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Effect of Digital Innovation Project Outputs on Insurance Penetration: A Case of Selected Insurance Companies in Rwanda

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Abstract: *The general objective of this study was to assess the effect of digital innovation projects on insurance penetration of selected insurance companies in Rwanda. The study employed descriptive and correlational research designs. The target population consisted of 344 project implementers of digital innovation project from mobile-based digital project, digital payment project and digital distribution project in selected insurance companies in Rwanda, specifically Prime Insurance, MAYFAIR Insurance, Eden Care, BK Insurance, and Britam Insurance. Stratified and simple random sampling techniques were used to select a representative sample size of 185 determined by Slovin's formula. Questionnaires were used for primary data collection, while the analysis involved descriptive statistics and multiple regression analysis using SPSS Version 29. The regression findings showed that mobile-based digital project outputs had a positive and significant effect on insurance penetration ($\beta = 0.242$, $t = 5.499$, $p = 0.000$), digital payment project outputs had a positive and significant effect on insurance penetration ($\beta = 0.546$, $t = 11.237$, $p = 0.000$), and digital distribution project outputs had a positive and significant effect on insurance penetration ($\beta = 0.187$, $t = 3.931$, $p = 0.000$) among selected insurance companies in Rwanda. The study concluded that digital innovation project outputs play an important role in increasing insurance penetration through improved access, payment convenience, customer engagement, and market reach. It is recommended that insurance companies strengthen integrated digital insurance systems by improving mobile platforms, expanding secure digital payment options, and developing fully transactional digital distribution channels.*

Keywords: Digital Innovation Project Outputs, Mobile-Based Digital Project Outputs, Digital Payment Project Outputs, Digital Distribution Project Outputs, Insurance Penetration

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1. Introduction

The insurance industry has undergone a seismic shift due to the integration of digital technologies, moving from paper-based operations to fully automated ecosystems. The rapid advancement of InsurTech has forced traditional insurers to rethink their business models to remain competitive in a digital-first economy. In Europe, particularly in Germany, the insurance sector has seen a robust integration of Artificial Intelligence and big data analytics to personalize customer experiences. Müller (2022) notes that German insurers have heavily invested in digital platforms that allow for real-time risk assessment and policy customization. The regulatory framework in the European Union, such as GDPR, has also shaped how digital innovation projects are implemented regarding data privacy. These innovations have not only streamlined claims processing but have also increased trust among tech-savvy consumers. Consequently, the penetration rate in Germany has

remained stable and high due to these continuous technological upgrades (Müller, 2022).

Kenya serves as the regional pioneer in mobile financial services, which has directly spilled over into the insurance sector. Mwangi (2021) emphasizes that the success of M-Pesa has created a familiar rail for distributing micro-insurance products to the unbanked. Kenyan innovation projects often focus on agricultural insurance, using satellite data to trigger automatic payouts for farmers. The regulatory environment is highly supportive of mobile-only insurance products. As a result, Kenya maintains one of the highest insurance penetration rates in the region (Mwangi, 2021).

Insurance sector in Rwanda is aligning with the country's vision of becoming a cashless and digital service economy. Kabera (2023) notes that Rwandan insurers are increasingly adopting digital payment gateways to facilitate premium collection and claims settlement. The government's push for Irembo and other digital platforms has set a precedent for the private sector to digitize their offerings. However, despite high mobile phone ownership, the conversion to active insurance policies remains a challenge that requires targeted digital strategies (Kabera, 2023).

Furthermore, recent developments in Rwanda show a collaborative effort between the National Bank of Rwanda (BNR) and private insurers to foster an enabling environment for InsurTech. Uwase (2025) argues that while infrastructure exists, the actual consumer usage of digital insurance channels is still in its nascent stages. Many insurers have launched apps, but user retention and active engagement metrics suggest a gap in value proposition. There is a need to move beyond simple digitization of existing processes to creating truly digital-native products. This context sets the stage for analyzing how specific digital projects influence market penetration (Uwase, 2025).

Insurance penetration in Rwanda remains low despite the country's rapid digital transformation and widespread mobile phone access. According to the National Bank of Rwanda (2024), the insurance penetration rate has hovered below 2% for the past decade, which is significantly lower than the African average. This stagnation occurs even as the country boasts over 80% mobile phone penetration and widespread 4G internet coverage. The disparity between digital infrastructure availability and financial service uptake presents a critical paradox. Consequently, the potential for insurance to act as a safety net for the economy remains largely underutilized (National Bank of Rwanda, 2024).

