

Effect of Digital Project Management Practices on Project Delivery Success: A Case of Rusumo Cross-Border Market Project in Kirehe District Under Rwanda Transport Development Agency

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Abstract: The study examined the effect of Digital Project Management (DPM) Practices on Project Delivery Success, focusing on the Rusumo Cross-Border Market Project in Kirehe District under the Rwanda Transport Development Agency (RTDA). The study was guided by four objectives: to evaluate the effect of digital planning and scheduling practices on project delivery success; to examine how digital collaboration and communication platforms influence stakeholder coordination and delivery outcomes; to assess the effect of digital risk management practices on project success; and to analyze how digital monitoring and control dashboards affect timeliness, cost management, and overall project delivery success. The study was anchored on the Technology Acceptance Model (TAM), Resource-Based View (RBV), and Stakeholder Theory, which collectively explain technology adoption, organizational capability utilization, and stakeholder engagement in project environments. A mixed methods approach employing descriptive and correlational research designs was adopted. The target population comprised 251 project stakeholders, including project managers, engineers, technicians, supervisors, and traders' representatives. Using the Taro Yamane formula, a sample size of 154 respondents was determined and selected through stratified and purposive sampling techniques. Data were collected using structured questionnaires, structured interviews, and documentary review. Quantitative data were analyzed using descriptive statistics, Pearson correlation, and multiple linear regression analysis with SPSS, while qualitative data were analyzed thematically. The findings revealed that all dimensions of digital project management practices significantly influenced project delivery success. Digital planning and scheduling practices exhibited the strongest relationship with project delivery success ($r = 0.988$, $p < 0.001$; $\beta = 0.848$, $p < 0.001$). Digital collaboration and communication platforms also showed a strong positive effect ($r = 0.925$, $p < 0.001$; $\beta = 3.573$, $p < 0.001$). Digital risk management practices significantly enhanced project success ($r = 0.887$, $p < 0.001$; $\beta = 3.652$, $p < 0.001$), while digital monitoring and control dashboards positively influenced project outcomes ($r = 0.967$, $p < 0.001$; $p = 0.005$). The regression model indicated that DPM practices collectively explained 81.0% of the variation in project delivery success ($R^2 = 0.810$, Adjusted $R^2 = 0.805$, $F = 158.852$, $p < 0.001$). The study concluded that digital project management practices significantly improve project delivery success through enhanced planning efficiency, stakeholder coordination, risk control, real-time monitoring, cost management, quality performance, and timely project completion. The study recommends that RTDA and other infrastructure agencies strengthen investments in digital project management systems, enhance staff digital competencies, institutionalize integrated digital platforms, and promote continuous monitoring and risk analytics to improve the success of future infrastructure and trade-facilitation projects in Rwanda.

Keywords: Digital Project Management, Project Delivery Success, Digital Planning and Scheduling, Digital Collaboration, Digital Risk Management, Monitoring and Control Dashboards, Infrastructure Project Performance.

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I. INTRODUCTION

With the rise of the complexity of projects and the increased appetite for accountability, speed, and efficiency, the global project management landscape has seen a major digital transformation in recent years. Today, advanced digital project management (DPM) practices such as Microsoft Project, Asana, Trello, Jira, and Primavera are pivotal for the planning, execution, monitoring, and evaluation stages. Project management practices also allow teams working on integrated projects to communicate smoothly, allocate resources, and proactively manage risks (PMI, 2020). In Britain's Cross rail Project, for example, 'integrated digital platforms to coordinate over 10,000 suppliers to ensure collaborative working among them and to minimize delays in the delivery of one of Europe's most complex urban infrastructure projects' (HM Government, 2019).

In Asia, the use of digital management solutions has transformed the way mega projects are delivered. Building Information Modelling (BIM) and digital scheduling platforms have been deployed for the Belt and Road Initiative in China to minimize inefficiencies and improve collaboration between actors, whether in multiple different countries or different industries (Zhang et al., 2021). Similarly, with Smart City Projects in India, the implementation of digital dashboards has been successful in streamlining transparency, real-time reporting and public accountability mechanisms. These cases illustrate that digital platforms are not just a means of delivering internal processes, but also a means of securing the trust of stakeholders in massive, public events (Singh & Gupta, 2020).

At the international level, the studies stress that the integration of digital project management practices has transitioned from an option to a necessity for organizations hoping to achieve successful project outcomes. Technologies e.g., Microsoft Project, Primavera, Jira, Asana are increasingly used to simplify processes, increase collaboration among geographically distributed teams, and to enhance the real-time monitoring of KPIs (Alsofiani, 2024; PMI, 2020). The proof that is there is that projects that embrace digital transformation do much better in controlling costs, minimizing delays and enhancing level of satisfaction of stakeholders than projects that only use traditional means. Digital project management practices are now increasingly being considered by stakeholders as an enabler for the successful delivery of projects from different industries. Integrating scheduling software, collaboration platforms, and real-time dashboards enables organizations to limit uncertainty, improve resource utilization, and improve stakeholder coordination. This transition demonstrates that in a more integrated and competitive world, the effective utilization of digital project management practices is a key driver of success or failure for complex projects (Alsofiani, 2024; Zhang et al., 2021).

Digital project management software adoption is evolving in the context of Sub-Saharan Africa where it is being found to contribute to some measurable results where

effective implementation has taken place. In South Africa for instance, the Gautrain Rapid Rail Project used Primavera for scheduling purposes to reduce project delay (Mokoena & Pretorius, 2019). In Nigeria, World Bank-funded Road projects implemented by road developers deployed digital monitoring systems that improved the accuracy of reporting and were also a precursor to implementation delays (Adeoye et al., 2020). Nevertheless, barriers for widespread implementation include limited ICT infrastructure, digital illiteracy and system resistance (Agyekum-Mensah and Knight, 2022). Despite this, one of the main arguments highlighted by scholars increasingly is that digital transformation is necessary to avoid delivery problems such as poor coherence, financial leakages, weak transparency in African projects (Okeke & Awuzie, 2023).

In regional terms, East Africa has had mixed results with digital adoption for project management. For example, the Arusha Namanga Athi River Road Project by Kenya and Tanzania, in association with the use of scheduling practices aligned binational stakeholding and reduced disputes (EAC, 2021). In Uganda, for example, oil infrastructure projects have already started to use digital dashboards to monitor environmental and social protections to improve compliance reporting, according to Katusiimeh (2022). Nonetheless, there remain challenges for many regional projects in the form of gaps in relation to stakeholder involvement and fragmented data systems, and there is significant room for greater unity on digital platforms (Mutinda, 2023). These results indicate that although digital project management practices may be widely appreciated, the region needs to focus on structural challenges of internet access and capacity building to capitalize on their gains. Digitalization is becoming more and more important for projects related to trade and infrastructure in the East African Community (EAC). One such case is Kenya's Lake Turkana Wind Power Project where the use of digital scheduling and resource tracking systems led to timely project completion and enhanced investor confidence.

At a policy level, EAC has established regional strategies to promote ICT integration to support trade facilitation and infrastructure, noting that digitalization is no longer an option but a requirement (EAC Secretariat, 2021). Yet, according to research, EAC projects face implementation problems when collaboration is conducted between multiple governments that possess different capacities (Mutuku, 2022).

While the Rusumo Hydropower Project is in cooperation with Rwanda, Tanzania, and Burundi (as above), the government-initiated project illustrates how political and technical pressures hinder implementation of digital strategies even when they are there which underscores the need for leaders and institutions to embrace digital project management practices in their projects (Mumba et al., 2022). At the national level, Rwanda aims to be a regional ICT hub, utilizing digital practices in sectors in order to realize its Vision 2050, as well as its National Strategy for Transformation (NST1). New forms like the Amplifying

Digital Opportunities in Cross-Border Trade (ADO-CBT) programme developed with ITC, IOM, UNCDF and UNCTAD are targeting smaller traders, including women, youth and persons with disabilities offering them access to digital information and online platforms (UN Rwanda, 2024).

