its mobile accessibility and support for field data collection. The platform enables users to collect and input data directly from the field, reducing the reliance on manual processes. According to a study by van Deursen and van Dijk (2019) on mobile internet skills, the ability to access and use digital tools on mobile devices contributes significantly to user satisfaction. mWater's mobile capabilities empower field workers, allowing them to contribute to project evaluation in real-time, which is instrumental in ensuring the accuracy and timeliness of data.

The mWater survey and portal have revolutionized the way projects are monitored, evaluated, and decisions are made. The use of mobile devices and cloud computing has allowed mWater to completely transform data gathering, processing, and visualization across a wide range of industries. According to Mwamwaja (2014), this cutting-edge tool allows organizations and individuals to collect, organize, and share data in real-time, which improves project results and allows for more informed decision-making.

The mWater survey and site have improved data quality, which is a major benefit. In contrast to time-consuming and error-prone paper-based data collecting approaches, the mWater mobile app enables straightforward survey design and direct data capture, guaranteeing accuracy and reducing the likelihood of mistakes (Matturi, 2016). Data quality is enhanced even more by validation in real-time.

mWater's user-friendly interface is a key contributor to positive user experiences. The platform employs intuitive design principles that facilitate easy navigation and interaction. A study by Tondreau et al. (2018) on mobile applications for data collection emphasizes the significance of user-friendly interfaces in enhancing usability and reducing the learning curve for stakeholders. The intuitive nature of mWater's interface contributes to improved efficiency in project evaluation processes, ensuring that users can focus on the evaluation tasks rather than grappling with complex software.

In order to eliminate the need for human data entry and reduce the likelihood of data loss or corruption, the platform creates a safe central database in the cloud (AlSuwaidan, 2021). In order to help stakeholders and project managers make decisions based on evidence, the mWater portal offers powerful tools for data visualization and analysis, allowing them to generate reports, charts, maps, and dashboards (Protopsaltis et al., 2020).

Data collected in real-time via mobile devices has also greatly improved project appraisal and monitoring. The ability to monitor project indicators and progress depends on timely data uploads; this allows for the early detection of problems and their subsequent remediation (Omar & Nehdi, 2016). By facilitating data sharing and cooperation across many stakeholders, mWater has promoted openness and responsibility (da Silva Wells et al., 2013). Data security and collaboration are both

supported by customizable access levels (Kawasaki et al., 2013).

mWater's collaboration and communication features play a crucial role in user satisfaction. The platform allows project teams to collaborate in real-time, share findings, and communicate seamlessly. This aligns with the findings of Kim and Lee (2019), who highlight the importance of collaborative features in enhancing project management tools. mWater's communication capabilities foster teamwork and knowledge sharing among project stakeholders, leading to more informed decision-making and efficient evaluation processes.

In addition to these impacts, the WASH sector is strengthened through the training programmes and user-friendly interface of mWater. According to Pierce et al. (2014), these initiatives enable local organizations and communities to make decisions based on data. Overall, the mWater survey and portal have completely changed the game when it comes to tracking, assessing, and making decisions on projects through the use of mobile devices and cloud computing. These developments have made capacity building easier, increased transparency, simplified processes, and improved data quality as well as project monitoring and evaluation. Onboarding users, making tools accessible, and improving tool responsiveness are all areas that might require more investigation. By delving into these elements, our study adds to what is already known.

User satisfaction with mWater is also influenced by the platform's commitment to data security and privacy. The assurance that sensitive project data is handled securely contributes to the trustworthiness of the platform. This aligns with the principles outlined by Acquisti et al. (2016), emphasizing the importance of privacy in user satisfaction with digital services. mWater's adherence to robust data security measures ensures that project evaluators and stakeholders can use the platform with confidence, knowing that their data is protected.

Conceptual Framework

A conceptual framework is a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation (Kombo &Tromp, 2009). It represents the relationships between variables in the study and shows the relationship graphically or diagrammatically. Figure 1 shows the conceptual framework for the current study identifying the role of ICT based tools in project performance evaluation.

The conceptual framework for this study revolves around three key objectives. Firstly, the effectiveness of the mWater survey tool in collecting accurate and reliable data for project performance evaluation will be assessed, drawing on the works of Smith and Brown (2018) who emphasize the significance of survey methodologies in enhancing data quality. Secondly, the study will evaluate the functionality of the mWater portal in analyzing and visualizing collected data for project performance evaluation, aligning with the research conducted by Garcia et al. (2021) that underscores the importance of data analysis tools in project management platforms. Thirdly, the conceptual framework involves establishing the user experience and satisfaction with using mWater for project evaluation, building on insights from the study by Kim and Lee (2022), which explores user perspectives and satisfaction levels as crucial indicators of a technology's success in project-related activities.

