



Project Risk Management Practices and the Success of the Electronic Billing Machine (EBM) Project: A Case of Gasabo District, Rwanda

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Abstract: This study looked at how project risk management practices affect the success of the Electronic Billing Machine (EBM) project in Gasabo District, Rwanda. The EBM system helps the Rwanda Revenue Authority (RRA) follow business sales for Value Added Tax (VAT). Even so, system failures, weak user skills, and taxpayer resistance still hold the project back. The study had four objectives: to find out the effect of risk identification, risk analysis, risk response, and risk monitoring on EBM project success. It used a mixed-methods design in which the quantitative and qualitative data were collected at the same time. From a population of 25,422 people, 378 were selected: 77 RRA staff by census and 301 taxpayers by purposive sampling. Data came from structured questionnaires and 15 key informant interviews. In total, 361 questionnaires were returned, a response rate of 95.5%. The data were analysed with descriptive statistics, Pearson correlation, and multiple regression in SPSS, and the interviews were analysed by theme. All four practices had a positive and significant effect on EBM project success: risk response ($\beta = 0.296, p = 0.000$), risk monitoring ($\beta = 0.271, p = 0.000$), risk analysis ($\beta = 0.238, p = 0.000$), and risk identification ($\beta = 0.214, p = 0.000$). Together, they explained 67.9% of the change in project success ($R^2 = 0.679, F = 189, p < 0.001$). The interviews agreed with these results and showed that taxpayer training, technical support, and contingency plans helped the project most. Some weak points also came out. Taxpayer resistance was not expected early enough, risk analysis used few numerical methods, money and staff for risk response were sometimes short, and risk reports did not always reach decision-makers. The study concludes that good risk management makes the EBM project more successful. It recommends that RRA pay more attention to behavioural risks, use stronger risk analysis tools, fund risk responses properly, and keep monitoring risks throughout the project.

Keywords: Project risk management, Risk identification, Risk analysis, Risk response, Risk monitoring, EBM project success

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1. Introduction

Risk management is now a key part of project management all over the world. It means finding risks, judging them, responding to them, and watching them so that a project can reach its goals (Project Management Institute [PMI], 2021). Good risk management helps organisations reduce uncertainty, avoid failure, control costs, and get better results. Governments and companies now accept that an information system succeeds because

of more than good technology. It also depends on how well risks are handled from the start of the project to the end (Kerzner, 2022).

Many countries have moved their tax systems online. The United States, Canada, Australia, and the United Kingdom use electronic tax systems to improve compliance, raise revenue, and serve citizens better. In these countries, success is closely linked to strong risk governance, clear rules, and good ICT infrastructure, which help them find and reduce risks early. In

developing countries, projects often face system integration failures, cyber threats, stakeholder resistance, budget overruns, and delays, because risk management is weaker or used unevenly (Marnewick et al., 2024). Brazil, India, and Indonesia have used electronic invoicing to make tax more open and to reduce evasion, but their results have been uneven and have depended on how well risks were handled (World Bank, 2021). The African Tax Administration Forum (ATAF, 2022) adds that weak risk identification, poor risk assessment, and weak monitoring often explain why some systems succeed and others struggle.

In Africa, the picture is the same. South Africa's electronic tax filing through the South African Revenue Service has done fairly well, while Kenya, Uganda, Tanzania, and Ghana have had mixed results with electronic invoicing and digital tax systems. Common problems include weak infrastructure, low taxpayer awareness, system failures, and resistance from taxpayers (Mascagni et al., 2021). In East Africa, Kenya's Electronic Tax Invoice Management System (eTIMS) and Uganda's Electronic Fiscal Receipting and Invoicing System (EFRIS) improved VAT monitoring, but both met user resistance and technical breakdowns that affected how well they worked (World Bank, 2021). Taken together, these cases suggest that how risk is managed, more than the technology itself, separates successful digital tax projects from struggling ones.

Rwanda treats digital change as a main pillar of its development plans, including Vision 2050 and the National Strategy for Transformation (NST2). The Rwanda Revenue Authority (RRA) has invested heavily in digital tax systems. The best known is the Electronic Billing Machine (EBM) project, which records business sales in real time for VAT. The EBM system now serves thousands of taxpayers across the country and has made tax records more open and easier to check. Even so, the project has met technical failures, maintenance problems, taxpayer resistance, work interruptions, and low user skills among some business owners. Reports from the Office of the Auditor General and assessments by RRA point to weak system use, uneven compliance, and operational problems in some sectors (Office of the Auditor General of Rwanda [OAG], 2022; RRA, 2024). These are the same kinds of risks that other studies link to project success or failure.

This study focused on the EBM project in Gasabo District, one of the busiest business districts in Rwanda, with a large number of registered businesses and EBM users. It treated project risk management as four practices: risk identification, risk analysis, risk response, and risk monitoring (PMI, 2021). It measured project success through system reliability, user satisfaction, project efficiency, and adoption rate (Kerzner, 2022; Varajão et al., 2022). The idea is simple. If a project team finds and deals with risks early, there will be fewer delays, fewer extra costs, and less resistance from users, so the project is more likely to succeed (Marnewick et

al., 2024). Yet no study has tested how far each of these four practices explains the success of the EBM project in a Rwandan district.

1.1 Problem Statement

The Government of Rwanda has made digital transformation a priority for better public services and stronger domestic revenue. Through RRA, it has introduced several digital tax tools, and the EBM system is one of the most important. EBM was introduced in 2013 to improve VAT compliance, reduce tax evasion, and make business transactions more open. Since then, the number of VAT-registered taxpayers required to use it has grown a lot.