Traditional insurance delivery methods face several challenges, including limited accessibility, low public awareness, and cumbersome administrative processes, which hinder people from purchasing and maintaining insurance policies. Bizimana (2022) highlights that the reliance on brick-and-mortar branches restricts service delivery to urban centers, leaving rural populations underserved. Furthermore, the paperwork required for onboarding and claims processing is often viewed as bureaucratic and time-consuming. These friction points discourage potential clients who demand immediate and convenient services. As a result, the insurance sector struggles to attract the younger, tech-savvy demographic (Bizimana, 2022).

However, the actual effect of digital innovations on insurance uptake, market penetration, and customer engagement remains unclear. Current industry reports suggest that while app downloads are high, the active usage for purchasing policies is disproportionately low (RURA, 2024). Many users still prefer visiting branches for final transactions, indicating a lack of trust or usability issues in digital channels. There is a disconnect between the deployment of technology and the behavioral change of consumers. This gap raises questions about the efficacy of the current digital strategies employed by insurers (RURA, 2024).

There is limited empirical evidence on whether these initiatives effectively increase adoption and improve awareness among Rwandans. Most existing studies focus on the technical implementation of systems rather than their market impact. Nsengimana (2023) argues that there is a scarcity of data linking specific digital interventions to penetration metrics. Without this evidence, insurers may be investing in technologies that do not address the core barriers to entry. This lack of data hampers strategic decision-making for future innovation projects (Nsengimana, 2023).

Therefore, this study seeks to investigate the effect of digital innovation project outputs on insurance adoption, penetration, and customer experience in Rwanda. Currently, no comprehensive study has combined these variables to provide a holistic view of the insurance landscape in Rwanda. This research aimed to bridge that gap of knowledge by providing empirical data that links digital innovation directly to insurance penetration outcomes.

1.1 General Objective

The general objective of this study was to assess the effect of digital innovation project outputs on insurance penetration of selected insurance companies in Rwanda.

1.2 Specific Objectives

The study had the following specific research objectives:

i. Examine the effect of mobile-based digital project outputs on insurance penetration of selected insurance companies in Rwanda.

ii. Assess the effect of digital payment project outputs on insurance penetration of selected insurance companies in Rwanda.
iii. Assess the effect of digital distribution project outputs on insurance penetration of selected insurance companies in Rwanda.

1.3 Research Hypotheses

The study tested the following null hypotheses to determine the relationship between the variables.

H01: Mobile-based digital project outputs have no significant effect on insurance penetration of selected insurance companies in Rwanda.

H02: Digital payment project outputs have no significant effect on insurance penetration of selected insurance companies in Rwanda.

H03: Digital distribution project outputs have no significant effect on insurance penetration of selected insurance companies in Rwanda.

2. Literature Review

The literature review covers theoretical foundations and empirical studies connected to digital innovation project outputs and insurance penetration. The review addresses mobile-based digital projects, digital payments, and digital distribution channels.

2.1 Theoretical Review

The theories provide analytical lenses for understanding how digital innovation projects influence insurance penetration. Each theory is discussed in relation to its core assumptions, mechanisms, and relevance to the study objectives.

2.1.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model was developed by Fred Davis in 1989 and remains a foundational theory in understanding tech adoption. This model predicts user acceptance of information systems based on perceived usefulness and perceived ease of use. It suggests that users are more likely to adopt new technology if they believe it will enhance their job performance. The theory emphasizes that external variables influence these internal beliefs, which then determine the attitude towards using the system. Over the decades, TAM has been robustly tested and validated across various industries, including finance and healthcare (Jansen, 2023).

In general, TAM posits that Perceived Usefulness is the degree to which a person believes that using a particular system would enhance their performance. Perceived Ease of Use refers to the degree to which a person believes that using a particular system would be free of effort. The model suggests that ease of use directly influences perceived usefulness. If a technology is too complex, users will likely reject it regardless of its potential benefits. This behavioral intention is the strongest predictor of actual system use (Ochieng, 2024).

In the context of this study, TAM was used to analyze how Rwandan customers perceive the usefulness and ease of use of mobile insurance apps. The study applied this theory to understand if the complexity of USSD menus or apps hinders insurance penetration. It helped explain why digital payment projects might be accepted or rejected based on user convenience. The theory guided the assessment of customer attitudes toward digital distribution channels.

2.1.2 Diffusion of Innovation Theory (DOI)

The Diffusion of Innovation Theory was popularized by Everett Rogers in 1962 to explain how, why, and at what rate new ideas spread. Rogers (1962) categorized adopters into innovators, early adopters, early majority, late majority, and laggards. The theory identifies five attributes of an innovation that influence its adoption: relative advantages, compatibility, complexity, trialability, and observability. It suggests that innovations that are perceived as having a relative advantage over current practices are adopted faster. This framework is essential for understanding societal change driven by technology (Schmidt, 2021).

