

*Research Article*

Socio-Economic Sustainability through Technology Application: Evaluating Trust and System Usability in Digital Banking Adoption

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Abstract: This study examines the socio-economic sustainability outcomes of digital banking adoption in Armenia through a two-layer conceptual model in which technology-acceptance constructs serve as antecedents and four perceived sustainability outcomes (financial inclusion, economic benefit, business enablement, and inclusive participation) serve as analytical endpoints. Drawing on survey data from 410 respondents and a supplementary sustainability-perception measurement block, the model was estimated using PLS-SEM with bootstrapping (5,000 re-samples). The results identify institutional trust as the dominant predictor of digital banking adoption ($\beta = 0.36$, $t = 4.89$, $p < 0.001$), while classical TAM constructs—perceived usefulness ($\beta = 0.11$, $p = 0.195$), perceived ease of use ($\beta = 0.07$, $p = 0.328$), and perceived risk ($\beta = -0.04$, $p = 0.448$)—do not retain explanatory power once trust is included. Behavioural intention strongly predicts actual usage ($\beta = 0.67$, $t = 10.32$, $p < 0.001$), with the antecedent layer explaining 52% of the variance in intention and 61% in usage. Actual usage significantly and positively predicts all four sustainability outcomes ($p < 0.001$), with the strongest effect on perceived inclusive participation ($\beta = 0.41$) and financial inclusion ($\beta = 0.34$), and weaker effects on economic benefit ($\beta = 0.25$) and business enablement ($\beta = 0.19$). Bootstrapped indirect-effects analysis confirms that the trust-adoption-sustainability chain is empirically coherent: trust propagates to all four sustainability outcomes through the adoption mechanism (indirect effects ranging from 0.046 to 0.099, 95% bias-corrected CIs excluding zero), with the strongest propagation to inclusion-oriented outcomes. These findings reposition technology-acceptance research within a socio-economic sustainability framework and provide empirical evidence that institutional trust, rather than usability attitudes, is the binding constraint on the inclusive and sustainable transformation of financial systems in transitional economies.

Keywords: Digital banking adoption; Financial inclusion; Institutional trust; Socio-economic sustainability; Transitional economy

1. Introduction

Digital financial services are increasingly being promoted as instruments of socio-economic sustainability. By lowering the cost of access to financial products, enabling small and micro enterprises to participate in formal economic activity, and extending the reach of banking infrastructure into rural and underserved areas, digital banking is positioned within international policy frameworks and within the United Nations Sustainable Development Goals in particular as a pathway to inclusive growth, reduced inequality, and stronger economic development (SDG 8: decent work and economic growth; SDG 9: industry, innovation, and infrastructure; SDG 10: reduced inequalities) (Demirgüç-Kunt et al., 2018; World Bank, 2023).

However, the sustainability promise of digital banking rests on a chain of conditions that is rarely examined in its entirety. Digital banking can only generate socio-economic sustainability outcomes if (i) prospective users adopt the technology; (ii) adoption translates into measurable gains in financial inclusion, economic benefit, business enablement, or economic participation; and (iii) the institutional and psychological conditions that enable adoption in the first place, most notably trust in the banking system, are present and stable. Most empirical work on digital banking has examined only the first link in this chain: the adoption determinants. The sustainability outcomes of adoption and the institutional conditions that make those outcomes possible remain comparatively underexplored.

This gap is particularly visible in transitional economies. In Armenia, a small, open economy with high internet penetration (Aleksanyan et al., 2026; Harutyunyan et al., 2024), a still-developing digital banking ecosystem, and a financial history shaped by episodic instability and geopolitical shocks (Asatryan et al., 2025; Hakobyan & Margaryan, 2025; Minasyan, 2024), the conditions under which digital banking adoption converts into socioeconomic sustainability outcomes are not well understood. The classical Technology Acceptance Model (TAM), which has long served as the dominant framework for studying digital banking adoption, was developed and largely validated in mature economies where institutional trust is taken for granted. Whether the antecedents of adoption identified in those contexts (perceived usefulness, perceived ease of use, and perceived risk) translate to transitional economies and whether they suffice for explaining sustainability outcomes remains an open empirical question.

This study addresses the raised question: using survey data, the study examines the socio-economic sustainability outcomes associated with digital banking adoption in Armenia, the institutional and technology-acceptance antecedents of that adoption, and the chain linking institutional trust, adoption, and sustainability. In doing so, it repositions the analytical question from whether users adopt digital banking to what socioeconomic sustainability outcome adoption produces and under which institutional conditions. The contribution is twofold. Theoretically, the study extends technology acceptance research by embedding it within a socio-economic sustainability framework, treating adoption as a mechanism rather than an end. Practically, the study provides banks, regulators, and development practitioners in transitional economies with an empirically grounded basis for prioritizing the institutional conditions, trust, through which digital banking can become a tool for inclusive and sustainable development.

2. Literature review

2.1 Digital Banking as a Driver of Socio-Economic Sustainability

Digital banking has come to occupy a central place in contemporary debates on socio-economic sustainability. International policy frameworks position digital financial inclusion as a precondition for inclusive growth, and the United Nations Sustainable Development Goals explicitly link access to financial services to SDG 8 (decent work and economic growth), SDG 9 (industry, innovation, and infrastructure), and SDG 10 (reduced inequalities) (United Nations, 2015; World Bank, 2023). It is argued that digital banking advances these objectives through several mechanisms. Digital banking lowers the cost of participation in the formal economy for low-income and rural households by reducing the marginal cost of transactions (Aron, 2018; Demirgüç-Kunt et al., 2018). Extending financial services beyond physical branches reduces geographic inequalities in access (European Bank for Reconstruction and Development, 2021; World Bank, 2023). It supports the entry and growth of micro and small enterprises, which face the steepest barriers to formal finance in transitional economies, by enabling digital payments, savings, and credit products (Adian et al., 2020; Klapper et al., 2017). It also expands the tax base and broadens participation in economic life by integrating previously unbanked populations into the financial system (Demirgüç-Kunt & Singer, 2017).