Still, problems continue. The Office of the Auditor General found weaknesses in system use, taxpayer compliance, technical support, and monitoring. Some taxpayers did not issue EBM receipts regularly, and others struggled with poor connectivity (OAG, 2022). RRA annual reports show that VAT revenue has generally risen, but compliance gaps and weak use of digital tax tools remain among some taxpayers, especially small and medium enterprises (RRA, 2024). In Gasabo District, which hosts a large share of Rwanda's registered businesses, taxpayer adoption, technical support, and compliance are still concerns.

Globally, studies suggest that 60% to 70% of information technology projects fail to fully reach their goals because risks are poorly managed (PMI, 2021). Research in developing countries also shows that digital tax projects often face stakeholder resistance, weak user training, system integration problems, technology failures, and poor monitoring (ATAF, 2022; World Bank, 2021). When risks are not found, assessed, answered, and watched, project results suffer.

Studies in Rwanda have mostly looked at taxpayer compliance, revenue collection, and the adoption of digital tax systems such as EBM and e-tax (Campion & Mukamurenzi, 2019; Mascagni et al., 2021). Few have asked how project risk management practices, namely risk identification, risk analysis, risk response, and risk monitoring, affect the success of EBM implementation. This leaves project managers, policymakers, and tax administrators with little evidence on what to improve. This study therefore assessed the effect of project risk management practices on the success of the EBM project in Gasabo District, Rwanda.

1.2 The study was guided by the following objectives

1.2.1 General objective

To assess the effect of project risk management practices on the success of the Electronic Billing Machine (EBM) implementation project in Gasabo District, Rwanda.

1.2.2 Specific objectives

The study set to achieve the following objectives:

1. To examine the effect of risk identification on the success of the EBM implementation project in Gasabo District, Rwanda.
2. To assess the effect of risk analysis on the success of the EBM implementation project in Gasabo District, Rwanda.
3. To determine the effect of risk response on the success of the EBM implementation project in Gasabo District, Rwanda.
4. To establish the effect of risk monitoring on the success of the EBM implementation project in Gasabo District, Rwanda.

1.3 The study tested the following null hypotheses

- i. **H₀₁**: Risk identification has no significant effect on the success of the EBM implementation project in Gasabo District, Rwanda.
- ii. **H₀₂**: Risk analysis has no significant effect on the success of the EBM implementation project in Gasabo District, Rwanda.
- iii. **H₀₃**: Risk response has no significant effect on the success of the EBM implementation project in Gasabo District, Rwanda.
- iv. **H₀₄**: Risk monitoring has no significant effect on the success of the EBM implementation project in Gasabo District, Rwanda.

2. Literature Review

This section covers the conceptual review, theoretical frameworks, and empirical studies linked to the research variables. It also presents the conceptual framework and the research gap that the study addresses.

2.1 Conceptual Review

2.1.1 Risk Identification

Risk identification is the first step of risk management. It means finding events and conditions that could help or hurt the achievement of project goals (PMI, 2021). In information system projects it matters even more, because technical and organisational complexity can lead

to failure, delays, extra costs, and weak results (Marnewick et al., 2024; Todorović et al., 2023). Recent work says risk identification should continue through the whole project, because new risks keep appearing (Makajić-Nikolić et al., 2023). ISO 31000:2018 adds that the project's internal and external setting should be taken into account (International Organization for Standardization [ISO], 2018). In digital tax projects, many risks come from taxpayer behaviour, technology, and weak institutional capacity. ATAF (2022) reported that many digital tax projects in Africa failed because social and behavioural risks were ignored. Mascagni et al. (2021) found that such projects focus on technical risks but are less ready for issues like taxpayer trust, digital skills, and non-compliance. In Rwanda, the Auditor General found procurement delays, technology integration problems, and taxpayer resistance in e-tax and EBM projects (OAG, 2022). This suggests that operational and behavioural risks were not always identified well.

2.1.2 Risk Analysis

Risk analysis means studying the risks already identified by asking how likely each one is and how much damage it could do to project goals (Hopkinson, 2022). It links risk identification to the choice of a response. In information system projects, technical, organisational, and stakeholder risks affect each other, and together they shape time, cost, and success (Bakker et al., 2023). Kutsch and Hall (2022) point out that risk analysis is also a management task, which depends on organisational culture, people's views, and the style of decision-making. Good analysis helps teams focus on high-impact risks (Hopkinson, 2022), and mixing numerical and judgement-based methods usually leads to better decisions (Zwikel & Ahn, 2022). However, many organisations only look at technical risks that are easy to manage and overlook behavioural ones (Kutsch & Hall, 2022). Wadesango and Mhaka (2023) found that public bodies in developing countries often use general risk assessment methods that do not fit local conditions. In Rwanda, the Auditor General reported weak assessment of procurement risks, taxpayer readiness, and system integration in e-tax and EBM projects (OAG, 2022).