There is hard empirical evidence within Rwanda that digital practices have a strong impact on the results of projects. Mukamihigo & Musoni (2024) indicated that ICT implementation had improved aspects of project performance at the Rusumo Cross-Border Market Project as indicated by findings from the study, however there were gaps in terms of digital skills and infrastructure. Uwineza & Gachiri (2024) also reported that planning practices, communication practices, and risk management platforms proved to have statistically significant effects on project implementation at Rwanda's Business Development Fund.

Ukundwanayo & Rulinda (2024) also showed that project management information systems enhanced outcomes in the New Life Women's Development Project, and they demonstrated that this was mainly through improved information quality and functionality. However, not all cross-border markets in Rwanda are performing well. Facilities such as Rusizi I and Rubavu markets have had low levels of occupancy (sometimes around 15%), attributed to lack of proper planning, poor location and weak management systems, despite significant capex investments. The findings highlight that Rwanda's digital transformation agenda is robust, but adoption of digital project management practices in infrastructure projects has not been universal, and can be under-leveraged (KT Press, 2023; Africa-Press, 2023).

Therefore, this study examines the effect of digital Project Management Practices on Project Delivery Success with a particular focus of Rusumo Cross-Border Market Project in Kirehe District under Rwanda Transport Development Agency. The Rusumo Cross-Border Market Project illustrates strategically how digital project management practices are applied to the delivery success. Though ICT implementation studies (e.g., Mukamihigo & Musoni, 2024) have demonstrated positive effects, little is known about the contribution of DPM practices (such as scheduling, risk management, collaboration platforms and monitoring dashboards). And limited digital skills, uneven infrastructure and management gaps continue to limit their effectiveness, too. This study is intended to contribute to new understanding of this question as it offers a systematic analysis of the role digital project management practices has on project execution performances in Rwanda (based on the Rusumo Cross-Border Market Project).

➤ *Statement of the Problem*

Digital project management (DPM) practices have become an essential component in improving the efficiency, transparency, coordination, and overall success of infrastructure and development projects. Through the use of digital scheduling systems, project monitoring dashboards, communication platforms, risk management applications, and real-time reporting practices, organizations are increasingly able to minimize delays, control project costs, enhance

stakeholder engagement, and improve decision-making processes. Countries that have effectively integrated digital project management systems into public infrastructure projects have reported significant improvements in timely project completion, resource utilization, accountability, and service delivery. Despite these global advancements, many developing countries, particularly in Sub-Saharan Africa, continue to experience major implementation gaps due to limited digital capacity, inadequate technical skills, fragmented systems, resistance to technological change, and weak institutional coordination (Adeoye *et al.*, 2020).

In Rwanda, the Government has strongly prioritized digital transformation as a key pillar for socio-economic development and public sector efficiency under the National Strategy for Transformation (NST2) and the Smart Rwanda Master Plan. Consequently, public institutions and development agencies are increasingly encouraged to adopt digital systems in project planning, implementation, monitoring, and evaluation. Nevertheless, many infrastructure and trade-facilitation projects in Rwanda continue to face recurring challenges such as implementation delays, budget overruns, weak stakeholder coordination, poor communication flow, inadequate monitoring mechanisms, and underutilization of completed facilities. These challenges significantly undermine the expected socio-economic benefits of public investments and limit the country's efforts toward regional trade integration and sustainable development.

The Rusumo Cross-Border Market Project in Kirehe District under the Rwanda Transport Development Agency (RTDA) presents a practical example of these challenges. The project was initiated to facilitate cross-border trade, strengthen regional economic integration between Rwanda and neighboring countries, create employment opportunities, and improve the livelihoods of border communities. Given the strategic importance of the project, effective project delivery was expected through proper planning, coordination, monitoring, and stakeholder engagement supported by digital management systems. However, despite the introduction of some ICT and digital management practices, the project continues to experience several implementation constraints including delays in execution, inadequate coordination among stakeholders, inefficient communication channels, inconsistent resource tracking, and challenges in monitoring project progress. Reports have further indicated that some cross-border market facilities in Rwanda operate below 20% of their intended operational capacity due to weaknesses in planning, management coordination, and operational systems, raising concerns about whether available digital project management practices are being effectively utilized to support successful project delivery (KT Press, 2023).

Several empirical studies have attempted to examine the relationship between digital systems and project performance both in Rwanda and internationally. Mukamihigo and Musoni (2024) established that ICT infrastructure, digital skills, and management support positively influenced project performance in the Rusumo Cross-Border Market Project; however, the study revealed that inadequate utilization of

digital practices and limited digital competencies constrained the effectiveness of ICT integration. Although previous studies provide valuable insights into ICT adoption and project management systems, most of them focused on isolated aspects of digitalization such as communication practices, monitoring systems, or ICT infrastructure without comprehensively examining how integrated digital project management practices collectively influence project delivery success.

Furthermore, limited empirical attention has been given specifically to infrastructure and trade-facilitation projects managed under RTDA, particularly the Rusumo Cross-Border Market Project. Existing studies also inadequately address how digital planning and scheduling practices, collaboration and communication systems, monitoring dashboards, and risk management platforms jointly contribute to key dimensions of project delivery success including timely completion, cost efficiency, quality achievement, and stakeholder satisfaction. Therefore, this study sought to examine the effect of digital project management practices on project delivery success using the case of the Rusumo Cross-Border Market Project in Kirehe District under RTDA. The study intends to provide comprehensive empirical evidence on whether and how digital project management practices contribute to improving project outcomes in Rwanda's infrastructure and trade-facilitation projects. The findings are expected to support policymakers, project managers, RTDA, and other stakeholders in strengthening digital project management frameworks and improving the effectiveness, sustainability, and success of future public infrastructure projects in Rwanda.

➤ *Objectives of the Study*

To examine the impact of Digital Project Management practices on project delivery success, for the Rusumo Cross-Border Market Project in Kirehe District under RTDA. This study aims to achieve the following specific objectives.

- To evaluate the effect of digital planning and scheduling practices on the delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA;
- To examine how digital collaboration and communication platforms influence stakeholder coordination and the delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA;
- To investigate the effect of digital risk management practices on the delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA;
- To analyze how digital monitoring and control dashboards impact timeliness, cost management, and delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA

➤ *Research Hypotheses*

The alternative hypotheses (Ha) were verified and tested in the current study:

- Ha1: Digital planning and scheduling practices have a significant positive effect on the delivery success of

Rusumo Cross-Border Market Project in Kirehe District under RTDA;

- Ha2: Digital collaboration and communication platforms have a significant positive effect on stakeholder coordination and project delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA
- Ha3: Digital risk management practices have a significant positive effect on the delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA;
- Ha4: Digital monitoring and control dashboards have a significant positive effect on timeliness, cost efficiency, and quality performance of Rusumo Cross-Border Market Project in Kirehe District under RTDA.

II. THEORETICAL REVIEW

This study emphasizes four central theories which they are the technology acceptance model (TAM), which describes the factors influencing users' acceptance toward digital practices; the resource-based view (RBV), which puts digital practices on a strategic asset level; contingency theory, stressing about keeping the practices up to date with the project environment; and stakeholder theory which highlights relationships and engagement in attaining that successfully.

➤ *Technology Acceptance Model (TAM)*

The Technology Acceptance Model (TAM), developed by Davis in 1989, is one of the most influential and widely applied theoretical frameworks in information systems research for explaining users' acceptance and use of technology. The model posits that individuals' behavioral intention to adopt a technology is primarily determined by two key beliefs: perceived usefulness and perceived ease of use by Davis in 1989 (Venkatesh & Bala, 2022).

Perceived usefulness refers to the degree to which an individual believes that using a particular system enhanced job performance, efficiency, and productivity (Davis, 1989; Venkatesh & Davis, 2000). In the context of digital project management (DPM), this implies that project stakeholders are more likely to adopt tools such as scheduling software, dashboards, communication platforms, and risk management systems when they believe these tools improve project delivery outcomes, including timeliness, cost efficiency, coordination, and decision-making effectiveness (Värzaru, 2022).

Perceived ease of use refers to the extent to which a user believes that using a particular system will be free of effort and easy to understand and operate (Davis, 1989). In project environments such as infrastructure development projects, ease of use plays a critical role because complex systems without adequate training and support often discourage consistent use among project staff (Mukamihigo & Musoni, 2024).