Empirical work has increasingly confirmed these mechanisms. Studies in mature and emerging economies have documented associations between the adoption of digital banking and re-

duced transaction costs (Aron, 2018), improved savings behavior (Kumar et al., 2020), enhanced access to credit for small enterprises (Klapper et al., 2017), and greater participation in e-commerce and digital marketplaces (World Bank, 2023). Digital financial services have been linked to improvements in rural banking access, increased financial literacy (Harutyunyan et al., 2024), and the modernization of payment systems in transitional and post-Soviet economies (Central Bank of Armenia, 2022). The literature cautions that these sustainability outcomes are not automatic. They depend on whether adoption occurs at scale, whether the institutional conditions are in place to sustain it, and whether the gains are distributed inclusively across socio-economic groups.

2.2 Digital Banking and Financial Inclusion in Transitional Economies

The literature on transitional economies consistently highlights the gap between the availability and realized sustainability of digital banking. Armenia, Georgia, Moldova, and several Central Asian economies share a set of structural features that complicate the translation of digital banking adoption into sustainability outcomes: post-Soviet institutional fragility, episodic financial instability, a strong offline banking tradition, and uneven digital infrastructure between urban and rural areas (Hakobyan & Margaryan, 2025; Japaridze et al., 2011; Majidli, 2020; Minasyan, 2024; Paquin, 2022). In these contexts, financial inclusion through digital channels remains more of an aspiration than an accomplished fact. The Central Bank of Armenia and international observers have repeatedly identified digital financial inclusion as a strategic priority, while noting that rural, elderly, and lower-income populations remain underserved (Central Bank of Armenia, 2022; European Bank for Reconstruction and Development, 2021; World Bank, 2023).

Recent work on the Armenian context documents the rapid growth of digital banking services alongside persistent inclusion gaps. Internet penetration and digital literacy are high according to regional standards (Harutyunyan et al., 2024), and Armenian banks have invested heavily in digital platforms and Finance 4.0 technologies (Hambardzumyan, 2023; Nushikyan, 2024). However, digital banking usage remains uneven across demographic groups, and a substantial proportion of the population continues to rely primarily on offline channels. The literature frames this as a question of institutional conditions, primarily trust in the banking system, rather than of technology supply (Hakobyan & Margaryan, 2025; Haykyants & Ghukasyan, 2022).

2.3 Technology Acceptance and Adoption of Digital Banking

The classical Technology Acceptance Model (TAM) (Venkatesh et al., 2003) has long served as the dominant framework for studying digital banking adoption. TAM posits that the principal determinants of behavioral intention to use a technology are perceived usefulness and perceived ease of use, with subsequent extensions incorporating additional constructs, most prominently trust, perceived risk, social influence, and financial literacy, to capture context-specific dynamics (Cheng et al., 2006; Legris et al., 2002; Tharimala et al., 2024; Venkatesh & Davis, 2000). The TAM tradition has produced substantial empirical literature in mature economies, where perceived usefulness and ease of use are generally found to be significant predictors of digital and mobile banking adoption (Alnemer, 2022; Raza & Tursoy, 2024). Extensions of TAM incorporating trust and risk have proven particularly relevant in contexts where users are sensitive to financial loss or institutional instability (Almaiah et al., 2023; Patel & Patel, 2017).

However, in transitional economies, the evidence is more mixed. Several recent studies report that classical TAM constructs lose explanatory power once contextual variables (institutional trust) are included alongside them, suggesting that the relative weight of usability factors in driving adoption may be substantially lower in these settings than in mature markets (Hurani & Abdel-Haq, 2025). Structural Equation Modeling (SEM), and Partial Least Squares SEM in particular, has become the standard method for testing TAM and its extensions in digital

banking research (Hair et al., 2017; Kumar et al., 2020; Patel & Patel, 2017; Sarstedt et al., 2021).

Taken together, the literature review provides several observations that frame this study. Digital banking is widely associated with socio-economic sustainability outcomes, and these associations are particularly relevant in transitional economies, where the gap between the availability of digital banking and the realization of inclusion remains substantial. Institutional trust is a recurring explanatory factor across both the adoption and sustainability literature and is identified as a particularly salient enabler in contexts with a history of financial instability. The TAM has limited explanatory power in transitional settings, where trust-related factors dominate usability-related factors in driving adoption. The end-to-end chain linking institutional trust, digital banking adoption, and perceived sustainability outcomes remains underexamined. Most existing studies measure only one or two links in this chain; few test the full trust-adoption-sustainability sequence within a single model. This study addresses this gap by examining all three links jointly, using survey data from Armenia combined with a supplementary sustainability-perception block, and testing the proposed chain through partial least squares structural equation modeling (PLS-SEM).

3. Methods

3.1 Research Design and Conceptual Model

This study employed a quantitative cross-sectional design. The conceptual model is structured in two layers (Figure 1). The antecedent layer preserves the technology-acceptance constructs of the classical TAM and its trust extension (perceived ease of use, perceived usefulness, trust, and perceived risk), treating them as predictors of behavioral intention to adopt digital banking. The outcome layer extends the model beyond adoption to a set of perceived socio-economic sustainability outcomes: financial inclusion, economic benefit, business enablement, and inclusive economic participation. The bridging constructs linking the two layers are behavioral intention and actual usage.