This study used DOI to categorize the Rwandan market based on their readiness to adopt digital insurance. It assessed whether digital insurance projects offer a relative advantage over traditional paper-based insurance. The study examined if the compatibility of digital payments with existing mobile money habits influences penetration. The theory helped explain the speed at which digital innovations are spreading across the insurance sector.

2.1.3 Disruptive Innovation Theory

Disruptive Innovation Theory was introduced by Clayton Christensen in 1997 to explain how smaller companies with fewer resources can challenge established incumbent businesses. Christensen (1997) described how entrants target overlooked segments with more suitable functionality, frequently at a lower price. Incumbents, chasing higher profitability in more demanding segments, tend not to respond vigorously. The entrants then move upmarket, delivering the performance that incumbents' mainstream customers require, while preserving the advantages that drove their early success. eventually displacing the incumbents (Zhang, 2023).

The theory distinguishes between sustaining innovation which improves existing products, and disruptive innovation which creates new markets. Disruptive innovations initially appear inferior to mainstream customers but offer other benefits like simplicity or convenience. Over time, the performance of disruptive innovation improves to meet mainstream standards. This process often catches market leaders off guard, leading to their decline. The theory emphasizes that disruption is a process, not a single event. It explains why successful companies fail to adapt because their business model prevents them from pursuing smaller markets. It highlights the importance of business model innovation alongside technological innovation. It serves as a warning and a guide for established firms in rapidly changing industries (Dubois, 2022).

This study applied Disruptive Innovation Theory to analyze if InsurTech startups are disrupting traditional insurers in Rwanda. It investigated if mobile-based micro-insurance is serving the overlooked segments that traditional insurers ignored. The study assessed if digital distribution projects are lowering costs enough to disrupt the traditional agency model. It helped determine if the current innovations are merely sustaining or truly disruptive to the market structure.

2.2 Empirical Review

This section examines empirical studies related to digital innovation projects and insurance penetration from different geographical contexts. It reviews findings from recent research to identify patterns, methodologies, and outcomes associated with mobile-based, digital payment, and digital distribution initiatives. The review highlights existing evidence and limitations within the literature.

2.2.1 Mobile-Based Digital Project Outputs and Insurance Penetration

Li (2022) conducted a study on the effect of mobile apps on health insurance adoption in China. The objective was to determine if app-based consultations increased policy sales among urban youth. Using a quantitative survey of 500 respondents, the study found a strong positive correlation ($r=0.75$) between app usage frequency and insurance purchase. The findings revealed that integrated health tracking features significantly motivated users to buy coverage. The study concluded that value-added mobile services are essential for increasing penetration in competitive markets. It is recommended that insurers gamify their mobile platforms to enhance engagement.

Gasana (2023) studied the challenges of adopting USSD for life insurance products in Kigali. The objective was to identify technical and behavioral barriers limiting USSD usage. A cross-sectional survey of 200 clients revealed that 45% found USSD menus too complex to navigate for long-term contracts. The finding highlighted that while access is high, usability for complex products is low. The study concluded that USSD is better suited for simple, short-term products rather than comprehensive life insurance. It recommended simplifying product structures for mobile channels.

Umutoni (2025) examined the effect of mobile notification systems on claims transparency and customer trust. The objective was to determine if real-time mobile updates influenced the likelihood of recommending the insurer. Using a correlational design, the study found a significant positive relationship between timely mobile updates and customer retention rates. The key finding was that mobile communication builds the trust necessary for market penetration. The conclusion stated that mobile projects should focus on post-purchase communication as much as sales. Recommendations included automating claim status updates via mobile apps.

2.2.2 Digital Payment Project Outputs and Insurance Penetration

Rao (2021) analyzed the effect of unified payment interfaces (UPI) on insurance premium collection in India. The study aimed to measure the reduction in policy lapses due to digital auto-debit features. Analyzing transaction data from three major insurers, the study found that digital autorenewal reduced lapse rates by 30%. The findings suggested that ease of payment is critical for maintaining insurance cover. The conclusion was that friction-free payment systems directly sustain higher penetration levels. The author recommended mandatory integration of recurring payment options.

Mugisha (2022) studied the adoption of MomoPay for community-based health insurance (Mutuelle de Santé) in Rwanda. The objective was to analyze if digital payment options improved timely subscription rates in rural districts. Data from RSSB showed a 20% increase in early renewals in districts with high MomoPay agent density. The finding proved that accessibility of digital payment points is crucial for national insurance penetration. The study concluded that digital payment infrastructure is vital for social insurance schemes. It recommended expanding agent networks to facilitate cash-in for digital payments.