Therefore, even when digital project management tools are available, their effective utilization largely depends on users' confidence in operating them with minimal difficulty. According to TAM, perceived usefulness and perceived ease

of use jointly influence users' attitude toward technology, which in turn determines their behavioral intention to use it and actual system usage (Venkatesh & Davis, 2000). Empirical studies confirm that when users perceive digital systems as both useful and easy to use, adoption levels increase significantly, leading to improved organizational performance and efficiency (Venkatesh & Bala, 2022).

In the context of project management, TAM has been widely used to explain the adoption of digital tools such as Project Management Information Systems (PMIS), scheduling applications, and collaboration platforms. Studies indicate that perceived usefulness strongly influences project managers' willingness to integrate digital tools into project operations, while perceived ease of use determines the consistency and depth of their utilization (Ukundwanayo & Rulinda, 2024; Uwineza & Gachiri, 2024).

However, TAM has been criticized for focusing mainly on individual perceptions while paying limited attention to organizational and contextual factors such as leadership support, institutional capacity, infrastructure readiness, and policy environment (Venkatesh & Bala, 2022). In public infrastructure projects such as the Rusumo Cross-Border Market Project under the Rwanda Transport Development Agency (RTDA), these external factors significantly influence whether digital project management tools are effectively adopted or underutilized (KT Press, 2023).

In relation to this study, TAM provides a relevant theoretical foundation for understanding the adoption of digital project management practices in the Rusumo Cross-Border Market Project. It explains how project stakeholders' perceptions of usefulness and ease of use influence the adoption and utilization of digital tools such as scheduling systems, communication platforms, risk management applications, and monitoring dashboards, which are expected to enhance project delivery success in terms of time, cost, quality, and stakeholder satisfaction (Davis, 1989; Venkatesh & Bala, 2022). Therefore, TAM is directly applicable to this study as it links user perceptions to technology adoption behavior, thereby helping to explain variations in the effectiveness of digital project management practices and their contribution to project delivery success in Rwanda's infrastructure and trade-facilitation projects under RTDA.

➤ *Resource-Based View (RBV)*

The Resource-Based View (RBV), developed by Barney in 1991, is a strategic management theory that emphasizes internal organizational resources as the primary source of sustained competitive advantage. The theory argues that organizations achieve superior performance when they possess resources and capabilities that are valuable, rare, inimitable, and non-substitutable (VRIN) (Teece, 2023).

In the context of digital project management (DPM), RBV suggests that the effectiveness of digital tools such as project scheduling software, monitoring dashboards, collaboration platforms, and risk management systems depends not only on their availability but also on how well they are integrated into organizational processes and

supported by skilled human resources (Teece, 2023). This means that digital systems alone do not guarantee project success unless they are complemented by competent project teams, strong institutional processes, and effective coordination mechanisms.

RBV further posits that organizations gain long-term performance advantages when they develop and strategically utilize unique combinations of technological, human, and organizational resources. In digital project management environments, this implies that institutions such as RTDA can only achieve improved project delivery outcomes when digital systems are combined with trained personnel, strong governance structures, and efficient project management practices. Recent developments in RBV extend the theory through the concept of dynamic capabilities, which emphasize an organization's ability to integrate, build, and reconfigure internal and external competencies in response to changing environments (Teece, 2023).

This perspective is particularly relevant to infrastructure projects, where project conditions, stakeholder requirements, and technological environments continuously evolve. In such contexts, the ability to adapt digital project management systems, upgrade skills, and improve internal coordination becomes a critical determinant of project success.

From a development perspective, RBV provides an important lens for Rwanda's public sector projects by highlighting that digital literacy, project management competencies, and ICT infrastructure should be considered strategic organizational assets rather than temporary technical tools (Mukamihigo & Musoni, 2024). This is particularly important for projects such as the Rusumo Cross-Border Market Project, where long-term performance depends on sustained institutional capacity rather than one-off technological adoption.

However, RBV has also been criticized for its strong internal focus, often overlooking external environmental factors such as donor requirements, regulatory frameworks, infrastructure limitations, and dependence on external technology providers. In public infrastructure projects, these external constraints significantly influence the effectiveness of digital project management practices and may limit the full exploitation of internal capabilities. Despite these limitations, RBV is highly relevant to the current study as it supports the analysis of how internal organizational resources and capabilities influence the effectiveness of digital project management practices.

➤ *Stakeholder Theory*

Stakeholder Theory, introduced by Freeman in 1984, is a foundational framework in management that emphasizes that organizational success depends on satisfying the needs and expectations of all stakeholders rather than focusing solely on shareholders or funders. Stakeholders typically include clients, project implementers, employees, government agencies, donors, communities, and regulatory bodies who either influence or are affected by project activities (Harrison & Wicks, 2022). In project management,

Stakeholder Theory underscores the importance of identifying, engaging, and managing relationships with all relevant stakeholders throughout the project lifecycle. This involves ensuring continuous communication, participation, and feedback mechanisms to align project objectives with stakeholder expectations (Harrison & Wicks, 2022). In this regard, project success is not only measured by traditional indicators such as cost, time, and quality, but also by the extent to which stakeholder satisfaction, trust, and engagement are achieved.

One of the key strengths of Stakeholder Theory is that it broadens the understanding of project success by incorporating relational, social, and institutional dimensions that are often overlooked in conventional performance measurement frameworks (Freeman, 1984). This perspective is particularly relevant in complex infrastructure and cross-border projects such as the Rusumo Cross-Border Market Project, where multiple actors including government institutions, funding partners, cross-border authorities, and local communities are involved in project design, implementation, and utilization (KT Press, 2023).

Recent developments in Stakeholder Theory have extended its application to digital environments, highlighting how digital technologies can enhance stakeholder engagement, transparency, and accountability (Harrison & Wicks, 2022). Digital project management tools such as dashboards, communication platforms, and reporting systems enable real-time information sharing, improved coordination, and more inclusive participation in decision-making processes. These tools are increasingly recognized as mechanisms that strengthen stakeholder relationships and improve governance in public projects (Harrison & Wicks,

2022; Vărzaru, 2022). However, despite its strengths, Stakeholder Theory also presents several practical challenges.

Identifying relevant stakeholders and prioritizing their often-conflicting interests can be complex, particularly in politically sensitive and multi-actor projects such as cross-border infrastructure developments. In addition, while digital platforms enhance transparency and communication, they do not automatically guarantee meaningful participation, as issues such as unequal access to information, digital literacy gaps, and institutional power imbalances may still limit effective engagement (Mukamihigo & Musoni, 2024).

Furthermore, there are concerns that digital stakeholder engagement tools may sometimes expose sensitive project information or be used in ways that do not fully reflect stakeholder interests, thereby limiting their effectiveness in ensuring inclusive participation (Harrison & Wicks, 2022). This highlights the need for careful design and governance of digital systems to ensure that they support rather than undermine stakeholder trust and collaboration.

➤ Conceptual Framework

This study adopts a conceptual framework that highlights how digital project management (DPM) practices shape the project delivery success. The framework positions DPM practices such as digital planning and scheduling platforms, collaboration and communication systems, digital risk management solutions, monitoring and control dashboards, and fully integrated project management suites as the independent variables, while project delivery success represented by timeliness of completion, budget adherence, quality of deliverables, stakeholder satisfaction, and sustainability of project outcomes as dependent variable.