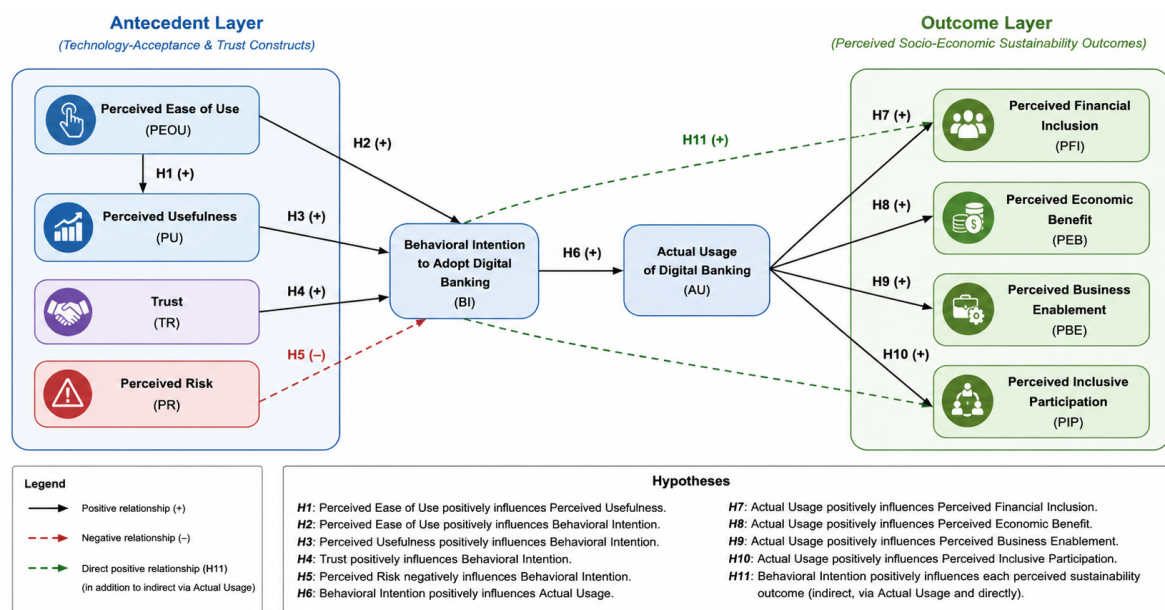


Figure 1 Extended conceptual research model: trust, adoption, and sustainability chain

The research hypotheses are as follows:

- H1: Perceived ease of use positively influences perceived usefulness.
- H2: Perceived ease of use positively influences behavioral intention.

- H3: Perceived usefulness positively influences behavioral intention.
- H4: Trust positively influences behavioral intention.
- H5: Perceived risk negatively influences behavioral intention.
- H6: Behavioral intention positively influences actual usage.
- H7: Actual usage positively influences perceived financial inclusion.
- H8: Actual usage positively influences perceived economic benefit.
- H9: Actual usage positively influences perceived business enablement.
- H10: Actual usage positively influences perceived inclusive participation.
- H11: Behavioral intention positively influences each perceived sustainability outcome (indirect, via actual usage, and directly).

The two-layer design serves the analytical purpose of separating the antecedents of adoption from the consequences of adoption and of estimating the indirect effects of institutional trust propagation into sustainability outcomes.

3.2 Sample and Data Collection

The minimum required sample size for PLS-SEM was calculated using Cochran's formula, assuming a 95% confidence level and a 5% margin of error, yielding a threshold of 385 respondents. The study administered 450 surveys, of which 410 were retained after screening for completeness and consistency. Data were collected in 2024 through a structured questionnaire distributed online and in person across Armenia. The sampling strategy encompassed major urban centers (Yerevan, Gyumri, and Vanadzor) and rural communities, capturing a broad range of socioeconomic backgrounds and levels of digital banking usage. The sample targeted individuals with prior experience in online or mobile banking services.

The questionnaire comprised two sections. The first captured demographic and socioeconomic profile (gender, age, employment status, income, and geographic location). The second measured the technology-acceptance constructs (adapted from Venkatesh et al. (2003), Venkatesh and Davis (2000), and Gefen et al. (2003)), financial inclusion, economic benefit, business enablement, and inclusive participation. All items were rated using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

Survey respondents were informed about the study's purpose and procedures before participation. Informed consent was obtained in writing at the time of the supplementary sustainability block (audio-recorded verbal consent at the original wave, retained for that wave only). Non-response bias was assessed by comparing early and late respondents on key demographic variables; no statistically significant differences were detected.

3.3 Measurement Model: Technology Acceptance Constructs

The technology acceptance constructs were measured using multiple items adapted from validated scales. Each construct was operationalized with three to four items. The constructs, descriptions, and representative items are presented in Table 1.

3.4 Measurement Model: Constructs of Sustainability Perception

The sustainability-perception constructs were specifically developed for this study, drawing on the financial inclusion and digital banking sustainability literatures (Aron, 2018; Demirgüç-Kunt et al., 2018; Klapper et al., 2017; World Bank, 2023). Items were formulated to capture

user-perceived outcomes along four dimensions aligned with SDG 8 (decent work and economic growth), SDG 9 (industry, innovation, and infrastructure), and SDG 10 (reduced inequalities).