2.1.3 Risk Response

Risk response means the actions taken to lower the chance or the effect of risks (Aven, 2023). It is the point where risk management turns into practical action. In information system projects, response planning is very important because technology, organisation, and stakeholder risks all affect time, cost, performance, and user acceptance (Pinto & Slevin, 2022). Four main types of response are used. Avoidance changes the plan to escape a threat. Reduction lowers the chance or effect of a risk through training, pilot tests, or staged rollout. Transfer passes the risk to another party, such as a vendor or an insurer. Acceptance means admitting the risk and

preparing for it when it cannot be reduced (Pinto & Slevin, 2022; Aven, 2023). Projects with planned responses do better than those that depend on crisis handling (Bakker et al., 2023), and responses must stay flexible and be updated over time (Olsson et al., 2023). In African digital tax projects, response plans often focus on technical problems and give too little attention to taxpayer skills, trust, and informal-sector behaviour (ATAF, 2022; Mascagni et al., 2021). In Rwanda, the Auditor General reported missing contingency plans, slow answers to procurement problems, and no staged rollout in e-tax and EBM projects (OAG, 2022).

2.1.4 Risk Monitoring

Risk monitoring is the continuous work of tracking known risks, spotting new ones, and checking whether the chosen responses work, from the start of the project to its end (Kerzner, 2022). Unlike identification and analysis, which happen mostly in the planning stage, monitoring goes on until the project is complete. Its aim is to keep risk within acceptable limits and to act when needed (Marle et al., 2023). Constant monitoring helps organisations catch emerging problems before they cause failure (Kerzner, 2022), and linking it with cost, schedule, and quality control improves performance (Marle et al., 2023). Clear monitoring duties improve accountability (Pinto & Slevin, 2022), and real-time monitoring helps teams act before problems grow instead of after (Sánchez et al., 2023). In Africa, ATAF (2022) found that many digital tax programmes counted outputs, such as taxpayers registered or EBM devices supplied, but did not track compliance, system reliability, or taxpayer satisfaction. In Rwanda, the Auditor General found weak monitoring of system integration, hardware performance, and taxpayer needs in e-tax and EBM programmes (OAG, 2022).

2.1.5 EBM Project Success

Project success is more than finishing on time, within budget, and to scope. It also means that the system reaches its goals and satisfies stakeholders (Varajão et al., 2022). For information system projects, success is often judged by four things: system reliability, user satisfaction, project efficiency, and adoption rate. System reliability is the ability of the system to work steadily and correctly without breaks. For EBM, frequent failures disrupt sales, lower taxpayer trust, and weaken compliance, while reliable systems improve operations and user trust (Jo & Park, 2023; Abdullah et al., 2024). User satisfaction is how far users feel the system meets their needs. It is a main measure of system success because satisfied users use the system well and keep using it (Al-Okaily et al., 2023). Project efficiency is how well objectives are met within the planned time, budget, and resources (Varajão et al., 2022; Loureiro et al., 2024). Adoption rate is how far the intended users accept and use the system after it is launched. A technically sound system cannot reach its goals if users do not use it

(Hii et al., 2023). In this study, EBM project success means a mix of these four measures.

2.2 Theoretical Review

2.2.1 Risk Management Theory

Risk Management Theory goes back to Knight (1921), who separated risks that can be measured from uncertainty that cannot. It was later developed through modern frameworks such as the PMBOK Guide (PMI, 2021) and ISO 31000:2018. The theory says that organisations succeed when they find, analyse, respond to, and monitor the risks that may affect their goals. Risks should not just be avoided but actively managed to reduce threats and make the most of opportunities. Its main strength is that it is practical and gives a clear structure for managing uncertainty in projects. Its limits are that it assumes organisations already have the resources and skills to carry out these steps, and it gives little attention to how users react to technology. The theory is directly linked to this study because the four independent variables come from its core processes.

2.2.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model was developed by Davis (1989) to explain why people accept and use technology. It says two beliefs matter most: perceived usefulness, which is how far people think a system improves their work, and perceived ease of use, which is how far they think the system takes little effort. TAM is simple and has been tested in many settings, including e-government, electronic taxation, and mobile banking. Its weakness is that it looks mainly at individual views and gives limited attention to organisational and project factors, such as risks and technical problems. TAM is relevant here because the success of EBM depends heavily on whether taxpayers accept and use it. Indicators such as user satisfaction and adoption rate are shaped by how useful and easy to use taxpayers find the system.

2.2.3 Systems Theory

Systems Theory was developed by von Bertalanffy (1968). It sees a project or organisation as a system made of connected parts that work together toward shared goals. A change in one part affects the others, so coordination is needed for overall success. The theory's strength is its whole-picture view of people, technology, processes, and resources. Its weakness is that it is broad and abstract, gives little practical guidance on what managers should do, and is hard to measure. It fits this study because the EBM project involves many linked actors, including RRA, taxpayers, technology providers, and government institutions. Good risk management in one part of the project can therefore improve reliability, efficiency, satisfaction, and adoption across the whole system.

2.3 Empirical Review

2.3.1 Risk Identification and EBM Project Success

Marnewick and Langerman (2021) used a quantitative survey and found that systematic risk management improves IT project results because problems are noticed and handled early. However, they studied IT projects in general, not electronic tax systems or Rwanda. Zwikael and Ahn (2011) surveyed project managers across industries and countries and found that effective risk management reduces the harm that risks do to project success, but they did not look at EBM or taxpayer-related risks. In Rwanda, Mukalay and Wabala (2025) studied the Rwanda Urban Development Project using a descriptive and correlational design and SPSS. They found that risk identification had a significant positive effect on project performance ($\beta = 0.249$, $p < 0.001$), although their project was about urban development, not electronic tax. Habimana and Gashema (2025) studied digital tax systems, including EBM, and revenue collection using a mixed-methods approach with 100 taxpayers and practitioners. All the businesses had EBMs, but poor internet, weak training, and technical failures remained. Their study did not look at risk identification as a project management practice. Overall, the studies show that early risk identification matters, but few have tested it for EBM in Rwanda.