Akimana (2025) examined the relationship between online banking usage and life insurance premium consistency in Rwanda. The objective was to determine if banked customers with apps were more consistent payers than cash payers. A comparative analysis showed that digital payers had a 95% consistency rate compared to 70% for manual payers. The key finding was that digital payment projects stabilize cash flow for insurers. The conclusion stated that promoting digital banking habits supports long-term insurance retention. Recommendations involved incentives for clients switching to direct debit.

2.2.3 Digital Distribution Project Outputs and Insurance Penetration

Tan (2021) explored the effect of online aggregators on price transparency and sales in Singapore. The objective was to see if comparison websites increased the total market volume or just shifted market share. Using regression analysis of market data, the study found that aggregators increased overall market penetration by 5% due to increased awareness. The finding suggested that digital distribution educates the consumer while selling. The conclusion was that third-party platforms are key drivers of new customer acquisition. It recommended insurers collaborate rather than compete with aggregators.

Karemera (2023) analyzed the effectiveness of insurer websites in generating leads in Kigali. The objective was to evaluate the user experience and traffic conversion of five major insurance websites. The study found that most websites were informational rather than transactional, resulting in low direct sales. The finding suggested that Rwanda's digital distribution is still at a brochure stage. The study concluded that fully transactional portals are needed to boost penetration. It recommended investing in end-to-end online purchase capabilities.

Uwimana (2025) examined the effect of influencer marketing on insurance awareness among university students in Rwanda. The objective was to see if digital content creators could drive traffic to insurance platforms. A qualitative study found that students were more likely to trust insurance brands endorsed by trusted digital personalities. The key finding was that digital distribution relies heavily on social proof. The conclusion stated that humanizing the digital channel is essential for the youth market. Recommendations included partnerships with local content creators.

3. Methodology

This section presents the study design, target population, sampling procedures, data collection, instrument testing, data processing, statistical analysis and ethical requirements.

3.1 Research Design

The study used a descriptive design to accurately portray the current state of digital innovation in Rwandan insurance companies. Correlational design was used to establish the relationship between the independent variables (digital project outputs) and the dependent variable (insurance penetration).

3.2 Study Population and Sampling

In this study, the population comprised 344 project implementers from the digital innovation project in the selected insurance companies: Prime Insurance, MAYFAIR Insurance, EDEN CARE, BK INSURANCE, and BRITAM INSURANCE. The categories of the population include senior management, IT officers, Marketing officers, Operations staff and Sales agents who are directly involved in digital projects.

The target population comprised 344 project implementers, and a sample of 185 was determined using Slovin's formula at a 5% margin of error. Stratified and simple random sampling techniques were used.

This study employed probability sampling to ensure representativeness. Sampling decisions was guided by population structure and research objectives. A combination of stratified and simple random sampling was used to capture diversity across insurance companies and departments.

The study used stratified sampling to divide respondents into categories based on job function, followed by simple random sampling within each stratum. This approach ensured proportional representation from all insurance companies and departments. It also improved the accuracy of comparisons across respondent categories.

3.3 Data Collection Instruments

The study utilized questionnaires and document reviews to collect relevant information on digital innovation project outputs and insurance penetration.

A closed-ended questionnaire using a five-point Likert scale (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree and 5: Strongly Agree) was administered to sample respondents. The questionnaire measured mobile-based digital projects, digital payment projects, digital distribution projects, and insurance penetration indicators. Data were collected through physical and electronic distribution methods.

3.4 Pilot Study, Validity and Reliability

A pilot study is a preliminary test of research instruments conducted before the main study. It helps identify weaknesses in design and instruments. Pilot testing improves clarity and reliability.

The researcher conducted a pilot study with 19 respondents (10% of the sample size) selected from insurance companies that are not part of the main study, specifically from institutions such as Radiant Insurance Company, Sonarwa General Insurance, and UAP Old Mutual Rwanda. The researcher administered the structured questionnaires to the pilot participants under conditions similar to the actual study. Respondents were guided on how to complete the instruments, and sufficient time was provided to ensure thoughtful response. The collected pilot data were then reviewed

and analyzed to identify inconsistencies, ambiguous questions, or any gaps within the instruments. Based on this evaluation, necessary revisions were made to improve clarity, reliability, and validity.

In this study, content validity was ensured through consultation with the research supervisor and selected experts with knowledge and experience related to the study variables. These experts reviewed the research instrument to assess the relevance, clarity, and appropriateness of each item in relation to the research objectives. Their feedback helped to refine the questionnaire by removing ambiguous items, modifying unclear statements, and ensuring that all relevant aspects of the variables are properly represented in the instrument.

The computed CVI of 0.84 confirms that the instrument was valid enough.

Reliability was tested using Cronbach's alpha with the support of Statistical Package for Social Sciences (SPSS) Version 29. A pilot study was conducted using a small sample of respondents who possess characteristics similar to those of the target population. Data collected from the pilot test were entered into SPSS to compute the Cronbach's alpha coefficient for each variable in the study. Instruments that meet the acceptable reliability threshold of 0.70 and above were retained and used in the main study, while items with lower reliability values were revised or removed to improve the consistency of the measurement tool.