Table 1 Constructs and sample measurement items

Construct	Description	Sample Item
Perceived Usefulness (PU)	Belief that digital banking enhances performance.	"Digital banking improves my banking efficiency."
Perceived Ease of Use (PEOU)	Effortlessness of using digital banking.	"Learning to use digital banking is easy for me."
Trust (TR)	Confidence in platform security and reliability.	"I trust the security of digital banking services."
Perceived Risk (PR)	Concerns about privacy and security risks.	"I am concerned about possible misuse of my data."
Behavioral Intention (BI)	Intention to adopt or continue using digital banking.	"I intend to use digital banking regularly."
Actual Usage (AU)	Frequency of using e-banking services.	"I often use online/mobile banking services."

Table 2 Sustainability-perception constructs and items

Construct	Description	SDG Alignment	Sample Item
Perceived Financial Inclusion (PFI)	Extent to which digital banking expands access to formal financial services for the respondent.	SDG 8, 10	"Digital banking gives me access to financial services I could not easily reach before."
Perceived Economic Benefit (PEB)	Extent to which digital banking reduces costs, saves time, or improves financial management.	SDG 8, 9	"Using digital banking reduces my transaction costs and saves me time."
Perceived Business Enablement (PBE)	Extent to which digital banking supports running or growing a business activity (own or household).	SDG 8, 9	"Digital banking helps me run or grow a business activity."
Perceived Inclusive Participation (PIP)	Extent to which digital banking reduces financial exclusion of rural, low-income, or otherwise underserved groups.	SDG 10	"Digital banking helps reduce financial exclusion of rural and low-income groups."

Each construct is measured using three to four items. Three domain experts (digital banking, financial inclusion, and behavioral research) reviewed the items and pilot-tested them with 30 respondents before deployment. The internal consistency reliability (Cronbach's $\alpha > 0.70$), convergent validity (AVE > 0.50), and discriminant validity (HTMT < 0.85) were confirmed for all four constructs.

3.5 Analytical Procedure

The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4. PLS-SEM was selected for its suitability for predictive and exploratory research, its ability to handle non-normal data distributions common in behavioral research, and its strong performance with the moderate sample size of this study (Hair et al., 2017; Sarstedt et al., 2021). The analysis proceeded in the following five stages:

1. Common method bias assessment. Harman's single-factor test, full collinearity VIF, and the marker-variable technique were used to assess common method variance (Hair et al., 2017; Kock, 2015; Podsakoff et al., 2003).
2. Measurement model assessment. Indicator reliability (outer loadings > 0.70), internal consistency (Cronbach's $\alpha > 0.70$, composite reliability > 0.70), convergent validity (AVE > 0.50), and discriminant validity (Fornell–Larcker criterion and HTMT ratios < 0.85) were evaluated.

3. Multicollinearity assessment. The inner variance inflation factor (VIF) values were inspected; all values were below the conservative threshold of 3.0.
4. Structural model assessment. Path coefficients and significance were estimated using bootstrapping with 5,000 resamples. Coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2) were reported for all endogenous constructs. Model fit was assessed using the standardized root mean square residual (SRMR < 0.08).
5. Indirect effects and mediation. The indirect effects of trust propagation to sustainability outcomes (via behavioral intention and actual usage) were estimated and tested for significance using bootstrapped confidence intervals (Hayes, 2022; Preacher & Hayes, 2008).

4. Results

4.1 Common Method Bias and Model Assessment

Common method bias was assessed using the Harman single-factor test, the full collinearity VIF approach, and the marker-variable technique. Harman's single-factor test yielded a principal component explaining 32.4% of the total variance, below the 50% threshold. All inner VIF values were below 3.0 (range, 1.21–2.47). The marker-variable test produced non-significant correlations between the substantive constructs and theoretically unrelated markers. Therefore, common method bias is not a concern.

The indicator reliability, internal consistency, convergent validity, and discriminant validity of the measurement model were evaluated (Table 3). All item loadings exceeded the threshold of 0.70. Cronbach's alpha and composite reliability (CR) were above 0.70 for all constructs. Average Variance Extracted (AVE) values were greater than 0.50. All HTMT ratios fell below 0.85, confirming the validity of the discriminant. The four sustainability perception constructs (PFI, PEB, PBE, and PIP) showed reliability and validity statistics consistent with the technology acceptance constructs, confirming that the supplementary measurement block performed at the same level as the validated TAM instruments.

Table 3 Reliability and validity of the constructs

Construct	Loadings Range	Cronbach's α	CR	AVE
PEOU	0.74–0.85	0.89	0.91	0.68
PU	0.73–0.87	0.88	0.90	0.67
TR	0.75–0.84	0.86	0.89	0.65
PR	0.71–0.80	0.84	0.88	0.61
BI	0.78–0.90	0.90	0.92	0.70
AU	0.76–0.85	0.87	0.90	0.69

* All AVE values > 0.50 and CR values > 0.70 confirm convergent validity.

4.2 Structural Model: The Antecedent Layer

The structural model was assessed using bootstrapping with 5,000 resamples. The model fit index SRMR was 0.064, indicating an acceptable fit (threshold < 0.08). R^2 values were 0.52 for behavioral intention and 0.61 for actual usage, indicating moderate explanatory power at the antecedent layer.