➤ Independent Variable

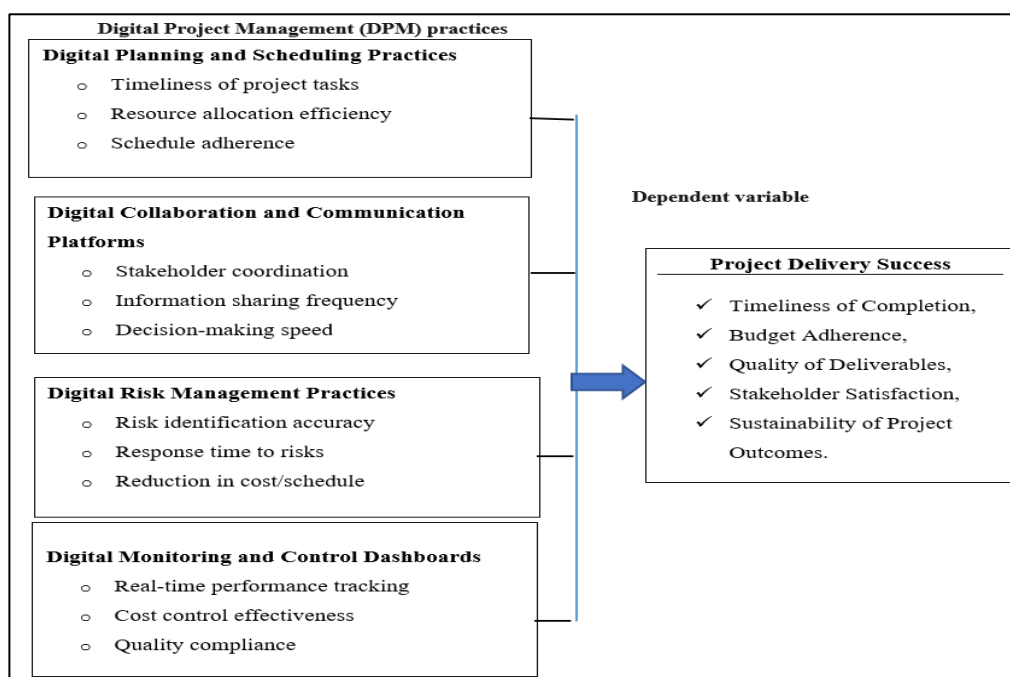


Fig 1 Conceptual Framework
Source: Researcher Conceptualization (2026)

III. METHODOLOGY

The study used mixed quantitative approach, combining descriptive and correlational research designs, in order to comprehensively examine the effect of Digital Project Management (DPM) practices on project delivery success in the Rusumo Cross-Border Market Project under the Rwanda Transport Development Agency (RTDA). The descriptive research design was used to provide a clear and systematic profile of the current status of Digital Project Management (DPM) practices within the project. It enabled the researcher to describe and summarize key characteristics of variables such as digital planning and scheduling tools, collaboration and communication systems, risk management platforms, and monitoring dashboards. Through the use of statistical measures such as frequencies, percentages, means, and standard deviations, the descriptive design helped to present an accurate picture of the extent to which these digital tools are being used in project implementation and how they contribute to project delivery processes. The combination of both descriptive and correlational designs was justified because it allowed the study to move beyond simple description of digital project management practices and further analyze how these practices were associated with project performance outcomes.

➤ Study Population

The target population comprised 251 individuals involved in the management team of the Rusumo Cross-Border Market Project. These individuals played crucial roles in the planning, execution, and oversight of project Digital Project Management (DPM) practices. Their perceptions were vital in assessing the relationship between Digital Project Management (DPM) practices and the project delivery success such as the Rusumo Cross-Border Market Project in enhancing trade facilitation and cross-border commerce in Rwanda.

➤ Sample Size and Sampling Techniques

A sample size calculation was conducted to determine the appropriate number of participants for survey questionnaire and interviews ensuring statistical significance and qualitative richness. In the current study, the researcher applied the formula of Taro Yamane elaborated in 1981 to calculate sample size. The sample size is calculated at 95% confidence level, an Alpha level of 0.05 which is margin of error of $\pm 5\%$; and 0.05 as the standard deviation which shows the variance expectation as responses.

$$n = \frac{N}{1 + N(e)^2}$$

n = Sample Size, **N** = Population

e = Margin of error

$$n = \frac{251}{1 + 251 \cdot (0.05)^2} = 154 \text{ respondents}$$

➤ Sampling Techniques

In the current study, stratified sampling and purposive sampling techniques are employed to ensure a representative and relevant selection of participants from the study population. Stratified sampling was used to categorize the study population into distinct sub-groups based on their roles and expertise in the Rusumo Cross-Border Market Project. This technique ensures that each category, such as project managers, engineers, technicians, and stakeholder is proportionally represented in the sample. Purposive sampling was applied to select key informants with specialized knowledge and direct involvement in project Digital Project Management (DPM) practices. This included high-level decision-makers, such as project managers, operations supervisors, and stakeholder representatives, who possess critical insights into planning, execution, and oversight processes.

➤ Data Collection Instruments

The questionnaires were in primary data collection practices that was used to gather insights from the management teams involved the Rusumo Cross-Border Market Project. This method was suitable for capturing variables such as opinions, perceptions, and experiences, which are essential for understanding the project Digital Project Management (DPM) practices practices on project delivery success in Rwanda. The questionnaire consisted of different sections that included demographic information, effect of digital planning and scheduling practices on the delivery success; how digital collaboration and communication platforms influence stakeholder coordination and project delivery outcomes; the effect of digital risk management practices on the success of the Rusumo Cross-Border Market Project; and how digital monitoring and control dashboards impact timeliness, cost management, and quality performance in the Rusumo Cross-Border Market Project. The questionnaire employed a 5-point Likert scale, ranging from strongly agree to strongly disagree. This scale allowed participants to express the intensity of their opinions. For instance, strongly agree indicates extremely positive responses, while strongly disagree represents very weak agreement with the statements provided.

➤ Data Analysis Methods

Quantitative data from the questionnaires were coded and entered into Statistical Package for the Social Sciences (SPSS) software for analysis. The following statistical analysis methods were applied: Descriptive Statistics measures such as frequencies, percentages, means, and standard deviations were used to summarize the characteristics of respondents and key study variables.

Mean In this study, the mean was used as a key statistical measure to evaluate the central tendency of responses collected from the survey. The mean helped in summarizing participants' perceptions and experiences regarding Digital Project Management (DPM) practices and the projects delivery success of Rusumo Cross-Border Market Project in enhancing trade facilitation and cross-border commerce.

The standard deviation (SD) is a key statistical measure that was used in this study to assess the variability and dispersion of responses collected from the survey questionnaire. A low standard deviation indicated that responses are clustered closely around the mean, suggesting a high level of agreement among respondents. A high standard deviation suggested greater variability in responses, indicating differing opinions among respondents. Standard deviation helped assess the reliability of responses in Likert-scale data. If the SD was low, it implied that most respondents provided similar answers, reinforcing the consistency of the data. If SD is high, it indicated diverse perspectives, necessitating further investigation into factors influencing these variations. The standard deviation was used to compare variations in responses between different respondent categories, such as project managers, engineers, and farmers' representatives.

➤ Correlation Analysis

Correlation analysis measured the strength and direction of the relationship between Digital Project Management (DPM) practices and projects delivery success of Rusumo Cross-Border Market Project in enhancing trade facilitation and cross-border commerce in Rwanda. The correlation coefficient (ranging from -1 to +1) indicated whether there is a positive or negative relationship between these variables, as well as how strongly they were related. Statistical correlation is measured by what is called coefficient of correlation (r). It's numerical value ranges from +1.0 to -1.0. The $r > 0$ indicates positive relationship, $r < 0$ indicates negative relationship while $r = 0$ indicates no relationship (or that the variables are independent and not related). The $r = +1.0$ describes a perfect positive correlation and $r = -1.0$ describes a perfect negative correlation. Closer the coefficients are to +1.0 and -1.0, greater is the strength of the relationship between the variables.

➤ Multiple Linear Regression

Multiple linear regression analysis was employed to assess how much variation in Digital Project Management

(DPM) practices is (X) represented by digital planning and scheduling practices; digital collaboration and communication platforms; digital risk management practices; digital monitoring and control dashboards; and integrated digital project management systems. Y is dependent variable which is project delivery success. This was adopted to show relationships using equation econometric models as formulated where $y=f(x)$; $Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \varepsilon$;

- x_1 : digital planning and scheduling practices;
- x_2 : digital collaboration and communication platforms;
- x_3 : digital risk management practices;
- x_4 : digital monitoring and control dashboards;
- β_0 : is the y-intercept; β_1 - β_4 : are the slopes of the line; ε : is an error term

IV. DATA ANALYSIS, PRESENTATION, AND INTERPRETATION OF FINDINGS

Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the data, while correlation and regression analyses were employed to examine the relationships between digital project management practices and project delivery success. The analysis focused on four key areas such as digital planning and scheduling, digital collaboration and communication, digital risk management, and digital monitoring and control dashboards.