2.3.2 Risk Analysis and EBM Project Success

Todorović et al. (2023) studied risk assessment in digital transformation projects using a quantitative approach. They found that involving stakeholders, assessing risk impacts, and considering how risks affect each other were linked to better project results. Their study was not done in Rwanda and did not cover digital tax. Zwikael and Ahn (2011) found that the project setting affects risk levels and that systematic risk management can reduce the negative effects of risk, but they did not test risk likelihood, severity, or interactions in electronic tax projects. In Rwanda, Mukalay and Wabala (2025) found that risk analysis significantly influenced project performance ($\beta = 0.217$, $p = 0.006$), but again in an urban development project. Habimana and Gashema (2025) listed poor connectivity, inadequate training, and technical failures as problems for digital tax systems, but they did not test risk analysis statistically. So the importance of assessing and ranking risks is clear, but evidence for EBM in Rwanda is thin.

2.3.3 Risk Response and EBM Project Success

Zwikael and Ahn (2011) showed that effective risk management practices reduce the harm risks do to project success. Identifying risks is not enough unless the right responses follow, but their study did not look at risk response in electronic tax projects. Todorović et al.

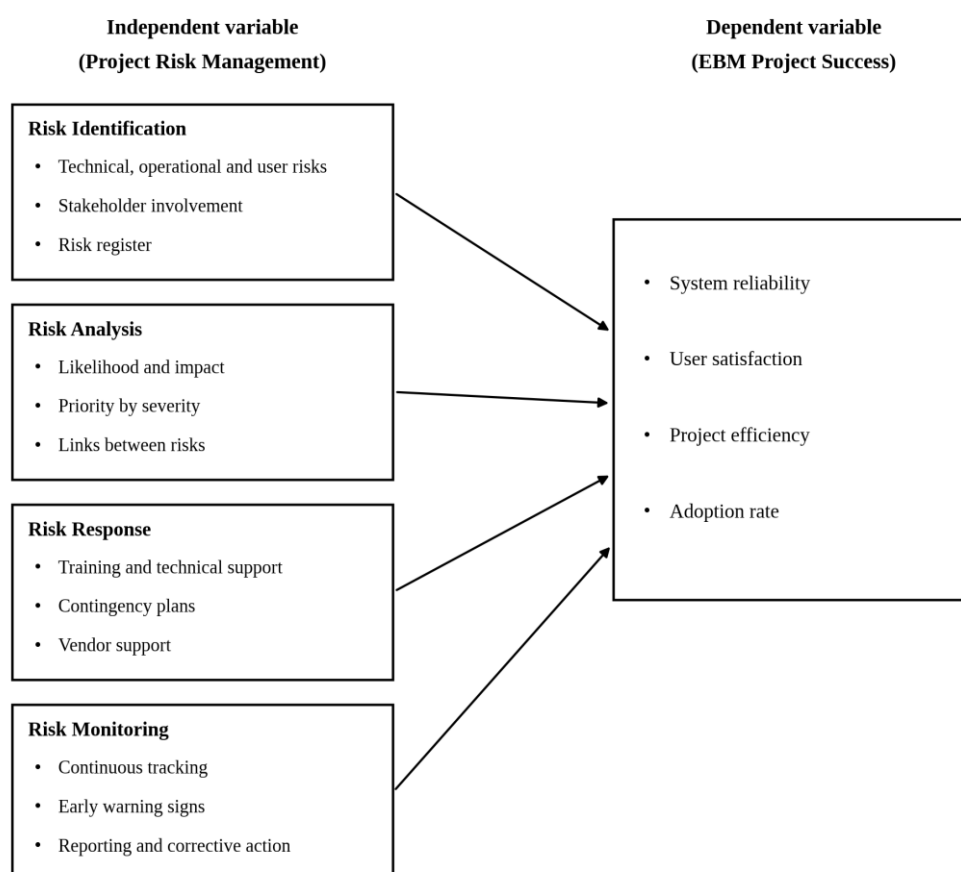
(2023) found that systematic risk assessment and management led to better project results, which shows why responses to linked risks must be well coordinated. They did not study taxpayer training, vendor support, or contingency measures in EBM. In Rwanda, Mukalay and Wabala (2025) found a significant positive effect of risk response planning on project performance ($\beta = 0.272$, $p = 0.002$). Habimana and Gashema (2025) found that weak training and technical failures affected the use of EBM and other digital tax systems, and they recommended professional support and better digital infrastructure. They did not test risk response directly as a driver of project performance. The evidence supports good risk responses but says little about their direct effect on EBM success in Rwanda.

2.3.4 Risk Monitoring and EBM Project Success

Marnewick and Langerman (2021) found that systematic project management practices improve IT project results, and technology projects need continuous watching of technical and operational risks. Zwikael and Ahn (2011) showed that effective risk management reduces the harm of risks, which supports continuous risk management because risks change during a project. Neither study looked at risk monitoring in EBM or in public digital tax systems. In Rwanda, Mukalay and Wabala (2025) found that risk monitoring and control had a significant positive effect on project performance ($\beta = 0.204$, $p = 0.003$). In their study, the four risk practices together explained 74.2% of the change in project performance ($R^2 = 0.742$). Habimana and Gashema (2025) found that EBMs were widely adopted, but poor internet, weak training, and technical failures still limited their use. This shows why technical performance and user problems need constant monitoring, but their study focused on revenue collection, not formal risk monitoring. Overall, the studies value continuous monitoring, but few have linked it to EBM project performance in Rwanda.