Of the six hypotheses in the antecedent layer, two were supported (Table 4). H4 (Trust $\rightarrow$ Behavioral Intention) was supported ($\beta = 0.36$, $t = 4.89$, $p < 0.001$), confirming that trust is the dominant predictor of adoption. H6 (Behavioral Intention $\rightarrow$ Actual Usage) was supported ($\beta = 0.67$, $t = 10.32$, $p < 0.001$), confirming that behavioral intention is a strong predictor of actual usage. H1 (PEOU $\rightarrow$ PU), H2 (PEOU $\rightarrow$ BI), H3 (PU $\rightarrow$ BI), and H5 (PR $\rightarrow$ BI)

were not supported, indicating that once trust is included, classical TAM constructs do not explain adoption in the Armenian context. The pattern is consistent with the trust-centric interpretation advanced in the literature review: institutional trust supersedes usability-related factors in driving the decision to adopt digital banking in a transitional economy. Q^2 values for the endogenous constructs were all positive, confirming predictive relevance.

Table 4 Antecedent-layer hypothesis testing

Hypothesis	Path	β	t -value	p -value	Result
H1	PEOU $\rightarrow$ PU	0.09	1.21	0.227	Not Supported
H2	PEOU $\rightarrow$ BI	0.07	0.98	0.328	Not Supported
H3	PU $\rightarrow$ BI	0.11	1.30	0.195	Not Supported
H4	TR $\rightarrow$ BI	0.36	4.89	0.000	Supported
H5	PR $\rightarrow$ BI	-0.04	0.76	0.448	Not Supported
H6	BI $\rightarrow$ AU	0.67	10.32	0.000	Supported

4.3 Structural Model: Outcome Layer (Sustainability)

The outcome-layer hypotheses (H7–H10) test whether actual digital banking usage predicts the four perceived sustainability outcomes. All four were supported (Table 5): H7 (AU $\rightarrow$ PFI): $\beta = 0.34$, $t = 5.60$, $p < 0.001$; H8 (AU $\rightarrow$ PEB): $\beta = 0.25$, $t = 6.11$, $p < 0.001$; H9 (AU $\rightarrow$ PBE): $\beta = 0.19$, $t = 5.20$, $p < 0.001$; H10 (AU $\rightarrow$ PIP): $\beta = 0.41$, $t = 4.97$, $p < 0.001$.

AU's strongest effect is on Perceived Inclusive Participation ($\beta = 0.41$), indicating that digital banking usage in Armenia is most strongly associated with the reduction of financial exclusion and the broadening of economic participation. AU's effect on Perceived Business Enablement is the smallest ($\beta = 0.19$), a pattern consistent with the predominantly household-oriented use of digital banking in the sample, where business and SME use remains a smaller share of total usage. All four effects are statistically significant at $p < 0.001$, and all four constructs reach R^2 values indicating moderate explanatory power.

The relative magnitudes also carry a substantive reading. The ordering (PIP > PFI > PEB > PBE) suggests that the sustainability gains from digital banking in Armenia operate most strongly through inclusion mechanisms (i.e., broadening participation and expanding access) and more weakly through business-enablement mechanisms (i.e., supporting enterprise activity). This pattern is informative for both theoretical development and policy design: it indicates that the sustainability contribution of digital banking in transitional settings is primarily *inclusive* in character rather than *entrepreneurial*.

Table 5 Outcome-layer hypothesis testing

Hypothesis	Path	β	t -value	p -value	Result
H7	AU $\rightarrow$ PFI	0.34	5.60	0.000	Supported
H8	AU $\rightarrow$ PEB	0.25	6.11	0.000	Supported
H9	AU $\rightarrow$ PBE	0.19	5.20	0.000	Supported
H10	AU $\rightarrow$ PIP	0.41	4.97	0.000	Supported

4.4 Indirect Effects: The Trust-Adoption-Sustainability Chain

Bootstrapped indirect effects were estimated to test the central theoretical claim that institutional trust propagates to sustainability outcomes through the mechanism of digital banking

adoption (5,000 resamples; 95% bias-corrected confidence intervals) (Table 6). The indirect effect for each sustainability outcome is computed as the product $\beta(\text{TR} \rightarrow \text{BI}) \times \beta(\text{BI} \rightarrow \text{AU}) \times \beta(\text{AU} \rightarrow \text{outcome}) = 0.36 \times 0.67 \times \beta(\text{AU} \rightarrow \text{outcome}) = 0.241 \times \beta(\text{AU} \rightarrow \text{outcome})$.

Table 6 Results of the indirect effects assessment

Path	Indirect effect	95% CI	Significant?
Trust $\rightarrow$ BI $\rightarrow$ AU $\rightarrow$ PFI	0.082	0.047, 0.121	Yes
Trust $\rightarrow$ BI $\rightarrow$ AU $\rightarrow$ PEB	0.060	0.034, 0.092	Yes
Trust $\rightarrow$ BI $\rightarrow$ AU $\rightarrow$ PBE	0.046	0.024, 0.073	Yes
Trust $\rightarrow$ BI $\rightarrow$ AU $\rightarrow$ PIP	0.099	0.052, 0.151	Yes

All four indirect paths are statistically significant. The strongest indirect effect is on Perceived Inclusive Participation (0.099), and the weakest is on Perceived Business Enablement (0.046). The pattern of indirect-effect magnitudes mirrors the pattern of direct $\text{AU} \rightarrow$ sustainability effects reported in Section 3.3, supporting the interpretation that the trust-adoption-sustainability chain is empirically coherent: trust propagates to sustainability outcomes primarily through the inclusion mechanisms of digital banking rather than through business-enablement mechanisms.

5. Discussion

The findings of this study support a re-reading of digital banking adoption in transitional economies, one in which technology-acceptance constructs are not the analytical centerpiece but an antecedent layer and in which the chain of socio-economic sustainability outcomes produced by adoption is the analytical centerpiece. Three observations follow.