Table 1: Reliability Results

Variables	N of Items	Cronbach's Alpha
Mobile-based digital project outputs	4	.819
Digital payment project outputs	4	.808
Digital distribution project outputs	4	.821
Insurance Penetration	5	.842

Source: Field Data, 2026

The findings in Table 1 indicate the reliability results for the study variables. The results show that mobile-based digital project outputs had Cronbach's Alpha of 0.819, digital payment project outputs had 0.808, digital distribution project outputs had 0.821, while insurance penetration had 0.842. All these values are above the acceptable threshold of 0.70, which means that the questionnaire items used to measure each variable were reliable and internally consistent.

3.5 Data Analysis

Data were analyzed using SPSS Version 29. Descriptive statistics summarized respondent characteristics and variable distributions. Inferential statistics included correlation and multiple regression analysis. The regression model examined the influence of digital innovation project outputs on insurance penetration.

The correlation coefficient measures the extent to which changes in one variable are associated with changes in another. It captures the direction and strength of the relationship, even when the pattern is not strictly linear. A negative correlation occurs when one variable increase while the other decreases.

Correlation is expressed using the statistical coefficient r, which ranges from –1 to +1. Values closer to +1 indicate a strong positive relationship, while values near –1 reflect a strong negative relationship. When r is close to 0, it implies that no meaningful association exists and that the variables are largely independent of each other.

3.6 Ethical Considerations

Ethical considerations ensure the protection of the rights and well-being of research participants. The researcher obtained an official introduction letter from the University of Kigali to gain formal entry into the insurance companies. All participants were informed about the purpose of the study and signed a consent form before participating. The identities of the respondents were kept confidential, and data was used solely for academic purposes. Questionnaires did not require names, ensuring that responses cannot be traced back to individuals. All sources used in the study were properly cited and referenced to acknowledge the authors' work.

4. Results and Discussion

The results are presented through response rate, inferential statistics and hypothesis testing. Each statistical table is followed by its original interpretation, while the discussion compares the findings with relevant studies and the theoretical foundations.

4.1 Response Rate

This section presents the participation level of sampled respondents from selected insurance companies in Rwanda, focusing on complete returned questionnaires, incomplete returned questionnaires, and unreturned questionnaires. Response rate is important because it shows whether the collected data were sufficient to

represent the views of employees involved in digital innovation projects and insurance penetration activities.

Table 2: Response Rate

Questionnaires	Frequency	Percentage (%)
Returned Complete	171	92.43
Unreturned	14	7.56
Total	**185**	**100.00**

Source: Field Data, 2026

The findings in Table 2 present the response rate for the study on digital innovation project outputs and insurance penetration among selected insurance companies in Rwanda. Out of 185 questionnaires distributed, 171 were returned complete, representing a response rate of 92.43%, while 14 questionnaires, equivalent to 7.56%, were not returned. The high response rate indicates that the majority of the sampled respondents participated in the study and provided complete information suitable for data analysis. Therefore, the 171 complete questionnaires provided an adequate basis for analysing respondents' views from Prime Insurance, MAYFAIR Insurance, Eden Care, BK Insurance, and Britam Insurance.

4.2 Inferential Statistics

This section presents inferential statistics used to examine the statistical relationship between digital innovation project outputs and insurance penetration of selected insurance companies in Rwanda. Correlation analysis was used to determine the strength and direction of relationships between mobile-based digital project outputs, digital payment project outputs, digital distribution project outputs, and insurance penetration. Regression analysis was used to determine the predictive effect of the independent variables on insurance penetration based on the specific objectives of the study.

4.2.1 Correlation Analysis

Correlation analysis was conducted to determine the direction, strength, and statistical significance of the relationship between each digital innovation project output and insurance penetration. The analysis focused only on the relationships under specific objectives, namely mobile-based digital project outputs, digital payment project outputs, and digital distribution project outputs in relation to insurance penetration.

Table 3: Correlation Analysis

		Mobile-based digital project outputs	Digital payment project outputs	Digital distribution project outputs	Insurance Penetration
Mobile-based digital project outputs	Pearson Correlation	1	.610**	.699**	.754**
	Sig. (2-tailed)		.000	.000	.000
	N	171	171	171	171
Digital payment project outputs	Pearson Correlation	.610**	1	.560**	.814**
	Sig. (2-tailed)	.000		.000	.000
	N	171	171	171	171
Digital distribution project outputs	Pearson Correlation	.699**	.560**	1	.700**
	Sig. (2-tailed)	.000	.000		.000
	N	171	171	171	171
Insurance Penetration	Pearson Correlation	.754**	.814**	.700**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	171	171	171	171

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

Source: Field Data, 2026

The results in Table 3 indicates correlation analysis between digital innovation project outputs and insurance penetration of selected insurance companies in Rwanda. The relationship between mobile-based digital project outputs and insurance penetration had a Pearson correlation coefficient of 0.754 with a significance value of 0.000. Since the significance value is below 0.05, the relationship was statistically significant. This means that improvements in mobile-based digital project outputs were associated with higher insurance penetration in the selected insurance companies.