2.4 Conceptual Framework

This study is guided by a framework in which project risk management is the independent variable and EBM project success is the dependent variable. Project risk management has four parts: risk identification, risk analysis, risk response, and risk monitoring. The parts are linked. Risks that are identified are analysed for how likely and how serious they are. The results guide the responses. Monitoring then checks whether the responses work and feeds back into the finding of new or changing risks. EBM project success is measured through system reliability, user satisfaction, project efficiency, and adoption rate. The framework draws on Risk Management Theory (Knight, 1921; PMI, 2021) and on the success measures of Varajão et al. (2022) and DeLone and McLean (2003).



Source: Researcher's Conceptualization, 2026

Figure 1: Conceptual Framework

2.5 Research Gap

Several gaps remain in the literature on project risk management and information system success. First, most global studies come from developed economies and focus on private-sector IT or construction projects (Marnewick & Langerman, 2021; Sánchez-Cazorla et al., 2023). Their findings do not fully carry over to tax administration in developing countries, where institutional capacity, taxpayer behaviour, and infrastructure are different. Second, African studies point out problems in digital tax systems, such as poor monitoring, resistance to technology, and weak mitigation (World Bank, 2021; Wadesango & Mhaka, 2023; Marnewick et al., 2024). But most are descriptive or qualitative, and they do not test the statistical link between specific risk practices and project success. Third, evidence in Rwanda rests mainly on audit reports, policy papers, and RRA records (OAG, 2022). These give useful insight into problems but do not model how risk practices affect EBM success, and they use little primary data from users, implementers, and taxpayers. Finally, few studies link risk practices to clear measures of success, such as system reliability, user satisfaction, project efficiency, and adoption rate, in one framework. This study fills these gaps by giving primary, context-

specific evidence from Gasabo District for the period 2018 to 2025.

3. Methodology

3.1 Research Design

The study used an explanatory research design with a mixed-methods approach, specifically the convergent parallel design. The quantitative part tested the links between risk identification, risk analysis, risk response, risk monitoring, and EBM project success using descriptive statistics, correlation, and regression. The qualitative part used interviews with key informants to explain how and why these links exist. In this design, the two kinds of data are collected at the same time, analysed separately, and then brought together (Creswell & Creswell, 2022; Fetter et al., 2023). This gave a fuller and more reliable picture than numbers or interviews alone.

3.2 Population, Samples and Sampling

The target population was 25,422 people. It included RRA staff who work on project planning, risk oversight,

auditing, and decision-making for tax systems, RRA staff in Gasabo District, and taxpayers who use EBM in the district. This mix of insiders and system users helped the study cover different views (Bryman, 2022). The sample size was worked out with Cochran's formula (Cochran, 1977) at a 95% confidence level and a 5% margin of error. The first result was 384, and after correcting for the size of the population, the sample came

to 378 respondents. All 77 RRA and district staff were included by census, because they are few and each one is directly involved in EBM and risk management. The 301 taxpayers were chosen by purposive sampling, so that only taxpayers who use or know the EBM system took part. The study also held interviews with 15 key informants who were involved in the project.

Table 1: Population and Sample

Category	Population	Sample	Sampling technique
Executive Management (RRA Headquarters)	7	7	Census
Planning and Research Department	12	12	Census
Internal Audit Department	3	3	Census
Risk Management Unit	43	43	Census
Tax Collection Staff (Gasabo District)	12	12	Census
Registered Taxpayers using EBM (Gasabo District)	25,345	301	Purposive
Total	25,422	378	

Source: RRA, 2026

3.3 Data Collection Tools

The main tools were a structured questionnaire and an interview guide. The questionnaire had closed questions on a 5-point Likert scale, from Strongly Disagree (1) to Strongly Agree (5). It had three sections: background information, project risk management practices, and EBM success indicators. Interviews with key informants added detail and explained the survey results. Secondary data came from RRA annual reports, the EBM

implementation plan, risk registers, procurement records, and audit reports of the Office of the Auditor General (OAG, 2022). The tools were pre-tested on 33 respondents. The supervisor and pre-test participants checked the questions for clarity and relevance, and unclear or irrelevant items were fixed or dropped. A Content Validity Index of 0.70 or more was treated as acceptable (Amin, 2005; Polit & Beck, 2006). Reliability was tested with Cronbach's alpha, where a value of 0.70 or above is acceptable (Tavakol & Dennick, 2011).

Table 2: Reliability Statistics

Variable	Number of items	Cronbach's Alpha	Interpretation
Risk identification	8	0.842	Good
Risk analysis	8	0.864	Good
Risk response	8	0.851	Good
Risk monitoring	8	0.879	Good
EBM project success	10	0.903	Excellent
Overall instrument	42	0.887	Good

Source: Field data, 2026

The results in table 2 show that all variables had Cronbach's alpha values above 0.80, ranging from 0.842 to 0.903, while the whole instrument scored 0.887. This is well above the 0.70 limit and shows that the questionnaire items were consistent. All items were therefore kept for the analysis.

3.4 Data Collection Procedure

Before the field work, the researcher received ethical approval from the University of Kigali ethical review committee. Questionnaires were then given to the sampled RRA staff and taxpayers, and the key informant interviews were held with selected people involved in the project. Each participant was told the purpose of the study and took part voluntarily. Completed questionnaires and interview notes were checked for

errors and missing answers after each interview session and as soon as questionnaires were returned. The researcher followed up with people who had not returned their questionnaires. The answers were then coded and entered into SPSS, and the interview responses were recorded and organised for thematic analysis.