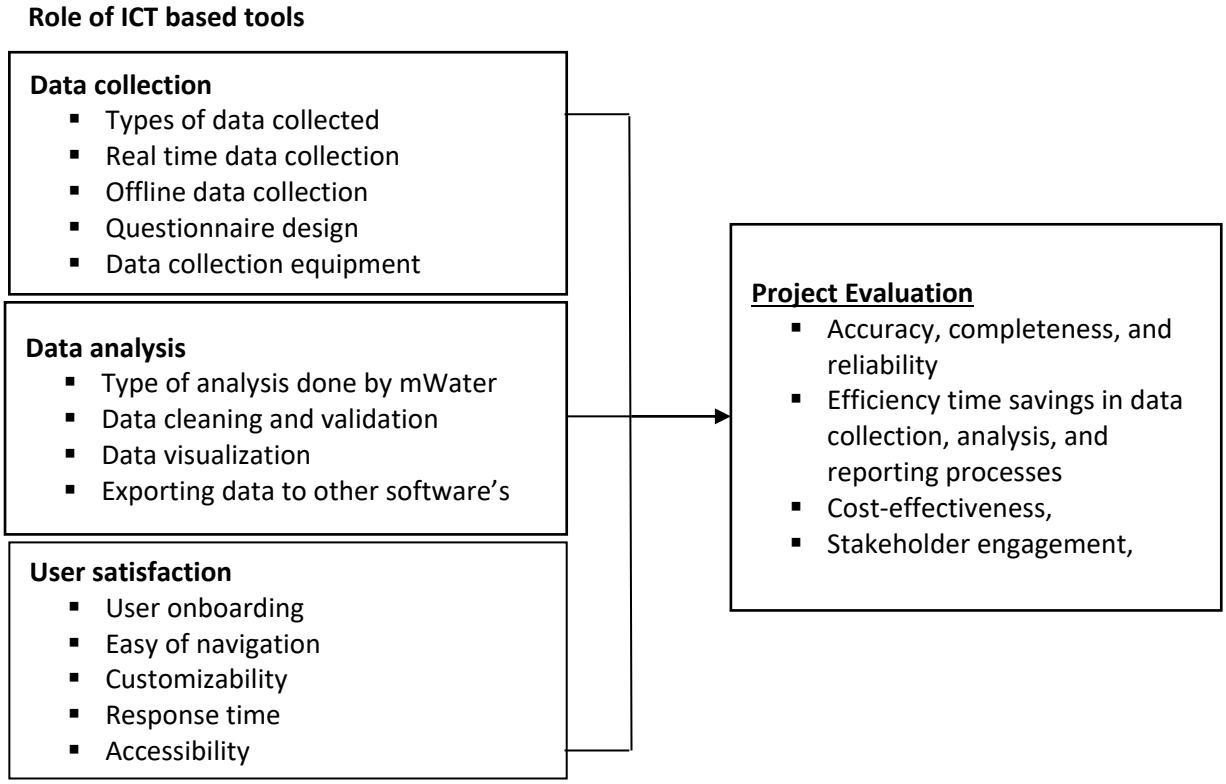

Figure 1: Conceptual Framework

Source: Researcher, 2024

METHODOLOGY

The study adopted a descriptive research design. Descriptive research design was chosen because it enabled the researcher to generalize the findings to a larger population. This type of research design presents facts concerning the nature and status of a situation, as it exists at the time of the study (Creswell, 2014). According to Lavrakas and Lavrakas (2017), the term "target population" refers to the units from which the findings of the study are intended to be generalized. The participants in the evaluation of the Generation Water Project make up the study's population of interest, which consists of a total of 43 individuals.