➤ Socio-Demographic Information of Respondents

In this study, the demographic profile of respondents was analyzed to determine whether participants possessed adequate educational qualifications and practical experience related to development and market infrastructure projects, thereby enhancing the credibility of the findings.

Table 1 Distribution of Respondents by Level of Education

Level of Education	Frequency (N)	Percent (%)	Cumulative Percent (%)
Diploma/Certificate	108	70.1	70.1
Bachelor's Degree	44	28.6	98.7
Master's Degree and Above	2	1.3	100.0
Total	154	100.0	

Source: Primary Data (2026)

The findings indicate that the majority of respondents, representing 108 participants (70.1%), possessed a Diploma or Certificate qualification. This was followed by 44

respondents (28.6%) who held a Bachelor's Degree, while only 2 respondents (1.3%) had attained a Master's Degree or higher qualification.

Table 2 Work Experience in Development or Market Infrastructure Projects

Work Experience	Frequency (N)	Percent (%)	Cumulative Percent (%)
Less than 2 Years	8	5.2	5.2
2-3 Years	49	31.8	37.0
4-5 Years	50	32.5	69.5
5 Years and Above	47	30.5	100.0
Total	154	100.0	

Source: Primary Data (2026)

The results reveal that 50 respondents (32.5%) had 4–5 years of experience, representing the largest proportion of participants in the study. This was closely followed by 49 respondents (31.8%) who had 2-3 years of experience, while 47 respondents (30.5%) reported having more than 5 years of experience. Only 8 respondents (5.2%) had less than two years of experience in development or market infrastructure projects. The findings indicate that the majority of respondents possessed substantial professional experience, with 94.8% having at least two years of involvement in development or market infrastructure initiatives.

➤ Descriptive Analysis of Study Variables

The analysis is based on mean scores and standard deviations, which were used to assess the level of agreement

and consistency of responses. The findings are presented according to the specific objectives of the study to provide a clear understanding of the contribution of each digital practice to project delivery success.

➤ Effect of Digital Planning and Scheduling Practices on the Delivery Success of the Rusumo Cross-Border Market Project,

This objective sought to assess respondents' perceptions regarding the contribution of digital planning and scheduling practices to the delivery success of the Rusumo Cross-Border Market Project.

Table 3 Descriptive Statistics on Digital Planning and Scheduling Practices

Statement	N	Mean	Std. Deviation
Digital planning practices have helped the project complete tasks on time	154	4.5974	0.63162
Scheduling platforms improved resource allocation efficiency	154	4.5974	0.56614
Real-time planning reduced unnecessary project delays	154	4.7470	0.47910
Scenario simulations ("what-if" planning) anticipated risks early	154	4.7597	0.51202
Planning software increased milestone achievement rates	154	4.6104	0.59751
Digital scheduling improved coordination among project teams	154	4.6299	0.63608
Overall Average (Grand Mean)	154	4.6570	0.5704

Source: Primary Data (2026)

The findings reveal that respondents strongly agreed that digital planning and scheduling practices significantly contribute to the successful delivery of the Rusumo Cross-Border Market Project, as demonstrated by the high overall average mean score of 4.6570 and a relatively low average standard deviation of 0.5704.

Among the assessed indicators, the statement that scenario simulations ("what-if" planning) anticipated risks early received the highest rating with a mean score of 4.7597 and a standard deviation of 0.51202. Similarly, real-time planning reducing unnecessary project delays recorded a mean score of 4.7470 and a standard deviation of 0.47910, indicating that respondents perceived digital planning systems as instrumental in improving project responsiveness and reducing implementation delays. The findings further show that digital scheduling improved coordination among project teams (Mean = 4.6299, SD

= 0.63608), while planning software increased milestone achievement rates (Mean = 4.6104, SD = 0.59751). In addition, respondents agreed that digital planning practices helped the project complete tasks on time (Mean = 4.5974, SD = 0.63162) and that scheduling platforms improved resource allocation efficiency (Mean = 4.5974, SD = 0.56614). The overall findings imply that the integration of digital planning and scheduling technologies has played a crucial role in enhancing project performance at the Rusumo Cross-Border Market Project.

➤ Influence of Digital Collaboration and Communication Platforms on Stakeholder Coordination and Delivery Outcomes,

This objective sought to examine the extent to which digital collaboration and communication platforms influence stakeholder coordination and overall delivery outcomes of the Rusumo Cross-Border Market Project.

Table 4 Descriptive Statistics on Digital Collaboration and Communication Platforms

Statement	N	Mean	Std. Deviation
Collaboration platforms enhanced coordination among stakeholders	154	4.8442	0.36389
Real-time messaging reduced information gaps	154	4.7597	0.45812
Shared platforms sped up task approvals and decision-making	154	4.8117	0.39224
Document-sharing practices improved project transparency	154	4.8247	0.38149
Virtual collaboration improved work with external stakeholders	154	4.7403	0.48244
Collaboration practices increased stakeholder satisfaction	154	4.7403	0.53389
Overall Average (Grand Mean)	154	4.7868	0.4353

Source: Primary Data (2026)

The findings demonstrate a remarkably high level of agreement among respondents regarding the contribution of digital collaboration and communication platforms to

stakeholder coordination and project delivery outcomes. This is evidenced by the overall average mean score of 4.7868 and a relatively low average standard deviation of 0.4353,

indicating strong positive perceptions and a high degree of consistency among respondents.

The highest-rated statement was that collaboration platforms enhanced coordination among stakeholders, which achieved a mean score of 4.8442 and a standard deviation of 0.36389.

Similarly, respondents strongly agreed that document-sharing practices improved project transparency (Mean = 4.8247, SD = 0.38149) and that shared platforms sped up task approvals and decision-making (Mean = 4.8117, SD = 0.39224). The study further revealed that real-time messaging reduced information gaps (Mean = 4.7597, SD = 0.45812), while virtual collaboration improved work with

external stakeholders (Mean = 4.7403, SD = 0.48244) and collaboration practices increased stakeholder satisfaction (Mean = 4.7403, SD = 0.53389).

➤ *Effect of Digital Risk Management Practices on the Success of the Rusumo Cross-Border Market Project,*

Risk management is a fundamental aspect of project management that enables organizations to identify, assess, monitor, and respond to uncertainties that may affect project performance. With the advancement of digital technologies, project managers increasingly rely on digital risk management tools to enhance risk identification, improve assessment accuracy, support timely responses, and strengthen project resilience.

Table 5 Descriptive Statistics on Digital Risk Management Practices

Statement	N	Mean	Std. Deviation
Digital practices improved early risk identification	154	4.6169	0.55067
Automated analysis enhanced risk assessment accuracy	154	4.8442	0.36389
Risk dashboards reduced response time to threats	154	4.7273	0.51478
Risk systems minimized cost and schedule overruns	154	4.7857	0.41166
Risk classification practices supported better resource allocation	154	4.7403	0.48244
Risk platforms improved project resilience and sustainability	154	4.7468	0.51844
Overall Average (Grand Mean)	154	4.7435	0.4736

Source: Primary Data (2026)

The findings reveal a very high level of agreement among respondents regarding the contribution of digital risk management practices to the success of the Rusumo Cross-Border Market Project. This is evidenced by the overall average mean score of 4.7435 and an average standard deviation of 0.4736, indicating strong positive perceptions and a high degree of consistency among respondents.

Among all the statements assessed, automated analysis enhanced risk assessment accuracy received the highest rating with a mean score of 4.8442 and a standard deviation of 0.36389. The low standard deviation further demonstrates substantial agreement among respondents regarding the effectiveness of automated analytical tools in supporting informed risk management decisions.