The relationship between digital payment project outputs and insurance penetration had a Pearson correlation coefficient of 0.814 and a significance value of 0.000. The result indicates a strong positive and statistically significant relationship because the significance value was below 0.05. This shows that better digital payment systems were associated with increased insurance penetration. The relationship suggests that premium payment, premium collection, electronic receipting, and electronic confirmation support wider use of insurance services.

The relationship between digital distribution project outputs and insurance penetration recorded a Pearson correlation coefficient of 0.700 with a significance value of 0.000. The significance value was below 0.05, showing that the relationship was statistically significant. This means that improved digital distribution project outputs were positively associated with insurance penetration. The result suggests that sales platforms, agent platforms, embedded insurance, and social media platforms help selected insurance companies reach more customers.

The correlation analysis shows that all digital innovation project outputs had positive and statistically significant relationships with insurance penetration. This implies that improvements in mobile-based digital project outputs, digital payment project outputs, and digital distribution project outputs are associated with higher insurance penetration among selected insurance companies in Rwanda. The results therefore provided a sound basis for conducting regression analysis to determine the effect of the independent variables on the dependent variable.

4.2.2 Regression Analysis

Regression analysis was conducted to determine the extent to which mobile-based digital project outputs, digital payment project outputs, and digital distribution project outputs predict insurance penetration among selected insurance companies in Rwanda. The model summary shows the explanatory power of the independent variables, the ANOVA table tests the overall model significance, and the coefficient table shows the specific effect of each independent variable on insurance penetration.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.887[a]	.787	.784	.18947	1.751

a. Predictors: (Constant), Digital distribution project outputs, Digital payment project outputs, Mobile-based digital project outputs
b. Dependent Variable: Insurance Penetration

Source: Field Data, 2026

The results in Table 4 indicates model summary for the effect of digital innovation project outputs on insurance penetration of selected insurance companies in Rwanda. The R value of 0.887 shows a strong positive association between the combined independent variables and insurance penetration. The R Square of 0.787 means that mobile-based digital project outputs, digital payment project outputs, and digital distribution project outputs jointly explained 78.7% of the variation in insurance penetration. The remaining 21.3% was explained by other factors not included in this regression model. The Durbin-Watson value of 1.751 was close to 2, indicating that there was no serious autocorrelation problem in the model residuals.

Table 5: ANOVA Summary

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	22.202	3	7.401	205.583	.000[b]
	Residual	5.995	167	.036		
	Total	28.197	170			

a. Dependent Variable: Insurance Penetration

b. Predictors: (Constant), Digital distribution project outputs, Digital payment project outputs, Mobile-based digital project outputs

Source: Field Data, 2026

The findings in Table 5 indicate ANOVA summary for the regression model on digital innovation project outputs and insurance penetration. The F value of 205.583 shows that the overall regression model was statistically strong in explaining insurance penetration. The significance value was 0.000, which is below the 0.05 level of significance. This means that mobile-based digital project outputs, digital payment project outputs, and digital distribution project outputs jointly had a statistically significant effect on insurance penetration. Therefore, the regression model was suitable for explaining the effect of digital innovation project outputs on insurance penetration among selected insurance companies in Rwanda.

Table 6: Coefficient Summary

Model	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1 (Constant)	.125	.172		.727	.468		
Mobile-based digital project outputs	.242	.044	.295	5.500	.000	.441	2.265
Digital payment project outputs	.546	.049	.521	11.143	.000	.593	1.686
Digital distribution project outputs	.187	.047	.202	3.979	.000	.483	2.071

a. Dependent Variable: Insurance Penetration

Source: Field Data, 2026

The adopted multiple regression model presented as follows:

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

Where:

Y = Insurance Penetration

X1 = Mobile-based digital project outputs

X2 = Digital payment project outputs

X3 = Digital distribution project outputs

β_0 = Constant; y-intercept that is, the value of y when x is equal to zero

β_1, β_2, β_3 = Coefficients of the model

The estimated regression model was: $Y = 0.125 + 0.242X1 + 0.546X2 + 0.187X3 + \varepsilon$

The results in Table 6 indicates coefficient summary for the effect of digital innovation project outputs on insurance penetration of selected insurance companies in Rwanda. For mobile-based digital project outputs, the unstandardized coefficient B was 0.242, meaning that one unit increase in mobile-based digital project outputs increased insurance penetration by 0.242 units when other variables were held constant. The t value was 5.499, showing that the variable made a meaningful contribution to the prediction of insurance penetration. The significance value was 0.000, which is below the 0.05 level of significance. The tolerance value was 0.441 and the VIF value was 2.265, indicating that multicollinearity was not a serious problem for this predictor. Therefore, H01 was rejected because mobile-based digital project outputs had a statistically significant effect on insurance penetration.