3.5 Data Analysis

The items for each variable were combined into mean scores. The four risk management practices formed the independent variable, and the four success indicators (system reliability, user satisfaction, project efficiency, and adoption rate) formed the dependent variable. Data were analysed in SPSS. Descriptive statistics (mean and standard deviation) summarised the views of respondents. Normality was checked with skewness and kurtosis. Pearson correlation was used to test the strength and direction of the links between the variables. Multiple linear regression was used to find how far risk identification, risk analysis, risk response, and risk monitoring predict EBM project success. The model was $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$, where Y is EBM project success, and X_1 to X_4 are risk identification, risk analysis, risk response, and risk monitoring. Results were judged at the 5% level of significance ($p < 0.05$). The interviews were analysed by theme, by grouping and interpreting the ideas that came up again and again, to explain the survey results.

3.6 Ethical Concerns

The study followed ethical rules throughout. Every participant gave informed consent after learning the purpose of the study, that taking part was voluntary, and

that they could withdraw at any time. Codes were used instead of names to protect identity (Bryman, 2022). Confidentiality was stressed, especially for RRA staff and taxpayers, because of the sensitive nature of the information they handle. Interviews did not ask questions that could put a business at risk or harm its relationship with clients. Data were stored and disposed of as required by university policy. Paper records were destroyed after the study, and electronic copies were deleted.

4. Results and Discussion

Of the 378 questionnaires given out, 361 were completed and returned, which gives a response rate of 95.5%. The other 17 (4.5%) were not returned. This is far above the 70% level that is seen as good for social science research (Bryman, 2022), so the data are strong enough for analysis. Most respondents were male (61.2%), and 38.8% were female. The largest age group was 26 to 35 years (40.4%), followed by 36 to 45 years (34.3%). Over half held a bachelor's degree (51.8%) and 26.6% held a master's degree. About 65% had worked with EBM for three years or more (34.9% for 3 to 4 years and 30.2% for 5 years or more). These details show that most respondents had enough education and experience to give reliable answers.

4.1 Descriptive Statistics

Table 3 summarises the views of the respondents on each variable. Respondents agreed with the statements on all five variables. Risk response, risk monitoring, and EBM project success had the highest means (4.18), followed by risk identification and risk analysis (4.09).

Table 3: Summary of Descriptive Statistics

Variable	Mean (SD)	Strongest statement (mean)	Weakest statement (mean)
Risk identification	4.09 (0.86)	Infrastructure risks such as internet connectivity were considered (4.22)	Taxpayer resistance was identified in advance (3.94)
Risk analysis	4.09 (0.85)	Risk analysis supported the choice of response strategies (4.21)	Both qualitative and quantitative methods were used (3.91)
Risk response	4.18 (0.76)	Training programmes were used to reduce user-related risks (4.30)	Enough financial and human resources were set aside (4.09)
Risk monitoring	4.18 (0.76)	Monitoring covered technical performance and user adoption (4.25)	Regular risk reports went to decision-makers (4.12)
EBM project success	4.18 (0.75)	EBM improved efficiency in recording and reporting transactions (4.30)	Many eligible taxpayers use EBM daily (4.05)

Source: Field data, 2026

Risk identification. The overall mean was 4.09 (SD = 0.86). The project did well at spotting technical and

infrastructure risks, especially internet connectivity (M = 4.22). Technical, operational, and user risks (M = 4.18)

and the use of a risk register ($M = 4.14$) also scored high. The weakest point was the early identification of taxpayer resistance ($M = 3.94$, $SD = 0.96$), which also had the widest spread of answers. The interviews gave the same message. Key informants said risks were found through planning meetings, stakeholder talks, and technical discussions, but more attention went to technical issues than to whether taxpayers would accept the system. This matters because resistance can hurt adoption, satisfaction, and compliance. The result agrees with Marnewick and Langerman (2021) on the value of systematic risk identification and with Mascagni et al. (2021) on taxpayer behaviour in digital tax systems.

Risk analysis. The overall mean was 4.09 ($SD = 0.85$). The strongest result was that risk analysis helped in choosing response strategies ($M = 4.21$), followed by the assessment of the impact of risks on system performance and tax operations ($M = 4.19$). This shows that analysis was used to guide real decisions and was not just paperwork. The weakest results were the use of both qualitative and quantitative methods ($M = 3.91$, $SD = 0.97$) and the study of how risks affect each other ($M = 3.95$, $SD = 0.93$). Key informants explained that assessments relied mainly on experience, professional judgement, and team discussion, with few numerical models. This is a gap, because EBM risks are linked. For example, poor internet can cause failed transactions, unhappy taxpayers, and lower adoption. These findings fit Todorović et al. (2023), Hopkinson (2022), and PMI (2021), who stress assessing likelihood, impact, and priority.

Risk response. The overall mean was 4.18 ($SD = 0.76$). Training to reduce user-related risks scored highest ($M = 4.30$, $SD = 0.68$), followed by specific strategies for high-priority risks ($M = 4.24$) and regular checks of how well the responses worked ($M = 4.20$). Enough financial and human resources scored lowest ($M = 4.09$, $SD = 0.83$). Interviewees described taxpayer sensitisation, user training, steady technical support, and teamwork with EBM vendors as the main responses. One senior project officer said: "After identifying the major implementation risks, we organized continuous taxpayer training, strengthened our helpdesk services, and worked closely with EBM vendors to resolve technical problems before they affected business operations" (Key Informant 10,

2026). Others added that money and staff were sometimes short. These results agree with Aven (2023) and PMI (2021), who say that planned and timely responses reduce uncertainty and improve results.