The second highest-rated statement was that risk systems minimized cost and schedule overruns (Mean = 4.7857, SD = 0.41166). Furthermore, respondents strongly agreed that risk platforms improved project resilience and

sustainability (Mean = 4.7468, SD = 0.51844), risk classification practices supported better resource allocation (Mean = 4.7403, SD = 0.48244), and risk dashboards reduced response time to threats (Mean = 4.7273, SD = 0.51478).

Additionally, respondents agreed that digital practices improved early risk identification (Mean = 4.6169, SD = 0.55067). Although this statement recorded the lowest mean score among the indicators, the value remains substantially high, indicating strong agreement that digital technologies facilitate proactive risk detection.

➤ *Impact of Digital Monitoring and Control Dashboards on Timeliness, Cost Management, and Quality Performance*

This objective sought to examine the extent to which digital monitoring and control dashboards influence timeliness, cost management, and quality performance in the Rusumo Cross-Border Market Project.

Table 6 Descriptive Statistics on Digital Monitoring and Control Dashboards

Statement	N	Mean	Std. Deviation
Dashboards improved real-time progress tracking	154	4.6299	0.54774
Monitoring practices enhanced financial control	154	4.8312	0.40913
Quality compliance improved through dashboards	154	4.7403	0.48244
Issues were detected and corrected faster using dashboards	154	4.7273	0.52733
Visual dashboards increased stakeholder confidence	154	4.6039	0.62013
Monitoring platforms improved timeliness of completion	154	4.7532	0.47571
Overall Average (Grand Mean)	154	4.7143	0.5104

Source: Primary Data (2026)

The findings indicate that respondents strongly agreed that digital monitoring and control dashboards have a significant positive impact on project performance. This is evidenced by the overall average mean score of 4.7143 and an average standard deviation of 0.5104, reflecting a high level of agreement and consistency among respondents.

Among the indicators assessed, the statement that monitoring practices enhanced financial control received the highest rating, with a mean score of 4.8312 and a standard deviation of 0.40913. The second-highest mean score was recorded for the statement that monitoring platforms improved timeliness of completion (Mean = 4.7532, SD = 0.47571).

Furthermore, respondents strongly agreed that quality compliance improved through dashboards (Mean = 4.7403,

SD = 0.48244) and that issues were detected and corrected faster using dashboards (Mean = 4.7273, SD = 0.52733). The findings also reveal that dashboards improved real-time progress tracking (Mean = 4.6299, SD = 0.54774) and that visual dashboards increased stakeholder confidence (Mean = 4.6039, SD = 0.62013).

➤ *Project Delivery Success of the Rusumo Cross-Border Market Project*

Assessing project delivery success provides valuable insights into the extent to which project outcomes align with planned goals and contribute to sustainable development. Therefore, this section sought to evaluate the level of project delivery success achieved under the implementation of the Rusumo Cross-Border Market Project.

Table 7 Descriptive Statistics on Project Delivery Success

Statement	N	Mean	Std. Deviation
The project was completed within the planned time schedule,	154	4.6299	0.54774
The project was completed within the approved budget	154	4.7078	0.45626
The project deliverables meet required quality standards	154	4.6818	0.55665
Stakeholders are satisfied with the project outcomes	154	4.7597	0.42864
The project outcomes are sustainable in the long term	154	4.7143	0.46743
Overall, project delivery success has been achieved effectively under RTDA implementation	154	4.6039	0.52914
Overall Average (Grand Mean)	154	4.6829	0.4976

Source: Primary Data (2026)

The findings indicate that respondents strongly agreed that the Rusumo Cross-Border Market Project achieved a high level of delivery success under the implementation of the Rwanda Transport Development Agency (RTDA). This is demonstrated by the overall average mean score of 4.6829 and an average standard deviation of 0.4976, which reflects a high level of agreement and consistency among respondents.

Among the indicators assessed, the statement that stakeholders are satisfied with the project outcomes recorded the highest mean score of 4.7597 with a standard deviation of 0.42864.

The second-highest mean score was recorded for the statement that the project outcomes are sustainable in the long term (Mean = 4.7143, SD = 0.46743). The findings further reveal that respondents agreed that the project was completed within the approved budget (Mean = 4.7078, SD = 0.45626) and that the project deliverables meet required quality standards (Mean = 4.6818, SD = 0.55665).

Similarly, respondents agreed that the project was completed within the planned time schedule (Mean = 4.6299,

SD = 0.54774), suggesting that implementation activities were effectively managed to avoid significant delays.

Although it recorded the lowest mean score among the indicators, respondents still strongly agreed that overall project delivery success has been achieved effectively under RTDA implementation (Mean = 4.6039, SD = 0.52914).

➤ *Inferential Statistics Analysis Results*

Inferential statistical analysis was conducted to examine the relationship between digital project management practices and project delivery success in the Rusumo Cross-Border Market Project. The analysis involved descriptive statistics, normality testing, correlation analysis, and multiple regression analysis.

➤ *Descriptive Statistics of Project Delivery Success*

Descriptive statistics were computed to summarize the distribution characteristics of the dependent variable, project delivery success. The results provide information regarding the central tendency, dispersion, and distribution pattern of the data.

Table 8 Descriptive Statistics of Project Delivery Success

Table 6 Descriptive Statistics of Project Delivery Success			Statistic	Std. Error
Project Delivery Success	Mean		75.5065	.61254
	95% Confidence Interval for Mean	Lower Bound	74.2964	
		Upper Bound	76.7166	
	5% Trimmed Mean		76.5455	

	Median	80.0000	
	Variance	57.781	
	Std. Deviation	7.60138	
	Minimum	44.00	
	Maximum	80.00	
	Range	36.00	
	Interquartile Range	7.00	
	Skewness	-2.234	.195
	Kurtosis	5.815	.389

Source: Primary Data (2026)

The findings show that project delivery success recorded a mean score of 75.5065 with a standard error of 0.61254, indicating a generally high level of project delivery performance among the respondents. The 95% confidence interval ranging from 74.2964 to 76.7166 suggests that the true population mean is likely to fall within this interval. The median value of 80.0000 is higher than the mean, while the 5% trimmed mean of 76.5455 is close to the mean score, indicating relatively stable data with minimal influence from extreme values. The standard deviation of 7.60138 and variance of 57.781 indicate moderate variability in respondents' perceptions regarding project delivery success.

The distribution further shows a minimum score of 44 and a maximum score of 80, resulting in a range of 36 and an interquartile range of 7, suggesting that most responses were concentrated within a relatively narrow

interval. Regarding the shape of the distribution, the skewness value of -2.234 indicates a negatively skewed distribution, implying that most respondents reported high levels of project delivery success. Additionally, the kurtosis value of 5.815 indicates a leptokurtic distribution characterized by a higher concentration of responses around the mean and heavier tails than a normal distribution. Overall, these findings suggest that respondents generally perceived the Rusumo Cross-Border Market Project as highly successful.

V. NORMALITY TEST RESULTS

Before conducting correlation and regression analysis, a normality test was performed to determine whether the data followed a normal distribution. The Kolmogorov-Smirnov and Shapiro-Wilk tests were used.

Table 9 Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Project Delivery Success	.333	154	.000	.648	154	.000

a. Lilliefors Significance Correction

Source: Primary Data (2026)

The results show that the significance values obtained from both the Kolmogorov-Smirnov test ($p = 0.000$) and the Shapiro-Wilk test ($p = 0.000$) are less than the threshold value of 0.05. According to statistical decision rules, when the significance value is less than 0.05, the null hypothesis of normality is rejected. Therefore, the findings indicate that project delivery success data were not normally distributed. This conclusion is further supported by the skewness and kurtosis values observed in the descriptive statistics analysis. Because the normality assumption was violated, the study

appropriately employed Spearman's Rank Correlation Coefficient, a non-parametric statistical technique that does not require normally distributed data. This approach ensured that the relationship analysis remained statistically reliable and valid.

➤ Correlation Analysis Results

Correlation analysis was conducted to determine the strength and direction of the relationships between digital project management practices and project delivery success.