For digital payment project outputs, the unstandardized coefficient B was 0.546, meaning that one unit increase in digital payment project outputs increased insurance penetration by 0.546 units when other variables were held constant. The t value was 11.237, showing that the

variable made a meaningful contribution to the prediction of insurance penetration. The significance value was 0.000, which is below the 0.05 level of significance. The tolerance value was 0.593 and the VIF value was 1.686, indicating that multicollinearity was not a serious problem for this predictor. Therefore, H02 was rejected because digital payment project outputs had a statistically significant effect on insurance penetration.

For digital distribution project outputs, the unstandardized coefficient B was 0.187, meaning that one unit increase in digital distribution project outputs increased insurance penetration by 0.187 units when other variables were held constant. The t value was 3.931, showing that the variable made a meaningful contribution to the prediction of insurance penetration. The significance value was 0.000, which is below the 0.05 level of significance. The tolerance value was 0.483 and the VIF value was 2.071, indicating that multicollinearity was not a serious problem for this predictor. Therefore, H03 was rejected because digital distribution project outputs had a statistically significant effect on insurance penetration.

Coefficient t summary shows that all three digital innovation project outputs had positive and statistically significant effects on insurance penetration. Digital payment project outputs had the strongest contribution, followed by mobile-based digital project outputs and digital distribution project outputs. The collinearity statistics were within acceptable limits because tolerance values were above the minimum concern level and VIF values were below the commonly accepted upper limit. These results show that selected insurance companies can improve insurance penetration by strengthening the combined implementation of mobile platforms, digital payments, and digital distribution channels.

4.2.3 Decision on Null Hypotheses

This section presents the decisions made on the null hypotheses based on the coefficient results from the regression analysis. The decisions were made using the 0.05 level of significance, where a null hypothesis was rejected when the significance value was below 0.05 and retained when the significance value was above 0.05.

Table 7: Decision on Null Hypotheses

Hypothesis	Null hypothesis	Statistical evidence	Decision
H01	Mobile-based digital project outputs have no significant effect on insurance penetration of selected insurance companies in Rwanda.	p = 0.000	Rejected
H02	Digital payment project outputs have no significant effect on insurance penetration of selected insurance companies in Rwanda.	p = 0.000	Rejected
H03	Digital distribution project outputs have no significant effect on insurance penetration of selected insurance companies in Rwanda.	p = 0.000	Rejected

Source: Field Data, 2026

The results in Table 7 indicate decisions on the null hypotheses of the study. H01 was rejected because mobile-based digital project outputs had a statistically significant effect on insurance penetration. H02 was rejected because digital payment project outputs had a statistically significant effect on insurance penetration. H03 was rejected because digital distribution project outputs had a statistically significant effect on insurance penetration, meaning that all specific objectives were supported by the regression findings.

4.3 Discussion of Research Findings

The research findings are discussed under the three specific objectives in relation to relevant empirical studies and theories. The discussion considers the direction and practical meaning of the observed effects on insurance penetration.

4.3.1 Mobile-Based Digital Project Outputs and Insurance Penetration

The results for mobile-based digital project outputs are supported by Li (2022), who emphasized that mobile applications could increase insurance adoption when they add practical value to customer service. The findings also resonate with Umutoni (2025), who explained that mobile notification and communication systems strengthen customer trust and retention. This literature supports the idea that mobile-based channels are important in building customer confidence and expanding insurance access.

The results for mobile-based digital project outputs are supported by Gasana (2023), who showed that USSD and mobile channels can influence insurance usage when they are simple enough for customers to navigate. They

also agree with Umutoni (2025), who emphasized that mobile communication strengthens claims transparency and customer trust. This literature suggests that mobile-based services contribute to penetration when they combine accessibility, communication, and confidence-building.

In the context of this study, TAM was used to analyze how Rwandan customers perceive the usefulness and ease of use of mobile insurance apps. The study applied this theory to understand if the complexity of USSD menus or apps hinders insurance penetration. It helped explain why digital payment projects might be accepted or rejected based on user convenience. The theory guided the assessment of customer attitudes toward digital distribution channels.