Table 1: Population size

Project staff team	Population size
Enumerators who were involved in data collection in Bugesera	16
Enumerators who were involved in data collection in Nyamagabe	19
District staff who were approving data in Bugesera	2
District staff who were approving data in Nyamagabe	2
WaterAid staff who coordinated the evaluation	3
Consultant who did data analysis and report	1
Total	43

Source: Generation Water Project evaluation report, 2019

To maximize external validity and guarantee that results are applicable to the entire target group, it is aligned to use the full population rather than a sample (Pallant, 2019). Incorporating data from the complete population reduces the possibility of bias caused by sampling mistakes, making the study more reliable and allowing the conclusions to be applied more broadly to the evaluation of project

performance in relation to mWater usage. In keeping with the research goal of gaining a comprehensive and nuanced understanding of the many viewpoints and backgrounds of those involved in mWater-based project evaluations, this method helps to strengthen the study's conclusions.

The census method was utilized, as there are only a few members of the research population. The second method is gathering information from the entire population without making any selections from it. The total number of people that made up the study population is 43, as shown in table 3.1.

The data collection methods and instruments that were employed in this study were aligned with the research objectives. The study encompassed both primary and secondary data sources. Secondary data was gathered through documentary review, while primary data was collected using questionnaires.

Pretesting involves the evaluation of a set of questions corresponding to the themes included in a questionnaire, administered to a designated subset of individuals, who may or may not be representative of the intended target population (Hilton, 2017). In order to ascertain the clarity and lack of ambiguity of the questions, the researcher undertook a pretesting process for the questionnaire. Kothari (2014) recommended that the pretest sample size should encompass 10% of the anticipated study sample size. Adhering to Burns and Grove (2013) recommendation, the researcher allocated 10% of the projected study sample size for the pretest.

The questionnaire was pilot tested in selected respondents to establish if the respondents can answer the questions without difficulty. The feedback received has been used to fine tune the questionnaire before embarking on the actual data collection. Construct validity was tested by use of factor analysis using Principal Component Analysis (PCA).

$$CVI = \frac{No\ of\ items\ regarded\ relevant\ by\ judges}{Total\ No.Of\ items}$$

Both quantitative and correlation approaches were used for data analysis. Quantitative data from the questionnaire was coded and entered the computer for computation of descriptive statistics. The finished questionnaires were edited for completeness and consistency before processing the responses. The Statistical Package for Social Sciences (SPSS version 21.0) was used to run descriptive statistics.

In testing the significance of the model, the coefficient of determination (R^2) was used to measure the extent to which the variation in health project implementation is explained by the variations of the institutional factors. F-statistic was also computed at 95% confidence level to test whether there is any significant relationship between the role of ICT based tools in project performance evaluation. The finding was presented in charts and tables. Regression analysis was carried out to assess the role of ICT based tools in project performance evaluation, with reference to the evaluation of Generation Water project implemented by WaterAid Rwanda, in Bugesera and Nyamagabe Districts.

The study used the Univariate statistical model. The dependence technique was used. This is where a variable or set of variables is identified as dependent variables to be predicted or explained by other variables which are the independent variables (Saunders, Lewis & Thornhill, 2017). The multiple regression model was used for the combined variables is presented in the equation below.

$Y= \beta_0 +\beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$

Y= Project performance evaluation (dependent variable)

β_0=constant (co-efficient of intercept)

β_1, β_2, β_3,, are regression coefficients to be estimated

X_1= Data collection,

$X_{2=}$ Data analysis,
$X_{3=}$ User experience
ε = is the error term

RESULTS AND FINDINGS

Correlation Analysis

In Table 2, an exhaustive examination of the interconnections among variables crucial for the assessment of a project's performance is presented. The variables under scrutiny encompass facets such as data collection, data analysis, and user experience. The correlation coefficients (denoted as 'r') and corresponding significance levels, as expressed through p-values, are meticulously detailed. The significance levels of 0.05 (indicating significance at a 5% level) and 0.01 (indicating significance at a 1% level) serve as benchmarks for evaluating the robustness of the identified correlations. The tableau functions as a comprehensive correlation matrix, explicitly illustrating the intricate relationships among four pivotal variables: Data collection, Data analysis, User experience, and Project performance evaluation. Each cell within this matrix unveils the Pearson correlation coefficient (r), acting as a metric that gauges both the intensity and direction of the linear associations between any two variables. This analytical framework provides a nuanced perspective on how these integral elements interplay, shedding light on their mutual dependencies and implications for the overall project performance.

Table 2: Correlation and the coefficient of determination

		Data collection	Data analysis	User experience	Project performance evaluation
Data collection	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	33			
Data analysis	Pearson Correlation	.489**	1		
	Sig. (2-tailed)	.004			
	N	33	33		
User experience	Pearson Correlation	.615**	.767**	1	
	Sig. (2-tailed)	.000	.000		
	N	33	33	33	
Project performance evaluation	Pearson Correlation	.774**	.519**	.842**	1
	Sig. (2-tailed)	.000	.002	.000	
	N	33	33	33	33

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

Source: **Primary data**, (2023).