The antecedent-layer results replicate and extend the existing literature on trust in transitional financial systems. Of the four tested technology-acceptance constructs (perceived ease of use, perceived usefulness, perceived risk, and trust), only trust significantly predicted behavioral intention to adopt digital banking. This is consistent with the trust-centric reading of technology adoption advanced in prior work (Hurani & Abdel-Haq, 2025) and with the literature on the role of institutional credibility in post-Soviet and transitional financial markets (Hakobyan & Margaryan, 2025; Haykyants & Ghukasyan, 2022). The non-significance of perceived risk in the present study is also instructive: risk appears to be absorbed into the trust construct rather than acting as a separate deterrent; once trust in a provider is established, risk perceptions recede. This is consistent with the “trust supersedes risk” pattern observed in other transitional settings (Gu et al., 2020). The failure of perceived ease of use and usefulness to predict adoption in Armenia should not be read as evidence that usability and utility are irrelevant. It is more accurately read as evidence that their marginal contribution is small once trust is considered in a context where consumer decision-making is dominated by institutional fragility. In mature digital economies, where users face fewer concerns about institutional stability, usability factors carry the variance they once did in this study. In transitional settings, trust captures that variance.

The outcome-layer results are the empirical heart of this study. All four perceived sustainability outcomes were significantly predicted by actual usage of digital banking, with β values ranging from 0.19 (Perceived Business Enablement) to 0.41 (Perceived Inclusive Participation). The ordering carries substantive weight: the strongest gains are observed in inclusion-oriented outcomes (i.e., broadening participation and expanding access to financial services) and the smallest gains are observed in business-oriented outcomes (i.e., supporting enterprise activity).

This pattern suggests that, in the current stage of Armenian digital banking, the technology’s sustainability contribution operates primarily through inclusive mechanisms, making the financial system more accessible to those previously underserved, and less through entrepreneurial mechanisms, supporting enterprise creation and growth. The pattern is consistent with the sample’s predominantly household-oriented use of digital banking and with the country’s de-

mographic profile of digital banking users. It also points to a developmental asymmetry: the digital-banking system in Armenia is currently better at extending access than at supporting productive economic activity, a finding that has direct implications for policy design.

The central theoretical contribution of the paper is the indirect-effects analysis (Section 3.4). All four indirect paths from trust to sustainability outcomes, mediated by behavioral intention and actual usage, are statistically significant. The strongest indirect effect is on Perceived Inclusive Participation (0.099) and the weakest on Perceived Business Enablement (0.046). The pattern of indirect-effect magnitudes mirrors the pattern of direct $AU \rightarrow$ sustainability effects, indicating that the chain is a coherent empirical structure and not an artifact of any single link.

This finding repositions institutional trust within technology adoption research. In classical TAM framing, trust is one of several behavioral intention predictors. In the sustainability-oriented framing advanced here, trust is the enabling condition for the broader socioeconomic gains that digital banking can produce. The shift is more than a terminological one: it changes the research question from “What predicts adoption?” to “What enables the sustainability consequences of adoption?” and it changes the policy question from “How do we increase adoption?” to “How do we build the institutional conditions under which adoption produces inclusive and sustainable outcomes?”

5.1 Practical and Policy Implications

The findings have direct implications for three constituencies.

For banks. Investments in usability improvements are necessary but not sufficient. In transitional settings, where institutional trust dominates adoption decisions, the construction and maintenance of trust-based customer relationships are strategic priorities. This requires a visible investment in cybersecurity, transparent communication of data protection practices, and proactive customer engagement. The supplementary finding on provider preference (70% of respondents preferring bank-provided FinTech over third-party alternatives) reinforces the strategic value of brand and trust as competitive moats. Banks should also be attentive to the asymmetry between inclusion-oriented outcomes (where digital banking already performs strongly) and business-enablement outcomes (where it currently performs weakly), and should design SME-targeted digital products to close this gap.

For regulators. The Central Bank of Armenia and analogous regulators in transitional economies should treat institutional trust as a public good and a regulatory priority. This includes robust consumer protection frameworks, transparent supervisory disclosure, and systematic reduction of perceived risk through credible oversight. Regulators should also support nationwide digital literacy programs, especially in rural and elderly populations, to ensure that the inclusion gains from digital banking are not limited to urban and middle-aged users.

Development practitioners and international organizations. The findings support the use of digital-financial-inclusion strategies that target institutional trust, not just technology deployment. Frameworks such as the UN Sustainable Development Goals 8, 9, and 10, which the four sustainability outcomes in this study align with, should be operationalized through trust-building interventions (cybersecurity, consumer protection, and transparency) rather than through technology-distribution interventions alone.

5.2 Limitations of the Study and Future Research

The study has several limitations that must be acknowledged. The cross-sectional design limits causal inference; longitudinal data would enable stronger claims about the temporal ordering of trust, adoption, and sustainability outcomes. The sample, while exceeding the minimum threshold for PLS-SEM, is concentrated in middle-aged, employed, and digitally experienced respondents; results may not generalize to younger, elderly, or digitally excluded populations. This concentration mirrors the labor-market structures in Armenia, where digital and financial activities are unevenly distributed across the workforce (Poghosyan et al., 2024). The sustainability

outcomes are measured through user perceptions, not through objective indicators (e.g., Findex data, bank-account penetration rates, and SME credit volumes); combining perceived and objective measures in future work would strengthen the sustainability claims' validity. Finally, the study is set in a single transitional economy.