Risk monitoring. The overall mean was 4.18 ($SD = 0.76$). Monitoring that covered both technical performance and user adoption scored highest ($M = 4.25$, $SD = 0.70$), followed by continuous monitoring of identified risks ($M = 4.22$). So the team did not only watch the machines; it also watched whether taxpayers were using them. The weakest points were regular risk reports to decision-makers ($M = 4.12$) and the use of monitoring results to update project strategy ($M = 4.14$). Key informants said progress reviews, field visits, technical assessments, and taxpayer feedback were used to find new problems and fix them. Taken together, the project was better at gathering risk information than at passing it on and acting on it at the strategic level. This agrees with PMI (2021) and Aven (2023) on the need for continuous monitoring.

EBM project success. The overall mean was 4.18 ($SD = 0.75$), so respondents saw the project as successful. The best results were better efficiency in recording and reporting transactions ($M = 4.30$), accurate and dependable records ($M = 4.28$), overall success ($M = 4.27$), better tax compliance ($M = 4.24$), and system reliability ($M = 4.21$). The lowest score was for the share of eligible taxpayers who use EBM daily ($M = 4.05$, $SD = 0.84$). Key informants reported better accuracy, openness, and compliance, but they stressed the need for more taxpayer education, awareness, and technical support. So EBM did better on system performance and administrative efficiency than on full and lasting adoption by users.

4.2 Correlation Analysis

Table 4 shows the Pearson correlations between the four risk management practices and EBM project success. Before this analysis, the data were checked for normality. Skewness values ranged from -0.231 to -0.167 and kurtosis values from 0.294 to 0.421 . Both are within the accepted range of -2 to $+2$ (George & Mallery, 2019), so the data were treated as approximately normal.

Table 4: Correlation Matrix

Variable	1	2	3	4	5
1. Risk identification	1				
2. Risk analysis	0.684**	1			
3. Risk response	0.652**	0.721**	1		
4. Risk monitoring	0.638**	0.697**	0.733**	1	
5. EBM project success	0.706**	0.742**	0.759**	0.748**	1

****Correlation is significant at the 0.01 level (2-tailed), N = 361. Source: Field data, 2026**

All four practices had a strong, positive, and significant link with EBM project success at the 1% level. Risk response had the strongest link ($r = 0.759$, $p < 0.01$), followed by risk monitoring ($r = 0.748$, $p < 0.01$), risk analysis ($r = 0.742$, $p < 0.01$), and risk identification ($r = 0.706$, $p < 0.01$). This means that when risk management practices improve, EBM project success tends to improve too. The strong link for risk response suggests that practical actions such as user training, technical support, and contingency measures were important for reaching project goals. The finding supports PMI (2021)

and Aven (2023), who say that projects do better when risks are managed in an organised way through the project life cycle.

4.3 Regression Analysis

Multiple regression was used to find how the four risk management practices together and separately affect EBM project success. The results cover model fit, ANOVA, the coefficients, and the hypothesis tests.

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.824	0.679	0.675	0.412

a. Predictors: (Constant), Risk monitoring, Risk response, Risk analysis, Risk identification. b. Dependent variable: EBM project success. Source: Field data, 2026

Table 5 shows an R value of 0.824, which means a strong overall link between the four practices and EBM project success. The R Square of 0.679 means that risk identification, risk analysis, risk response, and risk monitoring together explain 67.9% of the change in EBM project success. The remaining 32.1% is likely due to other factors such as leadership support, organisational

readiness, infrastructure, and the policy setting. The adjusted R^2 of 0.675 shows that the model stays strong after allowing for the number of predictors. This agrees with Zwikael and Ahn (2022) and Kerzner (2022), who found that structured risk management improves project results.

Table 6: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	85.426	4	21.357	189	.000
Residual	40.233	356	0.113		
Total	125.659	360			

Source: Field data, 2026

Table 6 shows an F value of 189 with a significance level of 0.000. Because this is below 0.05, the model as a whole is significant. The four risk management practices

together have a real effect on EBM project success, and the model fits the data collected in Gasabo District.

Table 7: Coefficients

Predictor variable	Beta (β)	Std. Error	t-value	Sig. (p-value)
(Constant)	0.624	0.186	3.355	.001
Risk identification	0.214	0.052	4.115	.000
Risk analysis	0.238	0.056	4.250	.000
Risk response	0.296	0.059	5.017	.000
Risk monitoring	0.271	0.058	4.672	.000

Source: Field data, 2026

Table 7 shows how much each practice adds to EBM project success. The regression equation is $Y = 0.624 + 0.214X_1 + 0.238X_2 + 0.296X_3 + 0.271X_4 + \epsilon$, where Y is EBM project success, and X_1 to X_4 are risk identification, risk analysis, risk response, and risk monitoring.