Table 10 Correlations Coefficient Matrix Results

Statistics of Project Delivery Success			Statistics of Project Delivery Success	Statistics of Project Delivery Success	Statistics of Project Delivery Success	Statistics of Project Delivery Success	Statistics of Project Delivery Success
Spearman's rho	Digital Planning and Scheduling	Correlation Coefficient	1.000				
		Sig. (2-tailed)	.				
		N	154				

	Digital Collaboration and Communication Platforms	Correlation Coefficient	.919**	1.000				
		Sig. (2-tailed)	.000	.				
		N	154	154				
	Digital Risk Management	Correlation Coefficient	.885**	.983**	1.000			
		Sig. (2-tailed)	.000	.000	.			
		N	154	154	154			
	Digital Monitoring and Control Dashboards	Correlation Coefficient	.978**	.899**	.865**	1.000		
		Sig. (2-tailed)	.000	.000	.000	.		
		N	154	154	154	154		
	Digital Project Management (DPM) Practices	Correlation Coefficient	.813**	.732**	.702**	.842**	1.000	
		Sig. (2-tailed)	.000	.000	.000	.000	.	
		N	154	154	154	154	154	
	Project Delivery Success	Correlation Coefficient	.988**	.925**	.887**	.967**	.808**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.
		N	154	154	154	154	154	154

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

The results reveal statistically significant positive relationships between all dimensions of digital project management practices and project delivery success at the 0.01 significance level ($p < 0.01$).

The findings indicate that Digital Planning and Scheduling exhibited the strongest positive relationship with project delivery success ($r = 0.988$, $p = 0.000$).

Similarly, Digital Monitoring and Control Dashboards demonstrated a very strong positive relationship with project delivery success ($r = 0.967$, $p = 0.000$).

The findings further reveal that Digital Collaboration and Communication Platforms were strongly and positively associated with project delivery success ($r = 0.925$, $p = 0.000$), indicating that effective digital communication enhances

stakeholder coordination and project outcomes. Likewise, Digital Risk Management showed a strong positive relationship with project delivery success ($r = 0.887$, $p = 0.000$), suggesting that effective digital risk identification, assessment, and mitigation practices improve project performance. The aggregate variable, Digital Project Management Practices, also recorded a strong positive correlation with project delivery success ($r = 0.808$, $p = 0.000$).

➤ Regression Analysis Results

Multiple regression analysis was conducted to determine the combined effect of digital planning and scheduling, digital collaboration and communication platforms, digital risk management, and digital monitoring and control dashboards on project delivery success.

Table 11 Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. Change	
1	.900 ^a	.810	.805	3.35713	.810	158.852	4	149	.000	1.857
a. Predictors: (Constant), Digital Monitoring and Control Dashboards, Digital Risk Management, Digital Planning and Scheduling, Digital Collaboration and Communication Platforms										
b. Dependent Variable: Project Delivery Success										

The results indicate a strong relationship between the predictor variables and project delivery success, as evidenced by a correlation coefficient ($R = 0.900$). The coefficient of determination ($R^2 = 0.810$) indicates that 81.0% of the variation in project delivery success is explained by digital planning and scheduling, digital collaboration and

communication platforms, digital risk management, and digital monitoring and control dashboards. The remaining 19.0% of the variation is attributable to other factors not included in the model.

The adjusted R^2 value of 0.805 further confirms that the model possesses strong explanatory power. Additionally, the Durbin-Watson statistic of 1.857 falls within the acceptable range of 1.5 to 2.5, indicating the absence of serious autocorrelation problems in the regression model.

These findings suggest that digital project management practices collectively explain a substantial proportion of project delivery success.

➤ *Analysis of Variance (ANOVA)*

ANOVA was performed to determine whether the regression model significantly predicts project delivery success.

Table 12 ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7161.220	4	1790.305	158.852	.000 ^b
	Residual	1679.274	149	11.270		
	Total	8840.494	153			
a. Dependent Variable: Project Delivery Success						
b. Predictors: (Constant), Digital Monitoring and Control Dashboards, Digital Risk Management, Digital Planning and Scheduling, Digital Collaboration and Communication Platforms						

The ANOVA results reveal that the regression model is statistically significant ($F = 158.852$, $p = 0.000$). Since the significance value is less than 0.05, the null hypothesis that

the independent variables have no influence on project delivery success is rejected.

Table 13 Regression Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.340	3.428		4.475	.000
	Digital Planning and Scheduling	3.561	.332	.848	10.723	.000
	Digital Collaboration and Communication Platforms	17.790	2.857	3.573	6.227	.000
	Digital Risk Management	18.145	2.686	3.652	6.756	.000
	Digital Monitoring and Control Dashboards	.008	.036	.009	.235	.005
a. Dependent Variable: Project Delivery Success1						

The results indicate that Digital Planning and Scheduling Practices had a positive and statistically significant effect on Project Delivery Success ($\beta = 0.848$, $B = 3.561$, $t = 10.723$, $p = 0.000$). This implies that a one-unit improvement in digital planning and scheduling practices would increase project delivery success by approximately 3.561 units, holding other factors constant. The high standardized beta coefficient further suggests that digital planning and scheduling was one of the strongest predictors of project delivery success. This finding demonstrates the importance of utilizing digital scheduling tools, resource allocation systems, and project planning software in enhancing project performance through improved adherence to schedules and efficient resource utilization.

Similarly, Digital Collaboration and Communication Platforms were found to have a positive and statistically significant influence on Project Delivery Success ($\beta = 3.573$, $B = 17.790$, $t = 6.227$, $p = 0.000$). The results suggest that improvements in digital communication and collaboration systems substantially enhance project outcomes. Effective digital communication platforms facilitate real-time information sharing, stakeholder engagement, faster decision-making, and improved coordination among project participants, thereby contributing significantly to project success.

The findings further reveal that Digital Risk Management Practices had a strong positive and statistically significant effect on Project Delivery Success ($\beta = 3.652$, $B = 18.145$, $t = 6.756$, $p = 0.000$). This indicates that strengthening digital risk identification, assessment, monitoring, and response mechanisms leads to considerable improvements in project performance. The positive coefficient suggests that projects that effectively utilize digital risk management tools are better positioned to anticipate uncertainties, minimize disruptions, control costs, and maintain project schedules, ultimately increasing the likelihood of successful project delivery.

In addition, Digital Monitoring and Control Dashboards exhibited a positive and statistically significant relationship with Project Delivery Success ($\beta = 0.009$, $B = 0.008$, $t = 0.235$, $p = 0.005$). Although the magnitude of the coefficient was relatively small compared to the other predictors, the positive coefficient indicates that digital monitoring systems contribute to project success by providing real-time performance tracking, facilitating timely corrective actions, and improving project oversight. These dashboards enhance project visibility and support informed managerial decision-making throughout the project lifecycle.

Comparatively, Digital Risk Management Practices emerged as the strongest predictor of Project Delivery Success based on the highest standardized beta coefficient ($\beta = 3.652$), closely followed by Digital Collaboration and Communication Platforms ($\beta = 3.573$). This suggests that effective management of project risks and efficient stakeholder communication play the most critical roles in determining project success within the Rusumo Cross-Border Market Project. Digital Planning and Scheduling Practices also demonstrated a substantial contribution, while Digital Monitoring and Control Dashboards provided supplementary support in enhancing project performance.

Overall, the regression results indicate that all four dimensions of Digital Project Management practices significantly contribute to Project Delivery Success. The

findings imply that increased adoption and utilization of digital planning and scheduling systems, communication and collaboration platforms, risk management tools, and monitoring dashboards collectively enhance project timeliness, cost efficiency, quality of deliverables, stakeholder satisfaction, and sustainability of project outcomes. Therefore, the study concludes that Digital Project Management practices are important determinants of successful project delivery within infrastructure development projects.

➤ Hypothesis Testing and Decision

The hypotheses were tested using the significance level of 5% ($p < 0.05$). The decision rule was that the alternative hypothesis (H_a) is accepted when the regression coefficient is positive and statistically significant ($p\text{-value} < 0.05$); otherwise, it is rejected.