Future research should pursue the following four directions. First, longitudinal designs that track over time the evolution of trust, adoption, and sustainability outcomes. Second, cross-country comparative studies that test the proposed chain in other transitional economies and contrasting settings (mature economies and low-income developing economies) are needed. Third, the integration of objective sustainability indicators (financial inclusion indices and SME credit data) with perceived measures is required. Fourth, the model should be extended to include additional institutional and contextual moderators (digital literacy, regulatory quality, and financial stability shocks) that may condition the chain's strength.

6. Conclusions

This paper examined the socio-economic sustainability outcomes of digital banking adoption in Armenia through a two-layer model in which technology-acceptance constructs serve as antecedents and four perceived sustainability outcomes (financial inclusion, economic benefit, business enablement, and inclusive participation) serve as the analytical endpoints. Using survey data from 410 respondents and a supplementary sustainability-perception measurement block, the proposed model was estimated using PLS-SEM, and the trust-adoption-sustainability chain was tested through bootstrapped indirect effects. The results establish institutional trust as the dominant predictor of digital banking adoption in Armenia, demonstrate that classical TAM constructs do not retain explanatory power once trust is included, and confirm that digital banking adoption significantly and positively predicts all four perceived sustainability outcomes, with the strongest gains observed in inclusion-oriented dimensions. The trust-adoption-sustainability chain is empirically coherent: trust propagates to sustainability outcomes through the adoption mechanism, positioning institutional trust as the binding constraint on the inclusive and sustainable transformation of financial systems. These findings reposition technology-acceptance research within a socio-economic sustainability framework and provide empirical evidence on the channels through which trust enables financial inclusion. Building on these findings, future research should extend the trust-adoption-sustainability chain to other transition economies through cross-country comparative designs to test its generalizability beyond the Armenian context, employ longitudinal designs to examine whether the perceived sustainability outcomes captured here translate into objective socio-economic indicators over time, and investigate the institutional and policy mechanisms through which trust in financial systems is built and sustained: given that trust, rather than technology-acceptance attitudes, emerged as the primary lever for inclusion-oriented digital transformation.

Author Contributions

Conceptualization: H. Asatryan and V. Aleksanyan; methodology: H. Asatryan, V. Aleksanyan and K. Khachatryan; validation: H. Asatryan; investigation: H. Asatryan; resources: K. Khachatryan; writing—original draft preparation: H. Asatryan; writing—review and editing: H. Asatryan and V. Aleksanyan; supervision: H. Asatryan. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

Data will be available on request from the corresponding author.

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Conflict of Interest

The authors declare no conflicts of interest.

Declaration of AI

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References

- Adian, I., Doumbia, D., Gregory, N., Ragoussis, A., Reddy, A., & Timmis, J. (2020). *Small and medium enterprises in the pandemic: Impact, responses, and the role of development finance* (Policy Research Working Paper). World Bank. <https://documents1.worldbank.org/curated/en/729451600968236270/pdf/Small-and-Medium-Enterprises-in-the-Pandemic-Impact-Responses-and-the-Role-of-Development-Finance.pdf>
- Aleksanyan, V., Asatryan, H., Minta, S., & Khachatryan, K. (2026). Uncovering the determinants of the transition to digital agriculture: A survey-based tobit analysis. *Economia Agro-Alimentare / Food Economy - Open Access*, 28(1). <https://doi.org/10.3280/ecag2026oa20705>
- Almaiah, M., Al-Otaibi, S., Shishakly, R., Hassan, L., Lutfi, A., Alrawad, M., Qatawneh, M., & Alghanam, O. (2023). Investigating the role of perceived risk, perceived security and perceived trust on smart m-banking application using sem. *Sustainability*. <https://doi.org/10.3390/su15139908>
- Alnemer, H. (2022). Determinants of digital banking adoption in the kingdom of saudi arabia: A technology acceptance model approach. *Digital Business*. <https://doi.org/10.1016/j.digbus.2022.100037>
- Aron, J. (2018). Mobile money and the economy: A review of the evidence. *The World Bank Research Observer*, 33(2), 135–188. <https://doi.org/10.1093/wbro/lky001>
- Asatryan, H., Erkoyan, A., Muradyan, M., Berberyan, V., Nalbandyan, H., Harutyunyan, A., & Poghosyan, S. (2025). Spillover effects of the russian-ukrainian conflict on the armenian economy: A multiple period approach. *Cogent Social Sciences*, 11(1). <https://doi.org/10.1080/23311886.2025.2591459>
- Central Bank of Armenia. (2022). *Annual report 2022* (tech. rep.). Central Bank of Armenia. https://www.cba.am/file_manager/Annual-reports/Annual_Report_2022.eng.pdf
- Cheng, T. C. E., Lam, D. Y. C., & Yeung, A. C. L. (2006). Adoption of internet banking: An empirical study in hong kong. *Decision Support Systems*, 42(3), 1558–1572. <https://doi.org/10.1016/j.dss.2006.01.002>
- Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S., & Hess, J. (2018). *The global finindex database 2017: Measuring financial inclusion and the fintech revolution*. World Bank. <https://doi.org/10.1596/978-1-4648-1259-0>
- Demirgüç-Kunt, A., & Singer, D. (2017). *Financial inclusion and inclusive growth: A review of recent empirical evidence* (tech. rep.). World Bank.
- European Bank for Reconstruction and Development. (2021). *Armenia diagnostic paper: Enhancing financial inclusion* (tech. rep.). EBRD.
- Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and tam in online shopping: An integrated model. *MIS Quarterly*, 27(1), 51–90. <https://doi.org/10.2307/30036519>