4.3.2 Digital Payment Project Outputs and Insurance Penetration

The evidence for digital payment project outputs is consistent with Rao (2021), who explained that digital autorenewal and payment systems support continuity of insurance cover by simplifying premium settlement. It also agrees with Akimana (2025), who showed that online banking and digital payment habits strengthen premium consistency. These studies confirm that digital payments are not only operational tools but also drivers of sustained insurance participation.

The outcomes for digital payment project outputs are in agreement with Mushi (2024), who highlighted the role of electronic payment gateways in increasing sector credibility and reducing fraud-related barriers. They also align with Mugisha (2022), who found that mobile payment channels support timely insurance subscription in Rwanda. These scholars show that payment digitization improves continuity, accountability, and client confidence in insurance systems.

This study used DOI to categorize the Rwandan market based on their readiness to adopt digital insurance. It assessed whether digital insurance projects offer a relative advantage over traditional paper-based insurance. The study examined if the compatibility of digital payments with existing mobile money habits influences penetration. The theory helped explain the speed at which digital innovations are spreading across the insurance sector.

4.3.3 Digital Distribution Project Outputs and Insurance Penetration

The relationship involving digital distribution project outputs is supported by Tan (2021), who indicated that online distribution platforms increase market awareness and customer acquisition. It is also aligned with Ochieng (2024), who argued that direct-to-consumer digital portals serve as important access points for insurance services in East Africa. This literature shows that digital distribution strengthens visibility, reach, and customer engagement in insurance markets.

The results for digital distribution project outputs are supported by Karemera (2023), who noted that insurance websites in Kigali need stronger transactional capacity to improve direct sales. They also resonate with Uwimana (2025), who emphasized the role of influencer and digital content strategies in increasing insurance awareness among young people. This literature indicates that distribution innovation must combine digital platforms with trust-building communication.

This study applied Disruptive Innovation Theory to analyze if InsurTech startups are disrupting traditional insurers in Rwanda. It investigated if mobile-based micro-insurance is serving the overlooked segments that traditional insurers ignored. The study assessed if digital distribution projects are lowering costs enough to disrupt the traditional agency model. It helped determine if the current innovations are merely sustaining or truly disruptive to the market structure.

5. Conclusions and Recommendations

The conclusions and recommendations follow the three specific objectives and the statistical results for selected insurance companies in Rwanda.

5.1 Conclusion

This section presents conclusions drawn from the study findings according to the specific objectives. The conclusions are based mainly on inferential statistics and show the meaning of the results in relation to digital innovation project outputs and insurance penetration.

The study concludes that mobile-based digital project outputs positively influence insurance penetration among selected insurance companies in Rwanda. USSD platforms, SMS engagement, mobile policyholder support, and digital enrollment create easier access to insurance services. These tools help companies reach clients beyond physical branches and improve communication with policyholders. Mobile-based innovation is therefore important for expanding insurance access and supporting customer engagement.

The study concludes that digital payment project outputs play a strong role in increasing insurance penetration. Premium payment, automated premium collection, electronic receipting, and electronic confirmation make insurance transactions easier and more reliable. These systems reduce payment barriers and strengthen customer confidence in insurance services. Digital payment innovation is therefore a major driver of continued insurance use and customer retention.

The study concludes that digital distribution project outputs contribute positively to insurance penetration. Sales platforms, agent platforms, embedded insurance, and social media platforms improve the visibility and accessibility of insurance products. These channels support wider customer reach and make insurance products easier to promote and purchase. Digital distribution is therefore an important pathway for increasing insurance market growth.

The study concludes that digital innovation project outputs have a meaningful influence on insurance penetration among selected insurance companies in Rwanda. Mobile-based platforms, digital payments, and digital distribution channels work together to improve access, convenience, engagement, and market reach. The selected insurance companies should therefore treat digital innovation as a strategic tool for increasing insurance participation. Stronger integration of these digital systems can help Rwanda's insurance sector serve more clients and improve financial protection.

5.2 Recommendations

The recommendations are drawn from the findings on the three dimensions of digital innovation project outputs and their respective effects on insurance penetration among the selected insurance companies in Rwanda.

1. Insurance companies should strengthen mobile-based digital project outputs by improving USSD service platforms, mobile policyholder support, and digital enrollment tools.
2. Insurance companies should expand SMS engagement systems to provide timely reminders, renewal alerts, claims updates, and product information.
3. Management of selected insurance companies should continue investing in secure digital payment systems for premium payment, premium collection, electronic receipting, and electronic confirmation.
4. The National Bank of Rwanda and insurance sector regulators should support policies that encourage wider use of digital insurance payment systems.
5. Insurance companies should develop fully transactional digital distribution platforms that allow customers to compare, select, pay for, and receive insurance cover online.

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