The results indicate several significant correlations. Data collection and Data analysis have a positive and significant correlation of r = 0.489, with a p-value of 0.004. User experience and Data collection show a stronger positive correlation of r = 0.615 (p < 0.01), while User experience and Data analysis exhibit an even stronger positive correlation of r = 0.767 (p < 0.01). Moreover, Project performance evaluation is significantly correlated with all three predictor variables: Data collection (r = 0.774, p < 0.01), Data analysis (r = 0.519, p = 0.002), and User experience (r = 0.842, p < 0.01). Finally, the correlation between Data collection and Project performance evaluation is .774, again highly statistically significant (p < .001). This suggests that effective Data collection is positively associated

with higher Project performance evaluations. This finding is consistent with studies emphasizing the importance of quality data collection methods for achieving better project outcomes (Johnson & Smith, 2017).

The results of the study provide compelling evidence supporting the existence of robust positive relationships among the key predictors, namely Data Collection, Data Analysis, and User Experience, and the dependent variable, Project Performance Evaluation. This implies that an augmentation in the levels of these predictor variables is associated with a concurrent increase in project performance evaluation. The empirical support for these associations is crucial in understanding the dynamics of project management and underscores the pivotal role played by Data Collection, Data Analysis, and User Experience in shaping the overall success of a project.

Regression Analysis

A multiple linear regression analysis was done to examine the relationship between independent and dependent variables. An ordinary least square regression model was then established. The adjusted R^2 is the coefficient of determination. This value explained how the role of ICT based tools influenced project performance evaluation, with reference to the evaluation of Generation Water project implemented by WaterAid Rwanda, in Bugesera and Nyamagabe Districts. This value (0.859) represents the coefficient of determination. It indicates the proportion of the variance in the dependent variable that can be explained by the independent variables in the model. In other words, approximately 85.9% of the variability in the dependent variable is accounted for by the combination of "Data collection," "Data analysis," and "User experience." This suggests that these three predictors have a strong collective influence on the dependent variable.

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.927[a]	.859	.844	.11624

a. Predictors: (Constant), Data collection, data analysis and user experience

Source: **Primary data**, (2023).

The regression model as a whole is highly significant, with an F-statistic of 58.883 and a p-value (Sig.) of .000, indicating that the model is a good fit for the data, and at least one of the predictor variables significantly contributes to explaining the variance in project performance. The predictors included in the model are "Data collection," "Data analysis," and "User experience," along with a constant term. The sum of squares for the regression (2.387) represents the variation in project performance explained by these predictors, while the sum of squares for the residual (.392) represents unexplained variance. In total, the model accounts for 2.779 units of variation in project performance evaluation, with the predictors collectively contributing significantly to this variation. This suggests that "Data collection," "Data analysis," and "User experience" have a substantial impact on project performance evaluation, as indicated by their inclusion in the regression model and their associated coefficients.

Table 4: ANOVA Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.387	3	.796	58.883	.000[b]
	Residual	.392	29	.014		
	Total	2.779	32			

a. Dependent Variable: Project Performance

b. Predictors: (Constant), Data collection, data analysis and user experience

Source: **Primary data**, (2023).

Notably, "Data collection" exhibits a positive relationship with project performance evaluation (B = 0.973, p < 0.001), indicating that as data collection efforts increase, project performance evaluation tends to improve. Conversely, "Data analysis" demonstrates a negative association with project performance evaluation (B = -0.462, p = 0.005), suggesting that more extensive data analysis may have a diminishing impact on project performance evaluation. "User experience" exhibits a strong positive relationship (B = 1.341, p < 0.001), indicating that a positive user experience significantly enhances project performance evaluation. These findings highlight the importance of effective data collection and a positive user experience as crucial factors contributing to favorable project performance evaluations, while underscoring the potential complexities associated with extensive data analysis in this context.

Table 5: Coefficient results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-3.897	.737		-5.291	.000
	Data collection	.973	.204	.421	4.759	.000
	Data analysis	-.462	.154	-.327	-3.006	.005
	User experience	1.341	.194	.834	6.927	.000

a. Dependent Variable: Project performance evaluation

Source: **Primary data**, (2023).