Risk response had the strongest positive and significant effect ($\beta = 0.296$, $p = 0.000 < 0.05$). This means that a one-unit improvement in risk response raises EBM project success by 0.296 units, when the other practices are held constant. Actions such as taxpayer training, technical help, vendor teamwork, and contingency planning clearly helped reduce problems. Hillson and Simon (2020) make the same point, that the response stage is where risk management brings its practical benefits. Risk monitoring was the second strongest

predictor ($\beta = 0.271$, $p = 0.000 < 0.05$). Continuous tracking, reporting, and corrective action helped the project stay on course, which agrees with Kerzner (2022). Risk analysis also had a significant effect ($\beta = 0.238$, $p = 0.000 < 0.05$), showing that judging the likelihood and impact of risks helped the team set priorities and use resources well, as Aven (2023) suggests. Risk identification had the smallest effect ($\beta = 0.214$, $p = 0.000 < 0.05$), but it was still significant. Early recognition of risks gave the project a base to build on, which supports PMI (2021), where identification is the starting point of risk management. The ranking is close to that of Mukalay and Wabala (2025) in the Rwanda Urban Development Project, where risk response also had the strongest effect.

Table 8: Hypothesis Testing Results

Null Hypothesis (H0)	p-value	Decision at $\alpha = 0.05$
H01: Risk identification has no significant effect on EBM project success	.000	Rejected H01
H02: Risk analysis has no significant effect on EBM project success	.000	Rejected H02
H03: Risk response has no significant effect on EBM project success	.000	Rejected H03
H04: Risk monitoring has no significant effect on EBM project success	.000	Rejected H04

Source: Field data, 2026

Table 8 shows that all four null hypotheses were rejected because their p-values were below 0.05. Risk identification, risk analysis, risk response, and risk monitoring each have a significant positive effect on the success of the EBM project in Gasabo District. Risk response was the strongest predictor, and risk monitoring came second.

In short, the survey and the interviews tell the same story. Good risk management practices went hand in hand with a more successful EBM project. The interviews also showed where the practices were weaker. Taxpayer resistance was not expected early enough, risk analysis used few numerical methods, resources for risk response were sometimes short, and risk reports did not always lead to strategic changes. These gaps may help explain why daily use by taxpayers, which scored lowest on the success measures, still needs attention.

4.4 Implications of the study

The study has both theoretical and practical implications. In theory, the results support Risk Management Theory (Knight, 1921; PMI, 2021) by showing that all four risk processes matter for project success. They also support the Technology Acceptance Model (Davis, 1989), because the weakest results were linked to taxpayer

acceptance and daily use. They fit Systems Theory (von Bertalanffy, 1968) too, since the practices work together and affect system reliability, user satisfaction, efficiency, and adoption as a whole. In practice, RRA and the EBM project team should put the most effort into risk response and risk monitoring, as these had the strongest effects, while also improving risk identification and risk analysis. For policymakers and tax administrators in Rwanda, the study gives evidence that digital tax projects should include risk management from planning to operation, with special attention to taxpayer behaviour. The model explains 67.9% of project success, so other factors such as leadership support, organisational readiness, infrastructure, and policy should also be looked at. The findings can guide similar digital government projects in Rwanda and beyond.

5. Conclusion and Recommendations

5.2 Conclusion

This study examined the effect of project risk management practices on the success of the Electronic Billing Machine (EBM) project in Gasabo District, Rwanda. The findings show that risk management makes a real difference to project success. Risk identification helped the team expect technical, operational, and

infrastructure problems, although behavioural risks, especially taxpayer resistance, were not expected well enough. Risk analysis helped the team rank risks and choose responses, but it relied mostly on experience and used few numerical methods or studies of how risks affect each other. Risk response was the strongest influence on EBM success, mainly through taxpayer training, technical support, vendor teamwork, and contingency plans, even though money and staff were sometimes short. Risk monitoring was also important, since it covered both technical performance and user adoption, but risk reporting and the use of monitoring results in strategic decisions were weaker. Overall, the study concludes that good risk identification, analysis, response, and monitoring raise the reliability, efficiency, user satisfaction, and adoption of the EBM system. Strengthening them will help EBM and other digital tax projects in Rwanda.

5.2 Recommendations

Based on the findings, the study makes the following recommendations:

1. Strengthen Risk Identification

RRA should widen risk identification to cover human and behavioural risks as well as technical ones. These include taxpayer resistance, low digital skills, and unwillingness to adopt electronic systems. Taxpayers, business representatives, and ICT experts should be involved early in planning so that the risk register reflects the real problems users face. Risk identification should also be repeated at set times during the project, so that new risks are found before they hurt results.

2 Improve Risk Analysis

RRA should combine expert judgement with more structured numerical methods, such as probability-impact matrices, scenario analysis, and risk scoring. Teams should also study how risks affect one another, for example how weak internet leads to failed transactions and lower adoption. Training should be given to project teams so that they can use these tools well and make decisions based on evidence.

3 Keep Strengthening Risk Response

RRA should continue its taxpayer training, technical support, and awareness campaigns, since risk response had the strongest effect on EBM success. It should also set aside enough money and trained staff for risk responses. Cooperation with EBM technology providers should be strengthened so that technical problems are solved quickly, and contingency

plans should be reviewed and updated often to deal with system failures, cyber threats, and new operational challenges.

4 Enhance Risk Monitoring and Reporting

RRA should improve real-time tracking, regular reporting, and taxpayer feedback channels. Clear indicators should be set for system performance, taxpayer adoption, technical problems, and compliance. Risk reports should reach decision-makers and other stakeholders on time, and the results should be used to adjust project plans. Monitoring should also continue after the first rollout, while the system is in daily use.

5 Suggestions for Future Research

Risk management practices explained 67.9% of EBM project success, so future studies should look at other factors, such as organisational readiness, technology infrastructure, leadership support, taxpayer digital skills, and regulation. Researchers could also compare several districts or public institutions, use longitudinal designs to see how risk practices affect long-term sustainability, and use larger samples with mixed methods to give wider insight into digital projects in Rwanda.

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