Table 13 Hypothesis Testing and Decision

Hypothesis	Statistical Evidence	Test Result	Decision
Ha ₁ : Digital planning and scheduling practices have a significant positive effect on the delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA.	Correlation results showed a very strong positive relationship between Digital Planning and Scheduling and Project Delivery Success ($r = 0.988$, $p = 0.000$). Regression results indicated a positive and significant effect ($B = 3.561$, $\beta = 0.848$, $t = 10.723$, $p = 0.000$).	Since $p\text{-value} (0.000) < 0.05$ and the regression coefficient was positive, digital planning and scheduling significantly influenced project delivery success.	Ha ₁ was accepted. Digital planning and scheduling practices significantly improved project delivery success through enhanced activity sequencing, resource allocation, milestone tracking, and schedule adherence.
Ha ₂ : Digital collaboration and communication platforms have a significant positive effect on stakeholder coordination and project delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA.	Correlation analysis revealed a strong positive relationship between Digital Collaboration and Communication Platforms and Project Delivery Success ($r = 0.925$, $p = 0.000$). Regression analysis showed a positive significant effect ($B = 17.790$, $\beta = 3.573$, $t = 6.227$, $p = 0.000$).	The $p\text{-value}$ was below 0.05, indicating a statistically significant positive influence of digital collaboration platforms on project delivery success.	Ha ₂ was accepted. Digital collaboration and communication platforms significantly enhanced stakeholder coordination, information sharing, decision-making, and overall project implementation effectiveness.
Ha ₃ : Digital risk management practices have a significant positive effect on the delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA.	The correlation results showed a strong positive relationship between Digital Risk Management and Project Delivery Success ($r = 0.887$, $p = 0.000$). Regression results indicated a significant positive effect ($B = 18.145$, $\beta = 3.652$, $t = 6.756$, $p = 0.000$).	Since $p\text{-value} (0.000)$ was less than 0.05, the effect was statistically significant.	Ha ₃ was accepted. Digital risk management practices significantly contributed to project success by improving risk identification, mitigation, uncertainty control, and prevention of project delays and cost overruns.
Ha ₄ : Digital monitoring and control dashboards have a significant positive effect on timeliness, cost efficiency, and quality performance of Rusumo Cross-Border Market Project in Kirehe District under RTDA.	Correlation analysis indicated a very strong positive relationship between Digital Monitoring and Control Dashboards and Project Delivery Success ($r = 0.967$, $p = 0.000$). Regression results showed a positive and statistically significant effect ($B = 0.008$, $\beta = 0.009$, $t = 0.235$, $p = 0.005$).	The significance value (0.005) was below 0.05, confirming a significant positive effect.	Ha ₄ was accepted. Digital monitoring and control dashboards significantly supported project timeliness, cost monitoring, quality assurance, and timely corrective decision-making.

➤ Hypothesis One (Ha₁)

Ha₁: Digital planning and scheduling practices have a significant positive effect on the delivery success of Rusumo Cross-Border Market Project in Kirehe District under RTDA. Correlation results showed a very strong positive relationship

between Digital Planning and Scheduling and Project Delivery Success ($r = 0.988$, $p = 0.000$). Regression results indicated a positive and significant effect ($B = 3.561$, $\beta = 0.848$, $t = 10.723$, $p = 0.000$). Since $p\text{-value} (0.000) < 0.05$

and the regression coefficient was positive, digital planning and scheduling significantly influenced project delivery success. H_{a1} was accepted. Digital planning and scheduling practices significantly improved project delivery success through enhanced activity sequencing, resource allocation, milestone tracking, and schedule adherence.

➤ *Hypothesis Three (H_{a3})*

The third hypothesis stated that Digital Risk Management Practices have a significant positive effect on the delivery success of the Rusumo Cross-Border Market Project in Kirehe District under RTDA. The results revealed a positive coefficient ($\beta = 3.652$), a t-value of 6.756, and a p-value of 0.000. Since the significance value was lower than 0.05, the study found a statistically significant positive relationship between Digital Risk Management Practices and Project Delivery Success. Therefore, H_{a3} was accepted. This indicates that effective digital risk identification, assessment, monitoring, and mitigation practices enhance project performance by reducing uncertainties, minimizing delays, and controlling project costs.

➤ *Hypothesis Four (H_{a4})*

The fourth hypothesis stated that Digital Monitoring and Control Dashboards have a significant positive effect on timeliness, cost efficiency, and quality performance of the Rusumo Cross-Border Market Project in Kirehe District under RTDA. The findings indicated a positive coefficient ($\beta = 0.009$), a t-value of 0.235, and a p-value of 0.005, which is below the threshold of 0.05. This demonstrates that Digital Monitoring and Control Dashboards significantly contribute to Project Delivery Success. Accordingly, H_{a4} was accepted. The results suggest that real-time monitoring systems and digital dashboards enhance project visibility, support performance tracking, facilitate timely corrective actions, and improve managerial decision-making, leading to better project outcomes.

➤ *Overall Hypotheses Verification*

The multiple regression results confirmed that all four digital project management practices had statistically significant positive effects on project delivery success. The overall regression model was significant ($F = 158.852$, $p = 0.000$) and explained 81.0% of the variation in project delivery success ($R^2 = 0.810$; Adjusted $R^2 = 0.805$). Therefore, all alternative hypotheses (H_{a1} , H_{a2} , H_{a3} , and H_{a4}) were accepted. The findings demonstrate that effective adoption of digital planning and scheduling, collaboration platforms, digital risk management systems, and monitoring dashboards substantially improves project performance outcomes in terms of timeliness, cost efficiency, quality delivery, and stakeholder coordination.

VI. CONCLUSION, AND RECOMMENDATIONS

➤ *Conclusion*

Based on the findings of the study, it is concluded that digital project management practices play a significant role in enhancing project delivery success within the Rusumo Cross-Border Market Project. The findings demonstrate that the adoption of digital technologies throughout the project

lifecycle contributes to improved efficiency, effectiveness, transparency, and accountability in project implementation.

The study concludes that digital planning and scheduling practices are critical drivers of project success because they facilitate proactive planning, efficient resource allocation, effective coordination, and timely project completion. The findings further indicate that digital collaboration and communication platforms strengthen stakeholder engagement, improve information sharing, and enhance decision-making processes, thereby contributing positively to project outcomes.

The study also concludes that digital risk management practices improve project resilience through effective risk identification, assessment, and mitigation. These practices enable project teams to anticipate uncertainties and implement appropriate responses before risks adversely affect project performance.

Furthermore, digital monitoring and control dashboards were found to enhance project oversight by providing real-time visibility into project activities, financial performance, and quality compliance. Such technologies support evidence-based decision-making and timely corrective interventions.

Overall, the study concludes that successful project delivery within the Rusumo Cross-Border Market Project was significantly influenced by the adoption and effective utilization of digital project management practices. The strong explanatory power of the regression model confirms that digitalization has become a strategic requirement for improving project delivery performance in contemporary infrastructure development projects.

➤ *Recommendations*

- RTDA should continue investing in advanced digital planning and scheduling systems to improve project coordination, resource allocation, and schedule management.
- Project managers should promote the use of scenario-based planning tools and predictive analytics to strengthen proactive decision-making and risk anticipation.
- RTDA should institutionalize the use of integrated collaboration and communication platforms to improve stakeholder coordination, transparency, and information sharing.
- Project teams should utilize cloud-based communication systems to facilitate real-time collaboration among stakeholders regardless of geographical location.
- Project management teams should strengthen the implementation of automated risk management systems to improve risk identification, assessment, monitoring, and mitigation.
- RTDA should establish centralized digital risk databases to support knowledge sharing and improve organizational learning across infrastructure projects.

- Project managers should regularly update risk dashboards to ensure timely detection and response to emerging project threats.
- RTDA should expand the use of digital monitoring and control dashboards to provide real-time project performance information.
- Project teams should integrate financial monitoring, quality assurance, and progress tracking systems into a unified dashboard framework.
- Management should utilize dashboard-generated reports to support evidence-based decision-making and continuous project improvement.
- The Government of Rwanda should develop policies that encourage the adoption of digital project management technologies across public infrastructure projects.
- Capacity-building programs should be strengthened to improve digital literacy and technical competencies among project managers and project teams.
- Public institutions should allocate adequate resources toward digital infrastructure and technology adoption to maximize project delivery performance.

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