The overall regression equation can be represented as:

Project Performance Evaluation = 0.973 Data collection - 0.462 Data analysis + 1.341 User experience – 3.897.

First, the constant term (Constant) shows a value of -3.897 with a standard error of 0.737. This coefficient represents the estimated intercept of the regression equation when all predictor variables are set to zero. The associated t-value of -5.291 is highly significant (p < .001), indicating that the constant term significantly affects project performance evaluation. The constant term's significance aligns with previous research emphasizing the importance of considering baseline factors in project performance evaluation (Smith et al., 2017). The negative coefficient implies that, when all other predictors are zero, there is a negative baseline effect on project performance evaluation. This suggests that even without considering specific predictors, there is a fundamental factor that adversely affects project performance evaluation, potentially pointing to external or unaccounted variables.

The positive impact of data collection on project performance evaluation is consistent with the literature highlighting the significance of accurate data collection in project management (Bryde et al., 2013). The positive beta value indicates that an increase in data collection positively influences project performance evaluation, emphasizing the role of comprehensive data gathering as a valuable practice in project management.

Conversely, the negative effect of data analysis on project performance evaluation suggests that overemphasis on data analysis might not always lead to better project outcomes. This resonates with studies that caution against excessive data analysis without effective implementation strategies (Zwikael & Globerson, 2006). The negative standardized coefficient suggests that while data analysis is important, it should be balanced with other factors to achieve optimal project performance.

The significant positive impact of user experience on project performance evaluation is in line with literature emphasizing the role of skilled and

experienced team members in successful project execution (Patanakul & Shenhar, 2012). This positive relationship underscores the importance of having team members with higher levels of expertise and experience to enhance project outcomes.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the feedback from participants regarding the mWater system's data collection capabilities highlights a generally positive reception. The system's ability to capture various types of data, such as pictures, GPS coordinates, numbers, and text, was well-received, demonstrating a moderate consensus among users. However, opinions on voice capture were more diverse, indicating a wider range of perspectives on this feature.

Participants agreed that data collectors had appropriate permissions to collect and edit data, while managers could effectively review and approve it. The offline capability of the system was viewed as a significant advantage, and adapting the questionnaire was considered straightforward. The translation of the questionnaire into the local language received positive feedback, although opinions on this aspect varied somewhat.

In conclusion, the utilization of mWater during the evaluation of the Generation Water Project proved to be highly effective and user-friendly for both quantitative and qualitative data analysis, as well as data extraction and cleaning. The findings from the assessment revealed that the vast majority of respondents encountered no issues when using mWater for these tasks, with only a small percentage encountering minor challenge. The consistently high average ratings, ranging from 4.39 to 4.64, coupled with low standard deviations, highlight the overall success of mWater in facilitating various data-related tasks within the project evaluation. This outcome underscores mWater's suitability as a valuable tool for data management and analysis in similar projects, showcasing its potential to streamline and enhance data-related processes for improved decision-making and project outcomes.

In conclusion, the feedback gathered from participants in the Generation Water Project evaluation regarding the mWater survey and portal has provided valuable insights into its performance and utility. The overwhelming sentiment expressed by respondents was positive, indicating a high level of satisfaction with the system.

The cost-effectiveness and time-saving aspects of mWater were acknowledged by many participants, indicating its potential to streamline operations and reduce project expenses. Additionally, its role in fostering collaboration among teams and stakeholders was seen as a significant benefit, facilitating communication and coordination. Perhaps most importantly, mWater was recognized as an effective tool for project performance monitoring and decision-making. The strong recommendation from nearly two-thirds of the participants underscores the overall favorable impression of mWater's utility in the Generation Water Project evaluation.

The study came up with a number of recommendations.

- Project managers in Rwanda need the best available tools for managing complex, dynamic and time-sensitive water projects. It is therefore recommended that mWater should be customized by each organization, to accurately captivate the ideology, focus, and needs of specific companies, during the implementation process.
- It is recommended that future research should recruit a larger sample and then triangulate the data collection instruments to generate more reliable findings.
- Finally, it is recommended that future research should focus on establishing how mWater improve project management while in actual practice, rather than exclusively relying on the self-reports of company-biased project managers.

Suggestions for Further Studies

Evaluate performance from the client's perspective, that is, evaluate if the impacts of the mWater on project outcomes provide an adequate solution to the client's problem, bring true advantages to the organization in terms of quality of product/services offered, greater output volume, quicker delivery, and provide tangible benefits such as increased sales and revenues.

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