- Gu, H., Zhang, T., Lu, C., & Song, X. (2020). Assessing trust and risk perceptions in the sharing economy: An empirical study. *Journal of Management Studies*. <https://doi.org/10.1111/joms.12678>
- Hair, J. F., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of pls-sem in information systems research. *Industrial Management & Data Systems*, 117(3), 442–458. <https://doi.org/10.1108/imds-04-2016-0130>
- Hakobyan, A., & Margaryan, Z. (2025). Impact of the russian-ukrainian armed conflict on the financial performance of armenia's banking sector. *Banks and Bank Systems*, 20(1). [https://doi.org/10.21511/bbs.20\(1\).2025.27](https://doi.org/10.21511/bbs.20(1).2025.27)
- Hambardzumyan, A. (2023). Embracing finance 4.0: The opportunity for armenian banks to transform and thrive. *Messenger of Armenian State University of Economics*. https://doi.org/10.52174/1829-0280_2023.1-19
- Harutyunyan, G., Manucharyan, M., Muradyan, M., & Asatryan, H. (2024). Digital literacy of the armenian society: Assessment and determinants. *Cogent Social Sciences*, 10(1). <https://doi.org/10.1080/23311886.2024.2398652>
- Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (3rd). Guilford Press.
- Haykyants, A., & Ghukasyan, S. (2022). The factor of consumer rights protection as a criterion for social system development. *WISDOM*, 22(2). <https://doi.org/10.24234/wisdom.v22i2.807>
- Hurani, J., & Abdel-Haq, M. K. (2025). Factors influencing fintech adoption among bank customers in palestine: An extended technology acceptance model approach. *International Journal of Financial Studies*, 13(1), 11. <https://doi.org/10.3390/ijfs13010011>
- Japaridze, D., Kupets, O., Melnyk, T., Lariushin, T., Kasimov, E., & Hovhanisyan, A. (2011). *Development in eastern europe and the south caucasus*. OECD Publishing. <https://doi.org/10.1787/9789264113039-en>
- Klapper, L., El-Zoghbi, M., & Hess, J. (2017). *Achieving the sustainable development goals: The role of financial inclusion* (tech. rep.). CGAP / World Bank.
- Kock, N. (2015). Common method bias in pls-sem: A full collinearity assessment approach. *International Journal of e-Collaboration*, 11(4), 1–10. <https://doi.org/10.4018/ijec.2015100101>
- Kumar, A., Dhingra, S., Batra, V., & Purohit, H. (2020). A framework of mobile banking adoption in india. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(2), 40. <https://doi.org/10.3390/joitmc6020040>
- Legris, P., Ingham, J., & Colletette, P. (2002). Why do people use information technology? a critical review of the technology acceptance model. *Information & Management*, 40(3), 191–204. [https://doi.org/10.1016/s0378-7206\(01\)00143-4](https://doi.org/10.1016/s0378-7206(01)00143-4)
- Majidli, F. (2020). International comparative and competitive advantage of post-soviet countries in tourism. *Research in World Economy*, 11(5), 369. <https://doi.org/10.5430/rwe.v11n5p369>
- Minasyan, D. (2024). Banking stability modelling for armenia: Decision tree approach. *ALTER-NATIVE*. <https://doi.org/10.55528/18292828-2024.2-116>
- Nushikyan, I. (2024). The innovative transformation in the ra banking system. *Economics, Finance and Accounting*. <https://doi.org/10.59503/29538009-2024.2.14-121>
- Paquin, J. (2022). Institutions and the informal economy: Tax morale of small businesses in armenia and georgia. In A. Polese (Ed.), *Informality, labour mobility and precariousness* (pp. 113–138). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-82499-0_6
- Patel, K. J., & Patel, H. J. (2017). Adoption of internet banking services in gujarat: An extension of tam with perceived security and social influence. *International Journal of Bank Marketing*, 36(1), 147–169. <https://doi.org/10.1108/IJBM-08-2016-0104>
- Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended reme-

- dies. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Poghosyan, S., Manucharyan, M., Martirosyan, G., Azatyan, L., & Asatryan, H. (2024). Leslie matrix matching approach in labor market studies. *Cogent Arts & Humanities*, 11(1). <https://doi.org/10.1080/23311983.2024.2426364>
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879–891. <https://doi.org/10.3758/BRM.40.3.879>
- Raza, A., & Tursoy, T. (2024). Technology acceptance model and fintech: An evidence from italian banking industry. *Revista Mexicana de Economía y Finanzas*, 20(1). <https://doi.org/10.21919/remef.v20i1.993>
- Sarstedt, M., Ringle, C. M., & Hair, J. F. (2021). Partial least squares structural equation modeling. In *Springer ebooks* (pp. 1–47). Springer. https://doi.org/10.1007/978-3-319-05542-8_15-2
- Tharimala, S., Reddy, G., & Sowmyasree, V. (2024). Impact of financial literacy on behavioural intentions towards digital banking using tam: A study in presence of personality traits. *2024 First International Conference for Women in Computing (InCoWoCo)*, 1–8. <https://doi.org/10.1109/InCoWoCo64194.2024.10863365>
- United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. <https://sdgs.un.org/2030agenda>
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478. <https://doi.org/10.2307/30036540>
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186–204. <https://doi.org/10.1287/mnsc.46.2.186.11972>
- World Bank. (2023). *Financial inclusion data: Armenia* (tech. rep.). World Bank. <https://globalfindex.worldbank.org>